A Study of the Fisheries Sector in India
An Overview of Current Demand and Future Prospect

Submitted to
**Department of Fisheries
Ministry of Fisheries, Animal Husbandry & Dairying
Government of India**

National Council of Applied Economic Research

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May 2023

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National Council of Applied Economic Research

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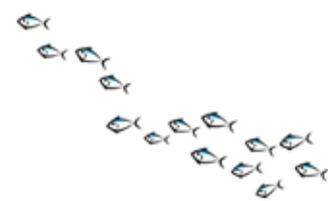
PREFACE

India is the second-largest fish-producing country in the world contributing around 7.6 per cent to global production and about 1.2 per cent to the country's Gross Value Added (GVA). The sector contributes around 7.3 per cent to the agricultural and allied sector's GVA. Fisheries and aquaculture in India are important sources of food, nutrition, income and livelihood for millions of people. After the Green and White Revolution, India is currently witnessing a 'Blue Revolution' to exploit the huge potential in this sector for sustaining food and nutritional requirements as well as meeting export demand.

In India, though fisheries are noted to be the fastest-growing food-producing sector amongst all agricultural sectors, it is least researched by economists. At the policy level, this sector does not get sufficient attention as it is with key field crops. As per the 7th Schedule of the Constitution of India, fisheries and aquaculture are the State Subjects. Only marine fisheries, beyond territorial waters, falls under the Union Subject. Therefore, there is a lack of a unified approach to developing this critical sector.

In this context the National Council of Applied Economic Research (NCAER) conducted a nationwide study for the Ministry of Fisheries, Animal Husbandry and Dairying, to estimate the consumption demand for fish and its spread among fish species across various States. Apart from quantifying species-wise fish consumption, the NCAER study relied more on qualitative research. The target groups/stakeholders interviewed in the primary survey include fish-eating households, hotels and restaurants serving fish, and district officials. The survey was carried out in 24 States and covered 12,600 households from rural and urban areas in these States.
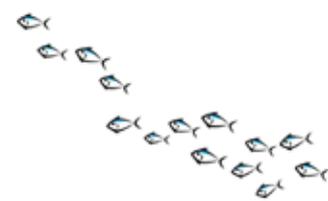
The key findings of the household survey are that in 2022 the overall household monthly consumption expenditure on fish as a proportion to total food expenditure has increased to 16.8 per cent compared to a 7.6 per cent share in 2011-12 as per the NSS survey (68th Round). And, the monthly consumption of fish has also shown a significant increase during the same period though the increase in demand for fish in the urban areas has outpaced the demand in rural areas.

The study has also estimated future demand for fish in India using three scenarios – (A) Business as Usual Scenario; (B) Moderately Optimistic Scenario; and (C) Highly Optimistic Scenario. The total availability of fish, which was around 15 million tons in 2022 is expected to reach 26 million tons in 2031 under Scenario A; 30 million tons under Scenario B; and, 35 million tons if we assume Scenario C.

The study noted nutritional inequality, in terms of demand and availability of fish across States and expenditure strata. For increasing fish consumption in the country, the study recommends creating reliable transportation, storage, and packaging facilities for fresh fish and semi-processed fish and fish products; better hygienic ways of handling fish; mass awareness campaigns on the health benefits of eating fish; and, making fish available in convenient forms ready-to-cook and ready-to-eat.

The study was led by Dr Saurabh Bandyopadhyay with Dr Laxmi Joshi, Dr Palash Baruah and Dr Nijara Deka as the Principal Investigators, along with a dedicated research and field team. I would like to express my appreciation for the teams' effort in completing the project within the timeline stipulated by the Ministry. I hope the study will provide valuable insights to the Ministry as well as policymakers and other stakeholders involved in the fisheries sector.

Poonam Gupta
Director General, NCAER

ACKNOWLEDGEMENTS

ABBREVIATIONS AND ACRONYMS

AAY	Antyodaya Anna Yojana	ICC	Integrated Cold Chain
APL	Above Poverty Line	ICDS	Integrated Child Development Services
APP	Application		
BIS	Bureau of Indian Standards	ICT	Information Communication Technology
BPL	Below Poverty Line		
CCE	Consumer-Centric Extension	KIIs	Knowledge-Intensive Interviews
CEB	Census Enumeration Block	MIG	Medium Income Group
CHD	Coronary Heart Disease	MIS	Market Information System
CIFT	Central Institute for Fisheries Technology	MPEDA	Marine Products Export Development Authority
CIPHET	Central Institute of Post-Harvest Engineering & Technology	MSP	Minimum Support Price
		NABCB	National Accreditation Board for Certification Bodies
COVID	Coronavirus Disease		
CPI	Consumer Price Index	NCAER	National Council of Applied Economic Research
DFOs	District Fishery Officers		
DGCI&S	Directorate General of Commercial Intelligence & Statistics	NE	North-East
		NECC	National Egg Coordination Council
DHA	Docosa Hexaenoic Acid	NFDB	National Fisheries Development Board
DoF	Department of Fisheries	NIFPHATT	National Institute of Fisheries Post Harvest Technology and Training
EPA	Eicosa Pentaenoic Acid		
FAO	Food and Agricultural Organisation	NSS	National Sample Survey
FBO	Food Business Operators	NSSO	National Sample Survey Organisation
FFPO	Fish Farmer's Producer Organisations	OBC	Other Backward Caste
FGD	Focus Group Discussion	OECD	Organisation for Economic Cooperation and Development
FMPIS	Fish Market and Price Information System		
		PMMSY	Pradhan Mantri Matsya Sampada Yojana
FSF	Fish-Sourced Food		
FSSAI	Food Safety and Standard Authority of India	RTC	Ready-To-Cook
		RTE	Ready-To-Eat
FY	Financial Year	SCs	Scheduled Castes
GI	Geographical Indication	SOFIA	Stratospheric Observatory for Infrared Astronomy
GVA	Gross Value Added		
HACCP	Hazard Analysis Critical Control Point	STs	Scheduled Tribes
HH	Household	UP	Uttar Pradesh
HIG	High Income Group	USAID	United States Agency for International Development
ICAR	Indian Council of Agricultural Research		
		UTs	Union Territories

CONTENTS

CHAPTER 1

CHAPTER 2

CHAPTER 3

CHAPTER 4

CHAPTER 5

CHAPTER 6

CHAPTER 7

CHAPTER 8

DEMAND-SUPPLY GAP AND ACTION PLAN NEEDED TO BOOST THE CONSUMPTION FOR FISH AMONG HOUSEHOLDS IN INDIA ... 77

CHAPTER 9

GLOBAL DEMAND FOR THE FISHERIES SECTOR ... 89

ANNEXURE A

ANNEXURE B 121

ANNEXURE C 125

ANNEXURE D 127

ANNEXURE E 129

LIST OF TABLES

LIST OF FIGURES

Executive Summary

CONTEXT AND THE BACKGROUND

India is noted to be the second largest fish-producing country in the world contributing around 7.56 per cent of global production and about 1.24 per cent of the country's Gross Value Added (GVA). The sector contributes over 7.28 per cent to the agricultural GVA[1]. Fisheries and aquaculture in India are an important source of food, nutrition, income and livelihood for millions of people. Fish is the best and cheapest source of animal protein. After the Green and White Revolution, India is currently converging on Blue Revolution to exploit the huge potential in this sector.

Higher disposable incomes, changing tastes, lifestyles, and urbanisation along with growing awareness of health issues, especially after COVID-19 are anticipated to have a positive impact on the demand for fish and fishery products for both domestic and export markets. The Government of India and various State Governments/UTs have laid major emphasis on increasing fish availability and are implementing several schemes to help augment consumers' propensity to consume fish. As a result, significant progress is noted in terms of the availability of varieties of fish and their exports during the last 5 years.

The NCAER study, at the behest of the Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, is the first study to estimate the consumption demand for fish and its spread among fish species. The target groups/ stakeholders covered for the primary survey include a survey of Fish-eating Households, Hotels and Restaurants serving fish, District Officials and FGD at the selected Fish Markets.

National Sample Survey (NSS) is the single source of data in India on consumer expenditure and the latest of its findings on expenditure to fish consumption pertains to the year 2011-12. But, in the aforesaid survey, NSS did not collect data on fish consumption by species. Therefore, in the present study, NCAER carried out a survey on species-wise fish demand across 24 States/UTs in India to determine the quantum and expenditure. It helped to collate data on the consumption of fish and related expenditures that are fundamental to gauge the updated trend after a decade. This, in turn, provided insight at the perceivable level of demand for fish based on the surveyed data and estimation. The qualitative assessment carried out on the ground provided actionable recommendations that are considered important in policy-making and its implementation.

SAMPLING METHODOLOGY

A three-stage stratified design was adopted to arrive at a representative sampling frame. A sample of 105 districts was allocated as first-stage units to all 24 selected States/ UTs in proportion to the total number of fish-consuming households (with a minimum of two districts per State/ UT). Villages formed the second stage units using the district-wise list of villages. The allocated number of sample villages in a selected district is based on Census 2011. In each selected village, a listing of 100 households was carried out and out of these, 15 fish-eating households were selected.

Urban wards /CEBs (Census Enumeration Blocks) formed the second stage units of sampling using the district-wise list of wards are available from Census 2011 records. In each selected word, a listing of 100 households was done and a sample of 15 households was selected from each sample ward/ CEB following the same procedure as in the case of rural samples.

A sample of 8040 households in rural and 4560 samples of urban were covered under the primary survey that spread over 24 selected States, 536 sample villages and 304 urban wards / CEBs

OBSERVATIONS FROM THE PRIMARY SURVEY OF HOUSEHOLDS

The primary survey of the fish-eating households includes the demographic characteristics, expenditure, consumption patterns, and preference for fish and other animal products. It also quantifies the level of

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[1] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1786303, dated 30/12/2021.

awareness of the health benefits of eating fish and the aspects like changes in consumption over the last five years and consumers' preferences for processed fish products like packaged fish, nuggets, fish fingers, fish tikka, Amritsari fish fry masala, etc.

The demographic profile of the surveyed households indicates that 12 per cent are illiterate, 27 per cent with no formal education but are able to read and with primary-level education. Another 21 per cent with senior secondary and above level qualifications. Forty per cent of the households are from OBC and 25 per cent belong to the general category. The majority of the households (83.9%) are Hindu by religion and BPL card holders (62.4%). Around 38.2 per cent of the households are non-agricultural labourers. The household expenditure pattern basically reflects upon the standard of living and captures the information on the share/ composition of food and non-food expenditure. Survey results revealed that among the fish-eating households, the share of food expenditure to total household expenditure constitutes 45 per cent in rural and 39 per cent in urban areas. The key finding of the study is that in 2022 the household monthly consumption expenditure on fish in proportion to total food expenditure has gone up to 16.77 per cent as compared to 7.63 per cent in 2011-12 in rural and urban areas combined. Similarly, monthly consumption of fish per household has also shown a quantum leap in ten years from 2.66 kg in 2011 to 4.99 kg in 2022 (urban and rural areas combined). The increase in the demand for fish in the urban area has outpaced the rural area. The State-wise comparison is detailed in the report. Again, out of total food expenditure the share of expenditure on fish forms 16.53 per cent in rural and 17.21 per cent in urban areas. Household expenditure on fish in total expenditure on animal products is 32.19 per cent and 33.22 per cent in rural and urban areas respectively.

As regards the consumption by type of fish, Freshwater fish has the major share of 77.0 per cent followed by marine fish at 16.0 per cent. The share of processed/ preserved fish forms just 0.3 per cent. Among the States, fish is the most preferred animal product in West Bengal (76%), followed by Tripura (73%) and Pondicherry (68%). Rohu and Catla are the two most preferred freshwater fish species in India. Among Marine fish, Sardines and Bhetki are mostly preferred. Further, the survey results reveal that at the all-India level, the average household consumption of freshwater fish in 30 days is 3.42 kg, marine fish 1.28 kg, processed/ preserved fish just 0.7 kg, chicken 2.30 kg, goat meat/mutton 0.71 kg and milk 36.82 litres. The majority of households (84%) purchase freshwater fish, only 2.5 per cent get it from their own ponds and 13.9 per cent get it from both sources. As regards the source of fish, 75.13 per cent of household purchase

freshwater fish from the local market and 18.54 per cent from the local vendor. Similarly, more than 90 per cent of households purchase all types of fish (fresh, frozen and dry) from the market. As regards the source of marine fish, about 75 per cent of households buy marine fish (fresh & frozen) from the local market.

Among the physical factors considered for buying fish, the majority (61.13%) go by the colour of the fish, followed by the colour of gills (11.47%), and the live fish constitute only 8 per cent. Other factors like the firmness of the body, the colour of the eyes, etc. hold little importance. The high price is the major determining factor that restricts the majority (73.8%) from buying fish apart from several other minor factors. However, it may be noted that 64 per cent of households from urban areas purchase fish without considering the price range, while the same is true for 36 per cent of rural households. More variety of fish in the local market attracts the majority of buyers (56.6%) to purchase than that of lower price rates (19.8%) and door-step delivery (12.71%). As far as the mode of purchase is concerned, only 15.92 per cent prefer to buy fish online and the rest (84.08%) are from the local markets. Amongst the buyers, the frequency of buying fish varies. The majority of buyers (57.5%) purchase fish on a frequency of 1-5 days a month. A little over 17 per cent purchase fish on a frequency of 6-10 days and around 13 per cent of the fish-eating households purchase fish on a frequency of 11-15 days.

The majority of the households surveyed (64%) are aware of the health benefits of eating fish and fishery products. However, in 12 out of 24 States/ UTs, the awareness level is less than the all-India average. The lowest level of awareness is reported from Chhattisgarh (23.94%) followed by Andhra Pradesh (39.9%), Telangana (41.36%) and Rajasthan (41.94%). As regards types of awareness, about 55 per cent are aware of the high-quality protein in fish. But awareness regarding omega-3 fatty acids, essential amino acids, and vitamins and minerals in fish is low, only 24 to 28 per cent know about it. Awareness about fish by-products too is very low at the all-India level (20%). Only 13 per cent and 11 per cent know about the benefit of using fish liver oil and fish body oil respectively. Awareness of the negative impact of consuming pre-mature / juvenile fish is low at 37 per cent.

The study on the consumption of fish at the household level over the last 5 years reveals that, while 59 per cent did not undergo any change, 28 per cent experienced increased consumption of fish. Only 29 per cent of the households believe that the availability of attractive fish products like packed fish nuggets, fish finger, fish tikka, Amritsari fish masala, etc. could help increase interest in the consumption of fish. However, across States, the opinions differ
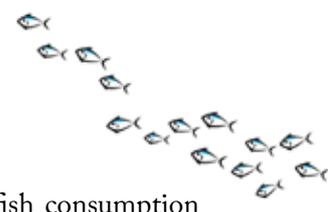
widely. Whereas in Gujarat (97%) and in Arunachal Pradesh, Bihar, Jharkhand, and West Bengal more than 50 per cent agree to this. In other States, the percentage of those in favour of this varies between 0.99 per cent in Uttar Pradesh to 11.39 per cent in Andhra Pradesh. In Delhi, Haryana and Punjab, none of the households have an agreement on this.

A linear regression model has been used to analyses the causal relationship between household fish consumption and eight other characteristics of 8 related variables which include education level, factors that help in buying fish, awareness of the nutritional value of fish, the religion of the household social groups, sectors (Urban/Rural), health expenditure and total expenditure (food and non-food) as a proxy of the economic status of the household. Findings indicate that doorstep delivery is the most preferred factor that positively impacts the consumption of fish, followed by more variety of fish in the market. Household awareness of the nutritional value of fish also has a positive impact. Consumption of fish is more in Urban than in Rural areas. However, expenditure on health has a negative relationship with fish consumption indicating that households consuming more fish spend less on health. Total household expenditure as the proxy of economic status has a positive impact on fish consumption.

OBSERVATIONS FROM THE CONSUMPTION PATTERN OF HOTELS & RESTAURANTS

The study also covered the hotels and restaurants that serve various dishes of different fish species. From each district, two residential hotels and one restaurant were selected for conducting the survey. The Survey of hotels reveal that only 42 per cent served only fish items, and 28 per cent served fish and prawns. More than 50 per cent serve fish during lunch and dinner time, and 34 per cent serve fish all time of the day. Over 60 per cent reported maximum sales during summer. More than 5 varieties of fish are served in 39 per cent of the hotels. Around 39 per cent of hotels found an increase in fish consumption by guests over the last 5 years. More than 50 per cent of the hotels reported that guests prefer chicken over fish, 28 per cent prefer mutton over fish and 4 per cent prefer beef over fish.

The primary observations from restaurants indicate that more than 52 per cent served only fish items on their menu, whereas fish and prawns are served by 26 per cent. About 65 per cent of fish dishes are sold during summer while 31 per cent of fish dishes are sold in winter. About 52 per cent of restaurants procure live fish while frozen fish is procured by 21 per cent of the restaurants. Around 60

per cent of restaurants opine that fish consumption over the last 5 years remained the same. About 59 per cent of restaurants believe that the availability of fish at a lower price could attract more customers to prefer fish. A clear preference for fish over chicken is seen in the State of West Bengal and Odisha.

OBSERVATIONS FROM THE QUALITATIVE RESEARCH OF STAKEHOLDERS

To understand the supply and market dynamics, Focus Group Discussion (FGD) was conducted in 85 district-level wholesale fish markets across 24 States. This helped in conducting in-depth discussions and collecting perceptions, viewpoints, beliefs and attitudes of different market players (aggregators, transporters, wholesalers and retailers, processors, etc.) across the sectors (freshwater & marine). The stakeholders who participated in the FGD highlighted the status of infrastructure in wholesale fish markets and the major challenges being faced by them.

It was observed from FGDs that the stakeholders cited the major problems associated with the fish markets, viz., the lack of infrastructure and amenities (74%), high transportation cost (62%), and high marketing cost (52%). Therefore, it is recommended that the government should focus more on creating market-related infrastructure facilities in the potential locations. The lack of land at strategic locations for the development of modern fish markets is a big challenge. The fisheries department should consult the municipal bodies and other local authorities to find out appropriate land in suitable locations for the construction of modern fish markets.

The study also collected data from the district offices which reveal that, among the major Inland fish species, Rohu, Catla and Mrigal are commonly consumed in all States/UTs. Common Crap variety is also found in almost all States. West Bengal reported the highest (10) types of fish species commonly consumed. Marine fish species are reported from coastal districts in the State of West Bengal, Odisha, Maharashtra, Gujarat, Kerala and Pondicherry. In all, 29 types of freshwater fish species have been reported from 20 States and 54 districts. In terms of availability, 20 districts were reported as 'deficit districts' in terms of the production and consumption of fish.

On the causes for low consumption of fish, about 73 per cent of the district officials agreed that, 'low consumption of fish among the people of Low-Income Group is due to their low purchasing power rather than their preferences'. Lack of post-harvest

processing for domestic market' and 'poor availability of ready-to-cook and ready-to-eat fishery products' also have a negative effect on overall fish consumption as agreed upon by 59.6 per cent. It also revealed that 54 per cent of buyers from the Medium-Income-Group (MIG) and High-Income Group (HIG) avoid going to the fish market for buying due to the poor hygienic condition in the market and /or lack of freshness in fish. The low consumption of fish is due to a 'lack of awareness on health benefits of fish' was agreed upon by 44.0 per cent.

As solutions for increasing fish consumption, almost all (98.1%) of the responding districts are in favour of undertaking mass awareness on the health benefits of fish, conducting fish festivals at the district level (92.3%), offering fish dishes to customers to help develop their taste, promoting the sale of live fish, creating the facilities for transportation and storage, and developing appropriate packaging for fish and fishery product. More than 80 per cent are in favour of constructing hygienic retail fish markets and fish kiosks at strategic locations and strengthening the mobile fish marketing facilities to increase consumption. Besides, online fish delivery systems, encourage the sale of preserved and processed fish in the domestic market, emphasizing on the branding of fish like "Ganges fish", "Himalayan Trout", "Sundarbans Fish", "Chilka Crab", etc. will further boost the demand for fish.

There are several requirements to enhance the infrastructure in terms of setting up of ice plants, cold storage, salting facilities, , fish hatcheries and other productive infrastructure, especially in the deficient districts to cope with the increasing demand for fish in India and abroad.

FUTURE PROSPECTS ON FISH DEMAND IN INDIA

In the present report, an attempt is made to assess the future demand for fish in India through the modelling of three probable scenarios, using the time-series data from the Fishery Statistics, published by the Department of Fishery, Government of India. Domestic availability is defined as:

Domestic Availability of Fish=Total Production–Export +Import.

Prediction for the total availability of fish is built on three distinct scenarios:

Scenario A: Business as Usual Scenario

Scenario B: Moderately Optimistic Scenario

Scenario C: Highly Optimistic Scenario

The total availability of fish, which is around 15 million tons in 2022, is expected to reach 26 million tons in 2031 if we assume Scenario A, 30 million tons in 2031 in Scenario B and 35 million tons in 2031 if we assume Scenario C.

KEY TAKEAWAYS

The study of fishery demand in India by NCAER is the first-ever estimation of consumption demand at the household level. This study has revealed that States that are traditionally considered low in generating consumption for fish, have enough potential and with policy support, it could achieve a higher level of consumption. Moreover, the level of consumption is observed to be distributed among major species from inland and marine varieties.

The NCAER household survey highlights that fish consumption in India consists of the major share of freshwater fish. Rohu and Catla are highly preferred fish varieties in the country. Among marine fishes, Sardine and Bhetki are comparatively preferred fish species. Consumption of fish consists of 32.19 per cent in rural and 33.22 per cent in urban areas in total expenditure on animal products.

As survey results show an increase in fish expenditure, which is 16.8 per cent in 2022 (NCAER) and 7.6 in 2011-12 (NSSO), different factors were considered in buying fish. The most significant factor is the ease of availability, followed by the price. The online fish market in India is still restricted to metropolitan cities only.

The linear regression model based on household data significantly highlights the positive impact of health awareness on the consumption of fish. Similarly, the model also indicates a negative relationship between health expenditure and consumption of fish which means household spending more on health actually consumes a lesser amount of fish. Urban households in India consume more fish. Moreover, a higher standard of living has a positive and significant impact on fish consumption.

The survey found that stakeholders in the Northern States experience significant challenges related to high marketing costs and a lack of infrastructure, while those in the Southern States face high transportation costs and no issues with product diversity. In the Eastern States, the main challenges are a lack of infrastructure, while the Western States struggle with a lack of business and poor product diversity. The Central States faces numerous problems, including transportation and infrastructure issues, high levels of competition, and a lack of product diversity. The North-Eastern States face fewer challenges than other regions, with their main issue being a lack of infrastructure.
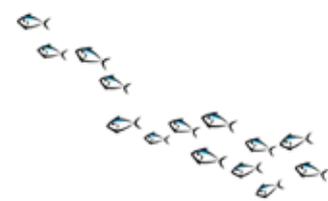
INTRODUCTION

1.1. INTRODUCTION

India is noted to be the second-largest fish producing country in the world contributing around 7.56 per cent of global production and about 1.24 per cent of the country's Gross Value Added (GVA). The sector contributes over 7.28 per cent to the agricultural GVA[2]. Fisheries and aquaculture in India are an important source of food, nutrition, income and livelihood to millions of people. Fish is the best and cheapest source of animal protein. After Green Revolution and White Revolution, India is currently converging on 'Blue Revolution' to exploit the huge potential in this sector.

India is endowed with rich freshwater, brackish water and marine resources. Besides its coastline of 8,118 km, and continental shelf of 0.42 million sq. km., India possesses vast inland aquatic resources in the form of 195,210 km of rivers and canal, 2.9 million ha of reservoirs, 2.41 million ha of ponds and tanks, 1.07 million ha of *beels*, oxbow lakes and derelict waters and 1.24 million ha of brackish water area. The river system of the country comprises 14 major rivers (catchments > 20,000 sq. km.), 44 medium rivers (catchments 2,000-20,000 sq. km.) and innumerable small rivers and desert streams. The floodplain lakes are primarily continuum of rivers Ganga and Brahmaputra. These are in the form of oxbow lakes (*Mauns, Chaurs, Jheels, Beels* as they are called locally), especially in Assam, Manipur, West Bengal, Bihar and eastern Uttar Pradesh. Globally it stands as the third-largest producer of fish (capture and culture production combined) and second in aquaculture production.

In this backdrop, higher disposable incomes, changing tastes, lifestyles, urbanisation along with growing awareness of the health issues especially after COVID-19 is anticipated to have a positive impact on the demand for fish and fish products for both domestic and export markets. Since the fisheries fall under the concurrent list, there is a deficiency of a unified approach to developing this critical sector. Despite this limitation, the Government of India and various State Governments/UTs have laid a major emphasis on increasing fish availability and are implementing several schemes to help augment consumers' propensity to consume fish. As a result, significant progress is noted in terms of the availability of varieties of fish and their exports during the last 5 years. NCAER has undertaken a study in early 2022 at the behest of the Department of Fisheries of the Government of India to conduct a nationwide survey to estimate species-wise demand for fish in India. The present study has the following objectives.

Training of the trainers by NCAER Research Team at NCAER Campus for undertaking fisheries survey across the country.

[2]https://www.pib.gov.in/PressReleasePage.aspx?PRID=1786303, dated 30/12/2021.

1.2. OBJECTIVES OF THE NCAER STUDY

The basic objectives of the NCAER study was to provide estimation of the household-level consumption of fish across 24 major States/UTs, along with, mapping the level and frequency of the consumption of fish and assessment of the penetration of major varieties/species in the household dishes. The objectives include estimation of the State-level position in terms of the household-level consumption of fish and provide an insight into the operation of the market scenario. Finally, the NCAER study will recommend measures to enhance the demand for fish and provide a holistic estimate in terms of consumption of fish for the next 5-10 years.

1.3. SURVEY OF DEMAND OF THE MAJOR VARIETIES OF FISH BY NCAER

The NCAER survey is designed to examine the potential of domestic markets for food source components from the fish marketing system in India with the help of direct observation, and interviews through a structured questionnaire, which has been filled in by a cross-section of consumers and other stakeholders. The fish market in India is divided into segments such as (a) freshwater fishes (b) marine fishes, (c) prawns, and (d) others like crabs, lobsters, squids, mussels, etc. Inland fishes are further divided into major species like Indian major carps, catfish, etc. At present, inland fishes lead the market, having a higher share. Depending on the types of processing, the market is further divided into fresh, frozen, dry, and other categories, while the market is branched into retail and wholesale ones as the major distribution channel.

A large number of species coming from coastal and inland sources characterize fish consumption in India. Each species differs in its commercial value, which is governed by the volume of catch, consumer's taste and preference. Consumer preference and demand pattern vary across the regions and require a disaggregated demand analysis of fish by the species.

It is important to understand the current demand for fish, which considerably varies across the regions due to dynamic food habits and the changed preference of the consumers for different varieties of fish.

In order to estimate the volume of demand for fish across major species, NCAER proposes to carry out an extensive primary survey in 24 States/UTs. The survey to assess demand for fisheries is a challenging one that requires scientific sampling. It is guided by the framework of assessment covering almost the entire country with the proportion of the consuming population as the basis of selection, both at the State as well as at the district level. Subsequent to an extensive discussion with the Ministry officials (on 14/01/2022), it is decided to conduct a survey in 24 States/UTs consisting of high, low and medium consumption categories of fish and fish products. This is done as per the data compiled from the 68th Round of the National Sample Survey Organisation (NSSO) data on "Household Consumer Expenditure: 2011-12" with 99 per cent coverage.

1.4. METHODOLOGY

A mixed method approach is followed for the study of fisheries demand in India. First, secondary information was collated to assess the State-wise importance in terms of available information. Second, a detailed survey plan was chalked out using the unit-level data of the NSS 68th round (2011-12). The NCAER study was carried out in 105 districts, covering 520 villages and 320 urban blocks to canvas structured questionnaire for 12,600 households, suitably stratified across 24 States/UTs. The selection of sample districts, village and urban units followed a scientific sampling process and elaborated in the Chapter 2. Third, NCAER emphasised more on qualitative research to draw insight through Focus Group Discussions (FGDs) and Knowledge-Intensive Interviews (KIIs) of the district-level officials. Based on the ground-level experience, the action plan to boost fish consumption and extending market access is chalked out in Chapter 8.
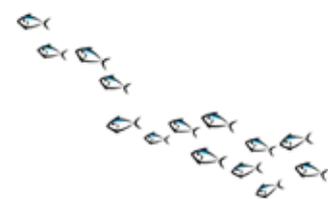
METHODOLOGY

2.1. SAMPLING METHODOLOGY & DESIGN

A three-stage stratified sample design was adopted for the survey to generate representative samples. Sample districts, villages/urban wards and households formed the first, second, and third stage sample units respectively for the selection of the rural/urban sample. A sample of 105 districts was allocated as first-stage units to all selected States/UTs in proportion to the total number of fish-consuming households in a State/UT (with a minimum of two districts per State/UT).

In order to provide adequate coverage of individual respondents within a State, district-wise fish-eating households were calculated (as per 68th Round of the NSSO data on "Household Consumer Expenditure: 2011-12") to form homogeneous strata. Using this consumption data along with the location of the districts (coastal or otherwise for the States having coastal belts) within a State where at least four districts are allotted (Table 2.1), districts were grouped into the desired number of strata (minimum of 2). The allocated number of sample districts was selected from each effective stratum with probability proportional to the size with replacement, where size is the estimated number of fish-consuming households in the district.

State-wise allocation of sample places (i.e. villages/wards) is done in proportion to fish-consuming households with a minimum of 20 sample places from each State. Accordingly, 840 sample places are allocated in proportion to the same. Further, this State-level allocation is distributed in proportion to the respective rural/urban population with a minimum of four places separately for the rural and urban areas. (Table 2.1)

2.1.1. Selection of Rural Sample

Villages formed the second-stage units. District-wise lists of villages are available from census records (Census 2011) along with the population. The allocated number of villages for each State was distributed among selected districts within the State approximately in proportion to the rural population of the districts with a minimum allocation of 2 villages to each district. The allocated number of sample villages in a selected district is chosen with probability proportional to size with replacement, where village population as per census 2011 was used as a size measure. In each of the selected village, a listing of up to 150 households was carried out. All the households listed were stratified into four strata based on their fish-eating habit (viz. High consuming regular fish-eating households, Medium consuming regular fish-eating households, Low consuming regular fish-eating households and Occasional fish-eating households) and a sample of households was selected separately from each of the four strata.

Pre-testing of questionnaire in Ghaziabad, Uttar Pradesh.

2.1.2. Selection of Urban Sample

Urban wards/Census Enumeration Blocks (CEBs) form the second stage units of sampling. District-wise lists of wards/CEBs are available from census records (Census 2011) along with the population. The allocated number of wards/CEBs for each State was distributed approximately in proportion to the urban population of the districts with a minimum allocation of two wards/CEBs to each district (Table 2.1). The allocated number of sample wards/CEBs in a selected district was chosen with probability proportional to size with replacement, where the ward's/CEB's population as per Census 2011 was used as a size measure.

In each selected ward/CEB, a listing of up to 150 households was carried out and arranged into 4 strata and a sample of 15 households was selected from each sample ward/CEB adopting the procedure suggested for rural samples (villages). Sample villages and wards from each district were finally selected in the form of two independent sub-samples.

Table 2.1: State-wise Summary of Sample Places for the Primary Survey

S. No.	State	Total number of sample district	Total number of sample places	Total number of sample villages	Total number of urban Wards/CEB's	Number of sample households (@15)-Rural	Number of sample households (@15)-Urban
1.	Andhra Pradesh	6	36	24	12	360	180
2.	Assam	6	48	36	12	540	180
3.	Bihar	8	64	48	16	720	240
4.	Chhattisgarh	3	20	12	8	180	120
5.	Delhi	2	20	4	16	60	240
6.	Goa	2	20	8	12	120	180
7.	Gujarat	3	20	12	8	180	120
8.	Haryana	2	20	12	8	180	120
9.	Himachal Pradesh	2	20	16	4	240	60
10.	Jammu & Kashmir	2	20	16	4	240	60
11.	Jharkhand	3	20	12	8	180	120
12.	Karnataka	3	20	12	8	180	120
13.	Kerala	7	60	32	28	480	420
14.	Madhya Pradesh	3	20	12	8	180	120
15.	Maharashtra	6	48	28	20	420	300
16.	Odisha	7	56	40	16	600	240
17.	Puducherry	2	20	4	16	60	240
18.	Punjab	2	20	12	8	180	120
19.	Rajasthan	2	20	16	4	240	60
20.	Tamil Nadu	10	56	28	28	420	420
21.	Telangana	4	32	20	12	300	180
22.	Tripura	3	20	12	8	180	120
23.	Uttar Pradesh	7	48	32	16	480	240
24.	West Bengal	10	112	72	40	1080	600
	Total	105	840	520	320	7800	4800

Note: For selecting the district, it is decided to allocate two districts to each State, one for rural and the other for urban making 48 districts in total. Rest 57 district (out of 105) was distributed based on the weighting diagram of fish-consuming households. While selecting the district, a minimum of 2 and a maximum of 10 was selected for a State. However, West Bengal is the only State which was exceeding the criteria i.e. 16 districts as per the previous distribution. Therefore, surplus 6 districts are redistributed and allocated through mutual discussion with the Ministry officials. Accordingly, 3 districts are added to Tamil Nadu, 2 districts to Andhra Pradesh, and 1 district to Uttar Pradesh.
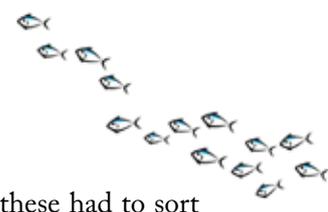
2.2. PRIMARY SURVEY: QUESTIONNAIRE, TRAINING, AND THE LAUNCH OF THE FIELD SURVEY

The primary survey preceded several processes as follows:

- Preparation of questionnaires for households, hotels, restaurants and district officials
- Outlining the FGD structure
- Pre-testing and finalisation of the questionnaires
- Developing the Mobile App to convert the questionnaire into a real-time method of collecting data from the field
- Extensive Training of the Supervisors of the Field Agencies engaged in the survey
- Pilot testing of the Mobile App in the nearby location of Delhi
- Preparation of Instruction Manual
- The formal launch of the Field Survey

2.3. PRIMARY SURVEY: PHASES AND GROUND-LEVEL CHALLENGES

The primary survey at the State level passes through numerous upheavals. First, team mobilisation and adapting the questionnaires into regional languages remained one of the major tasks. A separate training was carried out for the field enumerators for different States, which was time-consuming. Second, soon after it was launched the survey had to be halted in many places amid the outbreak of the third wave of COVID. Moreover, there was an enormous delay in releasing the second installment. Third, despite issuing instructions from the Ministry, District Fishery Officers (DFOs) were initially reluctant in allowing field surveys in their respective areas. West Bengal's example is a case in point. In this State, the survey process was stopped at an earlier stage. Similar was the case of Kerala. There were apprehensions and misinterpretations of the basic objective of the survey due to alleged political meddling. Senior-level NCAER and the Director-level Ministry official had to visit physically in the State and after several rounds of meetings with the senior officials including the Chief Secretary of West Bengal, the field survey was finally allowed. During the course of the field survey, multi-layered problems cropped up, the prominent of them are as follows.

The first of them is that not all people responded to the survey questionnaires. They were not willing to give their details to do the proper listing. Sometimes interviewers had to face technical glitches when the mobile app did not work right. All these had to sort out before the stratum formation and the selection of the required number of households from each stratum. At the ward level, some of the respondents did not allow to be photographed for authentication purposes. In the hotel survey, some hotels did not allow the field interviewer to take the survey even when they displayed the authorisation letter and ID. In the FGD discussion, market officials were not allowed to take interviews inside the market. Interviews were allowed outside or in any room only with a time limit. In some cases, sample places had to be replaced due to a lower number of households or non-accessibility of a location due to flood, insurgency, dense forest, or adverse road conditions. Bifurcations of districts also added to problems. For example, the East Godavari district of Andhra Pradesh has been split into three revenue districts now e.g. Kakinada, Alluri Sitarama Raju, and Vizag. A lot of time was needed to meet all the District Fishery Officers (DFOs) to inform them about the survey and get the required information, as most of the information was not available in any one of the districts. Collecting information from them too was very time-consuming. Due to the non-availability of fish-consuming households, or the issues like migration, sometimes the place code had to be replaced as well. However, this proportion is insignificant.

Moreover, household respondents did not allow the survey to be conducted unless members of the ward secretariat or village panchayat were allowed to accompany the agency-appointed field interviewers. To get this support, NCAER field supervisors had to meet and coordinate with officials of the different departments in advance to request them to support the survey work which took substantial time to converge. Sometimes, despite getting verbal assurance, village volunteers are not available, as they have been assigned other work of their own. These problems impeded the work process with a considerable time lag and had an impact on the financial resources. Added to this time-consuming survey process, incessant rains and flood-like conditions further affected the survey work, especially in the States of Gujarat, Goa, Telangana, Karnataka and Kerala.

2.4. SURVEY MULTIPLIER GENERATION

The multiplier is used to estimate the aggregate proportion for each indicator both in rural as well as in urban areas. The procedure and method of calculating the multiplier are given below:

Rural Sampling Design

Stage	Selection Unit	Sampling Technique Used
1st Stage	District selection	Probability proportional to size with a replacement where size is the estimated number of fish-eating households in the district
2nd Stage	Village selection	Probability proportional to size with a replacement where size is the number of households in the village as per Census 2011
3rd Stage	Household selection	Simple random sampling without replacement

Urban Sampling Design

Stage	Selection Unit	Sampling Technique Used
1st Stage	District selection	Probability proportional to size with a replacement where size is the estimated number of fish-eating households in the district
2nd Stage	Ward selection	Probability proportional to size with a replacement where size is the number of households in the village as per Census 2011
3rd Stage	Household selection	Simple random sampling without replacement

It may be mentioned that before selection of households from any sample village/ward, all the households listed were arranged into four strata based on their fish-eating habit (viz. High consuming regular fish-eating households, Medium consuming regular fish-eating households, Low consuming regular fish-eating households and Occasional fish-eating households) and a sample of households was selected separately from each of the four strata.

At the time of data collection, for operational convenience, entire ward/village could not be considered for listing of households. The fieldwork/listing exercise was carried out to only a maximum of around 150 households. Due adjustment was made for arriving at ward/village level estimate utilizing the information on approximate number of households in the entire ward/village, as ascertained from the knowledgeable persons.

The State-level estimates of aggregates have been derived using the following formula:

Finally,

$$\hat{Y} = \sum_s \hat{Y}_s \quad where \ \hat{Y}_s = \frac{Z_s}{d_s} \sum_{i=1}^{d_s} \frac{y_{si}}{z_{si}}$$

and

$$y_{si} = \frac{V_{si}}{n_{si}} \sum_{j=1}^{n_{si}} \frac{y_{sij}}{v_{sij}} \quad where \ y_{sij} = D_{sij} \sum_{k=1}^{4} \frac{H_{sijk}}{h_{sijk}} \sum_{l=1}^{h_{sijk}} y_{sijkl}$$

Thus, household level multiplier is given by

$$\hat{Y}_s = \frac{Z_s}{d_s} \sum_{i=1}^{d_s} \frac{V_{si}}{z_{si} \, n_{si}} \sum_{j=1}^{n_{si}} \frac{D_{sij}}{v_{sij}} \sum_{k=1}^{4} \frac{H_{sijk}}{h_{sijk}} \sum_{l=1}^{h_{sijk}} y_{sijkl}$$

where

$$\frac{Z_s}{d_s} \ \frac{V_{si}}{Z_{si} n_{si}} \ \frac{D_{sij}}{v_{sij}} \ \frac{H_{sijk}}{h_{sijk}}$$

s: First stage stratum (i.e. group of districts within a State)

d: Number of sample districts

i: i[th] sample district

z_{si}: Estimated number of fish-eating households as per NSSO's 68th round (consumer expenditure survey) in the ith sample district of sth stratum

Z_s: Estimated total number of fish-eating households as per NSSO's 68th round (Consumer Expenditure survey) in the sth stratum

j: j[th] sample village

n_{si}: Number of sample villages in the ith district of sth stratum

v: Number of households in the village/ward as per Census 2011

V: Total number of households in the district as per Census 2011

k: Third stage stratum number of households

D: Total number of segments formed in the given village/ward

h: Number of households surveyed

H: Total number of households listed

l: Suffix for sample household
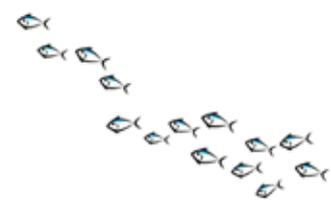
Profile of Household

3.1. FISH-EATING HOUSEHOLDS OF INDIA: DEMOGRAPHIC CHARACTERISTICS AND DEMAND

The present section describes observations from the primary survey of the fish-eating households, which includes demographic characteristics, expenditure, consumption patterns, and preference for fish and other animal products. It also quantifies the level of awareness of the benefits of eating fish and aspects like changes in consumption over the last five years and consumption likeness for attractive fish products, i.e. packaged fish, nuggets, fish fingers, fish tikka, Amritsari fish fry masala, etc.

3.1.1. Demographics and Social Profile

The distribution of educational achievement among the fish-eating households shows the highest percentage representation of those with a primary level of education and no formal education but are able to read and write (27%), followed by middle level (up to class VIII) of education (24%) Figure 3.1.

Figure 3.1: Distribution of HH (%) by Highest Level of Formal Education Achieved
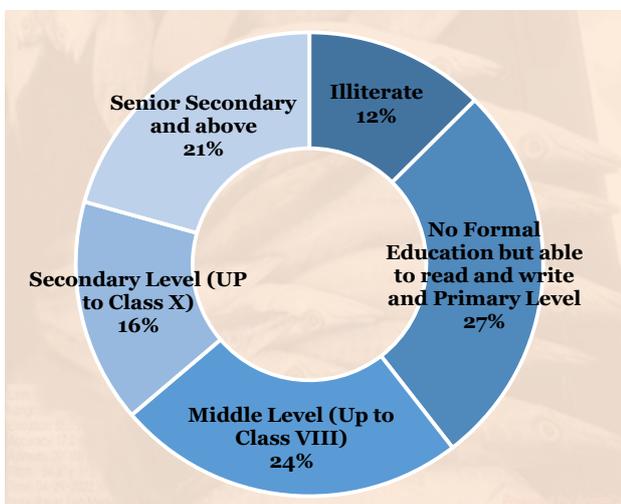
Source: NCAER computation from primary field survey.

The distribution of social groups among the fish-eating households reveals that 40 per cent of households belong to Other Backward Classes (OBCs), 25 per cent of the households belong to the general category, 27 per cent of belong to Scheduled Caste (SC) households and the remaining 8 per cent belong to Scheduled Tribe (ST) households (Figure 3.2).

Figure 3.2: Distribution of HH (%) by Social Groups
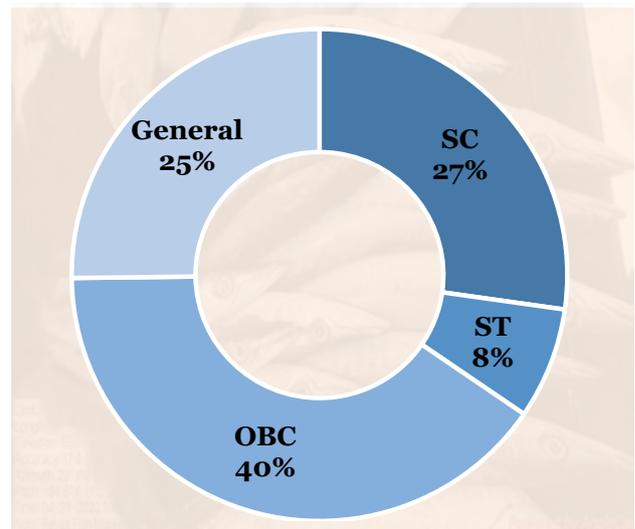
Source: NCAER computation from primary field survey.

The distribution of households in terms of religion shows that 84 per cent of the fish-eating households belong to the Hindu religion (Figure 3.3). The Muslims comprise 13 per cent, followed by Christian (2.73%).

The composition of households by type of ration card show that 62.4 per cent of the households have BPL card, 28.3 per cent of the households have an Above the Poverty Line (APL) card, 2.7 per cent of the households have Antyodaya Anna Yojana (AAY) card, and only 0.73 per cent of the households have Annapurna card.
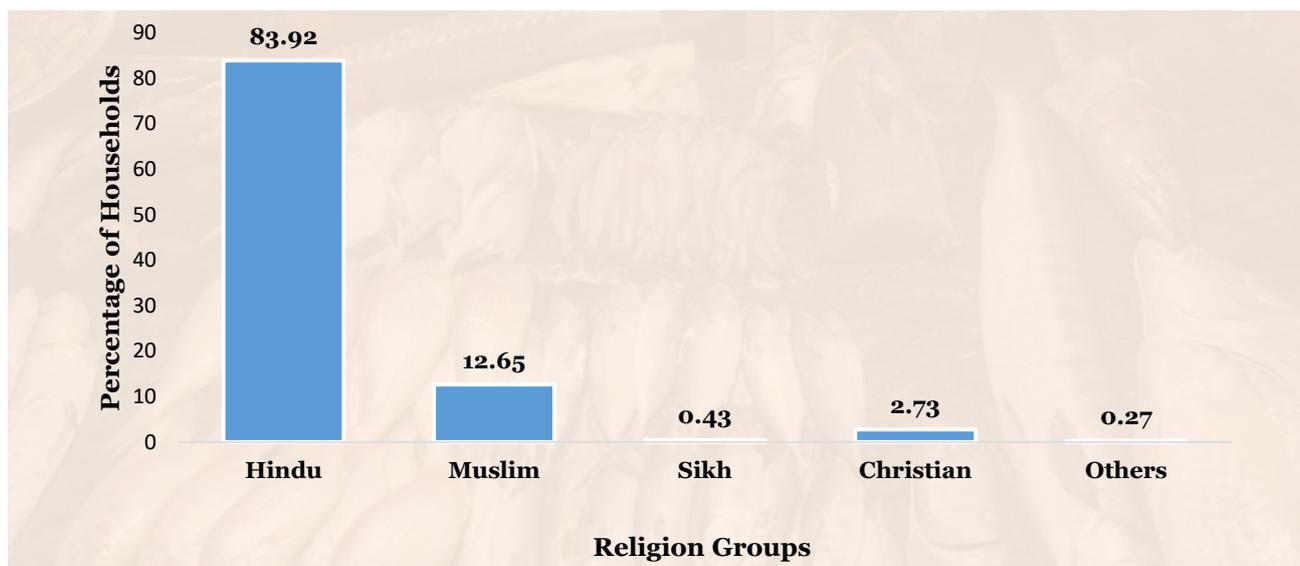
Source: NCAER computation from primary field survey.

Table 3.1: Distribution of HH (%) by Main Occupation of the Household and States

Occupations	Percentage of household
Cultivator	18.26
Agricultural Labourer	12.94
Non-Agricultural Labourer	38.18
Salaried	10.15
Other professionals (Doctor/Lawyer/CA/Teacher, etc.)	0.98
Skilled Worker (Carpenter/electrician/Plumber, etc.	2.2
Business	13.66
Others	3.63

Source: NCAER computation from primary field survey

The composition of occupational categories of households is an important determinant of household economic status. Around 38.2 per cent of the households belongs to non-agricultural laborer category, 18 per cent belongs to cultivators, 14 per cent of the households are doing business and 13 per cent are from agricultural labourer households (Table 3.1).

3.2. HOUSEHOLD EXPENDITURE PATTERN

Expenditure pattern is a proxy of the economic status of a household, which has implications for different other indicators related to standard of living. Among the fish-eating households, 43 per cent of the total expenditure is made on the consumption of food items, which is higher in rural (45%) as compared to urban areas (39%). Among States, Tripura (59%) has the highest proportion of food expenditure in total expenditure, followed by Chhattisgarh (59%) (Annex A.1) Figure 3.4.

Figure 3.4: Share (%) of Food Expenditure in Total Expenditure (Food and Non-food Expenditure)
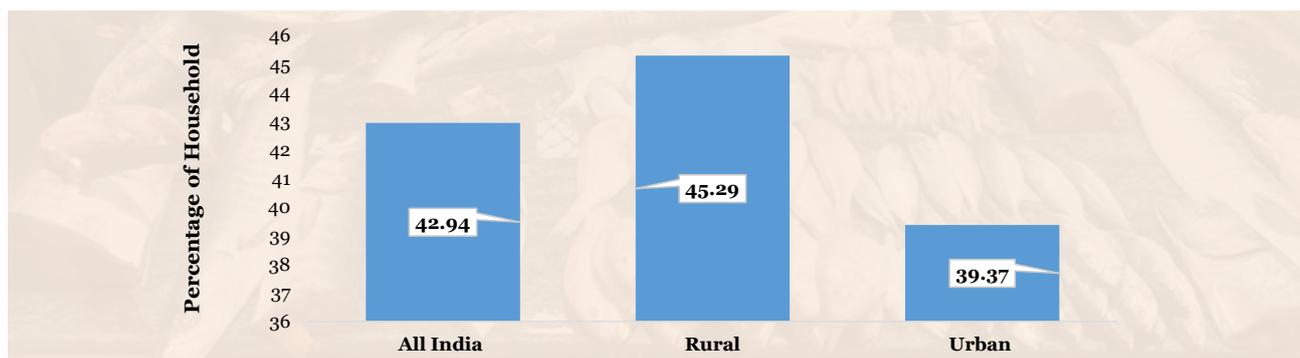
Source: NCAER computation from primary field survey.
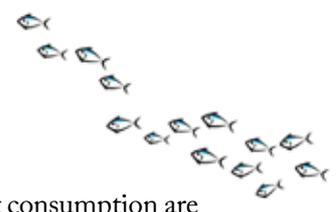
The decomposition of expenditure share on fish, meat/chicken, egg, milk and milk products in total food expenditure show that around 17 per cent of the total food expenditure is made on the consumption of fish (Figure 3.5). Fish and other meat consumption are higher in urban areas as compared to rural. However, egg and milk consumption are revealed to be higher in rural areas as compared to the urban ones.

Figure 3.5: Share (%) of HH Expenditure on Fish, Meat/Chicken, Egg, Milk and Milk Products in Total Food Expenditure
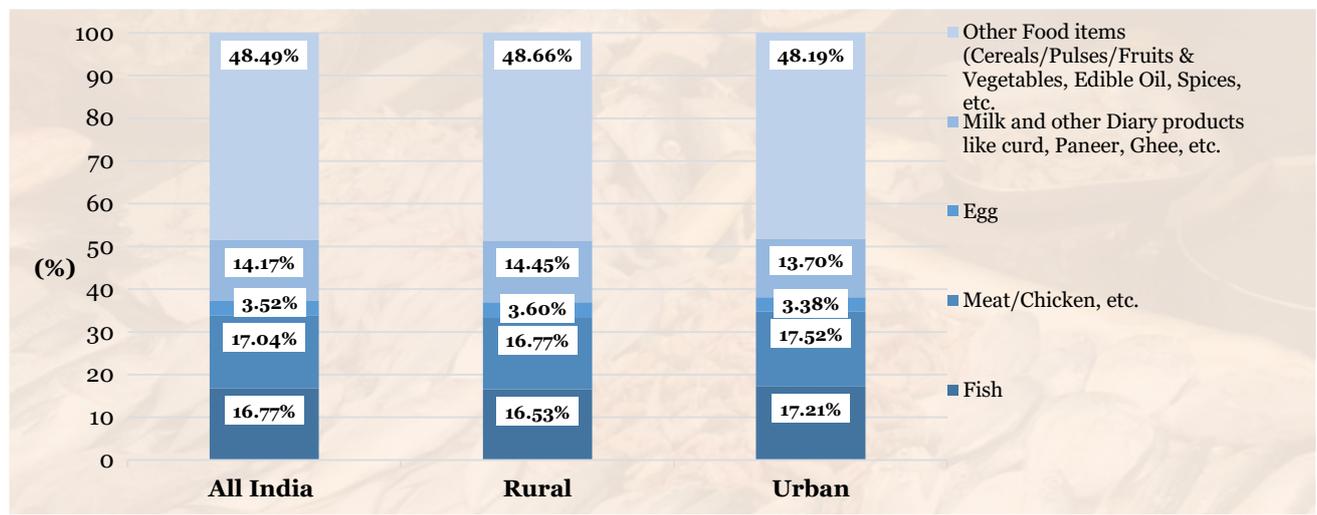
Source: NCAER computation from primary field survey.

In this respect, the share of each of the items in total animal product expenditure is important and noteworthy. The share of household expenditure in total animal products expenditure is higher in other meat/chicken (Figure 3.6). However, the share of expenditure of both fish and meat/chicken is slightly higher in urban area as compared to rural. Among animal product expenditure on milk and other dairy products expenditure in rural area is higher than that in the urban areas.

Figure 3.6: Share (%) of HH Expenditure on Fish, Meat/Chicken, Egg, Milk, and Milk Products in total Animal Products Expenditure
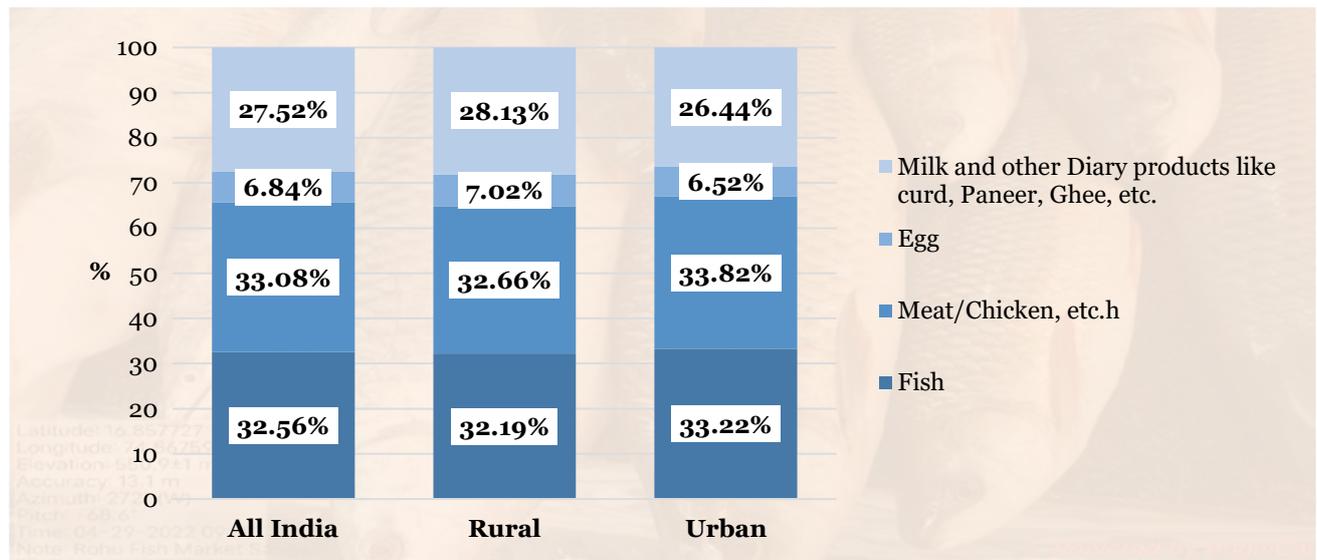
Source: NCAER computation from primary field survey.

3.3. SOURCE OF PURCHASE OF HOUSEHOLD FISH CONSUMPTION

This section highlights different sources of purchase of household consumption of fish by different categories of fish. Different fish categories are further subdivided into different fish types according to the present form of the fish.

Table 3.2: Percentage Share by Type of Fish Consumed by Households

Type	(%) Share
Freshwater Fish	h
Marine Fish	16.0
Prawn	2.0
Others (like Crab, Lobster, Squid, Mussel, etc.)	4.3
Processed/Preserved Fish	0.3

Source: NCAER computation from primary field survey.

According to the preference pattern for different fish categories, the highest preference is for freshwater fish (77.4%), followed by marine fish (16%) (Table 3.2). As, in most places of India, fresh fish is available, people's preference for processed/preserved fish is only 0.3 per cent.

In Table 3.3, different sources of purchasing freshwater fish for consumption is analysed. Freshwater fish is subdivided into fresh, frozen and others. For all fish types, local market is the most preferred option for buying freshwater fish followed by mandi and local vendor.

Table 3.3: Purchase of Freshwater Fish (HH %)

Sources	Fresh	Frozen	Others
Local Market	75.13	81.11	72.8
Mandi	2.96	3.45	7.19
Haat	0.99	2.01	2.91
Local Vendor	18.54	12.89	5.34
Online	0.02	0.02	0.01
Fish Booth	2.36	0.52	11.75

Source: NCAER computation from primary field survey.

Marine fish are categorised as fresh, frozen, dry, canned and others. As in Table 3.4, marine fish are also mostly purchased from local market. The household purchasing fresh marine fish from local market is 75.80 per cent followed by local vendor 18.11 per cent. Frozen marine fish also follows the same purchasing pattern. However, for dry, canned and other form of marine fish, local market and local vendor are more or less equally preferred by the households.

Table 3.4: Purchase of Marine fish (HH %)

Sources	Fresh	Frozen	Dry	Canned	Others
Local Market	75.80	74.95	51.26	30.74	48.51
Mandi	2.71	2.23	5.77	49.71	13.96
Haat	2.33	2.56	8.04	3.50	11.10
Local Vendor	18.11	13.11	31.90	15.68	23.85
Online	0.12	0.01	0.00	0.36	2.56
Fish Booth	0.93	7.14	3.02	0.00	0.02

Source: NCAER computation from primary field survey.

The sources of the purchase of prawn is shown in the Table 3.5. Local market is the most popular source of purchase for fresh (87.2%), frozen (85.4%), dry (63.7%) and other (89%) types of prawn. The local vendor is the next important source of purchase. However, for dry prawn purchase, households consider regular local market followed by haat.

Table 3.5: Purchase of Prawn (HH %)

Sources	Fresh	Frozen	Dry	Others
Local Market	87.21	85.38	63.73	89.01
Mandi	1.55	2.41	1.73	1.43
Haat	1.53	2.33	15.26	0.33
Local Vendor	8.48	8.27	19.02	9.24
Online	0.07	0.44	0.02	0.00
Fish Booth	1.17	1.17	0.24	0.00

Source: NCAER computation from primary field survey.

Table 3.6 highlights the sources of purchase of processed/preserved fish. Frozen (94.15%) and dry fish (93.02%) are highly purchased from local market. In processed/ preserved fish, canned and other categories are preferred from mandi, local vendor and haat, besides the local market.

Table 3.6: Purchase of Processed/Preserved Fish (HH %)

Sources	Frozen	Dry	Canned	Others
Local Market	94.15	93.02	36.11	34.52
Mandi	1.30	2.52	8.97	24.96
Haat	1.70	2.31	23.80	36.15
Local Vendor	1.84	2.11	30.05	4.05
Online	0.00	0.04	0.57	0.33
Fish Booth	1.02	0.00	0.51	0.00

Source: NCAER computation from primary field survey

3.4. PREFERENCE FOR FISH AND ANIMAL PRODUCTS

This section highlights the preference pattern of fish-eating household for fish and other animal products.
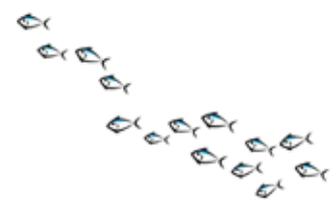
Figure 3.7: Preference for Animal Products (HH %)
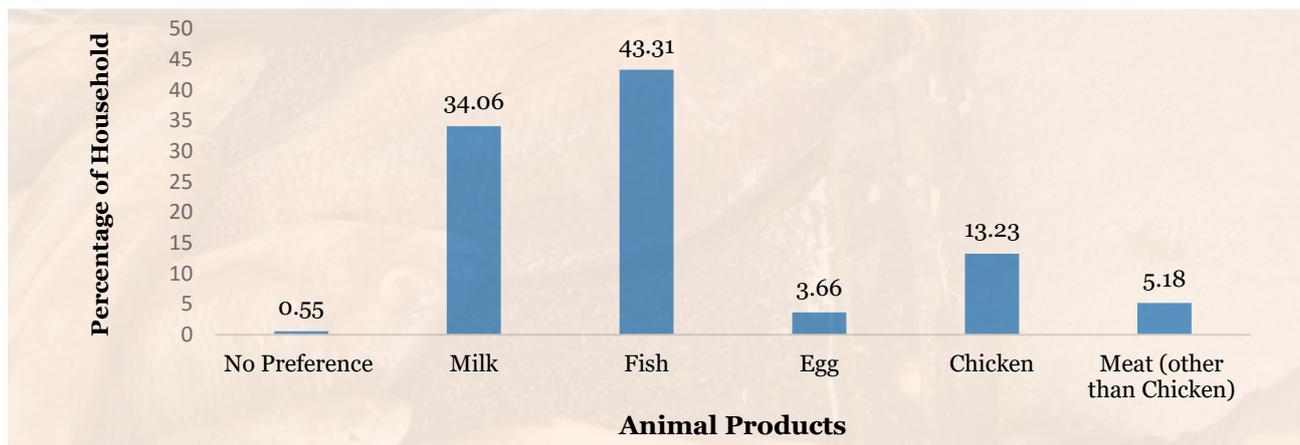
Source: NCAER computation from primary field survey.

The percentage of households having the highest preference for fish among the other animal products is 43 per cent, followed by milk (34%) (Figure 3.7).

However, among States, fish is the most preferred animal product in West Bengal (76%), followed by Tripura (73%) and Puducherry (68%) (Annex A. 6).

Figure 3.8: Preference for Freshness of Fish (HH %)
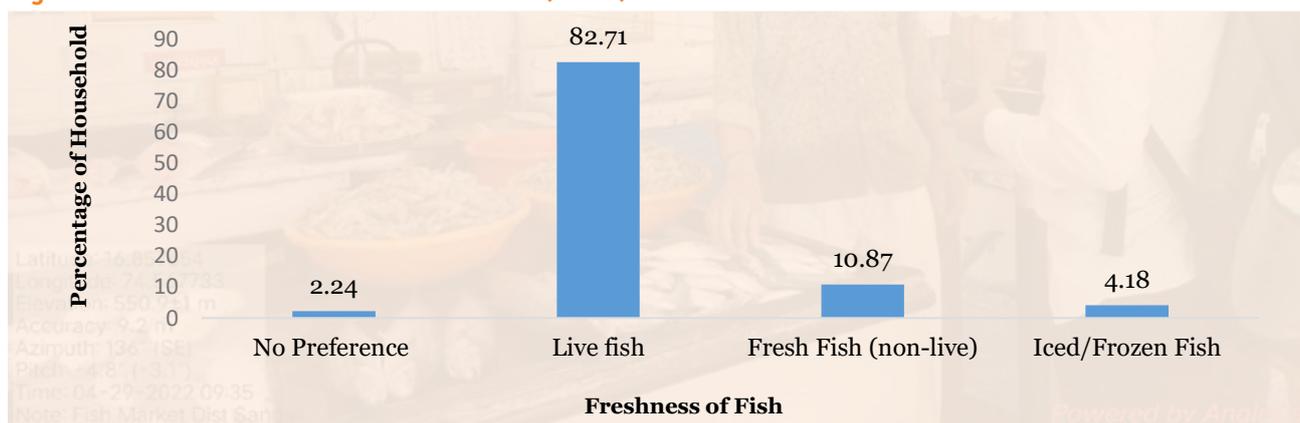
Source: NCAER computation from primary field survey.

The preference for freshness of fish is highest for live fish (83%), followed by fresh fish but not live (11%) (Figure 3.8).

Figure 3.9: Preference for Processed Fish (HH %)
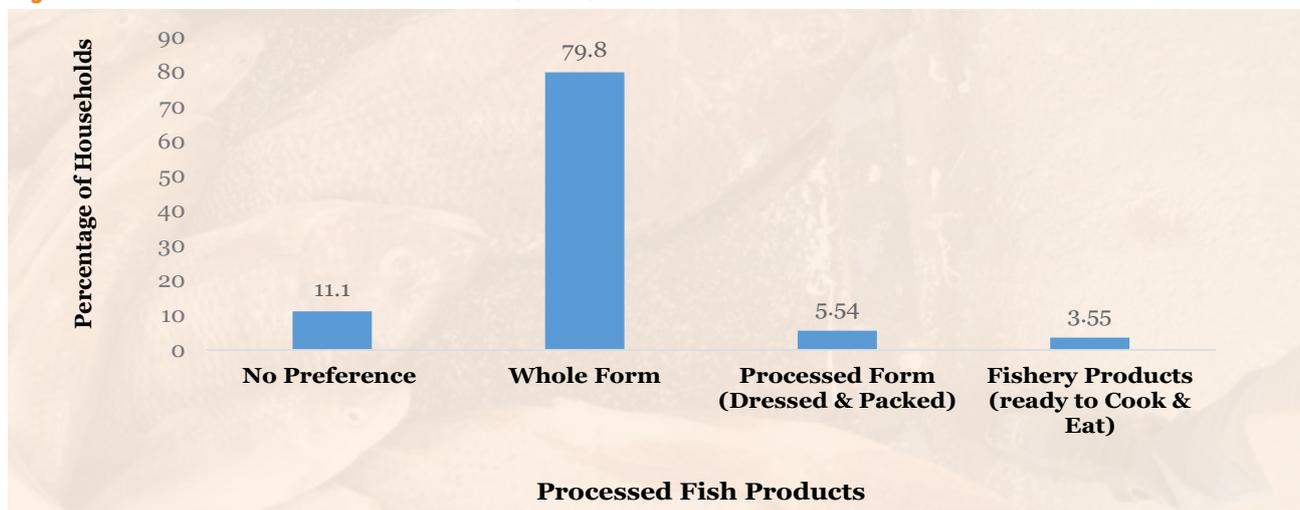
Source: NCAER computation from primary field survey.

The household distribution of freshness of fish (Figure 3.9) shows that preference for processed fish is low. However, among the processed fish, 80 per cent of the households preferred it in the whole form, only 6 per cent of the households preferred the packed form, followed by 4 per cent for ready-to cook and eat.
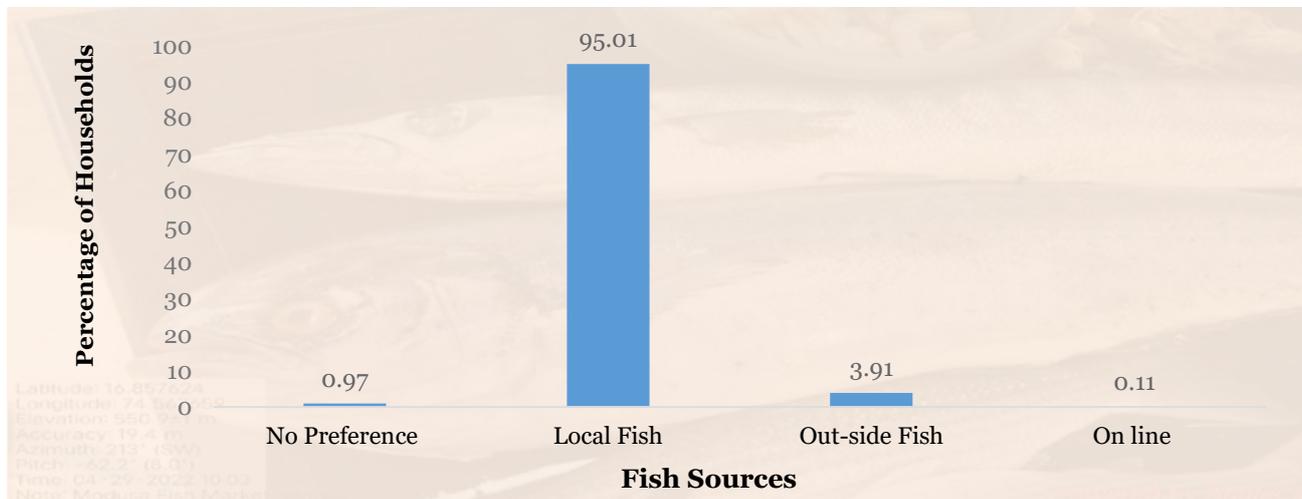
Source: NCAER computation from primary field survey.

Among, the fish sources, most households in India preferred to have fish from local sources. The primary survey by NCAER revealed that in many parts of the country, 95 per cent of the fish-eating households prefer to have fish from local sources (Figure 3.10). This has the resemblance with the forgoing analysis in Section 3.3, where consumption pattern of the fish has been tabulated for different types of fish. As in Figure 3.10 households' highest preference is for local fish, it is noted in Section 3.3 that different types of fish are mostly purchased from local markets.

Among the fish species, Rohu and Catla are two most preferred freshwater fish in India. Among marine fish, Sardine and Bhetki are the most preferred fish in India. The State-wise five most preferred fish names are given in Table 3.7.

Table 3.7: Names of Five Most Preferred Fish

Freshwater Fish	Marine	Processed
Rohu	Sardine	Tuna
Catla	Bhetki	Rohu
Basa	Hilsa	Kingfish
Mangur	Pomfret	Catla
Tilapia	Mackerel	Mackerel

Source: NCAER computation from primary field survey.

Figure 3.11: Season-wise (%) Share in Total Fish Consumption in a Year on an Average
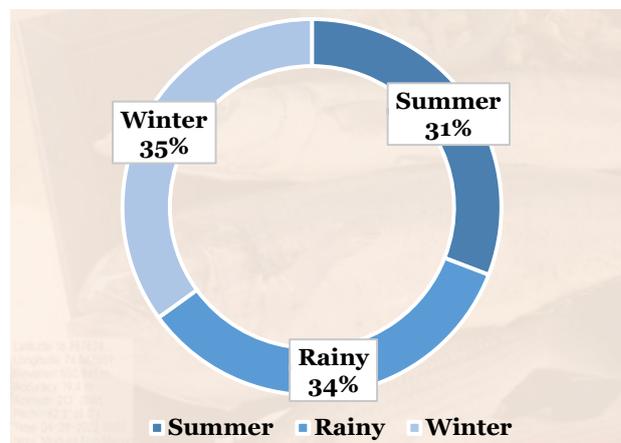
Source: NCAER computation from primary field survey.

The consumption of fish among households was found to be the highest in the winter season (35%), followed by the rainy season (34%) and summer (31%) (Figure 3.11). There is not much difference between winter and rainy seasons.

3.5. FACTORS DETERMINING THE PURCHASE OF FISH

Although food habits and cultural factors mostly determine the consumption of fish in India, there are other factors, which cause people's preference for the purchase of fish.
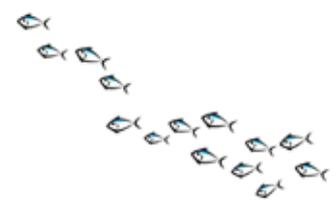
Figure 3.12: Importance of Physical factors while Buying Fish
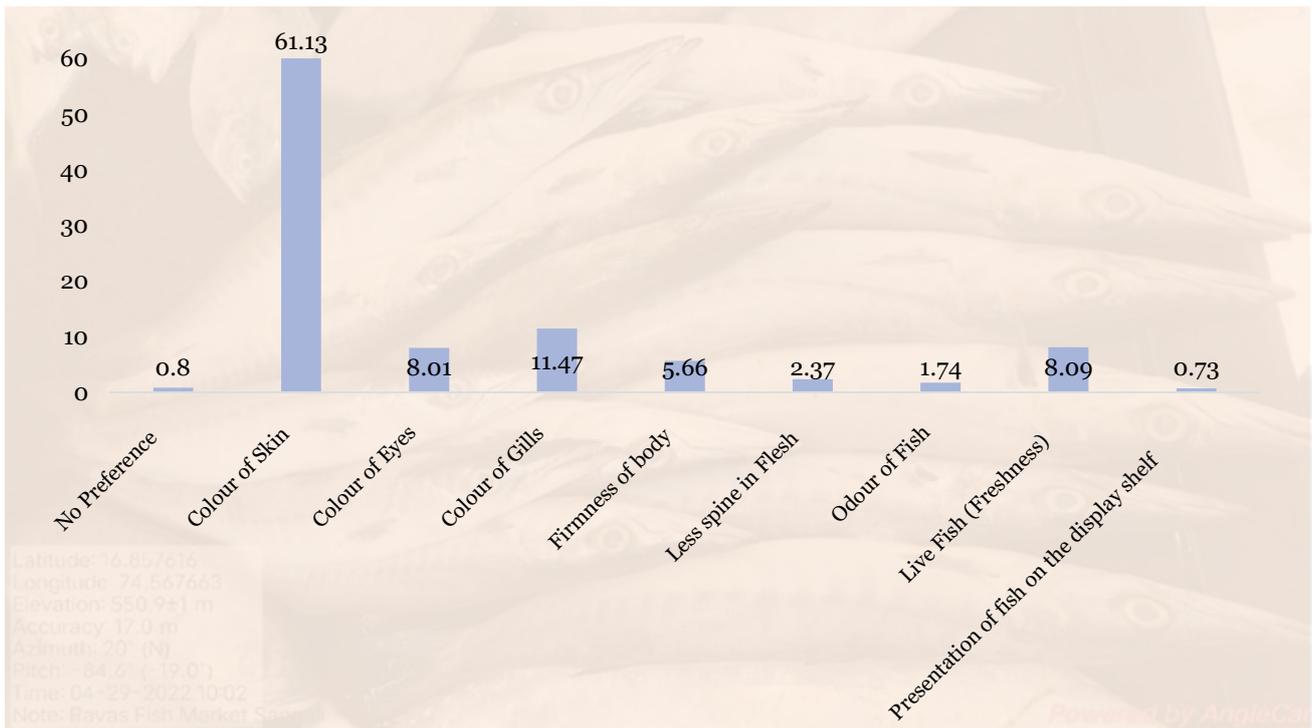
Source: NCAER computation from primary field survey.

While considering the important physical factors considered in buying fish, the highest proportion of households (61%) considers the colour of skin, followed by the colour of gills (11%) in India (Figure 3.12).

Figure 3.13: Factors Restricts in Buying Fish
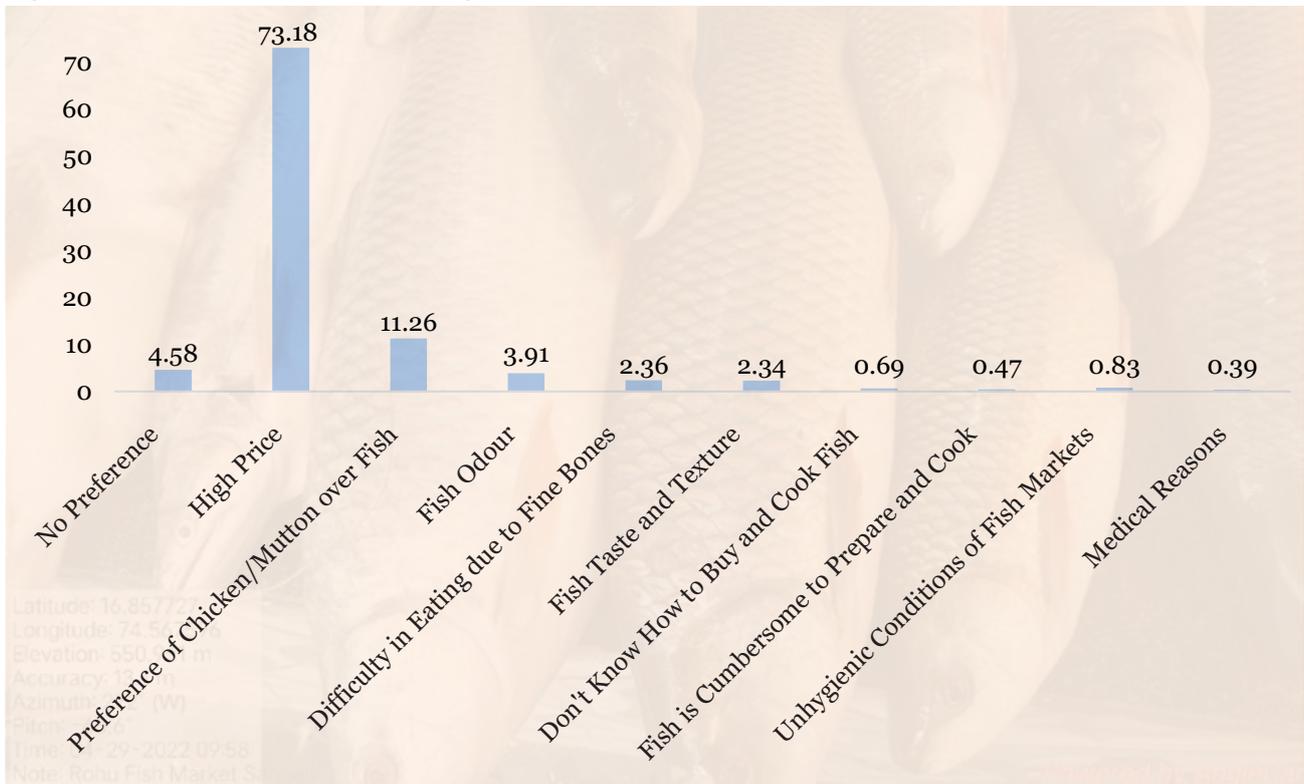
Source: NCAER computation from primary field survey.

The most important factor that restricts a customer from buying fish is singled out to be price (73.2%). Preference for chicken/mutton over fish comes next (11.3%) (Figure 3.13).

Figure 3.14: Factors that Helps in Buying Fish

Factor	Value
No Preference	5.17
More variety of Fish sold by the Local Retailer	56.4
More variety of Fish sold by the online Retailer	2.71
Doorstep Delivery	12.71
More Frozen Products	1.29
Lower Price Range	19.8
Good Hygienic Condition of Retail Markets	1.92
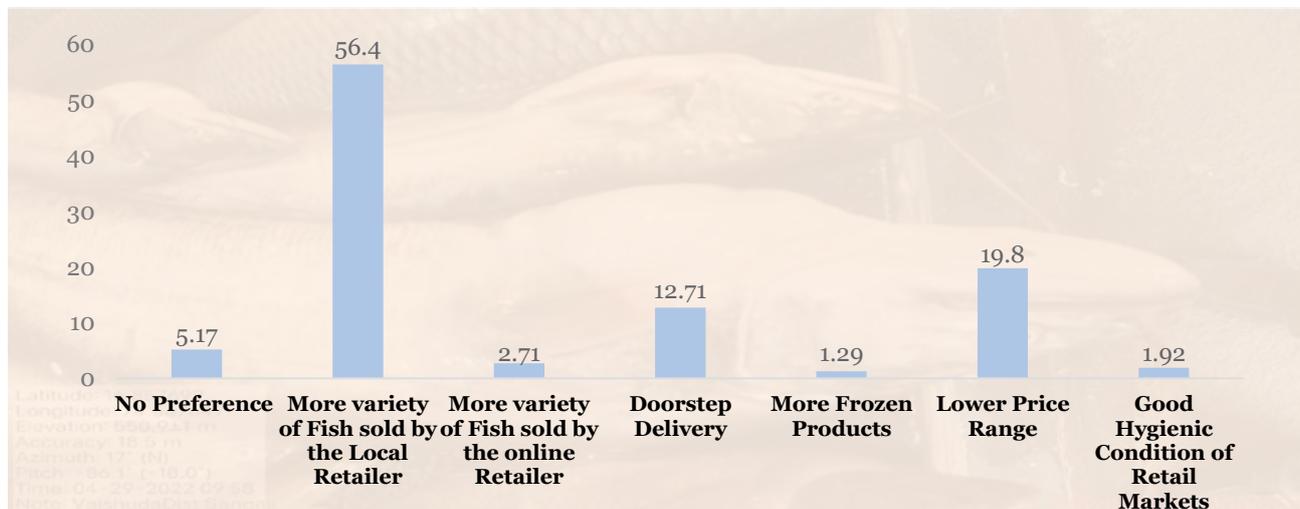
Source: NCAER computation from primary field survey.

Factors that help in buying fish is reported to be the availability of more varieties in the market (56.4%), Lower price range (20%) and doorstep delivery (13%) come next subsequently (Figure 3.14).

Figure 3.15: Preference for Online Retailers

Online, 15.92

Market Based, 84.08
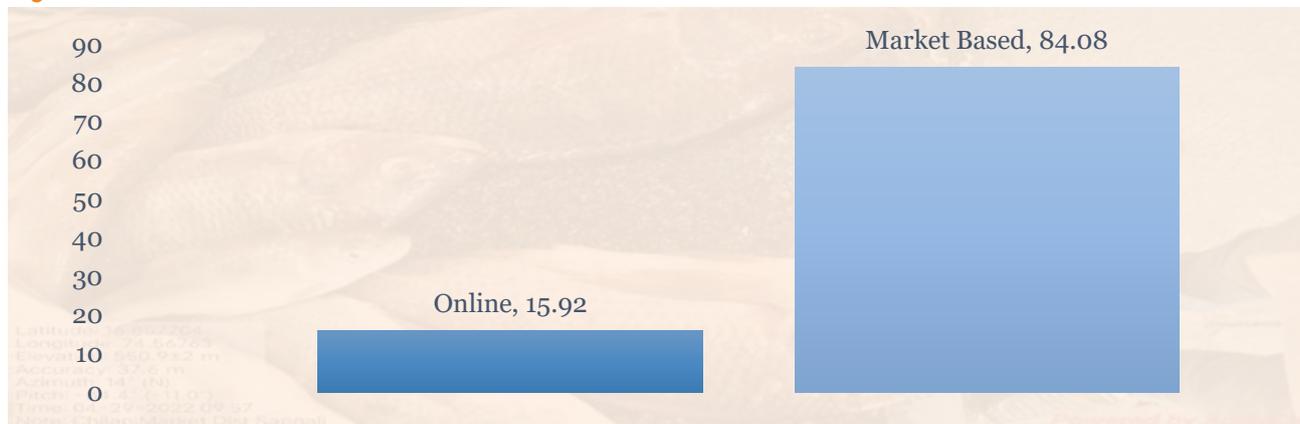
Source: NCAER computation from primary field survey.

The fourth determinant of the purchase of fish is the preference for online retailer to buy fish (Figure 3.15). Online retailers are not popularised in India except some metropolitan cities. Only 16 per cent of the households prefer to buy fish online.
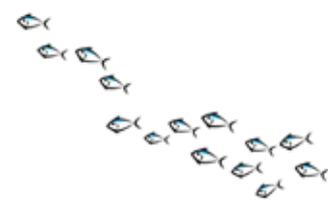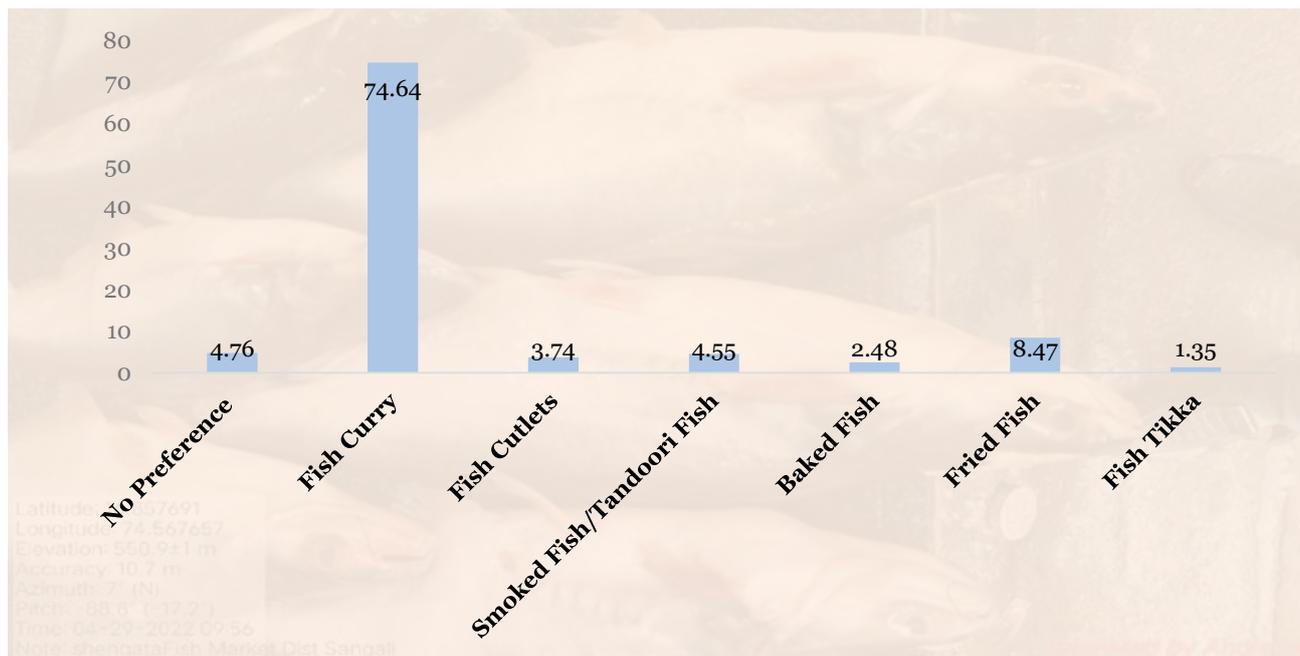
Source: NCAER computation from primary field survey.

The fifth determinant of consumer preference (Figure 3.16) is fish products/preparation and dishes. Fish curry is most preferred fish dish in India (75%), followed by fried fish (8%) (Figure 3.16).

3.6. FISH CONSUMPTION: FREQUENCY, QUANTITY, AND TYPES

Most households in India consume fish on a frequency of 1 to 5 days in a month (58%), followed by 6 to 10 days in a month (17%). In urban areas, households' preference for fish consumption is higher for the range of 26 to 30 days in a month (it is also higher in 11-15, 16-20- and 21-25-days range) (Table 3.8).

Table 3.8: Distribution of HH by Frequency of Fish Consumption in a Month Usually (30 Days) and State (HH %)

Percentage of Households			
Days	Rural	Urban	Total
No Response	0.75	0.53	0.67
1—5	60.33	52.5	57.53
6—10	17.9	16.4	17.36
11—15	11.34	14.7	12.54
16—20	7.63	9.21	8.19
21—25	1.75	2.93	2.17
26—30	0.3	3.73	1.53

Source: NCAER computation from primary field survey.

3.6.1. Quantity of Fish, Meat, Egg, Milk, and Dairy Products Consumed

Average household consumption of freshwater fish in India is 3.42 kg in a month. Average household monthly consumption of marine fish is 1.28 kg. The average number of eggs consumed in a household is 41 in a month. Milk consumption in a household is 37 litres (Table 3.9).

Table 3.9: Per HH Average Quantity of Fish, Meat, Egg, Milk and Dairy Products Consumed During the 30 Days Preceding the Date of The Interview

Items	Quantity
Freshwater Fish (kg)	3.42
Marine Fish (kg)	1.28
Prawn (kg)	0.21
Other (like Crab, Lobster, Squid, Mussel, etc.) (kg)	–
Processed/Preserved (kg)	0.07
Egg (number)	40.95
Goat Meat/Mutton (kg)	0.71
Beef/Buffalo Meat (kg)	0.35
Pork (kg)	0.11
Chicken (kg)	2.30
Other Animal meat (kg)	0.03
Milk: Liquid (litre)	36.82
Curd/Paneer/Ghee/Butter (kg)	–
Other milk products (sweets, etc.) (kg)	–

Source: NCAER computation from primary field survey.

The State-level average household consumption of different types of fish is given in Table 3.10. Average household consumption fish is highest in Kerala (13.37 kg/month), followed by West Bengal (7.17 kg/month) and Assam (6.11 kg/month). In Kerala, most household consume marine fish (10.48 kg /month). However, in West Bengal most of the households consume freshwater fish 5.21 kg/month and in Assam it is 4.32 kg per month.

Table 3.10: Per HH Average Quantity of Fish Consumed During the 30 Days Preceding the Date of the Interview

States	Freshwater Fish (kg)	Marine Fish (kg)	Prawn (kg)	Processed/ Preserved (kg)	Total
Andhra Pradesh	2.53	0.28	0.06	0.05	2.93
Assam	4.32	1.55	0.14	0.10	6.11
Bihar	3.49	0.01	0.13	0.01	3.65
Chhattisgarh	1.57	0.53	0.08	0.00	2.18
Delhi	3.80	0.00	0.00	0.00	3.80
Goa	0.70	4.81	0.19	0.08	5.78
Gujarat	1.05	0.58	0.00	0.59	2.23
Haryana	2.45	1.27	0.01	0.01	3.73
Himachal Pradesh	2.47	0.08	0.03	0.03	2.61
Jammu & Kashmir	3.12	0.55	0.52	0.56	4.74
Jharkhand	3.49	0.00	0.00	0.01	3.50
Karnataka	2.22	1.96	0.00	0.00	4.18
Kerala	1.63	10.48	0.71	0.56	13.37
Madhya Pradesh	3.30	0.00	0.00	0.00	3.30
Maharashtra	2.08	0.71	0.02	0.03	2.83
Odisha	4.93	0.35	0.15	0.04	5.47
Puducherry	1.50	2.60	0.79	0.28	5.17
Punjab	2.46	0.77	0.15	0.12	3.50
Rajasthan	3.59	0.09	0.02	0.02	3.72
Tamil Nadu	3.39	1.50	0.12	0.09	5.11
Telangana	2.02	0.00	0.00	0.00	2.02
Tripura	3.16	2.19	0.32	0.00	5.67
Uttar Pradesh	2.92	0.00	0.00	0.03	2.95
West Bengal	5.21	1.30	0.63	0.03	7.17
Total	3.42	1.29	0.21	0.07	4.99

Source: NCAER computation from primary field survey.

The Map 3.1 below provides a pictorial overview of States in India that are distinctly divided in terms of consumption based on household's response of fish consumption in 30 days reference period prior to interview.
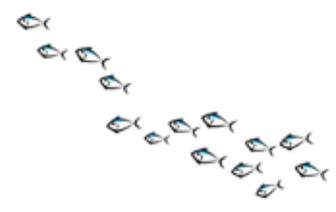
Map 3.1: Fish Consumption Behaviour of the States in India

State-wise Per HH average quantity of fish consumed (in kg) during the 30 days preceding the date of the interview in India (based on the NCAER Household Sample Survey 2022)

High Fish Eating States
Medium Fish Eating States
Low Fish Eating States

Jammu & Kashmir (4.74)
Himachal Pradesh (2.61)
Punjab (3.5)
Rajasthan (3.72)
Uttar Pradesh (2.95)
Gujarat (2.23)
Madhya Pradesh (3.3)
Maharashtra (2.83)
Goa (5.78)
Karnataka (4.18)
Kerala (13.37)

Jharkhand (3.5)
Bihar (3.65)
Haryana (3.73)
Delhi (3.8)
Assam (6.11)
Tripura (5.67)
Chhattisgarh (2.18)
West Bengal (7.17)
Telangana (2.02)
Andhra Pradesh (2.93)
Odisha (5.47)
Puducherry (5.17)
Tamil Nadu (5.11)

Figures in the parenthes are as per HH counsumption of fish during last 30 days.

States excluded in the sample: *Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim & Uttarakhand.*
Union Territories excluded in the sample: *Andaman & Nicobar Islands, Chandigarh, Dadra and Nagar Haveli, Daman & Diu, Ladakh & Lakshadweep.*

3.7. AWARENESS OF BENEFITS OF EATING FISH AND FISH BY-PRODUCTS

This section highlights the awareness of fish-eating households about the benefits of eating fish and fish by-products.

Figure 3.17: Distribution of HHs (%) by Awareness on Nutritional Value of Fish
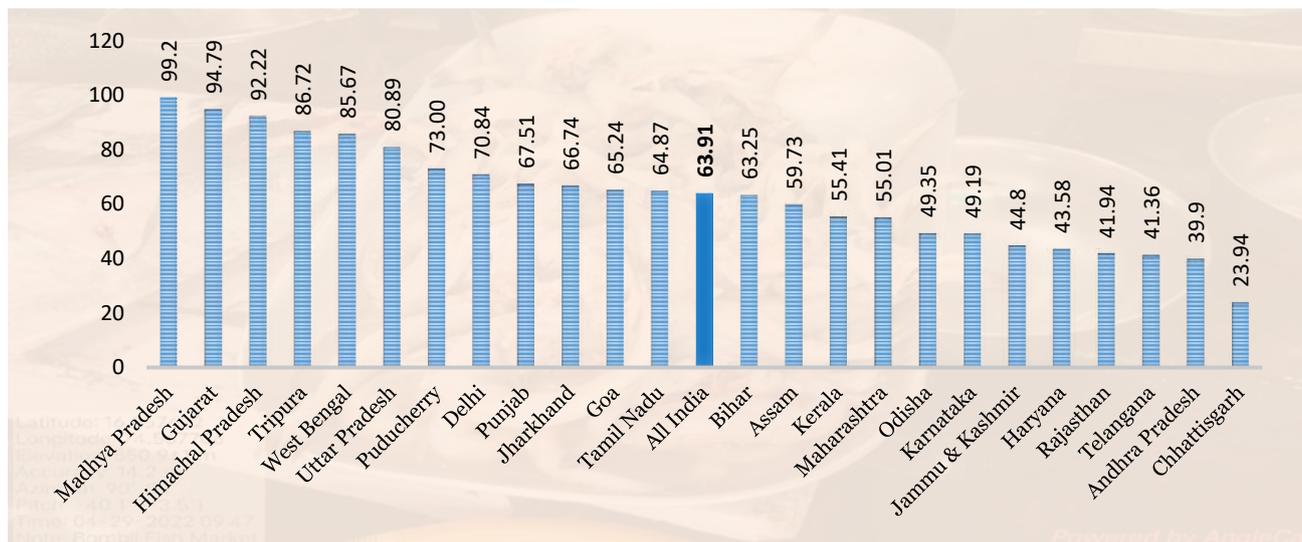
Source: NCAER computation from primary field survey.

According to the Figure 3.17, most people in India are aware of the benefits of eating fish (64%). Highest awareness (Figure 3.17) was observed in Madhya Pradesh (99%) and lowest in Chhattisgarh (24%).

Figure 3.18: Distribution of HH (%) by types of Awareness on Nutritional Value of Fish
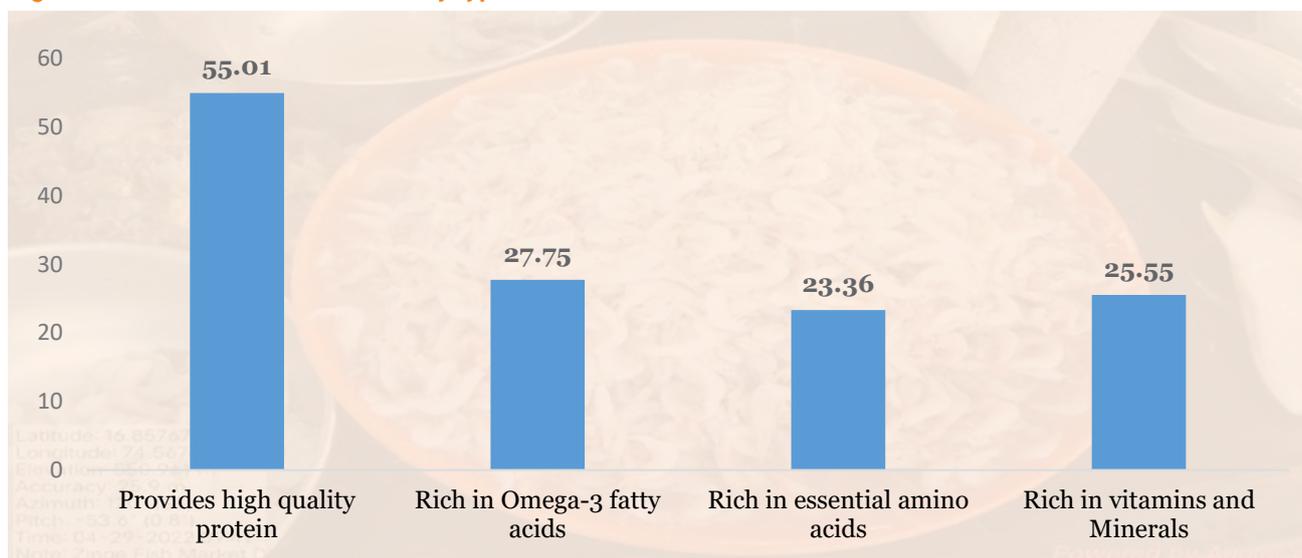
Source: NCAER computation from primary field survey.

In terms of types of awareness (Figure 3.18), most households are (55%) are aware that it provides high-quality protein, followed by the awareness among 28 per cent of the household that fish is rich in omega-3 fatty acids, while 25 per cent of the households are aware of the richness in vitamins and minerals.
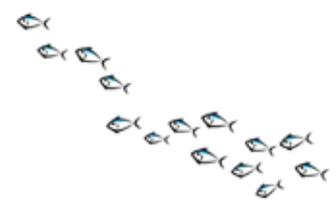
Figure 3.19: Household Awareness of Consumption/Use of Fish by-products (HH %)

Bar chart values:
Gujarat 95.15, Haryana 78.02, Rajasthan 65.74, Himachal Pradesh 64.63, Madhya Pradesh 61.88, Punjab 57.52, Uttar Pradesh 45.52, Maharashtra 29.77, Goa 27.24, Assam 22.58, Tamil Nadu 21.92, All India 20.42, West Bengal 18.61, Jammu & Kashmir 17.68, Jharkhand 15.42, Bihar 14.63, Tripura 14.28, Odisha 11.95, Andhra Pradesh 8.24, Kerala 5.31, Delhi 3.79, Puducherry 3.25, Karnataka 3.08, Telangana 0.05, 0
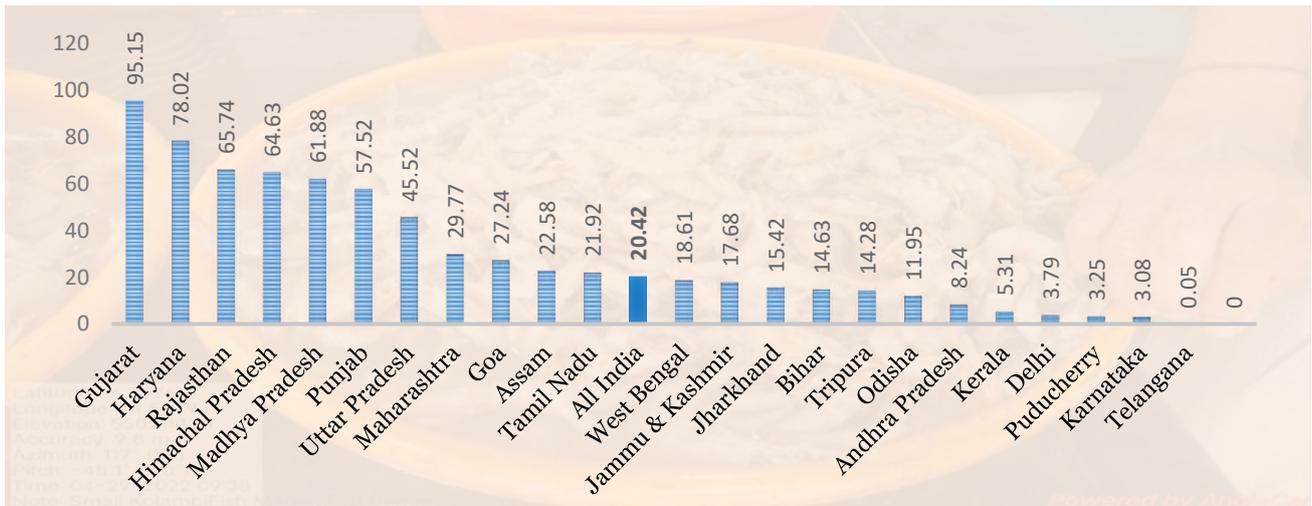
Source: NCAER computation from primary field survey.

As shown in Figure 3.19, awareness of fish by-products is very less in India (20%). Highest awareness about the fish by-products was observed in Gujarat (95%), followed by Haryana (78.02%) and Rajasthan (66%).

Figure 3.20: Households Awareness of Consumption/Use of types of Fish by-products

Bar chart — Percentage of Households vs Types of Fish by-products:
Liver Oil 12.62, Fish body oil 11.48, Fish protein powder 9.7, Nutraceuticals from fish 6.46, Agar-Agar 3.85, Products from seaweed 3.02, Others 0.45
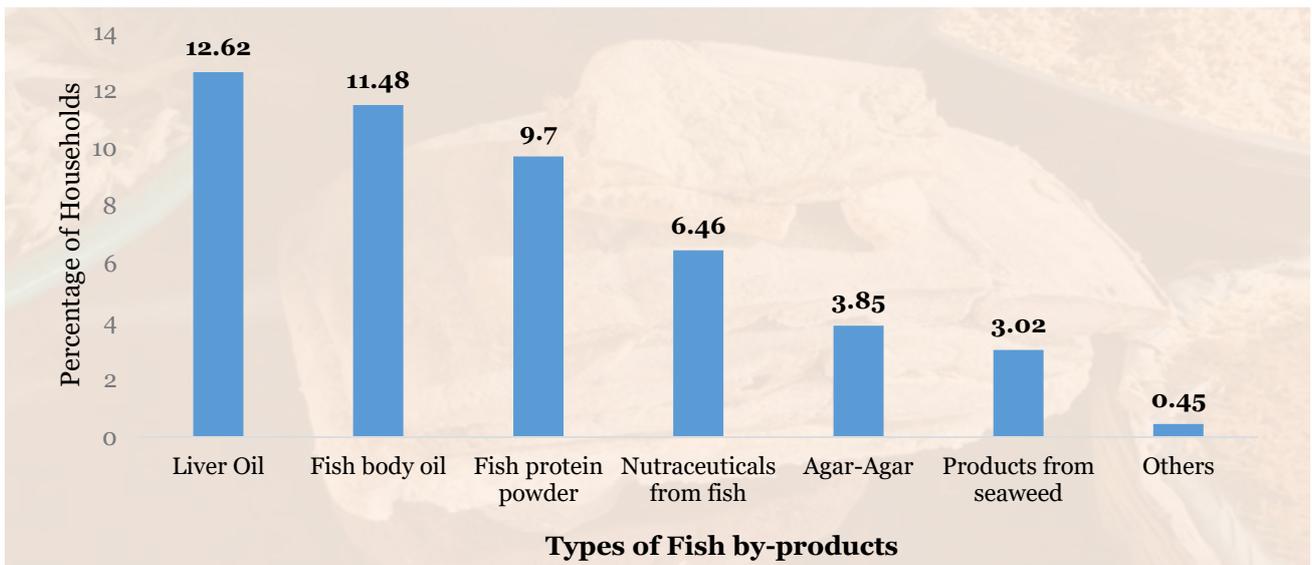
Source: NCAER computation from primary field survey.

The Figure 3.20 decomposes the different types of households' awareness of consumption of fish by-products. Most people know about the uses as fish liver oil (13%) followed by fish body oil (11%) and fish protein powder (9.7).

3.7.1. Consumption of Premature /Juvenile Fishes

Awareness about the impact of consuming premature/ juvenile fish is less in India. The proportion of consuming premature/juvenile fish is 37 per cent in India (Figure 3.21). The households which do not consume premature fish are also not aware of it.

Figure 3.21: Consumption of Premature/Juvenile Fishes (HH %)
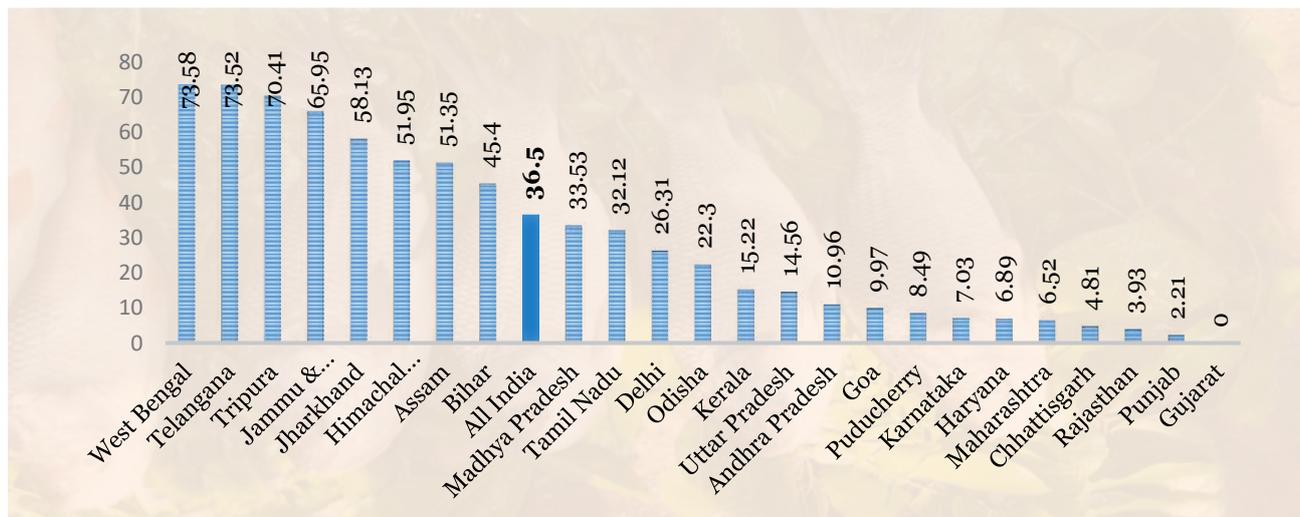
Source: NCAER computation from primary field survey.

Although the proportion of households, consuming premature/juvenile fishes is only 37 per cent, all the households, not consuming premature/ juvenile fish are also not aware of the negative impact of consuming the premature/juvenile fish.

Figure 3.22: Awareness of The Negative Impact of Catching or/and Eating Premature/Juvenile/Broodfish on the Environment (HH %)
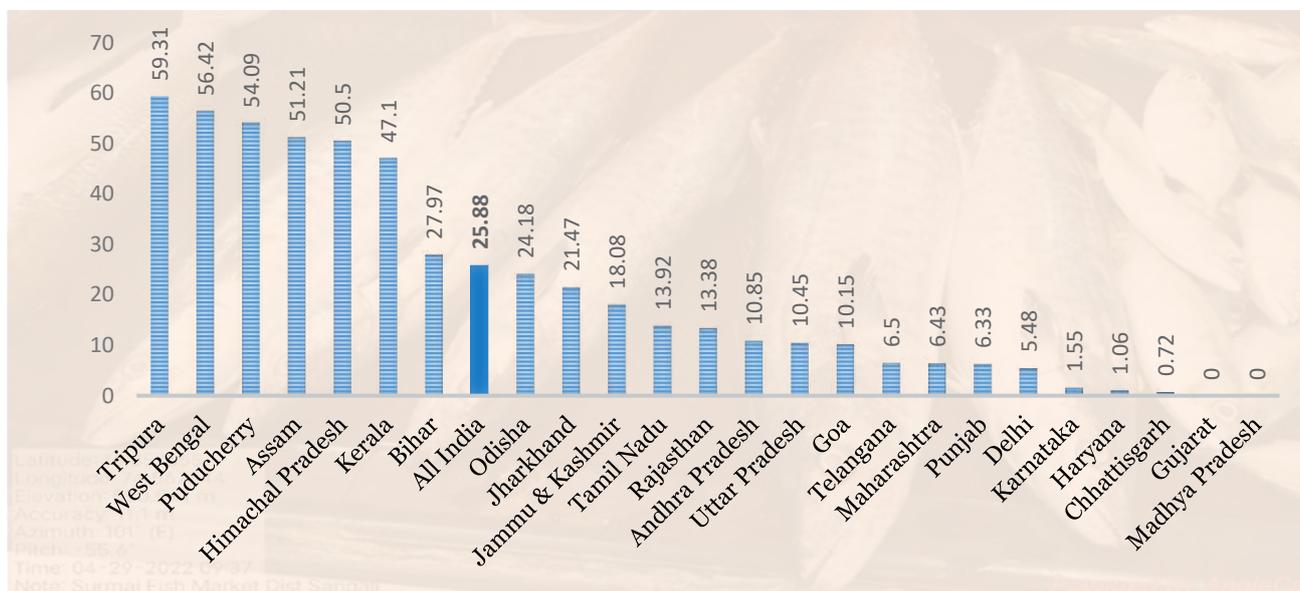
Source: NCAER computation from primary field survey.

However, it is noted from the survey that only 26 per cent of the households are aware of the negative impacts of catching or eating premature/juvenile fish on the environment (Figure 3.22).

Figure 3.23: Awareness about Negative Impact of Catching or/and Eating Premature /Juvenile/Broodfish on The Environment. Then Types of Impact
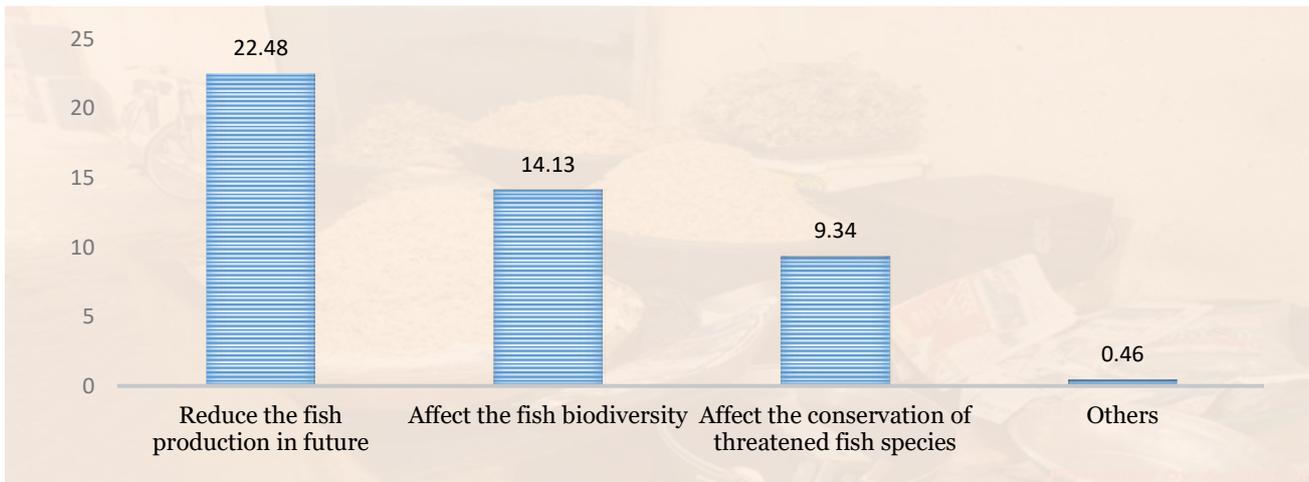
Source: NCAER computation from primary field survey.

Yet, among the households aware of the negative impact of catching or/and eating pre-mature/juvenile /broodfish on the environment, 22.48 per cent of the households think it will reduce the fish production in future, 14 .13 per cent of the households think it will affect the fish biodiversity and 9.34 per cent of the households think it will affect the conservation of threatened fish species (Figure 3.23).

3.8. CHANGE IN CONSUMPTION OF FISH AT THE HOUSEHOLD LEVEL

In India, according to household responses, there is no much changes in the quantity consumed of fish. However, 28 per cent of households experienced change in consumption of fish in the last five years (Figure 3.24).

Figure 3.24: Change in Quantity of Fish Consumed by Households Over the last 5 Years (HH %)

Source: NCAER computation from primary field survey.

At State level, in Himachal Pradesh (74.39%) most households have experienced changes in the quantity of fish consumption over the last 5 years, followed by West Bengal (55%).

Figure 3.25: Extent of Change in Quantity of Fish Consumed Over Last Five Years

Source: NCAER computation from primary field survey.

However, as in Figure 3.25, only 21 per cent of the households responded increased consumption of fish over the last five years and 7.10 per cent of the fish-eating households responded as eating less fish now over the last 5 years.

Figure 3.26: Availability of Attractive Fish Products Like Packaged Fish Nuggets; Fish Finger, Fish Tikka, Amritsari Fish Masala, etc. Will Help Increase Interest in Consumption of Fish (HH %)
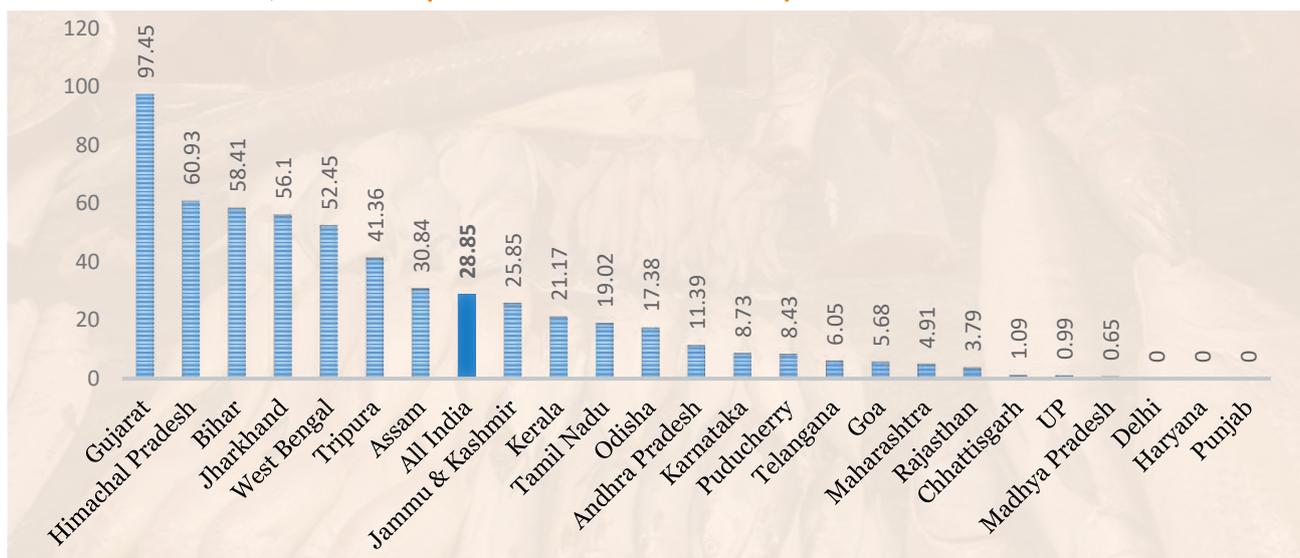
Source: NCAER computation from primary field survey.

Attractive fish products like packaged fish, nuggets, fish fingers, fish tikka, Amritsari fish fry masala, etc. are also assumed to bring changes in the consumption habits of the households (Figure 3.26). Nevertheless, most households (29%) believe that these types of fish products will sparsely stimulate the consumption of fish.

3.8.1. Determinants of Preference for More Attractive Fish Products

In Table 3.11, determinants of attractive fish products is analysed using a binary logistic model, where the dependent variable is whether the household considers the consumption of attractive fish product

or not. Ten explanatory variables have been selected to explain the determinants of consideration for consumption of attractive fish products.

The first explanatory variable is sector, which is categorised as urban and rural. Although the attractive fish products are more of urban-focused than that of rural, the rural households also prefer to have attractive fish products. According to the model, there are 90 per cent less chances of considering attractive fish products in urban areas than that in rural areas.

The second variable is religion of the household. This is categorised as Hindu, Muslim and others. Religions have no significant impact on consideration of attractive fish products.

The third variable is awareness of the nutritional value of fish which has positive and significant impacts on the consumption of attractive fish products.

The fourth variable is stratum groups, i.e. high fish-consuming, medium fish-consuming, low fish-consuming and occasional fish-consuming households. Medium and low-fish consuming households have insignificant impact on attractive fish product consumption. Yet, occasional fish-consuming households have 58 per cent less chances of considering attractive fish products as compared to high fish-consuming households. This indirectly indicates that high fish-consuming households mostly preferred to have attractive fish products.

Among the social groups, OBCs have 80 per cent less chances of considering attractive fish products as compared to SC households. Yet, general category households have a positive impact on attractive fish product consumption.

Table 3.11: Determinants of Attractive Fish Products

S. No.	Variables	β Coefficient	Standard Error
1.	Sector		
	Urban	0.899*	0.074
	Rural®		
2.	Religion		
	Hindu	0.895	0.212
	Muslim	1.313	0.331
	Others®		
3.	Awareness of Nutritional Value of Fish		
	Yes	4.183***	0.381
	No®		
4.	Stratum Groups		
	Medium Fish Eating	0.929	0.078
	Low Fish Eating	1.032	0.096
	Occasional Fish Eating	0.584**	0.103
	High Fish Eating®		
5.	Social Groups		
	ST	1.014	0.171
	OBC	0.8*	0.081
	General	1.204*	0.124
	SC®		
5.	Fish Types		
	Freshwater Fish	0.324**	0.135
	Marine	0.222**	0.096
	Processed /Dry®		
6.	Preference for Animal Products		
	Milk	0.477***	0.041
	Egg	1.078	0.263
	Chicken	0.216***	0.029
	Other Meat	0.414***	0.086
	Fish®		
7.	Preference for Freshness of Fish		
	Live Fish	3.24**	1.428
	Fresh Fish (Non-Live)	2.055	0.937
	Iced/Frozen Fish	6.027***	2.752
8.	Household Size	0.95*	0.019
9.	Total Expenditure (Food + Non Food)	1.000***	0.00062
10.	Health Expenditure	1.000*	0.00096

Source: NCAER computation from primary field survey.

Note: ***, ** and * significant at 1 per cent, 5 per cent and 10 per cent.
® is the reference category.

The fifth variable is fish type. According to this variable, processed/dry fish consumption have a positive impact on the consumption of attractive fish products. In States like Gujarat, where the preference for attractive fish products is very high, the preference for processed /dry fish consumption is also comparatively higher than other States.

The variable on preference for animal products highlights that preference for milk, chicken and other meats have a negative impact on the consumption of attractive fish products.

Similarly, the preference for live fish and iced/frozen fish have a positive impact on the consumption of attractive fish products.

Increasing household sizes have 95 per cent less chances of considering attractive fish products. Small families' consideration for attractive fish products is high.

Local Fish Market in Sangali, Maharashtra

The variable on total expenditure represents the household's economic condition. Increasing economic condition has a positive impact on considering attractive fish products.

The expenditure on health expenditure also has a positive impact considering attractive fish products. This means that considering attractive fish products may have a negative impact of health which leads to increase in health expenditure.

3.9. DETERMINANTS OF HOUSEHOLD FISH CONSUMPTION

This section highlights some important determinants of household fish consumption in India. A linear regression model is used to analyze the causal relation between household fish consumption and eight other household characteristics related variables. The dependent variable in the model is household total consumption of fish. The list of independent variables includes six categorical variables and two continuous variables.

The first independent variable is the education level of the household. In this household questionnaire data is collected on the respondent's highest level of formal education and in most cases the respondent is the head of the household. Education status of the head of the household determines the overall social status of the family. Therefore, the education level of the head of the household is assumed to represent the education level of the household. It has been categorised as unable to read or write, able to read and write with and without primary level of education, middle and secondary, and senior secondary and above. Here, unable to read and write is the reference category.

Second independent variable is the factors that help in buying fish. This is also a categorical variable.

Local Fish Market in Madhya Pradesh
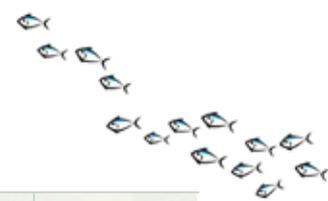
The categories are more fish variety in market, doorstep delivery, more frozen products, lower price, market hygiene and no preference for any factor. Here the no preference is taken as the reference category.

Third independent variable is the awareness of nutritional value of fish. It is categorised as having awareness and not having awareness. Having awareness is assumed to the reference category.

Fourth independent variable is the religion of the household. Categories are Hindu, Muslim, Sikh, Christian and others. For this variable, Hindu is the reference category.

Fifth independent variable is the social group. The categories are general, ST, OBC and SC. General is taken as the reference category.

Sixth independent variable is sector, which is rural and urban. Here rural sector is the reference category.

Lastly, household health expenditure and total expenditure are continuous variables. The household expenditure consisting of food and non-food expenditure is taken a proxy for economic condition of the household. Table 3.12 gives the results of the linear regression model determining fish consumption in India.

Table 3.12: Determinants of Fish Consumption

S. No.	Variables	β Coefficient	Standard Error
1.	Education level		
	Read and write with and without primary level of education	0.564***	0.148
	Middle and secondary education	1.123***	0.147
	Senior secondary and higher education	1.423***	0.203
	Unable to read and write®		
2.	Factors helps in buying fish		
	More variety of fish in market	1.852***	0.185
	Doorstep delivery	2.182***	0.238
	More frozen product	1.696***	0.435
	Lower price	1.585***	0.218
	Market hygiene	0.916*	0.544
	No preference for any factor®		
3.	Awareness of nutritional value of fish		
	Not aware	-0.82***	0.131
	Aware®		
4.	Religion of the household		
	Muslim	0.497**	0.217
	Sikh	1.687	1.144
	Christian	1.319**	0.421
	Others	3.754***	1.028
	Hindu®		
5.	Social Groups		
	ST	-1.948***	0.196
	OBC	-1.155***	0.172
	SC	-1.237***	0.181
	General®		
6.	Sectors		
	Urban	0.49***	0.141
	Rural®		
7.	Health Expenditure	-0.0009****	0.00002
8.	Total Expenditure	0.00012***	0.00001

Source: NCAER computation from primary field survey.
Note: ***, ** and * significant at 1 percent, 5 per cent and 10 per cent
® is the reference category.

The result of the model indicates that:

- A positive and significant relation exists between increasing level of education and consumption of fish. This indicates the significance of knowledge as a driver of consumer behaviour for better food basket.

- Among the factors, those help in buying more fish: doorstep delivery is the most preferred factor positively impacting the consumption of fish, followed by more variety of fish in market.

- Awareness of nutritional value of fish is also an important factor determining food habit, specifically in the aftermath of COVID. According to the model, household awareness of nutritional value of fish has a positive impact on increasing fish consumption.

- Among the religion groups, Muslims and Christians has higher intensity of consuming fish as compared to Hindus. Among social group, general has the highest intensity of consuming fish as compared to the other social groups.

- Regarding sectoral comparison of fish, the model significantly highlights that fish is more consumed in urban areas.

- Health expenditure has a negative and significant relation with fish consumption. This indicates that households consuming more fish spend less on health. Consumption of fish impacts health positively and makes people spend less on health.

- Total expenditure, as the proxy of economic status of the household, has a positive impact on the consumption of fish.

3.9.1. Factors Determining Household Consumption of Freshwater Fish as Compared to Chicken

The Table 3.13 shows some important determinants of household consumption of freshwater fish as compared to consumption of chicken. A linear regression model is formed taking the ratio of household consumption of freshwater fish to household consumption of chicken as dependent variable which represents the amount of consumption of freshwater fish as a proportion of consumption of chicken. The independent variables are both categorical and continuous. First independent variable is sector, which is categorised as rural and urban sectors, and the rural sector is considered as the reference category. Secondly, religion is categorised as Hindu, Muslim and others, and Hindu is considered as the reference category. The third variable is restriction of buying fish as high price, preference for chicken/mutton and others. The other category in restriction of buying includes fish odour, difficulty in eating due to fine bones, fish taste and texture, lack of knowledge of how to buy and cook fish, unhygienic condition of fish markets and medical reasons. Since these categories have very insignificant impact, these are clubbed in one category and considered as the reference category. The fourth variable is factors helping in buying more fish, which is categorised as more variety of fish in market, doorstep delivery, more frozen products, lower price range, good hygienic condition of retail markets and no preference. Here "no preference" is the the reference category. Awareness of nutritional value of fish and consideration of attractive fish products are another independent variable where "no"

is considered as the reference category. Independent variable of social group is categorised as ST, OBC, General and SC, where SC is the reference category. Last independent variable is the household size, which is a continuous variable.

Table 3.13: Determinants of Household Fresh water Fish Consumption as a proportion of consumption of Chicken

S. No.	Variables	β Coefficient	Standard Error
1.	Sector		
	Urban	-0.0464***	0.045
	Rural®		
2.	Religion		
	Muslim	-0.232***	0.065
	Others	-0.514***	0.085
	Hindu®		
3.	Restriction in buying Fish		
	High Price	0.316***	0.059
	Preference for Chicken/Mutton	-0.0265	0.075
	Others®		
4.	Factors helps in buying Fish		
	More variety	0.514***	0.095
	Door step delivery	0.813***	0.108
	Frozen Product	0.706***	0.161
	Lower price	0.850***	0.101
	Hygiene Market	0.462**	0.176
	No Preference®		
5.	Awareness of nutritional value of Fish		
	Yes	0.139**	0.049
	No®		
6.	Attractive Fish Product		
	Yes	0.439***	0.051
	No®		
7.	Social Group		
	ST	-0.372***	0.075
	OBC	-0.078	0.053
	General	0.272***	0.062
	SC®		
8.	Household Size	0.071***	0.011

Source: NCAER computation from primary field survey.
Note: ***, ** and * significant at 1 per cent, 5 per cent and 10 per cent.
®is the reference category.

The results of the model indicate that

- In urban areas, households consume less amount of freshwater fish as a proportion of consumption of chicken.

- High price is positive and significant restricting

factor. This means that those who consume higher amount of fish as compared to chicken find high price a restring factor in increasing their consumption of fish.

- Doorstep delivery and lower price are two very significant factor leading to higher substitution of freshwater fish for chicken.

- Apart from these, more fish variety in market, frozen products and hygienic market also positively impacts the substitution of freshwater fish for chicken.

- Awareness of nutritional value of fish also positively impacts the higher consumption of freshwater fish as compared to chicken.

- Attractive fish products also positively impact the consumption of freshwater fish as compared to chicken.

- Among the social groups, STs and OBCs substitute less amount of freshwater fish for chicken and general category households consume more freshwater fish as a proportion of chicken.

- Household size has a positive impact on higher substitution of freshwater fish for chicken. Big families substitute more fish for chicken consumption.

3.10. DETERMINANTS OF LOW HOUSEHOLD CONSUMPTION OF FISH

This section highlights the factors leading to low or comparatively less household consumption of fish in different States. In order to have a comparative analysis of fish consumption habit of households, this section considers the stratum division of the sample households, i.e. high, medium, low and occasional fish consuming households.

The Table 3.14 represents the factors that restricts more fish buying among different stratum groups. Among all, high price (73.18%) is one of the most significant factors which restrict the consumers from buying more fish. Second factor that restricts more fish buying is the preference for chicken/mutton (11.26%).

Table 3.14: Factors which Restricts Buying Fish in Different Stratum Groups (HH %)

	High Fish-Eating Household	Medium Fish-Eating Household	Low Fish-Eating Household	Occasional Fish-Eating Household	Total
No Preference	4.61	4.39	4.31	5.68	4.58
High Price	73.25	72.55	76.94	63.46	73.18
Preference of Chicken/Mutton over Fish	10.83	11.96	9.39	15.92	11.26
Fish Odor	3.75	4.67	3.44	4.03	3.91
Difficulty in eating due to Fine bone	2.02	2.23	1.72	5.01	2.36
Fish Taste and Texture	3.28	2.26	1.9	2.31	2.34
Don't Know How to Buy and Cook Fish	0.9	0.75	0.41	1.04	0.69
Fish is Cumbersome to Prepare and Cook	0.49	0.27	0.71	0.12	0.47
Unhygienic Conditions of Fish Markets	0.55	0.7	0.71	1.84	0.83
Medical Reasons	0.32	0.21	0.47	0.59	0.39

Source: NCAER computation from primary field survey.
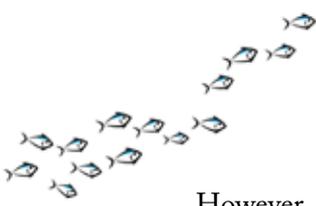
However, when the factors are decomposed in terms of different stratum groups, high price is still the most important factor in all the stratum groups. But among occasional fish-eating households, apart from the high price (63.46%), preference for chicken/mutton over fish (16%), fish odour (4.03), difficulty in eating due to fine bone (5%), etc. also limits the consumption (buying) of fish.

Although, price remains the most important factor in restricting consumption of fish, our State-level analysis highlights different other significant factors to be considered. Among the high fish-eating households, in most of the States, high price and preference for chicken/mutton over fish are the two import factors (Table 3.15). However, in States/UTs like Andhra Pradesh, Chhattisgarh, Gujarat and Puducherry, fish odour significantly restricts buying fish. Difficulty in eating fish due to fine bone impacts the buying habit of fish in States of Haryana and Maharashtra among the high fish-eating households. Fish taste and texture restricts the buying habit of people living in Delhi, Haryana and Karnataka among the high fish-eating households.

Table 3.15: Factors Restricting Buying Fish Among High Fish-eating Households by States (HH %)

States/UTs	No Preference	High Price	Preference of Chicken/ Mutton over Fish	Fish Odor	Difficulty in Eating due to Fine Bones	Fish Taste and Texture	Don't Know How to Buy and Cook Fish	Fish is Cumbersome to Prepare and Cook	Unhygienic Conditions of Fish Markets	Medical Reasons
Andhra Pradesh	0.08	52.35	30.81	**13.25**	0.62	2.31	0.05	0	0	0.54
Assam	7.05	80.52	5.59	0	1.19	3.92	0	0	0	1.74
Bihar	2.84	92.71	0.74	1.97	0	0.31	0	0.52	0.49	0.42
Chhattisgarh	9.47	57.69	0.35	**32.5**	0	0	0	0	0	0
Delhi	0	1.21	16.36	16	8.24	**58.19**	0	0	0	0
Goa	0	60.44	28.84	0	7.78	0.78	1.04	1.02	0.1	0
Gujarat	5.31	62.32	9.49	**11.71**	0.64	**10.13**	0.14	0.26	0	0
Haryana	0	1.35	10.12	6.04	**15.15**	**60.58**	0.71	0	0	6.04
Himachal Pradesh	0	72.75	12.12	4.38	1.74	5.94	3.06	0	0	0
Jammu & Kashmir	0	100	0	0	0	0	0	0	0	0
Jharkhand	2.02	95.6	0	1.87	0	0	0	0	0.5	0
Karnataka	1.83	48.75	11.91	2.51	0.76	**30.66**	0	2.88	0.64	0.06
Kerala	0.04	93.86	1.12	3.98	0	0.53	0	0	0.47	0
Madhya Pradesh	0	95.89	2.57	1.54	0	0	0	0	0	0
Maharashtra	0	37.89	20.14	4.21	**15.15**	1.89	**15.23**	2.85	2.64	0
Odisha	4.21	93.89	1.17	0	0.32	0	0	0.41	0	0
Puducherry	0.52	69.39	3.81	**15.59**	2.03	1.15	0.46	0.56	6.23	0.27
Punjab	0	0	100	0	0	0	0	0	0	0
Rajasthan	0	0	0	0	0	0	0	0	0	0
Tamil Nadu	0.76	36	43.37	5.02	5.68	3.71	1.78	0.24	2.28	1.16
Telangana	0	92.44	2.01	0	5.37	0.18	0	0	0	0
Tripura	0.98	87.11	9.83	2.08	0	0	0	0	0	0
Uttar Pradesh	15.67	84.33	0	0	0	0	0	0	0	0
West Bengal	9.55	81.99	5.04	0.73	1.46	0.48	0.15	0.42	0.18	0
Total	4.61	73.25	10.83	3.75	2.02	3.28	0.9	0.49	0.55	0.32

Source: NCAER computation from primary field survey.

As the Table 3.15, highlights only high fish-eating households, the households of States consuming more fish do not consider factors other than high price. In the States having mixed culture, like Delhi, Haryana and Maharashtra, people consider factors other than high price. The following Table 3.16 highlights the factors limiting consumption of fish among medium fish-eating households, which follows the same pattern as in high fish-eating households.

Table 3.16: Factors Restricts Buying Fish Among Medium Fish-eating Households by States (HH %)

States/UTs	No Preference	High Price	Preference of Chicken/ Mutton over Fish	Fish Odor	Difficulty in Eating due to Fine Bones	Fish Taste and Texture	Don't Know How to Buy and Cook Fish	Fish is Cumbersome to Prepare and Cook	Unhygienic Conditions of Fish Markets	Medical Reasons
Andhra Pradesh	5.04	43.61	24.9	22.04	1.1	0.62	0.05	0	0.02	2.61
Assam	7.93	82	2.75	6.14	0	1.18	0	0	0	0
Bihar	0.94	90.88	1.11	5.31	0.13	0.87	0	0	0.77	0
Chhattisgarh	3.06	60.39	3.37	32.91	0	0	0.27	0	0	0
Delhi	0	0	25.54	11.98	24.68	24.86	0	0	0.61	12.34
Goa	0	43.08	41.35	0	6.5	4.33	3.3	1.3	0.14	0
Gujarat	1.95	55.35	13.79	24.76	0	3.41	0.74	0	0	0
Haryana	0	3.34	13.41	0	78.16	1.42	3.67	0	0	0
Himachal Pradesh	0	67.49	16.95	3.36	0	0	2.31	1.49	6.68	1.72
Jammu & Kashmir	0	0	0	0	0	0	0	0	0	0
Jharkhand	2.75	85.86	5.49	5.68	0	0	0	0.22	0	0
Karnataka	1.35	37.64	32.23	3.14	0.98	24.08	0	0.57	0	0
Kerala	0	94.91	0.02	1.65	0.02	2.26	0.5	0.26	0.4	0
Madhya Pradesh	0	99.17	0.83	0	0	0	0	0	0	0
Maharashtra	0.78	35.22	23.86	0.81	20.49	0.11	12.59	4.07	2.07	0
Odisha	1.25	97.79	0.47	0	0	0	0	0.5	0	0
Puducherry	0.93	61.2	7.49	14.54	0.59	5.54	0.67	0.65	7.51	0.88
Punjab	0	16.67	50	0	0	0	33.33	0	0	0
Rajasthan	0	0	0	0	0	0	0	0	0	0
Tamil Nadu	0.76	33.85	47.38	3.53	6.63	3.45	1.24	0.08	3.08	0
Telangana	0	92.21	1.04	0	6.75	0	0	0	0	0
Tripura	0	91.71	5.93	0.86	0	0	1.5	0	0	0
Uttar Pradesh	14.49	85.51	0	0	0	0	0	0	0	0
West Bengal	10.51	83.5	4.28	0.24	0.65	0.3	0	0	0.52	0
Total	4.39	72.55	11.96	4.67	2.23	2.26	0.75	0.27	0.7	0.21

Source: NCAER computation from primary field survey.
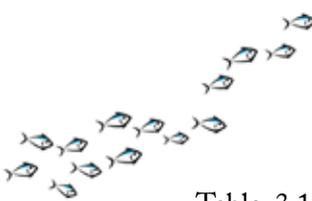
Table 3.17 highlights the consumer behaviour of low fish-eating households. High price and preference for chicken/mutton over fish are again the significant factor restricting fish consumption in low fish-eating households. In Chhattisgarh, Gujarat and Puducherry, fish odour significantly restricts the purchase/consumption of fish among low fish-eating households. Difficulty in eating fish due to fine bone has also restricted the buying/consuming fish in States of Goa, Haryana and Maharashtra. The low fish-eating households in Karnataka also find difficulty in fish taste and texture.

Table 3.17: Factors Restrict Buying Fish Among Low Fish-eating Households by States (HH %)

States/UTs	No Preference	High Price	Preference of Chicken/ Mutton over Fish	Fish Odor	Difficulty in Eating due to Fine Bones	Fish Taste and Texture	Don't Know How to Buy and Cook Fish	Fish is Cumbersome to Prepare and Cook	Unhygienic Conditions of Fish Markets	Medical Reasons
Andhra Pradesh	3.59	63.18	22.25	6.83	0.43	1.93	0	0	0.04	1.75
Assam	6.48	87.02	3.75	0	1.28	1.25	0	0	0.22	0
Bihar	1.82	96.27	0.88	0.09	0	0	0	0.01	0	0.93
Chhattisgarh	7.1	70.43	0.1	22.37	0	0	0	0	0	0
Delhi	0	52.01	45.09	0.01	0	2.89	0	0	0	0
Goa	0	39.79	35.22	0	11.71	5.8	1.91	5.06	0.51	0
Gujarat	1.99	61.25	5.45	24.19	2.56	3.71	0.32	0	0.53	0
Haryana	0	2.41	9.22	0	81.34	4.63	0	2.41	0	0
Himachal Pradesh	0	80.61	10.67	3.91	0.68	0	0	2.75	0	1.38
Jammu & Kashmir	0	100	0	0	0	0	0	0	0	0
Jharkhand	2.08	91.85	0	6.07	0	0	0	0	0	0
Karnataka	1.2	45.63	22.7	5.07	0	25.16	0	0.25	0	0
Kerala	0	86.15	4.41	5.73	0	1.58	0.01	0.54	1.59	0
Madhya Pradesh	0	98.30	0	1.7	0	0	0	0	0	0
Maharashtra	0.08	33.95	34.38	3.82	14.05	4.42	4.2	4.66	0.45	0
Odisha	3.32	95.66	0.08	0	0	0	0	0.74	0.2	0
Puducherry	0	43.83	16.94	34.03	0	0	0	0	2.95	2.24
Punjab	0	25.00	0	0	0	0	75	0	0	0
Rajasthan	0	0	0	0	0	0	0	0	0	0
Tamil Nadu	0	38.56	34.38	6.44	7.4	0.18	2.12	3.95	5.46	1.5
Telangana	0	93.92	1.39	0	4.03	0	0	0	0	0.65
Tripura	0	93.23	0	6.77	0	0	0	0	0	0
Uttar Pradesh	10.27	88.63	1.1	0	0	0	0	0	0	0
West Bengal	10.86	81.70	4.66	1.3	0.61	0.57	0	0.11	0	0.2
Total	4.31	76.94	9.39	3.44	1.72	1.9	0.41	0.71	0.71	0.47

Source: NCAER computation from primary field survey.
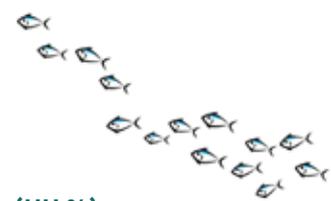
Table 3.18: Factors Restricts Buying Fish Among Occasional Fish-eating Households by States (HH %)

States/UTs	No Preference	High Price	Preference of Chicken/Mutton over Fish	Fish Odor	Difficulty in Eating due to Fine Bones	Fish Taste and Texture	Don't Know How to Buy and Cook Fish	Fish is Cumbersome to Prepare and Cook	Unhygienic Conditions of Fish Markets	Medical Reasons
Andhra Pradesh	39.18	20.63	0.67	0	**35.33**	4.19	0	0	0	0
Assam	28.74	57.33	0.89	0.89	0	10.14	0	0	0	2.01
Bihar	0	95.01	0.33	1.53	0.33	0	0	0	0	2.8
Chhattisgarh	13.76	75.67	0.24	9.59	0.74	0	0	0	0	0
Delhi	3.59	19.49	5.36	**15.94**	**15.52**	**34.18**	0.45	0	2.45	3.02
Goa	0	84.72	13.36	0	0.88	0	0	1.04	0	0
Gujarat	0	64.84	0	11.61	**15.38**	8.17	0	0	0	0
Haryana	7.84	67.39	20.45	0.49	0.16	2.28	1.39	0	0	0
Himachal Pradesh	0	60.99	14.4	0	7.15	1.45	0	3.96	**9.82**	2.23
Jammu & Kashmir	0	98.5	0.82	0.1	0.59	0	0	0	0	0
Jharkhand	0	85.95	0	**14.05**	0	0	0	0	0	0
Karnataka	5.59	0	**78.29**	9.4	0	4.94	0	1.79	0	0
Kerala	0	91.05	6.85	2.09	0	0	0	0	0	0
Madhya Pradesh	0	100	0	0	0	0	0	0	0	0
Maharashtra	0	31.94	35.05	2.96	**20.81**	0	4	0	5.24	0
Odisha	19.36	77.14	1.07	0	2.3	0	0	0	0.14	0
Puducherry	0	22.45	1.26	41	0	0	0	0	35.29	0
Punjab	0	55.68	38.84	1.19	0.19	0	4.1	0	0	0
Rajasthan	1.66	75.16	8.64	**14.09**	0	0	0.45	0	0	0
Tamil Nadu	0	27.71	38.23	5.7	0.21	8.98	0	0	**19.17**	0
Telangana	0	96.37	2.6	0	1.03	0	0	0	0	0
Tripura	0	90.84	9.16	0	0	0	0	0	0	0
UP	11	88.43	0.57	0	0	0	0	0	0	0
West Bengal	0	8.97	57.1	0	0	6.83	0	**27.11**	0	0
Total	5.68	63.46	15.92	4.03	5.01	2.31	1.04	0.12	1.84	0.59

Source: NCAER computation from primary field survey.

For occasional fish-eating households, in Delhi, Jharkhand and Rajasthan, the odour, taste and texture of fish is are significant restricting factors in buying fish. Occasional fish eaters in Andhra Pradesh, Delhi, Gujarat and Maharashtra consider difficulty in eating fish due to fine bone is another restricting factor in buying fish. In West Bengal, occasional fish eaters consider preparing and cooking fish difficult which limits their consumption of fish. In Himachal Pradesh, Puducherry and Tamil Nadu, unhygienic condition of fish market is considered to be the significant limitation among occasional fish eaters (Table 3.18).

From the preceding analysis it can be summarised that

- For high fish-eating households, high price is less impacting their fish consumption behaviour as compared to the low and occasional fish-eating households. They consider other factor like fish odor, fish bone, taste and texture, etc. are significant.

- But in high fish-eating States, irrespective of any stratum groups, only high price restricts the buying of fish. In these States, households do not consider other factors.
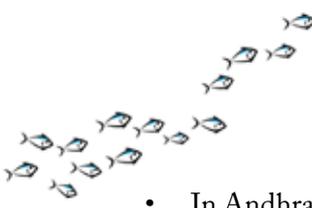
- In Andhra Pradesh, apart from the high price and preference for chicken/mutton, fish odour and fish bone restrict the buying of fish.
- In Chhattisgarh, fish odour is considered significantly in buying fish which restricts the fish consumption.
- In Delhi, fish odour, taste and texture, and fish bone are important restricting factors.
- 81 per cent of the low fish-eating households in Haryana consider fish bone a restricting factor in buying fish.
- Occasional fish eaters in West Bengal (27%) consider the process of preparing and cooking fish a limiting factor in buying fish.
- Occasional fish eaters in Himachal Pradesh, Puducherry and Tamil Nadu find unhygienic condition of fish market limiting the buying of fish.

3.11. NON-VEGETARIAN-NON-FISH-EATING HOUSEHOLDS: CASE STUDIES TO FIND OUT THE FACTORS RESTRICTING IN EATING FISH

In order to find out the factors restricting the non-vegetarian households in eating fish, some case studies have been done in different parts of the country. These studies have been explained in the following boxes.

Case Study 1: Cheaper fish with more varities could motivate people to go for more fish than for chicken

A Focus Group Discussion (FGD) of non-fish eaters, was organised in Napad Vanta, Anand, in the State of Gujarat on 13th February 2023. The FGD was attended by 6 males aged 32-70 years and 2 females, aged 23 and 25 respectively from varied occupations like private service, social workers, school teacher, business and watchman. All respondents have been consuming non-vegetarian food since their childhood and most of them don't take fish for disliking.

Some of them don't like to take fish for its smell and taste. Some are concerned about small bones though they like the taste as it takes too much time to remove small bones and by that time it becomes cold and less enjoyable. Some of them prefer river fish, whereas others don't like local pond fish.

Those don't prefer fish due to small bones were asked if they will be comfortable to consume fish with less bones or with a single bone. To this, the participants mentioned that those types of fish are not easily available and at the same time price is very high for those. But they prefer boney fish for better taste than boneless ones. They don't like the smell and taste of prawn, as preparation of fish dishes is very tedious and time-taking, nobody in the household takes interest in cooking it.

Respondents were asked if they could substitute chicken for fish available in the following forms like: desirable varities of fish are made available in local market, completely dressed fish devoid of bones, live fish and processed fish varities are available. Hygienic fish market in their locality, fresh and properly dressed fish is delivered at their doorstep through online purchase at a relatively cheaper price than chicken. Creating awareness of the nutritional value of the fish among the public over other non-veg food, conducting 'fish festivals' with display of different fish varities, their nutritional value, method of preparing various dishes, regular advertisements on the health benefits of fish consumption, readymade fish dishes like fish tikka, fish burger, fish finger fry, fish cutlet made available at reasonable prices.

If these conditions are fulfilled, then people will prefer fish more than chicken and the number of fish eaters will increase. Cheaper fish with more varities could motivate people to prefer fish over chicken. Fish species be produced locally in the area include Rohu, Catla, Pomfret and Surmai. To sum up, hygienic market, availability of clean and fresh fish should be at a competitive price could increase the consumption manifold.

Case Study 2: Live fish is not available in local market

An FGD of non-fish eaters was organised at Guntur, Andhra Pradesh on 19th of February 2023. The event was attended by 6 participants, 2 males aged 25-32 years and 4 females aged 28-38 years. All respondents have been consuming non-vegetarian food for the last 10 years or so except fish.

All of them mentioned that they have stopped consuming fish due to non-availability of fresh and processed fish in their area and also due to very high rates. The major reasons for not taking fish are: foul smell emanating from the fish market, freshness not assured, dressed fish not available and it is cumbersome to dress fish at home, price of fish is not value for money as compared to chicken, preparation of fish dishes is difficult, preferred fish is not available in the locality and processed form and cooking of various dishes of fish is not known.

The majority of the participants mentioned that they would like to substitute chicken for fish if available at a competitive price as compared to other non-vegetarian items, availability of fish in boneless and desirable form, availability of processed fish, upgrading the fish markets to make clean and hygiene, availability of attractive fish snacks (e.g. fish tikka, fish cutlet, fish finger, fish burger, fish pizza, etc.).
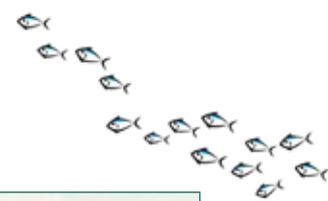
Apart from the above, the factors that could help substitute chicken for fish are: creating awareness about nutritious value and health benefits of fish like presence of omega-3 and protein value. Awareness about nutritional value will help in improving fish-eating culture among masses. Since many don't know how to cook various fish recipes, fish festivals could showcase and demonstrate various fish cousins for the audience. Regular advertisement of explaining the benefits of eating fish could be very useful. For example, the American Heart Association recommends eating fish at least two times per week is part of healthy diet. Attractive advertisements like eating fish help prevent heart diseases, contain hair fall, help rejuvenates skin and immunity, etc. The government should advertise through social media platforms such as Twitter and Facebook to create awareness. The electronic media is now very useful. Fish dishes with recipes should be explained in the media advertisement. At the same time, media should explain the benefits of fish eating. The variety of fishes and its availability in a particular region should also be informed in the media.

Live fish is not available in all local markets. Chicken, meat and eggs are easily available, but the market is often neither clean nor hygienic. Rates are very high also, and processed fish is not available. It is very cumbersome to clean fish and cook. It takes much time. The awareness is also very low about the benefits of fish consumption. Street vendors of cooked fish dishes are also not found. If fish dish stalls, hotels or shops like pakoda/idli-dosa stalls are opened in various locations, it will increase fish-eating habits. If all these problems are addressed then there should be no issue for the non-vegetarians in not eating fish.

Case Study 3: Cleanliness must be maintained at the market place

An FGD of non-vegetarians not eating fish was conducted in Ghaziabad, Uttar Pradesh, on 17th February 2023 comprising 8 male participants. Out of them, four have studied up to 8th and 9th class class (aged 19-42 years), with education up to the middle class, two of them studied up to 12th class (aged 20-21 years) and another pursuing M.A. (24 years). The purpose was to find out the factors that is deterrent for taking fish and what are the conditions for promotion of fish consumption among this segment of non-fish eaters. All of them are taking non-veg food items except fish for the last 14-35 years.

Among the reasons for not taking fish, out of 8, four of them mentioned that, smell of fish, bones that deter them from taking fish. Some of them don't like the taste. Three of them said that they don't like fish as they live in dirty water. Unhygienic, dirty market place, stinking environment around, bad smell becomes a discouraging factor for entering the fish market was reported by 3-4 participants. One of them prefers costly varieties not available in their area. Fresh fish is not readily available in their market and if available it's doubtful.

The respondents were asked if they could consider in certain forms and certain conditions as availability of preferred variety of fish, availability of fish in boneless form, availability of processed fish in desirable form, availability of live fish in the market, upgrading the fish markets to make it cleaner and hygienic, easy availability of fish in nearby stores like frozen dairy products, online and doorstep delivery of fish, availability of attractive fish snacks (e.g. fish tikka, fish cutlet, fish finger, fish burger, fish pizza, etc., availability of fish at cheaper price). If all above mentioned conditions are available, *75 per cent of the respondents said they will start eating fish.*

Specifically, they could eat fish if available without smell. It should be neat and clean, availability of fresh live fishes, market place should also be neat and clean. Online availability of fish is a good option for them to buy fish.

Apart from above other factors they mentioned could motivate them to eat fish are: Creating awareness about the nutritional value and health benefits of fish eating, it means making people more and more aware about the nutritional value of fish, organizing 'fish festivals' to develop taste of fish in different forms/to serve fishes in different attractive forms, regular advertisements mentioning different benefits of eating fish. Most of them also believe the recommendations by the American Heart Association that eating fish at least twice a week is part of a healthy diet, prevents heart disease, makes healthy skin and improves immunity.

At the end, suggestions given by the participants to improve fish consumption is as follows: Fresh fish with good variety and in neat and clean form with less bones should be supplied. Different varieties of fish at cheaper rates as compared to chicken and mutton should be available. Good quality fishes will have good quantity of vitamins also. These should be available in nearby market/shops, while cleanliness must be maintained at the marketplace.

3.12. COMPARISON WITH NSS (68TH ROUND) AND THE BROAD TREND OBSERVED

The quinquennial NSS consumer expenditure survey is the single source of data in India on consumer expenditure surveys and its latest findings on expenditure on fish consumption pertain to the year 2011-12. Data on the per household monthly consumption expenditure on fish in proportion to total food expenditure[3] in 2011-12 both for the rural and urban, and comparing the same[4] with the primary survey of fish-eating households of NCAER on 2022, we can observe that expenditure on fish, which was 7.63 per cent in 2011-12 has gone up to 16.77 per cent in 2022. The State-wise comparison is detailed in Appendix C (Figure 3.27).

Figure 3.27: NSS and NCAER Estimation of Expenditure on Fish as Proportion to Total Food Expenditure (%) of The Fish-eating Households in Rural and Urban India
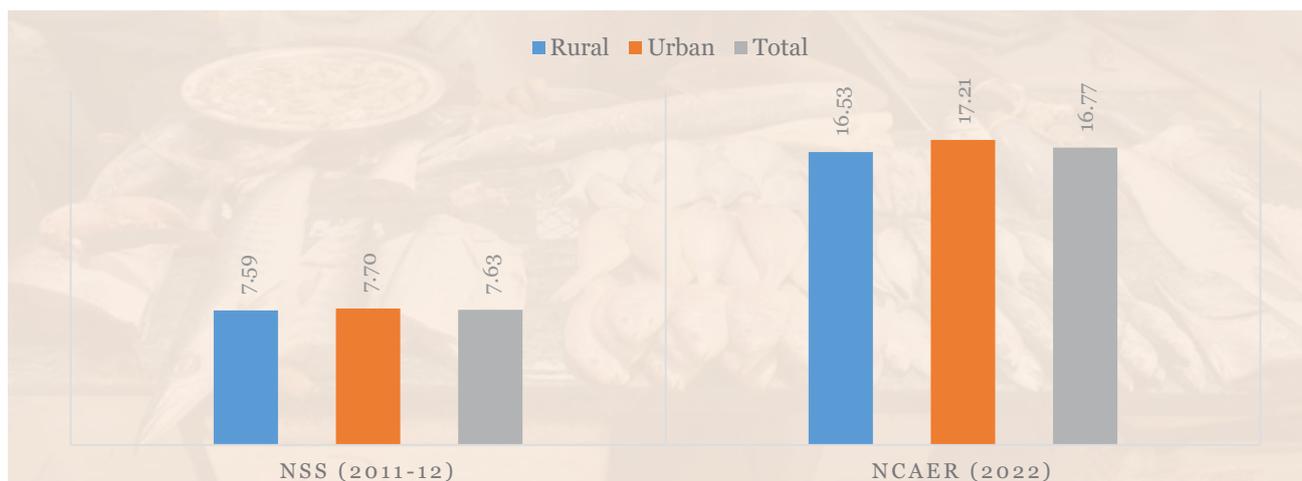
Source: NSSO 68th Round (2011-12) and NCAER (2022).

Similarly, it is important to compare the quantity consumption of fish (Figure 3.28). Overall, the comparable estimation shows that monthly consumption of fish (in kg) per household has shown a quantum leap in the past ten years as shown in the following graph. It is important to note that there is a significant increase in the demand for fish in the urban areas of India. The State-wise comparison is given in Appendix C.

Figure 3.28: NSS and NCAER Estimation of the Average Quantity of Fish Consumed (Kg) of the Fish-eating Households in Rural and in Urban India (Household Per Month)
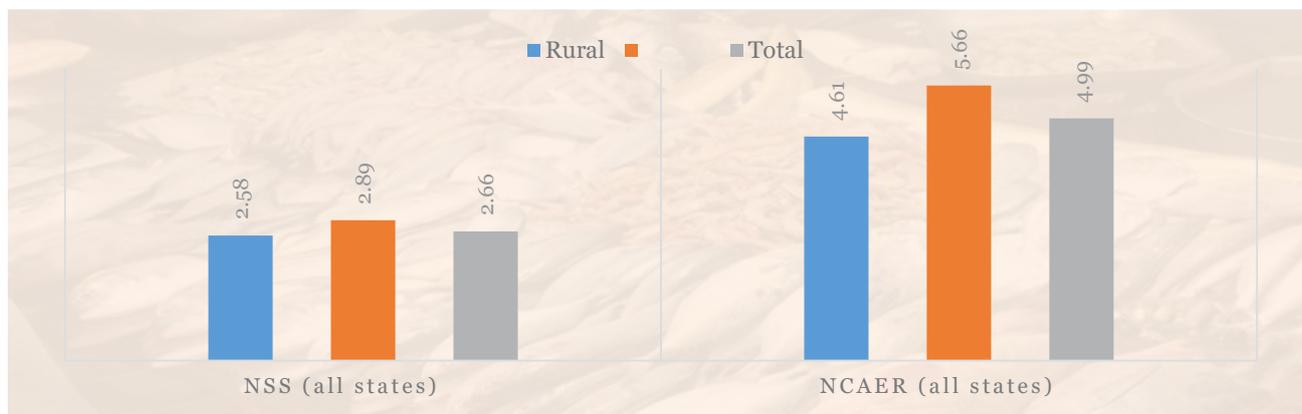
Source: NSSO 68th Round (2011-12) and NCAER (2022).

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[3]Fish-eating household is considered.

[4]With the same number of States, i.e., 24. Telangana was inclusive in the NSS estimation of 2011-12, while it is estimated separately in the NCAER survey.
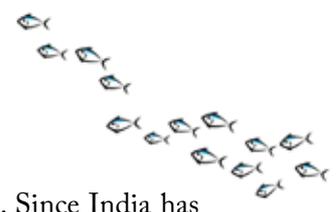
However, NSS has not collected data on fish consumption by species. The NCAER study is important in several counts. First, it provides data on the consumption of fish and fish-related expenditure that are fundamental to gauge the updated trend after a decade. Second, it provides an understanding on species-wise consumption of fish that was not obtainable from the earlier NSSO reports. Third, it has provided an insight into the perceivable level of demand for fish based on data and estimation recorded in the present exercise.

In this count, per capita consumption of fish from the NCAER survey result provides an important insight into the penetration and deepness of the consumption of fish as food in India. The average per capita consumption of fish, which was 7.1 kg per annum a decade ago is now 13.14 kg per annum, which is lower compared to international estimate (OECD & FAO) of 20.5 kg per capita (2019-20)[5], but has high potential to catch up the predicted level of 21.4 kg per capita by 2031[6]. Since India has high growth potential in the coming decade, there is possibility that per capita fish consumption will catch up to the international standard. The figure below shows how the per capita consumption of fish as food are distributed across States.

The distribution of the per capita consumption of States shows three distinct patterns. First, States with high per capita consumption has deep penetration in terms of culture, food habit and preference for fish. The per capita consumption in these States are higher than the national average and will grow in future (Figure 3.29). Second, States below national average too have high potential and revealed higher preference for fish. A better infrastructure and ease of availability of different fish varities could provide additional impetus. Third, the States with less than 5 kg per capita consumption needs special attention in terms of awareness and policy-oriented action.

Figure 3.29: NCAER Estimation of the per Capita Average Quantity of Fish Consumed (kg per Annum) Across States in India

Source: NCAER (2022).
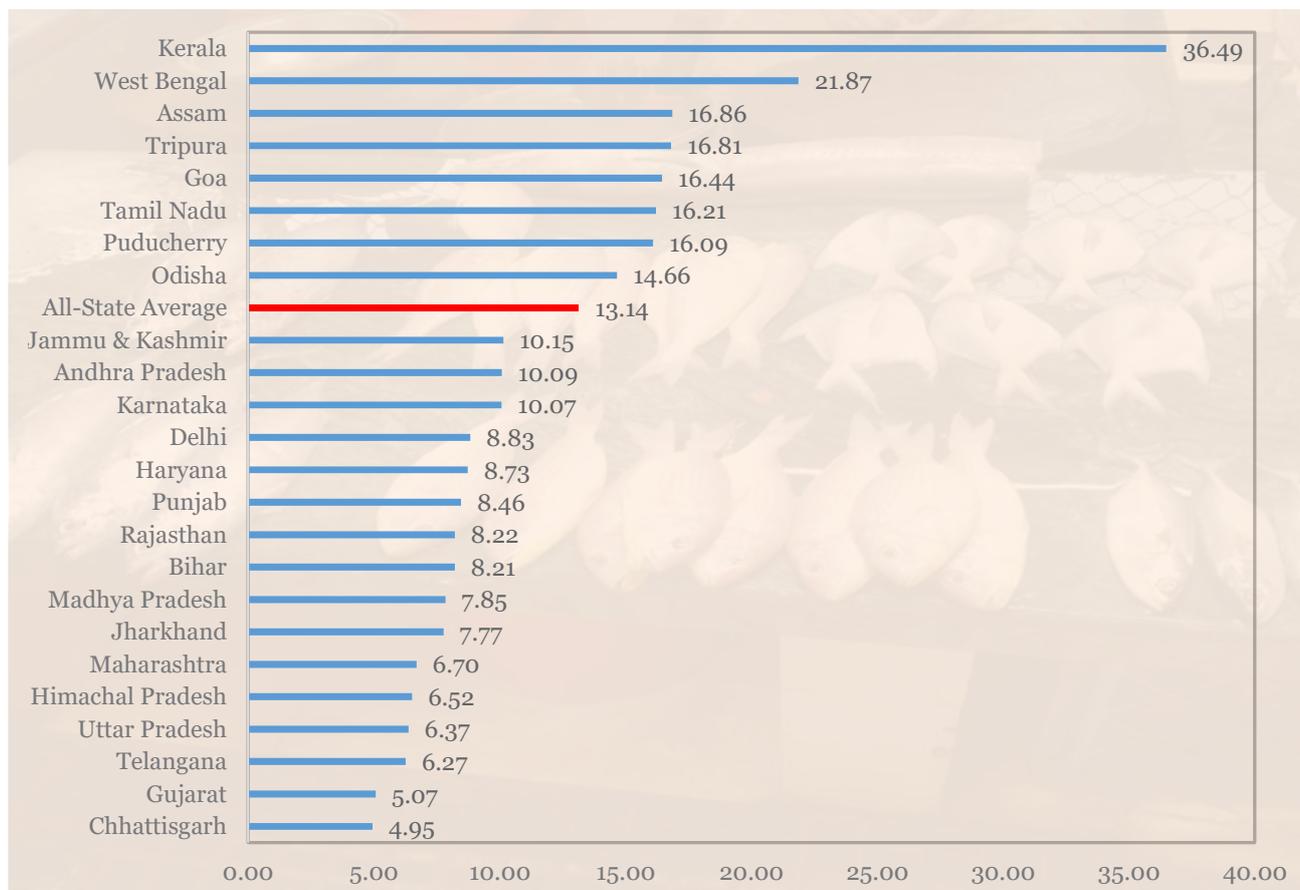
[5]https://www.agri-outlook.org/commodities/oecd-fao-agricultural-outlook-fish.pdf.
[6]ibid.

3.13. SUMMARY

Section 3 above categorically explains the household fish consumption behaviour. The following are the key points of the analysis.

- First important finding of the household survey analysis is that food expenditure as a proportion of total expenditure is higher in rural area (45.19%) as compared to the urban area (39.37%). The decomposition of food expenditure in terms of different food items highlights that the fish-eating households in urban area spends (17.21%) more on fish as compared to the rural area (16.53%).

- Due to the easy availability of freshwater fish in different parts of the country, 77.4 per cent of the total estimated households preferred to consume it. Marine, prawn, crab, lobster, squid, mussel are also preferred among fish-eating households with a very high regional specific characteristic. Processed or preserved fish are mostly not preferred among fish-eating households in India. Only an insignificant 0.3 per cent of the estimated fish-eating households preferred processed/preserved fish.

- Local market and local vendors are the most popular sources of purchasing fish. Although most households purchase fish for consumption, in rural areas some people go for fishing for household consumption.

- Although live fish (82.71%) is the most preferred choice of fish consumption (Figure 3.8), those who preferred to consume processed fish consider fish in its whole form (80%) (Figure 3.9).

- Apart from the price, which significantly determine the consumption of fish, households also prefer colour of skin, more variety in market, fish odor, etc. while buying fish (Figure 3.12, Figure 3.13, Figure 3.14).

- Among the fish dishes, fish curry and fried fish are the two most preferred dishes among the households (Figure 3.16).

- Per household average quantity consumption of fish in last 30 days preceding the survey is 4.99 (Table 3.10). Kerala (13.37 kg) is the highest fish-consuming State followed by West Bengal (7.17 kg) and Assam (6.11 kg).

- Awareness of the nutritional value of fish is one of the most important determinants of consumption of fish. 64 per cent of the households estimated to be aware of the nutritional value of fish (Figure 3.17).

- Fish by products like liver oil, fish body oil, fish protein power, etc. have rich health and nutritional value. But this is not very popular among the fish-eating households in India. Only 20.42 per cent of the households are estimated to be aware of consuming or using fish by-products (Figure 3.20).

- Consumption of premature/juvenile fish has a broad environmental impact. A total of estimated 36.5 per cent of the households consume premature/juvenile fish in India (Figure 3.21).

- When households were asked if there is any change in the consumption of fish in the last five years, 28 per cent of the households responded there is a change (Figure 3.24) and 21 per cent said they eat more fish and 7 per cent of the households responded that they have been eating less fish over the last five years (Figure 3.25).

- Availability of attractive fish products like packaged fish, nuggets, fish finger, fish tikka and Amritsari fish masala may help in increasing interest in consumption of fish. 29 per cent of the households believe these types of attractive fish snacks will increase consumption of fish in different parts of the country (Figure 3.26).

- Although attractive fish products are assumed to be more urban-centered, the rural households among the fish-eating households are more attracted towards the different types of fish snacks (Table 3.11) as compared to that in the urban area.

- In Figure 3.5 and Figure 3.6, urban households' spending on fish is higher as compared to the rural households. Not only in fish, urban households spend more in other meat and chicken as compared to the rural households. As a determinant of fish consumption also urban is positive and significant (Table 3.12). However, while analyzing the determinants of substitution of freshwater fish and chicken, urban has a negative impact. This indicates that urban households consume more fish as compared to the rural households but when the level of consumption is compared to the chicken, they still preferred to consume more chicken (Table 3.13). This implies that urban households spend more both on fish

and other meat varities or chicken as compared to rural areas. Therefore, if urban households preferred to substitute more fish for chicken, their consumption of fish may increase more. In rural areas, absolute consumption of fish is lower but relative consumption fish as compared to chicken is higher. Therefore, rural households' fish consumption can be increased by availing different fish snacks which are more preferred in rural area (Table 3.11).

- Awareness of nutritional value of fish has a positive impact on the consumption of fish (Table 3.12 and Table 3.13) and also the relative consumption of freshwater fish as compared to that of chicken. Attractive fish products are also preferred significantly by those having aware of the nutritional value of fish (Table 3.11).

- Doorstep delivery has a very significant and positive impact on higher consumption of fish (Table 3.12) as well as in substituting more freshwater fish for chicken (Table 3.13).

- Households having less health expenditure actually consume more fish, which indicates a positive impact of fish consumption on health (Table 3.12). On the other hand, increasing health expenditure has positive impact on preference for attractive fish products/fish snacks (Table 3.11), which indicates healthy people do not prefer to consume these attractive fish products.

- Economic condition of the people has a positive impact on fish consumption (Table 3.12) as well as preference for attractive fish products (Table 3.11).

- High fish-consuming households also prefer the attractive fish products as compared to the low or occasional fish consuming households. Occasional fish consumers have significant less preference for attractive fish products. This implies that preference for attractive fish products are directly linked with fish consumption (Table 3.11).

- Preference for consumption of processed or dry fish has significant and positive impact on the preference for attractive fish products. Also, those who prefer egg over fish have more preference for attractive fish products (Table 3.11). These indicate that the category of households which want easy cooking process prefer to consume more attractive fish products.

- Small families prefer more attractive fish products as compared to big families (Table 3.11).

- The lower overall consumption of fish is related to the price in most cases. The high fish consuming States always consider price as a deterrent in increasing their fish consumption. But the high fish-eating households in lower fish-eating States find fish odour, difficulty in eating due to fine bones, fish taste and texture, etc. as restricting factors (Table 3.15).

- Lower or occasional fish eaters in high fish consuming States find cooking process of fish and unhygienic condition of fish market a restricting factor in buying more fish (Table 3.18).

- The fish consumption at the household level nearly doubles during the period 2011-12 (NSS 68th Round) and the NCAER study of 2022.
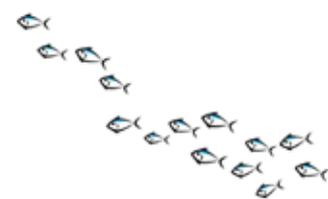
HOTEL & RESTAURANT

4.1. INTRODUCTION

This section provides an outline of the status of hotels and restaurants that consume different species of fish through primary assessment by NCAER. For each district, two residential hotels and one restaurant in the selected district headquarters serving fish were selected for conducting the survey through the structured questionnaire.

4.2. OBSERVATION FROM HOTELS

The NCAER study observed that out of the sample size of 210 hotels, around 53 per cent of the respondents were hotel managers. Among the hotels surveyed, 29 per cent hotels are 3-star, while 22 per cent are luxury hotels. Only 4 per cent hotels were 5-star in terms of facilities. About 44 per cent of the

hotels had only AC rooms. Ten per cent hotels have a turnover of over Rs 5 crore per year, 22 per cent have a turnover in the range of Rs10-24 lakh per year and 14 per cent hotels have an annual turnover of less than Rs 10 lakh.

NCAER Research Team and Officials of the empaneled agencies during pilot study.

Figure 4.1: Fish Products Served in the Hotels
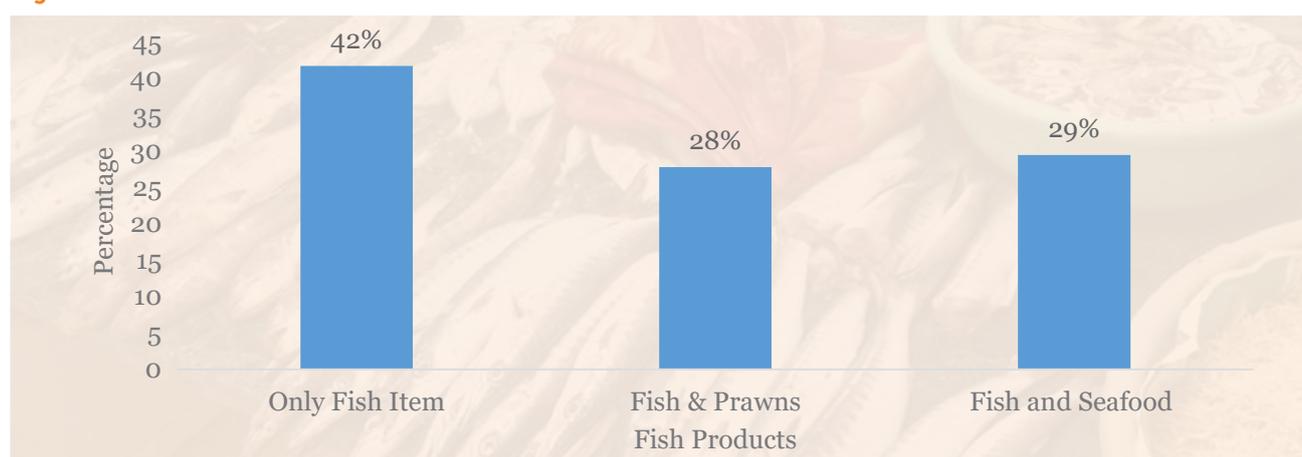
Source: NCAER primary survey, 2022.

It was observed from Figure 4.1 that 42 per cent of the hotels served only fish products. Fish and prawns were served in 28 per cent of hotels. More than 50 per cent of the hotels serve fish during lunch and dinner time. 34 per cent of hotels serve fish during all times of the day. 61 per cent of hotels responded that the sale of fish is maximum during summers. Around 75 per cent of the hotels source

their fish from local markets. More than 5 varieties of fish are served in 39 per cent of hotels. Around 46 per cent fish purchased by hotels are iced fish. Hotels give the least preference to frozen fish while purchasing. Around 69 per cent of hotels responded that guests find out the difference between the different kind of fish that are served like iced, frozen and live fish.

Figure 4.2: Guest Preference for the Dishes Served in the Hotels
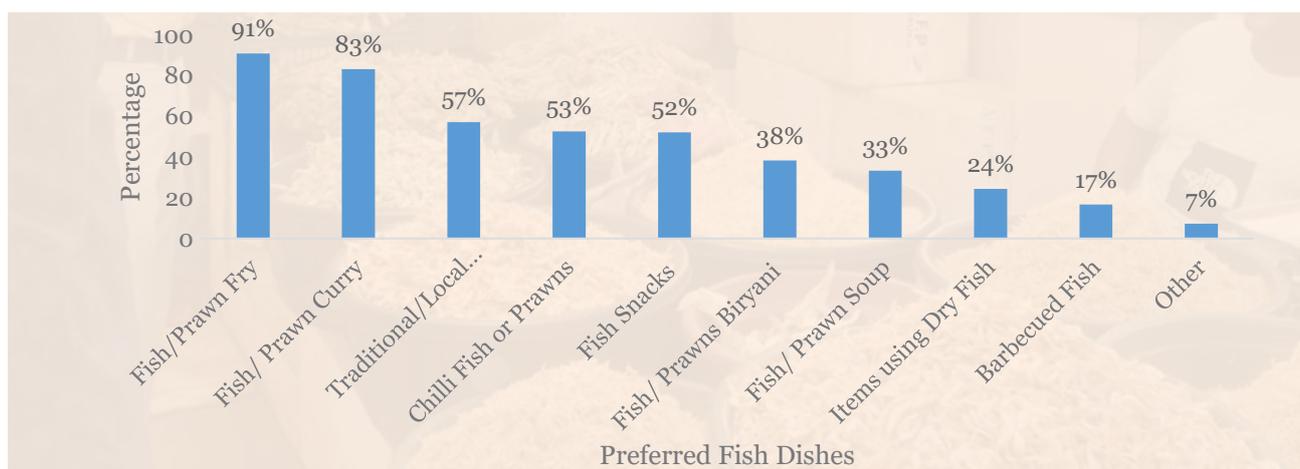
Source: NCAER primary survey, 2022.

Figure 4.2 indicates that 80 per cent of hotels responded that guests prefer fish/prawn curry over other items. The least preferred item according to hotel respondents is barbequed fish. Additionally, other items such as fish snacks, chill fish/prawns, and local delicacies are also preferred. Around 71 per cent of hotels responded that guests were aware of the nutritional value of fish.

From Figure 4.3, we observe that around 39 per cent of hotels saw an increase in fish consumption by guests over the last 5 years as we can see in Figure 4.3. Only 12 per cent of hotels recorded a decrease in consumption. Around 98 per cent of hotels responded that guests primarily refer to consuming fish dishes in restaurant. Only 33 per cent preferred ordering online. Around 52 per cent of the hotels served 100-200 grams in their fish dish. Around 39 per cent of the hotels responded that their most popular fish dish was in the price range of Rs 200-300.

Figure 4.3: Change in Consumption of Fish Over the Last 5 Years in the Hotels
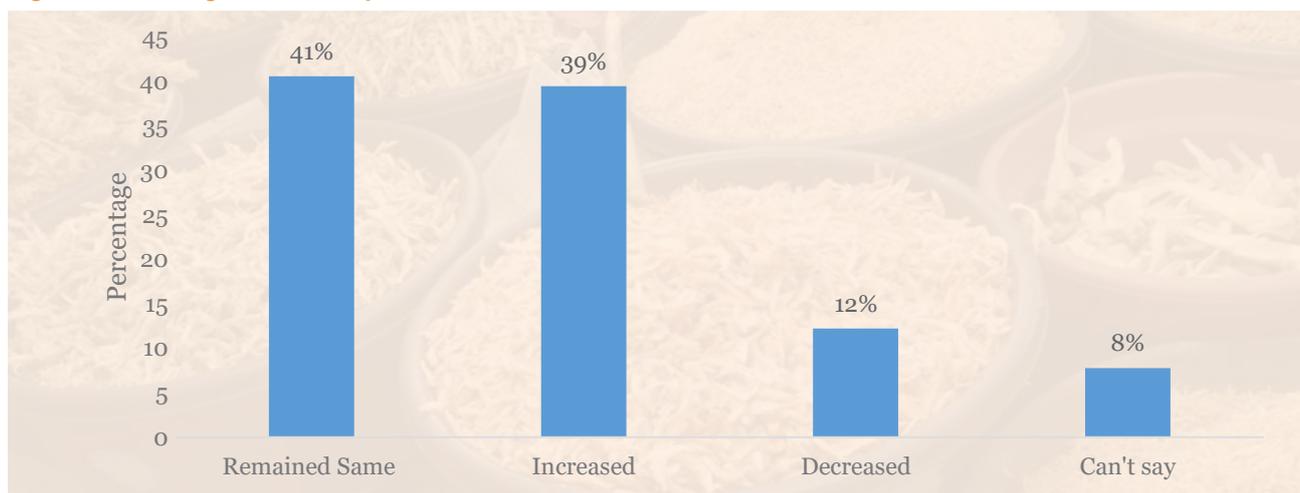
Source: NCAER primary survey, 2022.

More than 50 per cent of the hotels said guests prefer chicken to fish, 28 per cent of the hotels said guests prefer mutton to fish and 4 per cent of the hotels said guest prefer beef to fish. However, 53 per cent of the response from hotels recorded that if the price of fish dishes were lower, a greater number of customers would have preferred fish.

4.3. OBSERVATION FROM RESTAURANTS

The NCAER study observed that out of a sample size of 105 restaurants, around 61 per cent of the survey questions were answered by the owner/proprietor of
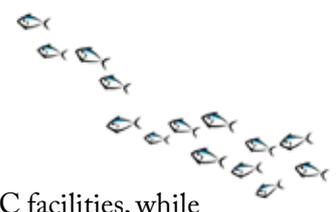
the restaurant, followed by managers and supervisors. More than 40 per cent of the restaurants had a seating capacity of more than 30 seats. More than 50 per cent of the restaurants were not having AC facilities, while 31 per cent of the restaurants had an annual turnover of more than Rs 10 lakh.

Figure 4.4: Fish Served in Restaurants
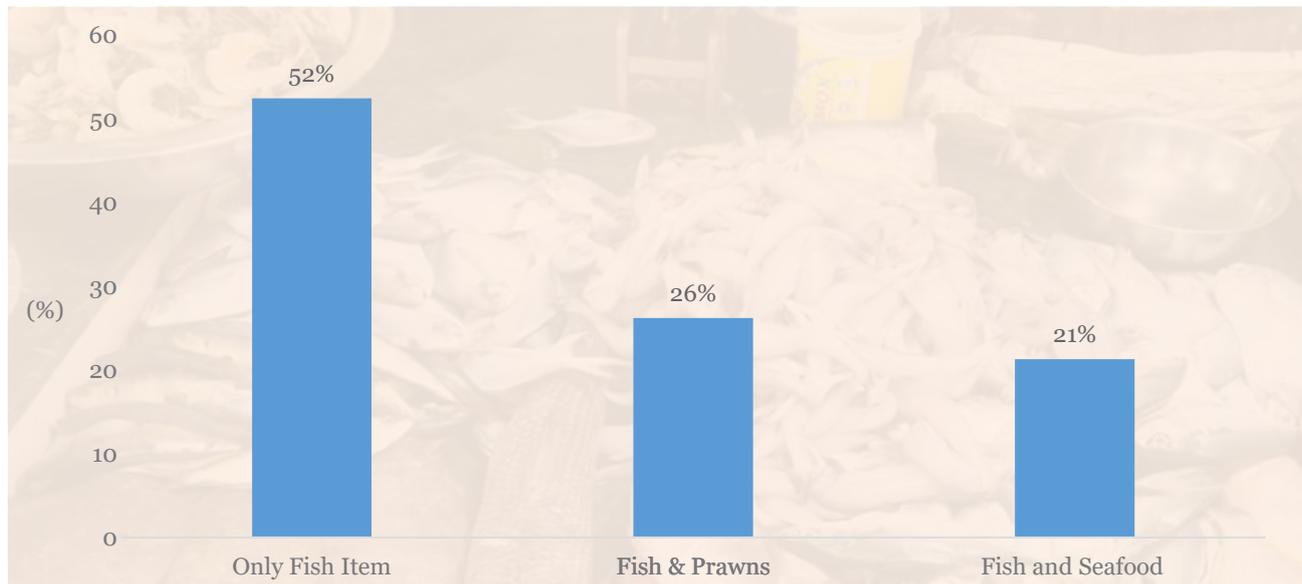
Source: NCAER primary survey, 2022.

It was observed that 52 per cent of restaurants served only fish items on their menus (Figure 4.4). Fish & prawns were served in 26 per cent of restaurants. Most of the restaurants served fish during lunch and dinner (close to 50%), while 33 per cent of restaurants served fish at all times. It is noted from the responses that 65 per cent of fish are sold during summer, while 31 per cent of fish are sold in winter.

Most of the restaurants' source their supply from the local markets. The second most preferred source is direct delivery. Around 39 per cent of restaurants serve 1-3 varieties of fish. More than 5 varieties of fish are served in 36 per cent of the restaurants. Fifty-two per cent of restaurants purchase live fish. The second type of fish purchased is iced fish, while frozen fish is purchased by only 21 per cent of restaurants.

Figure 4.5: Guest Preference for the Dishes Served in the Restaurants
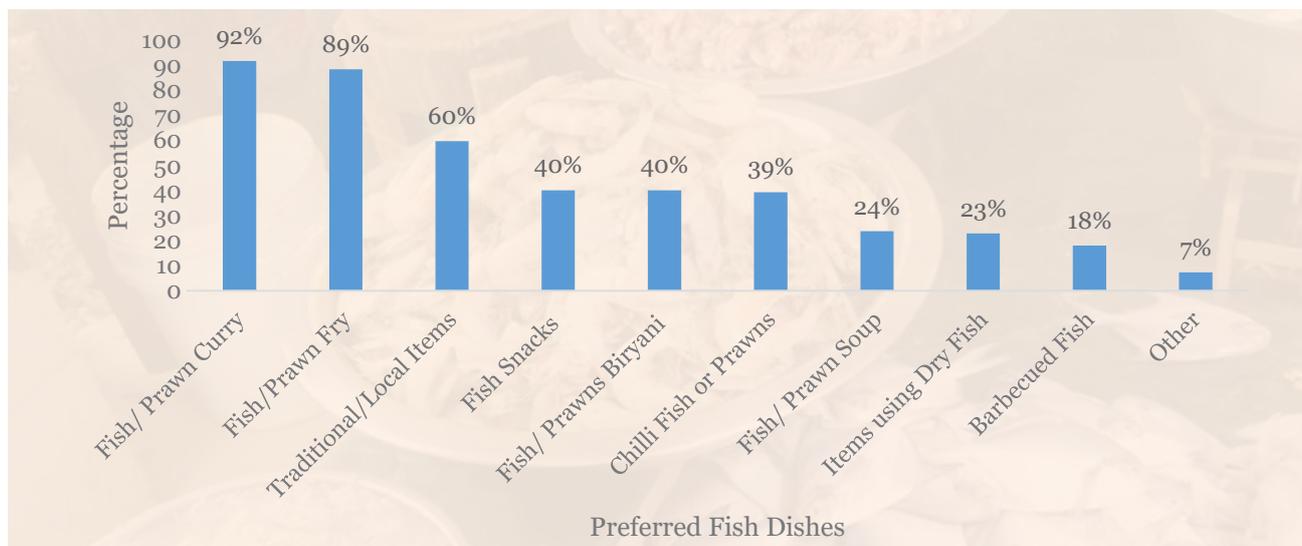
Source: NCAER primary survey, 2022.

Three-fourths of respondents feel guests can make a difference between the types of fish that are served (Figure 4.5). Among the fish dish, fish/prawn curry is the most preferred dish in restaurants, followed by fish/prawn fry. Traditional local items are also preferred in States like Bihar, Maharashtra, Odisha, Tamil Nadu and West Bengal.

Figure 4.6 indicates that around 47 per cent of restaurant respondents felt that fish consumption over the last 5 years remained the same. A larger section of guests prefers consuming fish in the restaurant itself. Around 60 per cent of restaurants serve 100-200 gram in their fish dishes. The most popular fish dish in restaurants lies in the price range of Rs 200 – 300 in over 39 per cent of restaurants.

Figure 4.6: Change in Consumption at Restaurants Over the Last 5 Years
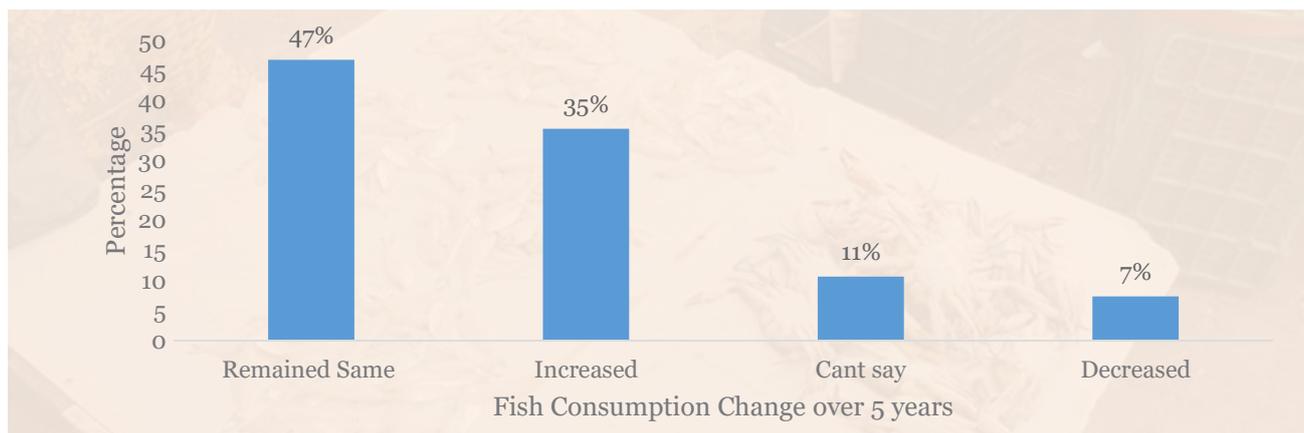
Source: NCAER primary survey, 2022.

NCAER Research Team at Dasna Village, Uttar Pradesh

There is a clear preference for fish over chicken is seen in States like West Bengal and Odisha. However, 34 per cent of restaurants say fish is not preferred to mutton. About 59 per cent of restaurant respondents felt that if fish was available at a lower price more customers would prefer eating fish.
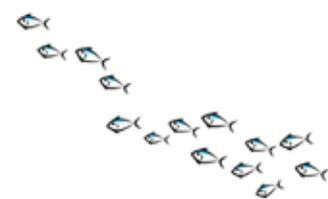
PREDICTION OF FISH DEMAND

5.1. INTRODUCTION

Prediction of domestic consumption of fish in India till 2031 is mainly based on secondary information. The data of fish production is available from the publicly available Fishery Statistics by the Department of Fishery of the Government of India. The export and import of fish are collated from the data published by the Directorate General of Commercial Intelligence & Statistics (DGCI&S). The data period ranges from 2010-11 to 2021-22. The total domestic availability of fish is arrived at by deducting export and adding import in the total production figures.

5.2. DATA OUTLINE AND ASSUMPTIONS

Any exercise concerning prediction requires assumptions regarding the behaviour of the

Local Fish Market, Andhra Pradesh

independent variables in the multivariate regression model framework. The following Table 5.1 provides a snapshot on the assumptions of the independent variables that are used to predict the dependent variable till 2031.

Table 5.1: Independent Variable and Assumptions

Variable	Data used for Projection
Population	Population Projection Report (2011-36), Report of the Technical Group on Population Projection, July, 2020 and published by the National Commission on Population, Ministry of Health & Family Welfare
GVA	India's long-term projection of GVA is based on International Agency's projection of healthy growth of agricultural productivity, improved rural demand, strength in services sector exports, demand growth in travel & tourism sector along with the central government's consistent focus on pushing capital expenditure. A few considerations while estimating the long-term projection of GVA. First, Morgan Stanley predicted India to be the third largest economy in the World by 2027. The report titled "Why this India's decade", India's current $3.4 trillion to $8.5 trillion over the next decade. As per the projection by Government sources, India is projected to grow by 7 per cent in 2023 and 6.8 per cent in 2024. Considering the growth projection at various sources, an average 6.5 per cent growth is assumed between 2022 and 2031.
India's per capita GVA	India's per capita GVA is estimated by dividing the projected GVA with the projected population as reported in Population Projection Report (2011-36). The per capita GVA is growing at an average rate of 5.7 per cent per annum from 2022 to 2031. This is reasonable, in view of retarding growth of population and higher growth in GVA.
Price of Indian Fishery	Price of Indian fishery is estimated as price deflator, i.e., the ratio between current and constant GVA of fishery. The average of prices between 2017-18 to 2021-22 is around 3.3 per cent and this has been applied to derive the projected series
Consumer Price Index	The last 5 years average CPI, i.e. 4.9 per cent is applied to estimate the projected series
Relative price ratio	The variable, i.e., the relative price ratio is derived as a ratio between the price of Indian fishery and the CPI and used as an independent variable to impact the total availability

5.3. RESULTS BASED ON MULTIVARIATE PROJECTION MODELS

The projection models and its estimation as EViews output is given in Appendix D.

The projection of the Indian fishery sector is fraught with many presumptive assumptions of which three scenarios are extremely important.

Scenario A: This is the Business as Usual scenario based on the trend growth rate.

Scenario B: In this model, the relative price of fish and lagged income are chosen as independent variables. The lagged explanatory variable is used in this model that could occur when the explanatory variable has a causal effect on the response variable, but the causal effect occurs gradually and manifests in changes to the response later in time. In this model, price elasticity is less than one that allows for income adjustment (which is elastic) with a lag, i.e. in this model, the positive income effect outweighs the negative substitution effect and allows for sustainable consumption. The model resembles stationary State scenario with a random walk, with the first order difference of per capita income.

Scenario C: In this model, the relative price of fish and current income are chosen as independent variables. The same period explanatory variable used in this model allows a full-fledged competitive process for the fishery sector. In this model, the relative price variable is observed to be above one, reflecting an elastic price scenario, in which price would play a key role. With improved infrastructure and strengthening of the supply chain, the fishery could emerge as a crucial substitution to chicken and competitive, just like aquatic chicken (Tilapia) even for high-value fish with other alternatives. This model reflects a steady State equilibrium in which income growth brings in successive changes in consumption growth and higher production trajectory.

Figure 5.1: Fish Demand Projection in India (Million Metric Ton)
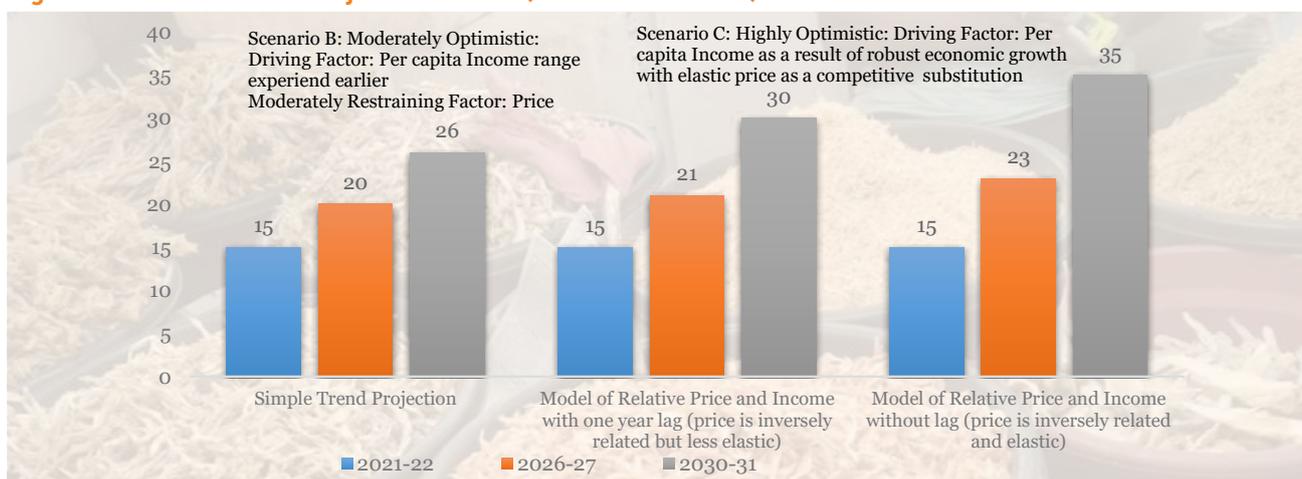
Source: NCAER Estimation.
Note: 2021-22=Baseline availability (actual).

5.4. DEMAND PROJECTION: A RATIONAL OUTLOOK

Fish consumption in India is increasing with the rise in production. Looking into the future, the growing populations would continue to demand more fish and production growth is expected to be the major force to satisfy the demand growth. The Government of India has launched 'Pradhan Mantri Matsya Sampada Yojana (PMMSY)' with a total outlay of Rs 20,050 crore (comprising a central share of around Rs 9,400 crore, the State share of nearly Rs 5,000 crore and beneficiaries' contribution of over Rs 5,000 crore) which is being implemented for a period of five years from 2020-21 to 2024-25 in all States/Union Territories. The PMMSY is contributing to addressing the gaps in fish production and productivity, quality, technology, and post-harvest infrastructure, strengthening of the value chain, and establishing a robust fisheries management framework and the fishers' welfare. The present study has used the situation in the financial year 2021-22 as a baseline to project the fish demand in 2016-27 and 2030-31. This short-term projection of a nine-year horizon is selected to facilitate the planning horizon for fisheries development in the country. The scenario-based approach is adopted for the demand projections where scenario A represents the business-as-usual outlook which is based on simple trend projection. Scenario B denotes the moderately optimistic outlook based on the presumption that the policies and ongoing schemes of the government to scale up fish consumption would yield a moderate/partial impact. Scenario C is based on the highly optimistic outlook with the assumption that the policies and ongoing schemes of the government to boost fish consumption would yield a high/full impact and thereby fueling the demand for fish.
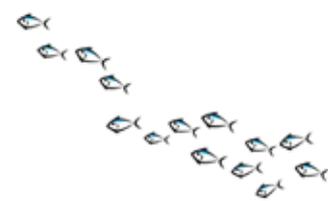
DISTRICT-LEVEL OBSERVATIONS

6.1. INTRODUCTION

A structured questionnaire was canvassed to collect data from the selected district officials to access the production and consumption pattern of freshwater and marine fish, reasons for low consumption of fish in these districts, solutions for increasing fish consumption and proposals for schemes/activities for the government to implement in order to increase the demand for fish among the consumers.

6.2. OBSERVATIONS FROM DISTRICT OFFICIAL DATA

Despite all the efforts data could be collected from 57 districts. The field team had to pay several visits to most of the offices as an immediate response was not available due to several reasons like the absence of competent authority at the time of the visit, and the non-availability of readily available records.

Meeting with district officials, Goa

The States covered include Assam, West Bengal and Tripura (East & North-East Region), Madhya Pradesh and Chhattisgarh (Central Region), Gujarat & Maharashtra (Western Region), J&K, Himachal Pradesh & Rajasthan (Northern Region) and finally Andhra Pradesh, Telangana, Kerala and Pondicherry representing the Southern Region (Table 6.1).

Meeting with different stakeholders at Vasco, Goa

Table 6.1: District-level Fishery Offices Covered in the NCAER Study

S. No.	State	Inland	Coastal
1.	Andhra Pradesh	Kurnool; East Godavari	Kakinada
2.	Assam	Darrang; Tinsukia; Golaghat ; Sonitpur; Nagaon	–
3.	Bihar	Muzaffarpur; Madhubani; Kaimur; Patna	–
4.	Chhattisgarh	Narayanpur; Bastar	–
5.	Gujarat	–	Navsari; Anand; Vadodra
6.	Haryana	Faridabad	–
7.	Himachal Pradesh	Solan; Mandi	–
8.	Jammu & Kashmir	Jammu; Kupwara	–
9.	Jharkhand	Ranchi; Hazaribagh	–
10.	Kerala	Idukki	Malappuram
11.	Madhya Pradesh	Tikamgarh; Ratlam; Narsimhapur; Raigad; Thane-Palghar	–
12.	Odisha	Koraput	Ganjam
13.	Puducherry	-------	Puducherry;
14.	Punjab	Bathinda	–
15.	Rajasthan	Ajmer	–
16.	Telangana	Adilabad; Nizamabad; Warangal	–
17.	Tripura	Dhalai; South Tripura; West Tripura	–
18.	Uttar Pradesh	Kushinagar; Pratapgarh; Saharanpur; Etawha; Hardoi; Raibareli	–
19.	West Bengal	Birbhum; Cooch Behar; Uttar Dinajpur; Jalpaiguri; Darjeeling; Barasat; Barddhaman;	Purba Medinipur; South 24 Parganas

Source: NCAER primary survey, 2022.

6.3. MAJOR FISH SPECIES IN SELECTED DISTRICTS

Data received from the district fisheries offices on five major fish species available in the district is presented in Table 6.2. The findings reveal that, among the major inland fish species, Rohu, Katla and Mrigal are commonly found in all States covered. The 'Common Carp' variety is also found in almost all States. West Bengal reported the highest number of fish species (10 species) followed by J&K (8 species).

Fish species reported from coastal districts in the State of West Bengal, Odisha, Maharashtra, Gujarat, Kerala and Puducherry (UT) mostly vary from each other. Pomfret being the most demanding, relatively being less costly and a popular fish is reported from West Bengal and Maharashtra. The 'Bombay Duck' variety has been reported from West Bengal, Maharashtra and Gujarat. Lobster is reported only from Gujarat (Table 6.2).
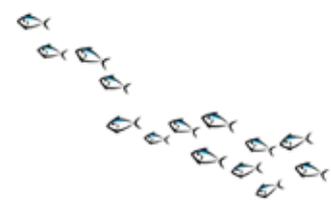
Table 6. 2: Major Fish Species in Selected States

S. No.	State	Freshwater fish species	Marine fish
1.	Andhra Pradesh (Kakinada, Kurnool, East Godavari)	Rohu, Catla, Mrigal, Common Carp, Prawn, Roopchanda, Prawn	
2.	Assam (Darang, Tinsukia, Golaghat, Nagaon, Sonitpur)	Catla, Rohu, Mrigal, Silver Carp, Grass Carp, Roopchanda	
3.	Bihar (Muzaffarpur, Mahbubani, Kaimur, Patna	Rohu, Catla, Basa, Common Carp, Rohu, Mrigal, Common Carp, Grass Carp	
4.	Chhattisgarh (Narayanpur, Bastar)	Catla, Rohu, Mrigal, Grass Carp, Common Carp	
5.	Gujarat (Navsari, Vadodara)	Catla, Rohu, Bighead Carp, Tilapia, Mrigal, Barracuda, Senegalus	Bombay Duck, Malet, Lobster, Pomfret, Tuna
6.	Haryana	Catla, Rohu, Mrigal, Singhi, Bhangaon	
7.	Himachal Pradesh (Solan, Mandi)	Common Carp, Rohu, Mrigal, Catla, Mahasheer, Rainbow Trout	
8.	Jammu And Kashmir (Jammu, Kupwara)	Boal Fish, Catla, Mrigal, Common Carp, Rohu, Brown Trout, Rainbow Trout, Silver Carp	
9.	Jharkhand (Ranchi, Hazaribagh)	Rohu, Catla, Mrigal, Tilapia, Basa	
10.	Kerala	Tilapia, Common Carp, Basa, Koi, Shol, Catla, Rohu, Tuna, Karimeen, Sardine, Sankara, Nethili	Sardine Longiceps, Japnies, Thread Fin, Malabar Tongur, Shol, Tunsh, Anchovies
11.	Madhya Pradesh (Tikamgarh, Ratlam, Narsimhapur)	Rohu, Catla, Mrigal, Common Carp, Grass Carp, Catla	
12.	Maharashtra (Raigarh, Thane Palghar)	Catla, Rohu, Common Carp, Tilapia, Mrigal	Seer Fish, Pomfret, Tuna, Acetus, Shrimp, Bombay Duck
13.	Odisha (Ganjam, Koraput)	Rohu, Catla, Mrigal, Rohu, Tilapia	Kabal, Sabala, Golara, Kani, Tumbuda, Prawn
14.	Puducherry (UT)	Catla, Rohu, Mrigal, Grass Carp, Common Carp	Oil Sadine, Mackerel, Seer Fish, Tuna, Perches
15.	Punjab	Common Carp, Catla, Rohu, Mrigal, Silver Carp	
16.	Rajasthan	Rohu, Mrigal, Gold Fish, Grass Carp	
17.	Telangana (Adilabad, Nizamabad, Warangal)	Catla, Rohu, Common Carp, Mrigal, Murrel, Grass Carp	
18.	Tripura (Dhalai, South Tripura, West Tripura)	Rohu, Catla, Mrigal, Common Carp, Silver Carp	
19.	Uttar Pradesh (Kushinagar, Pratapgarh, Saharanpur, Etowah, Hardoi, Raebareli	Basa, Roopchanda, Rohu, Catla, Grass Carp, Mrigal, Silver Carp, Common Carp, Basa	
20.	West Bengal (Birbhum, Cooch Bihar, Purba Medinipur, Uttar Dinajpur, Jalpaiguri, Darjeeling, Barasat, Bardhhaman, South 24-Parganas.	Catla, Rohu, Mrigal, Silver Carp, Common Carp, Boal, Pabda, Grass Carp, Bata, Tilapia, Silver Carp	Hilsa, Pomfret, Bombay Duck, Ribbon Fish, Thread Fish, Bhetki, Tiger Prawn, Crabs

Source: NCAER primary survey, 2022.
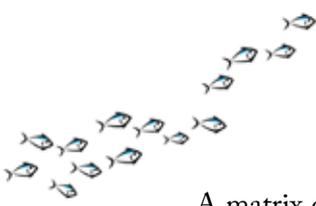
A matrix on fish species consumed across States provides the ranking of highly consumed to less consumed fish species across States (Appendix B4). The districts selected from each State are based on the highest weightage to cover all fish species used in the State. In all, 29 types of freshwater fish species have been reported from 20 States/UT and 54 districts. The major fish species commonly used in almost all States are Catla, Rohu and Mrigal. Common Carp is reported from 14 States and Grass Carp from 10 States. Silver Carp and Tilapia are reported from only 6 States. The rest of the fish species like Basa, Roopchanda, Boal, Rainbow Trout, Battachuda, Bata, Bhangaon, Bighead Carp, etc. are used in the least number of States.

6.4. FISH AVAILABILITY IN TERMS OF PRODUCTION AND CONSUMPTION IN SELECTED DISTRICTS

Based on availability in terms of production and consumption of fish, the selected districts were classified into three types viz. 'self-sufficient districts', 'fish-surplus districts' and 'fish-deficient districts' (Table 6.3). Self-sufficient refers to the parity between the demand and supply of fish in the district. The fish surplus could mainly be attributed to supply-side factors like the production of fish within the district or adjacent areas exceeding the demand. When the supply of fish is not enough to cater to the demand for fish, a district is termed fish-deficit. Overall, out of 57 districts, 20 districts reported as "fish-deficit districts" (Table 6.3). Appropriate measures and initiatives need to be taken at the government level with involvement of private players to exploit this unmet demand through increasing the production of fish in these areas and/or removing the constraints that hinder the supply of fish due to various factors.

Regional Training Camp in North 24 Paraganas, West Bengal

Discussion with the stakeholders, Karnataka
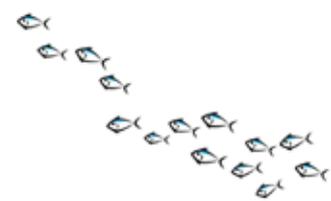
Table 6.3: Fish Availability in Terms of Production and Consumption in Selected Districts

S. No.	State	Freshwater Fish			Marine Fish		
		Self-sufficient districts	Deficit districts	Surplus districts	Self-sufficient districts	Deficit districts	Surplus districts
1.	Andhra Pradesh	Kurnool	–	Kakinada, East Godavari	–		–
2.	Assam	Nagaon	Darrang, Tinsukia, Golaghat , Sonitpur	–	–		–
3.	Bihar	Madhubani, Kaimur	Muzaffarpur, Patna	–	–		–
4.	Chhattisgarh	–	Narayanpur, Bastar	–	–		–
5.	Gujarat	Navsari, Vadodara, Anand	–	–	Navsari, Anand		–
6.	Haryana	Faridabad	–	–	–		–
7.	Himachal Pradesh	Solan	Mandi	–	–		–
8.	Jammu And Kashmir	–	Jammu, Kupwara,	–	–		–
9.	Jharkhand	–	Ranchi, Hazaribagh	–	–		–
10.	Kerala	Malapuram	Idukki		Malapuram		
11.	Madhya Pradesh	Tikamgarh, Ratlam, Narsimhapur	–	–	–		–
12.	Maharashtra	Raigad, Thane-Palghar	–	–	–		Raigad, Thane-Palghar
13.	Odisha	Ganjam	Koraput	–	–		Ganjam
14.	Puducherry	Puducherry	–	–	Puducherry		–
15.	Punjab	Bathinda	–	–	–		–
16.	Rajasthan	Ajmer	–	–	–		–
17.	Telangana	Adilabad	–	Nizamabad, Warangal	–		–
18.	Tripura	–	Dhalai, South Tripura, West Tripura	–	–		–
19.	Uttar Pradesh	Pratapgarh, Saharanpur, Etawha, Hardoi, Raibareli	Kushi Nagar	–	–		–
20.	West Bengal	Uttar Dinajpur, Barasat, Barddhaman	Jalgaipuri, Darjeeling	Birbhum, Cooch Behar, Purba Medinipur, South 24 Parganas	–		Purba Medinipur

Source: NCAER primary survey, 2022.

6.5. CAUSES FOR LOW CONSUMPTION OF FISH IN SELECTED DISTRICTS

Causes for low consumption of fish in terms of 'level of agreement' and 'disagreement' to certain Statements reveal (Figure 6.1).

About 73 per cent of the responding districts agreed that 'low consumption of fish among the people in Low-Income Group (LIG) is due to their low purchasing power. For Medium-Income-Group (MIG), low consumption of fish is due to 'lack of awareness about health benefits of fish' was agreed upon by 44.0 per cent.

In High Income Group (HIG), most of the people avoid going to the fish market for buying due to the *poor hygienic condition in the market* and/or lack of freshness of fish', was agreed upon by 53.8 per cent.

Lack of post-harvest processing for domestic market' and 'poor availability of ready-to-cook and ready to-eat fish products' have a negative effect on overall fish consumption, was agreed by 59.6 per cent.

Figure 6.1: Level of Agreement with Regard to Causes for Low Consumption of Fish – All Regions (%)
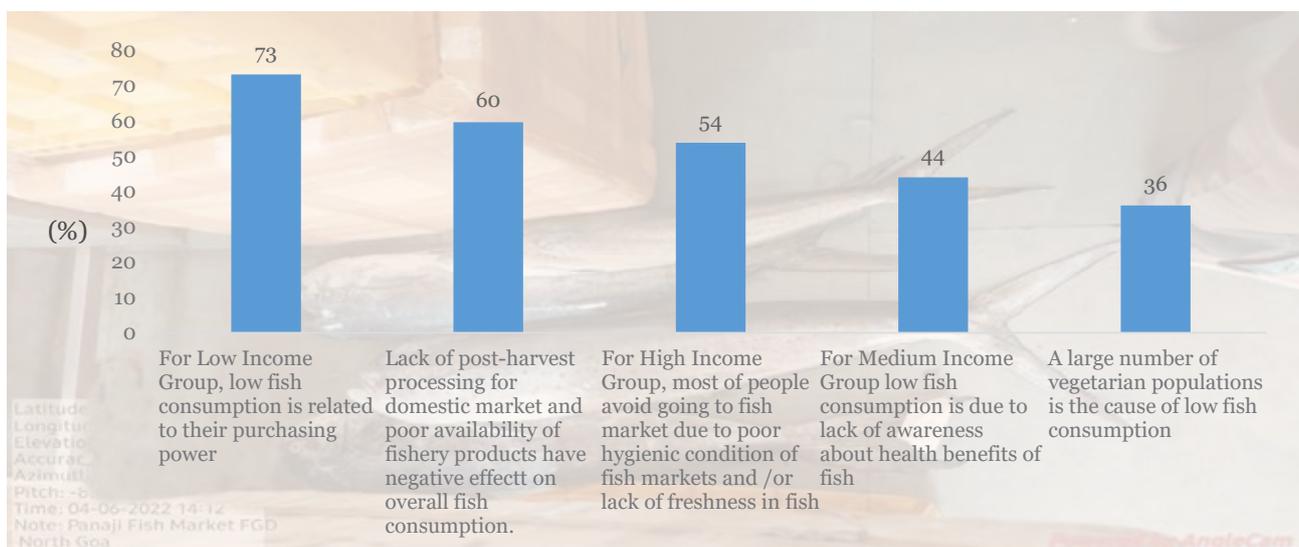
Source: NCAER primary survey, 2022.

6.6. SOLUTIONS FOR INCREASING FISH CONSUMPTION

Similarly, opinion on the, 'solutions for increasing fish consumption' in the district was collected in terms of level of 'agreement' and 'disagreement' towards certain Statements from the district fisheries office (Figure 6.2). In the above graph, the level of agreement with regard to solutions for increasing fish consumption in all regions has been discussed and creating awareness is found to be the greatest solution agreed upon by all States as the awareness campaign conducted on the health benefits of fish. Among other solutions, developing better packaging material, strengthening mobile fish marketing facilities and online fish delivery systems, encouraging the sale of preserved and processed fish in domestic market and emphasizing the branding of the fish like "Ganges fish", "Himalayan Trout", "Sundarban Fish", "Chilka Crab", etc. and conducting 'fish festivals' at the district-level offering fish dishes of various species along with constructing hygienic retail fish markets were the important ones.

Source: NCAER primary survey, 2022.

6.7. SUGGESTIONS FOR INCREASING FISH CONSUMPTION IN SELECTED DISTRICTS

Considering the potential and need in the district, some of the key proposals from the district fisheries office to implement schemes/activities to increase the demand for fish in the district, the major recommendations are as follows:

• Establish door-to-door fish vending, mobile vending centres and hatcheries and processing plants in rural areas

• Establish retail fish kiosks and live fish vending centres

• Construct hygienic and well-equipped fish marketing infrastructure in all municipal areas

• Conduct training and wide publicity through electronic and mass media to create mass awareness regarding the health benefits of fish and fish products.

• Preparation and marketing of value-added fish by-products.

The recommendations received from the selected districts/States have been clubbed together to arrive at the region-wise recommendations (Table 6.4). For district-wise recommendations, please refer Appendix 8.8.

Table 6.4: Considering the Potential and Need of the District, Proposed Schemes and Activities for Govt. to Implement in Order to Increase the Demand for Fish Amongst the Consumers - Region-wise Observations

CENTRAL
• Establishment of retail fish kiosks and live fish vending centres.
• Awareness generation on nutritional values and health benefits of eating fish.
• Small shops should be set up for the sale of different types of fish species.
EAST
• At least one hygienic fish market in every ward of the municipal body.
• Awareness of government-sponsored schemes for increasing fish production through SHGs.
• Awareness generation on nutritive values and health benefits of eating fish.
• Establishment of a centralised fish market.
• Create a well-developed live fish wholesale market at the block level.
• Demonstration of newly introduced fish species culture like Pabda, Bhetki, etc.
• Sell diversification of available fish species based on deficiency of availability.

(Contd.)

- Easy credit facilities should be arranged for inputs.
- Fish stalls/kiosks at every prime location i.e. busy railway stations/ bus stands, etc. with processed/ packaged fish items including live fish run by SHG/FPG& FCS with technical support.
- Hatchery for Pangasius or seed production facility at the local level.
- Imposing restrictions on the use of toxic/banned chemicals for fish preservation.
- Increase the network of seed production.
- Infrastructure creation for selling live fish, reservoirs sites like landing sites, handling sites, etc.
- Infrastructure for marketing processed products.
- Infrastructure to promote quality seed production of various species.
- Infrastructure to promote research on fisheries.
- Creation of mobile fish kiosks in each panchayat and urban ward.
- Modern and hygienic fish market.
- More and more supply of fresh/live fish at a low price to increase consumption.
- Need to organize more awareness on pisciculture techniques and scientific implementation of government-run schemes.
- Providing hygienic kits to fish sellers, retailers and wholesalers.
- Providing three-wheelers to fish suppliers and traders.
- Regional training in fisheries would help grow efficient handling of supply-demand balance.
- Regular non-stop publicity in various media regarding the health benefits of fish consumption.
- Renovation of fish seed hatchery and govt. ponds.
- Specific training programme on fish processing, and cooking for women.
- Subsidy on input items should be continued to boost the level of production.
- Supply of quality seed is a prime requirement to ensure sustainable growth in production.
- Well-equipped shops on a rental basis for poor sellers at prime locations could boost consumption and income generation.
- Value addition in fish products is required for increasing fish consumption.
- Well-equipped vehicle for fish selling /transportation.

NORTH-EAST

- Renovation of existing fish ponds under the Wetland Development Scheme which should be combined with the Beel Fisheries Development Scheme in a sustainable manner.
- Breeding unit for locally important fish species such as Singhi and Mangur.
- Inputs for fish growers on fish seed, feed, etc.
- Input assistance to fish farmers in their existing ponds.
- Development of inland fishing ports at river Brahmaputra.
- Organizing frequent river ranching (river ranching is a form of aquaculture in which a population of a fish species is held in captivity for the first stage of their lives. They are then released and later harvested as adult programmes which would create value addition in fish).
- Mobile live fish vending centres (Three-wheeler/ Four-Wheeler).
- Installation of fish processing plants.
- Construction of hygienic fish marketing infrastructure.
- Making available ready-to-eat fish products.
- Wide publicity through electronic and social media regarding the health benefits of consuming fish.
- Flags, banners and hoardings should be displayed depicting the nutritional value of fish in major marketplaces.
- Mass awareness programme in blocks, panchayats & village level.
- Encouraging paddy-cum-fish culture.
- Renovation of existing ponds and input distribution.
- The establishment of hatcheries is highly required.
- Need to enhance the storage and transportation facilities.
- Farmers should be given more training in fish culture.

(Contd.)

Table 6.4: (Contd.)

NORTH
• Construction of hygienic retail fish markets and fish kiosks. • Increase in mobile fish marketing facilities and online fish delivery system. • Develop post-harvest and fish processing units. • Provision for transportation of live fish and storage. • Construction of fish landing centres on leased water bodies. • Regular marketplace for fish should be provided. • Need to arrange technical training for fish farmers in local areas to develop skills in terms of Bio-Flocks and other new fisheries-related schemes. • Government should start a scheme related to fish insurance. • A massive awareness programme on the health benefits of fish protein is needed to increase fish consumption. • Need to uplift the socio-economic conditions of fishermen.
SOUTH
• Strengthening cold chain and fish storage facilities. • More facilities are needed for live fish marketing. • Various ready-to-eat and ready-to-cook value-added products of freshwater fish could help boost the level of market activities and consumption.
WEST
• Promotion of fish production on a large scale. • Standards and traceability in the fisheries sector from "catch to consumers". • Establishing a robust fisheries management framework. • Enhancement of fisheries export competitiveness. • Construction of fish seed hatchery. • Web development and e-commerce.

Source: NCAER primary survey, 2022.

The level of agreement on low consumption of fish by the different district-level officials in the region are shown in the following graph (Figure 6.3).

Figure 6.3: Level of Agreement with Regard to Causes for Low Consumption of Fish by Region (%)

■ For Low Income Group, low fish consumption is related to their purchasing power

■ For Medium Income Group low fish consumption is due to lack of awareness about health benefits of fish

■ For High Income Group, most of people avoid going to fish market due to poor hygienic condition of fish markets and /or lack of freshness in fish

■ A large number of vegetarian populations is the cause of low fish consumption

■ Lack of post-harvest processing for domestic market and poor availability of fishery products have negative effectt on overall fish consumption.

Source: NCAER primary survey, 2022.

In the above graph, if we see the data of the central region the cause for the low consumption of fish is because of low-income group, a large number of vegetarians in the area and lack of post-harvest processing for the domestic market and poor availability of fish products. In the Eastern region, the major cause of low fish consumption is due to their low purchasing power, lack of post-harvest processing and poor fish availability.

In the Northern region, the major cause of low consumption of fish is because of a large number of vegetarian populations, and low-income groups and due to lack of post-harvest processing and poor availability of fish products. In the Southern region, as per the data, high-income groups avoid going to fish markets because of hygienic conditions and lack of freshness. Also, the lack of post-harvest processing and poor availability of fish products also causes low fish consumption. (Please refer to Appendix D).

We can conclude that in all regions people agreed for conducting mass awareness campaigns on the health benefits of fish. And apart from the Northern region all other regions agree with 100 percentage for conducting fish festivals at the district level offering fish dishes of various species and cuisines to customers to help develop their taste of fish. Encouraging sales of preserved and processed fish in domestic market is favoured in Central and North-East regions but not by the northern States. And all regions accept promoting live fish sales, storage facility and development of appropriate fish products packaging material to increase fish consumption in the market.
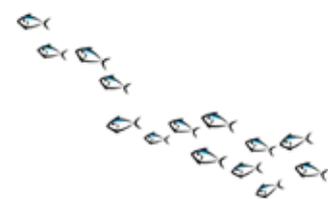
Focus Group Discussion with Stakeholders of the Fisheries Sector

7.1. INTRODUCTION

Fish is a complex and perishable commodity that needs to be disposed of from the point of production/landing to the place of consumption as quickly as possible. The perishability of fish requires careful handling, transportation and other special facilities like icing, cold storage, assembling yards, etc. for rapid delivery to consumers. These are essential to maintain quality and reduce physical and nutritional losses in fish. Many a time, the long supply chain, poor road conditions, and inadequate infrastructure at fish markets cause quality deterioration and high spoilage losses. In order to study the existing fish markets and assess their performance, FDGs were conducted in various district-level wholesale fish markets across the country. This section is based on the findings of the FGDs conducted by the NCAER team across all 24 States/UT in which 85 districts have been covered out of 105 districts selected for the study. The purpose of the FGDs was to conduct in-depth discussion and to collect perceptions, viewpoints, beliefs and attitudes of different market players (aggregators, transporters, wholesalers, retailers, processors, etc.) across the sectors (freshwater & marine) to understand the supply and market dynamics. The stakeholders who participated in the FGD highlighted the status of infrastructure acceptance in wholesale fish markets and the major challenges being faced by them.

In this chapter and the next, the emphasis is given on the different infrastructures of the district-level wholesale fish markets across the country. Information with regards to market structure, infrastructural acceptance, fish arrival and disposal sources, problems/constraints faced, etc. were collected which are important for planning the various interventions related to the development of the fisheries sector. Since we are dealing with the demand side of the fisheries sector, the perspective

Discussion with the retailers, Jammu & Kashmir

of the stakeholders associated with fish markets becomes important. This chapter captures the same.

An impetus was placed on how acceptable all States have the infrastructure facilities in district-level wholesale fish markets in terms of parking area, transportation, cold storage, icing, live fish keeping facility, salting, drying, pre-processing facilities, water supply for washing and cleaning, drainage, drinking water, toilets, power back-ups, waste disposal facilities, etc. It also looks at the challenges faced by the traders, and the suggestions they consider would improve the same.

7.2. MARKETING CHANNELS

Fish and fish products, whether for domestic consumption or for export, move in the marketing chain through different channels. The marketing channels vary from each other on the basis of market functionaries involved in carrying the produce from the farmers/fishermen to the consumers. The length of the marketing channel depends on the size of the market, the nature of the commodity and the pattern of demand at the consumer level. Fish marketing systems in India involve several marketing channels, each with a number of intermediaries between producer and consumer.

The common marketing channel for freshwater fish involves traders and fishermen cooperatives (Figure 7.1). The traders collect fish from the farms/landing centres (either through auctions or at fixed prices) and supply the fish to the markets for a commission. The fishermen's co-operatives carry out the same function as the trader. Both the traders and co-operatives sell their fish to the wholesalers. The wholesalers sell off their fish to retailers or mobile traders or bulk consumers like hoteliers. The retailers sell the fish to the consumers with or without value addition.

Figure 7.1: Marketing Channel for Freshwater Fishes
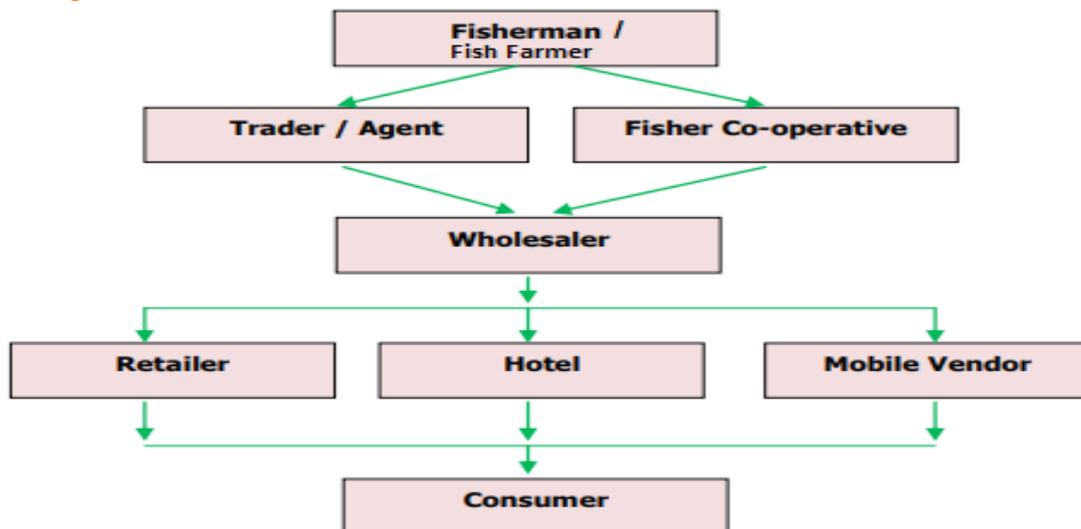
The common domestic fish marketing channel for marine fish in India is one that has the auctioneer, commission agent, wholesaler and retailer as intermediaries (Figure 7.2). The fishermen sell their catch through the auctioneer, usually at the landing centre, without any value addition. Generally, each fisherman has a pre-fixed auctioneer through whom he sells his catch. The auctioneer conducts the auction and sells the fish to the local dealers/fish collectors, who then take it to the wholesale market and auction it off to the wholesalers. The wholesalers in turn sell their fish to the retailer after re-icing, salting, cleaning, size grading, etc. Vendors and hoteliers also might buy their supply of fish from the wholesaler directly. Retailers carry out further value addition by re-icing, size grading, dressing and filleting the fish and selling the same to the consumers.

Figure 7.2: Marketing Channel for Marine Fishes
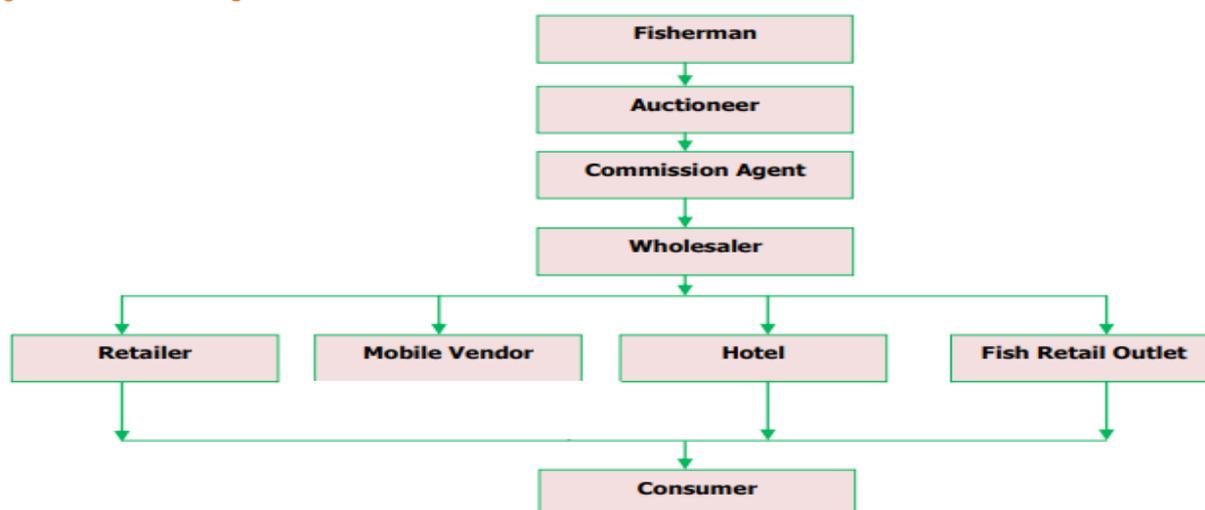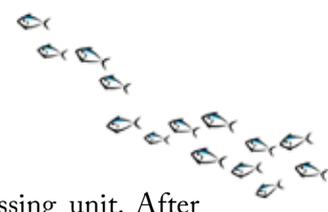
For export, the common marketing channel for fish involves the trader or agent and the fish processing unit (Figure 7.3). Fish is purchased from the producer by traders or agents of the export processing unit. The traders sell their fish to the processing unit. After processing, the fish are sent to foreign destinations by the exporters.

Figure 7.3: Marketing Channel for Export of Fish from India

7.3. MARKET STRUCTURE AND SPREAD

The wholesale fish markets across the country can be categorised into two distinct categories; traditional markets (old markets) and modern markets (comparatively new markets). The traditional markets are typical wholesale markets, often located at the district headquarters or on major railway junctions. Although fish from local areas were also traded in a majority of these markets, the percentage of local fish was comparatively low. Over the last decade, there has been a visible increase in the share of local production which has necessitated changes in the trading systems in the traditional markets. At the same time, due to the enhanced local production, the new markets (modern ones) have come up dealing more in local fish and in locations which were closer to the production zones and different from the traditional markets. These modern markets are different from the traditional markets in the Table 7.1.

Table 7.1: Traditional and Modern Market-based Systems

Traditional markets	Modern markets
A mandi-based market system, converging essentially to a bazaar format for selling fisheries products to the consumers	Mostly the online and supply-oriented format through adding value additions to the value chains system
Located mostly in district headquarters and nearer to consumption pockets.	Located near the production clusters and often away from major consumption pockets
Located on government or municipal land under a designated urban marketplace. The development of these markets is difficult due to the paucity of space. The infrastructure and facilities are mostly old.	Many new markets are being created by the government under various schemes. The market locations are spread across urban centres as well as production clusters. Infrastructure and facilities are adequate and modern.
Traditional markets generally focus on the ease of the retailers in buying the fish and carrying it to their retail points. Retail markets are generally closer to traditional markets.	Modern markets deal more in local fish and focus on the ease of the farmers to sell their produce.
The business rapport between buyers as well as sellers is well-developed in traditional markets.	Business services like ice supply, transport, storage, packing, skilled labour, etc. are being developed adequately in modern markets.
Quantity and variety of fish arrivals are well planned and communicated among market players.	Quantity and variety of arrivals lack predictability and information exchange is rudimentary.

7.4. GENERAL INFORMATION ABOUT FISHERIES SECTOR

The fisheries industry plays a significant role in global food systems, providing a source of protein for millions of people around the world. However, the management of this sector can be complex, with a range of challenges related to sustainability, resource allocation and economic viability. One important aspect of fishery management is the control of market forces, which can impact the viability of individual fishing operations and the overall health of the industry. The figure below presents the analysis of market control in this sector. It can be observed that local bodies have the highest level of control at 42 per cent, while government control accounts for only 25 per cent followed by cooperative societies at 19 per cent of the fish market. These findings suggest that local bodies play a significant role in controlling the fisheries sector (Figure 7.4).

Figure 7.4: Market Control in Fisheries Sector
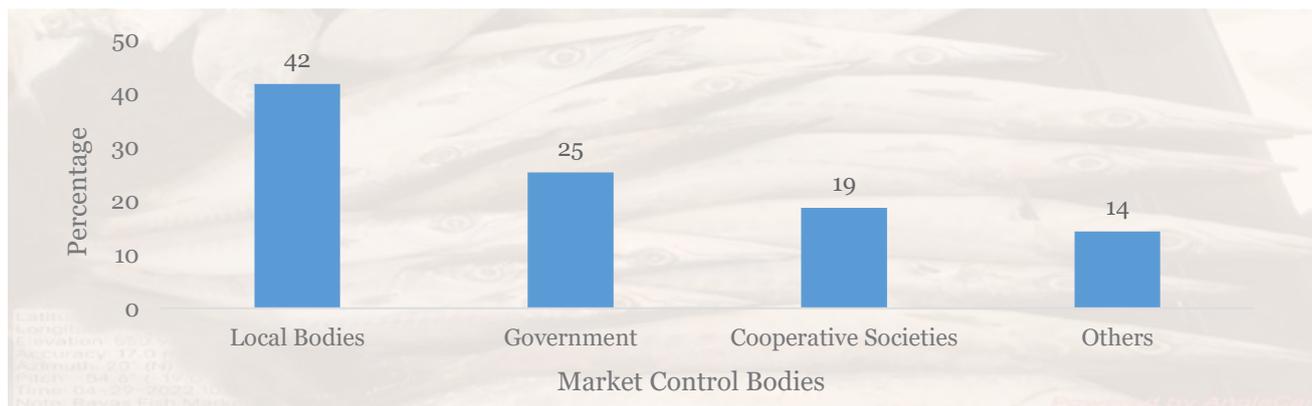
7.5. WEB-BASED FISH MARKET

A Fish Market and Price Information System (FMPIS) is a web-based platform that provides real-time or near real-time information on fish prices, availability, and other market data to stakeholders in the seafood industry. This can include fishermen, fish farmers, seafood processors, wholesalers, retailers and consumers.

FMPIS can help improve the efficiency and transparency of seafood markets by providing timely and accurate market information to all participants. This can reduce the information asymmetry that often exists between different market actors, and can also help to reduce price volatility.

FMPIS can also help to improve food security by providing information on the availability and price of different types of fish, which can help to ensure that people have access to affordable, high-quality seafood.

Overall, FMPIS can play a valuable role in supporting the seafood industry and promoting sustainable, efficient, and transparent markets. But according to the survey results, *only 12 per cent of fishermen reported that their markets are connected to a Fish Market & Price Information System (FMPIS), while 88 per cent of fishermen reported that their markets are not connected to any web–based FMPIS.*

The results of a survey on the prevalence of FMPIS can have important implications for the future prospects of the fisheries sector. Some potential implications of these results for the future prospects of the sector could include:

- **Limited transparency and efficiency:** If a significant proportion of fishermen do not have access to FMPIS, this could limit the transparency and efficiency of the fishery sector. This could result in higher costs and reduced competitiveness for producers, and potentially higher prices for consumers.

- **Reduced profitability:** Without access to real-time or near real-time market data, fishermen may have difficulty in making informed decisions about the sale and purchase of fish. This could result in reduced profits or increased financial risk.

- **Increased risk of exploitation:** Without access to market information, fishermen may be more vulnerable to exploitation by buyers or intermediaries who may offer them lower prices than they could otherwise get in a more transparent market. This could result in reduced profits and increased financial risk for fishermen.

- **Limited data for policy-making**: Without access to comprehensive market data, it may be difficult for policy-makers to make informed decisions about the management and regulation of seafood markets. This could result in policies that are less effective at promoting sustainable, efficient and transparent markets.

- Overall, the lack of access to web-based FMPIS could have negative implications for the future prospects of the fisheries sector, including reduced transparency, efficiency and profitability.

7.6. INFRASTRUCTURAL ACCEPTANCE IN WHOLESALE FISH MARKETS

The focus group discussion (FGD) included an assessment of infrastructure in India, including parking areas, transportation, cold storage, icing, live fish-keeping facilities, salting, drying, pre-processing facilities, water supply for washing and cleaning, drainage, drinking water, toilets, power back-ups, and waste disposal facilities. This assessment was based on the discussion that took place during the FGD.
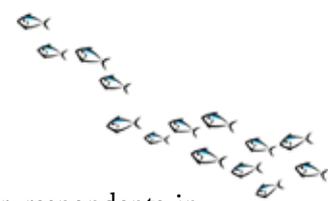
1. **Parking area:** During the survey, respondents in Kerala, Tamil Nadu and Tripura reported that parking facilities were acceptable, while those in Assam, Chhattisgarh, Gujarat, Haryana, J&K and Rajasthan Stated that parking facilities were moderately acceptable. However, respondents in Bihar, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Punjab, Telangana, Uttar Pradesh and West Bengal reported that parking facilities were not acceptable (Table 7.2).

Table 7.2: Sufficient and Deficient District Representation of Infrastructural Acceptance Adequacy in Wholesale Fish Markets Based on Parking Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Parking area	Assam	Bongaigaon, Darrang, Sonitpur	Golaghat, Nagaon, Tinsukia
	Bihar	Buxar, Kaimur (Bhabua), Patna	Bhagalpur, Darbhanga, Gaya, Madhubani, Muzaffarpur
	Chhattisgarh	Raipur	Bastar
	Delhi	North	
	Goa	North Goa	
	Gujarat	Vadodara	Navsari
	Haryana	Faridabad	Hisar
	Himachal Pradesh		Mandi, Solan
	Jammu & Kashmir	Jammu	Kupwara
	Jharkhand	Ranchi	Godda, Hazaribagh
	Karnataka	Udupi	Mandya
	Kerala	Palakkad, Thrissur	
	Madhya Pradesh	Narsinghpur	Ratlam, Tikamgarh
	Maharashtra	Raigarh, Sangli	Akola, Amravati, Nandurbar, Thane
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Punjab		Bathinda, Jalandhar
	Puducherry	Karaikal	
	Rajasthan	Jodhpur	Ajmer
	Tamil Nadu	Dharmapuri, Erode, Nagapattinam, Thoothukkudi, Tiruchirappalli	Madurai, Thiruvallur
	Telangana		Adilabad, Nizamabad, Warangal
	Tripura	Dhalai, South Tripura, West Tripura	
	Uttar Pradesh		Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal	Darjeeling	Bardhaman, Birbhum, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Purba Medinipur, South 24 Parganas, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

2. **Cold storage:** During the FGD, respondents in Rajasthan and Tamil Nadu reported that cold storage facilities were acceptable, while those in Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Telangana, Tripura, Uttar Pradesh and West Bengal Stated that cold storage facilities were not acceptable (Table 7.3).

Table 7.3: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Cold Storage Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Cold storage facilities	Assam		Bongaigaon, Darrang, Golaghat, Nagaon, Sonitpur, Tinsukia
	Bihar	Patna	Bhagalpur, Buxar, Darbhanga, Gaya, Kaimur (Bhabua), Madhubani, Muzaffarpur
	Chhattisgarh		Bastar, Raipur
	Delhi	North	
	Goa		North Goa
	Gujarat		Navsari, Vadodara
	Haryana		Faridabad, Hisar
	Himachal Pradesh	Solan	Mandi
	Jammu & Kashmir		Jammu, Kupwara
	Jharkhand		Godda, Hazaribagh, Ranchi
	Karnataka		Mandya, Udupi
	Kerala		Palakkad, Thrissur
	Madhya Pradesh		Narsinghpur, Ratlam, Tikamgarh
	Maharashtra		Akola, Amravati, Nandurbar, Raigarh, Sangli, Thane
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Puducherry		Karaikal
	Punjab		Bathinda, Jalandhar
	Rajasthan	Ajmer	Jodhpur
	Tamil Nadu	Dharmapuri, Thoothukkudi, Tiruchirappalli	Erode, Madurai, Nagapattinam, Thiruvallur
	Telangana		Adilabad, Nizamabad, Warangal
	Tripura		Dhalai, South Tripura, West Tripura
	Uttar Pradesh		Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal		Bardhaman, Birbhum, Darjeeling, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Purba Medinipur, South 24 Parganas, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

3. **Icing facilities:** During the survey, respondents in Himachal Pradesh and Tamil Nadu reported that icing facilities were acceptable, while those in Assam, Bihar, Gujarat, Haryana, J&K, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Telangana, Tripura, Uttar Pradesh and West Bengal Stated that icing facilities were not acceptable (Table 7.4).

Table 7.4: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Icing Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Icing facilities	Assam	Darrang	Bongaigaon, Golaghat, Nagaon, Sonitpur, Tinsukia
	Bihar		Bhagalpur, Buxar, Darbhanga, Gaya, Kaimur (Bhabua), Madhubani, Muzaffarpur, Patna
	Chhattisgarh	Raipur	Bastar
	Delhi	North	
	Goa	North Goa	
	Gujarat		Navsari, Vadodara
	Haryana		Faridabad, Hisar
			Hisar
	Himachal Pradesh	Mandi, Solan	
	Jammu & Kashmir		Jammu, Kupwara
	Jharkhand		Godda, Hazaribagh, Ranchi
	Karnataka		Mandya, Udupi
	Kerala		Palakkad, Thrissur
	Madhya Pradesh	Narsinghpur	Ratlam, Tikamgarh
	Maharashtra	Akola	Amravati, Nandurbar, Raigarh, Sangli, Thane
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Puducherry		Karaikal
	Punjab	Jalandhar	Bathinda
	Rajasthan	Jodhpur	Ajmer
	Tamil Nadu	Dharmapuri, Erode, Nagapattinam, Thiruvallur, Thoothukkudi, Tiruchirappalli	
	Telangana	Adilabad	Nizamabad, Waranga
	Tripura		Dhalai, South Tripura, West Tripura
	Uttar Pradesh		Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal		Bardhaman, Birbhum, Darjeeling, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Purba Medinipur, South 24 Parganas, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

4. **Live fish-keeping facilities:** During the survey, respondents in Delhi, Himachal Pradesh, J&K, Tamil Nadu, and Telangana reported that live fish-keeping facilities were acceptable, while those in Assam, Bihar, Gujarat, Haryana, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tripura, Uttar Pradesh and West Bengal Stated that live fish-keeping facilities were not acceptable (Table 7.5).

Table 7.5: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Live Fish-keeping Facility

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Live fish-keeping facilies	Assam		Bongaigaon, Darrang, Golaghat, Nagaon, Sonitpur, Tinsukia
	Bihar		Bhagalpur, Buxar, Darbhanga, Gaya, Kaimur (Bhabua), Madhubani, Muzaffarpur, Patna
	Chhattisgarh	Raipur	Bastar
	Delhi	North	
	Goa		North Goa
	Gujarat		Navsari, Vadodara
	Haryana		Faridabad, Hisar
	Himachal Pradesh	Solan	Mandi
	Jammu & Kashmir	Kupwara	Jammu
	Jharkhand		Godda, Hazaribagh, Ranchi
	Karnataka		Mandya, Udupi
	Kerala		Palakkad, Thrissur
	Madhya Pradesh	Narsinghpur	Ratlam, Tikamgarh
	Maharashtra	Akola	Amravati, Nandurbar, Raigarh, Sangli, Thane
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Puducherry		Karaikal
	Punjab		Bathinda, Jalandhar
	Rajasthan		Ajmer, Jodhpur
	Tamil Nadu	Dharmapuri, Erode, Madurai, Thiruvallur, Thoothukkudi, Tiruchirappalli	Nagapattinam
	Telangana	Nizamabad, Warangal	Adilabad
	Tripura		Dhalai, South Tripura, West Tripura
	Uttar Pradesh	Saharanpur	Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli
	West Bengal		Bardhaman, Birbhum, Darjeeling, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Purba Medinipur, South 24 Parganas, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

5. **Salting facilities:** During the survey, respondents in Delhi, Himachal Pradesh, and Tamil Nadu, the salting facilities were found to be acceptable. However, respondents from Assam, Bihar, Gujarat, Haryana, J&K, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Telangana, Tripura, Uttar Pradesh and West Bengal reported that the salting facilities were not acceptable (Table 7.6).

Table 7.6: Self-sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Salting Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Salting facilities	Assam		Bongaigaon, Darrang, Golaghat, Nagaon, Sonitpur
	Bihar		Tinsukia, Bhagalpur, Buxar, Darbhanga, Gaya, Kaimur (Bhabua), Madhubani, Muzaffarpur, Patna
	Chhattisgarh		Bastar, Raipur
	Delhi	North	
	Goa		North Goa
	Gujarat		Navsari, Vadodara
	Haryana		Faridabad, Hisar
	Himachal Pradesh	Mandi	Solan
	Jammu & Kashmir		Jammu, Kupwara
	Jharkhand		Godda, Hazaribagh, Ranchi
	Karnataka		Mandya, Udupi
	Kerala		Palakkad, Thrissur
	Madhya Pradesh		Narsinghpur, Ratlam, Tikamgarh
	Maharashtra		Akola, Amravati, Nandurbar, Raigarh, Sangli, Thane
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Puducherry		Karaikal
	Punjab		Bathinda, Jalandhar
	Rajasthan		Ajmer, Jodhpur
	Tamil Nadu	Dharmapuri, Nagapattinam, Thiruvallur, Thoothukkudi, Tiruchirappalli	Erode, Madurai
	Telangana		Adilabad, Nizamabad, Warangal
	Tripura		Dhalai, South Tripura, West Tripura
	Uttar Pradesh	Saharanpur	Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli
	West Bengal		Bardhaman, Birbhum, Darjeeling, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Purba Medinipur, South 24 Parganas, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

6. **Drying facilities:** During the survey, respondents in Haryana, J&K, Puducherry, Rajasthan, Tamil Nadu and Telangana felt that the drying facilities were acceptable. However, respondents from Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Telangana, Tripura, Uttar Pradesh and West Bengal reported that the drying facilities were not acceptable (Table 7.7).

Table 7.7: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Drying Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Drying facilities	Assam		Bongaigaon, Darrang, Golaghat, Nagaon, Sonitpur, Tinsukia
	Bihar		Bhagalpur, Buxar, Darbhanga, Gaya, Kaimur (Bhabua), Madhubani, Muzaffarpur, Patna
	Chhattisgarh		Bastar, Raipur
	Delhi		North
	Goa		North Goa
	Gujarat		Navsari, Vadodara
	Haryana	Hisar	Faridabad
	Himachal Pradesh		Mandi, Solan
	Jammu & Kashmir	Jammu	Kupwara
	Jharkhand		Godda, Hazaribagh, Ranchi
	Karnataka	Udupi	Mandya
	Kerala		Palakkad, Thrissur
	Madhya Pradesh		Narsinghpur, Ratlam, Tikamgarh
	Maharashtra		Akola, Amravati, Nandurbar, Raigarh, Sangli, Thane
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Puducherry	Karaikal	
	Punjab		Bathinda, Jalandhar
	Rajasthan	Ajmer	Jodhpur
	Tamil Nadu	Dharmapuri, Erode, Nagapattinam, Thoothukkudi, Tiruchirappalli	Madurai, Thiruvallur
	Telangana	Adilabad, Warangal	Nizamabad
	Tripura		Dhalai, South Tripura, West Tripura
	Uttar Pradesh		Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal		Bardhaman, Birbhum, Darjeeling, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Purba Medinipur, South 24 Parganas, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

7. **Pre-processing facilities:** During the survey, respondents in Haryana, J&K, Puducherry, Rajasthan, Tamil Nadu and Telangana reported that the pre-processing facilities were acceptable. However, respondents from Assam, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Telangana, Tripura, Uttar Pradesh and West Bengal reported that the pre-processing facilities were not acceptable (Table 7.8).

Table 7.8: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Pre-processing Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Pre-processing facilities	Assam	Darrang	Bongaigaon, Golaghat, Nagaon, Sonitpur, Tinsukia
	Bihar		Bhagalpur, Buxar, Darbhanga, Gaya, Kaimur (Bhabua), Madhubani, Muzaffarpur, Patna
	Chhattisgarh	Raipur	Bastar
	Delhi	North	
	Goa		North Goa
	Gujarat		Navsari, Vadodara
	Haryana		Faridabad, Hisar
	Himachal Pradesh	Mandi	Solan
	Jammu & Kashmir	Jammu, Kupwara	
	Jharkhand	Ranchi	Godda, Hazaribagh
	Karnataka		Mandya, Udupi
	Kerala		Palakkad, Thrissur
	Madhya Pradesh	Narsinghpur, Ratlam, Tikamgarh	
	Maharashtra		Akola, Amravati, Nandurbar, Raigarh, Sangli, Thane
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Puducherry		Karaikal
	Punjab		Bathinda, Jalandhar
	Rajasthan		Ajmer, Jodhpur
	Tamil Nadu	Dharmapuri, Madurai, Thiruvallur, Thoothukkudi, Tiruchirappalli	Erode, Nagapattinam
	Telangana	Adilabad, Nizamabad	Warangal
	Tripura		Dhalai, South Tripura, West Tripura
	Uttar Pradesh		Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal		Bardhaman, Birbhum, Darjeeling, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Purba Medinipur, South 24 Parganas, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

8. **Water supply for washing and cleaning:** During the survey, respondents in Assam, Delhi, Goa, Himachal Pradesh, J&K, Rajasthan, Tamil Nadu, Telangana and West Bengal reported that the water supply for washing and cleaning were acceptable. However, respondents from Jharkhand, Kerala, Madhya Pradesh, Odisha, Punjab, Tripura and Uttar Pradesh reported that the water supply for washing and cleaning were not acceptable (Table 7.9).

Table 7.9: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Water Supply for Washing and Cleaning

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Water supply for washing & cleaning	Assam	Bongaigaon, Golaghat, Nagaon, Sonitpur	Darrang, Tinsukia
	Bihar	Buxar, Darbhanga, Kaimur (Bhabua), Patna	Bhagalpur, Gaya, Madhubani, Muzaffarpur
	Chhattisgarh	Raipur	Bastar
	Delhi	North	
	Goa	North Goa	
	Gujarat	Navsari	Vadodara
	Haryana	Hisar	Faridabad
	Himachal Pradesh	Mandi, Solan	
	Jammu & Kashmir	Jammu, Kupwara	
	Jharkhand	Ranchi	Godda, Hazaribagh
	Karnataka	Mandya	Udupi
	Kerala		Palakkad, Thrissur
	Madhya Pradesh	Narsinghpur	Ratlam, Tikamgarh
	Maharashtra	Raigarh, Sangli, Thane	Akola, Amravati, Nandurbar
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Puducherry		Karaikal
	Punjab		Bathinda, Jalandhar
	Rajasthan	Ajmer, Jodhpur	
	Tamil Nadu	Dharmapuri, Madurai, Nagapattinam, Thiruvallur, Thoothukkudi, Tiruchirappalli	Erode
	Telangana	Adilabad, Nizamabad, Warangal	
	Tripura		Dhalai, South Tripura, West Tripura
	Uttar Pradesh		Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal	Bardhaman, Darjeeling, North 24 Parganas, Purba Medinipur, South 24 Parganas, Uttar Dinajpur	Birbhum, Howrah, Jalpaiguri, Cooch Behar

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

9. **Drainage facilities:** During the survey, respondents in Assam, Bihar, Delhi, Goa, Himachal Pradesh, J&K, Tamil Nadu, Telangana, Tripura and West Bengal reported that the drainage facilities were acceptable. However, respondents from Gujarat, Madhya Pradesh, Maharashtra, Odisha, and Uttar Pradesh reported that the drainage facilities were not acceptable (Table 7.10).

Table 7.10: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Drainage Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Drainage facilities	Assam	Bongaigaon, Golaghat, Nagaon, Sonitpur, Tinsukia	Darrang
	Bihar	Bhagalpur, Buxar, Darbhanga, Gaya, Kaimur (Bhabua), Patna	Madhubani
	Chhattisgarh	Raipur	Bastar
	Delhi	North	
	Goa	North Goa	
	Gujarat		Navsari, Vadodara
	Haryana	Hisar	Faridabad
	Himachal Pradesh	Mandi, Solan	
	Jammu & Kashmir	Jammu, Kupwara	
	Jharkhand	Godda, Ranchi	Hazaribagh
	Karnataka	Mandya	Udupi
	Kerala	Thrissur	Palakkad
	Madhya Pradesh		Narsinghpur, Ratlam, Tikamgarh
	Maharashtra	Raigarh, Thane	Akola, Amravati, Nandurbar, Sangli
	Odisha	Puri	Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput
	Puducherry		Karaikal
	Punjab	Jalandhar	Bathinda
	Rajasthan	Jodhpur	Ajmer
	Tamil Nadu	Dharmapuri, Erode, Madurai, Nagapattinam, Thiruvallur, Thoothukkudi, Tiruchirappalli	
	Telangana	Adilabad, Nizamabad, Warangal	
	Tripura	Dhalai, South Tripura, West Tripura	
	Uttar Pradesh	Hardoi	Etawah, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal	Bardhaman, Birbhum, Jalpaiguri, North 24 Parganas, Purba Medinipur, South 24 Parganas, Uttar Dinajpur	Darjeeling, Howrah, Cooch Behar

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

10. **Drinking water:** During the survey, respondents in Delhi, Goa, Himachal Pradesh, J&K, Maharashtra, Rajasthan, and Tamil Nadu reported that the drinking facilities were acceptable. However, respondents from Assam, Gujarat, Haryana, Jharkhand, Karnataka, Madhya Pradesh, Odisha, Puducherry, Telangana, Tripura, Uttar Pradesh and West Bengal reported that the drinking water facilities were not acceptable (Table 7.11).

Table 7.11: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Drinking Water

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Drinking water	Assam	Nagaon	Bongaigaon, Darrang, Golaghat, Sonitpur, Tinsukia
	Bihar	Buxar, Darbhanga, Kaimur (Bhabua), Patna	Bhagalpur, Gaya, Madhubani, Muzaffarpur
	Chhattisgarh	Raipur	Bastar
	Delhi	North	
	Goa	North Goa	
	Gujarat		Navsari, Vadodara
	Haryana		Faridabad, Hisar
	Himachal Pradesh	Mandi, Solan	
	Jammu & Kashmir	Jammu, Kupwara	
	Jharkhand	Ranchi	Godda, Hazaribagh
	Karnataka		Mandya, Udupi
	Kerala	Thrissur	Palakkad
	Madhya Pradesh		Narsinghpur, Ratlam, Tikamgarh
	Maharashtra	Amravati, Raigarh, Sangli, Thane	Akola, Nandurbar
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Puducherry		Karaikal
	Punjab	Jalandhar	Bathinda
	Rajasthan	Ajmer, Jodhpur	
	Tamil Nadu	Dharmapuri, Erode, Madurai, Nagapattinam, Thiruvallur, Thoothukkudi, Tiruchirappalli	
	Telangana		Adilabad, Nizamabad, Warangal
	Tripura	Dhalai	South Tripura, West Tripura
	Uttar Pradesh	Hardoi	Etawah, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal	Bardhaman, South 24 Parganas	Birbhum, Darjeeling, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Purba Medinipur, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

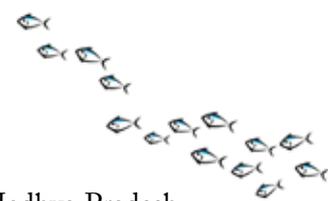**11. Toilet facilities:** During the survey, respondents in Assam, Bihar, Delhi, Goa, Tamil Nadu, and Tripura reported that the toilet facilities were acceptable. However, respondents from Haryana, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Puducherry, Punjab, Telangana and Uttar Pradesh reported that the toilet facilities were not acceptable (Table 7.12).

Table 7.12: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Toilet Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Toilets facilities	Assam	Bongaigaon, Darrang, Golaghat, Nagaon, Sonitpur, Tinsukia	
	Bihar	Buxar, Darbhanga, Kaimur (Bhabua), Muzaffarpur, Patna	Bhagalpur, Gaya, Madhubani
	Chhattisgarh	Raipur	Bastar
	Delhi	North	
	Goa	North Goa	
	Gujarat	Navsari	Vadodara
	Haryana		Faridabad, Hisar
	Himachal Pradesh	Mandi	Solan
	Jammu & Kashmir	Jammu	Kupwara
	Jharkhand	Godda	Hazaribagh, Ranchi
	Karnataka	Mandya, Udupi	
	Kerala	Thrissur	Palakkad
	Madhya Pradesh	Narsinghpur	Ratlam, Tikamgarh
	Maharashtra	Raigarh, Thane	Akola, Amravati, Nandurbar
	Odisha	Puri	Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput
	Puducherry		Karaikal
	Punjab		Bathinda, Jalandhar
	Rajasthan	Ajmer, Jodhpur	
	Tamil Nadu	Dharmapuri, Madurai, Nagapattinam, Thiruvallur, Thoothukkudi, Tiruchirappalli	Erode
	Telangana	Adilabad	Nizamabad, Warangal
	Tripura	Dhalai, West Tripura	South Tripura
	Uttar Pradesh		Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal	Bardhaman, Cooch Behar, North 24 Parganas, Purba Medinipur, South 24 Parganas	Birbhum, Darjeeling, Howrah, Jalpaiguri, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

12. **Power back-up facilities:** During the survey, respondents in Delhi, Goa, J&K and Telangana reported that the power bank-up facilities were acceptable. However, respondents from Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Puducherry, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal reported that the power back-up facilities were not acceptable (Table 7.13).

Table 7.13: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Power Back-up Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Power back-up facilities	Assam	Bongaigaon, Darrang, Nagaon	Golaghat, Sonitpur, Tinsukia
	Bihar	Buxar	Bhagalpur, Darbhanga, Gaya, Kaimur (Bhabua), Madhubani, Muzaffarpur, Patna
	Chhattisgarh		Bastar, Raipur
	Delhi	North	
	Goa	North Goa	
	Gujarat		Navsari, Vadodara
	Haryana		Faridabad, Hisar
	Himachal Pradesh		Mandi, Solan
	Jammu & Kashmir	Jammu, Kupwara	
	Jharkhand		Godda, Hazaribagh, Ranchi
	Karnataka		Mandya, Udupi
	Kerala		Palakkad, Thrissur
	Madhya Pradesh		Narsinghpur, Ratlam, Tikamgarh
	Maharashtra	Raigarh	Akola, Amravati, Nandurbar, Sangli, Thane
	Odisha		Bhadrak, Gajapati, Ganjam, Kendrapara, Koraput, Puri
	Puducherry		Karaikal
	Punjab		Bathinda, Jalandhar
	Rajasthan		Ajmer, Jodhpur
	Tamil Nadu	Dharmapuri, Thoothukkudi	Erode, Madurai, Nagapattinam, Thiruvallur, Tiruchirappalli
	Telangana	Adilabad, Warangal	Nizamabad
	Tripura		Dhalai, South Tripura, West Tripura
	Uttar Pradesh		Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal	Bardhaman, Purba Medinipur, South 24 Parganas	Birbhum, Darjeeling, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Uttar Dinajpur

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

13. Waste disposal facilities: During the survey, respondents in Assam, Delhi, Goa, Karnataka, Puducherry, Tami Nadu, Telangana, and Tripura reported that the waste disposal facilities were acceptable. However, respondents from Bihar, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Uttar Pradesh and West Bengal reported that the waste disposal facilities were not acceptable (Table 7.14).

Table 7.14: Sufficient and Deficient District Representation of Infrastructural Acceptance in Wholesale Fish Markets Based on Waste Disposal Facilities

Infrastructure	States/UTs	Sufficient districts	Deficient districts
Water disposal facilities	Assam	Bongaigaon, Darrang, Golaghat, Nagaon, Sonitpur, Tinsukia	
	Bihar	Buxar	Bhagalpur, Darbhanga, Gaya, Kaimur (Bhabua), Madhubani, Muzaffarpur, Patna
	Chhattisgarh	Raipur	Bastar
	Delhi	North	
	Goa	North Goa	
	Gujarat		Navsari, Vadodara
	Haryana	Hisar	Faridabad
	Himachal Pradesh		Mandi, Solan
	Jammu & Kashmir	Jammu	Kupwara
	Jharkhand		Godda, Hazaribagh, Ranchi
	Karnataka	Mandya, Udupi	
	Kerala	Thrissur	Palakkad
	Madhya Pradesh	Narsinghpur	Ratlam, Tikamgarh
	Maharashtra	Akola, Raigarh, Thane	Amravati, Nandurbar, Sangli
	Odisha	Koraput, Puri	Bhadrak, Gajapati, Ganjam, Kendrapara
	Puducherry	Karaikal	
	Punjab	Jalandhar	Bathinda
	Rajasthan	Jodhpur	Ajmer
	Tamil Nadu	Dharmapuri, Madurai, Nagapattinam, Thiruvallur, Thoothukkudi, Tiruchirappalli	Erode
	Telangana	Adilabad, Nizamabad, Warangal	
	Tripura	Dhalai, South Tripura, West Tripura	
	Uttar Pradesh		Etawah, Hardoi, Jalaun, Kushinagar, Pratapgarh, Raebareli, Saharanpur
	West Bengal	Bardhaman, South 24 Parganas	Birbhum, Darjeeling, Howrah, Jalpaiguri, Cooch Behar, North 24 Parganas, Purba Medinipur, Uttar Dinajpur

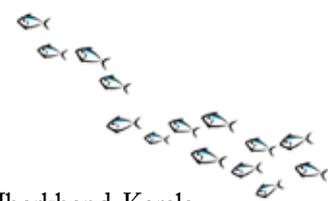*Source:* NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

7.7. PROBLEM FACED BY THE STAKEHOLDERS IN WHOLESALE FISH MARKETS

The survey conducted by NCAER asked the respondents about the problems/constraints faced by them in fish markets which are identified as:

- Facing high marketing costs when introducing a product to the market;
- There is a lack of infrastructure facilities and proper workspace;
- Transportation cost is very high due to which fish bought from distant places costs higher;
- Lack of diversity is also noticeable in the product range;
- Due to the cut-throat competition, it is difficult for them to carry on the business for very long; and
- Lack of business is also a problem in some cases.

At all India-level, it is quite noticeable that the stakeholders are aware of the major problems associated with the fish markets, viz., the lack of infrastructure and amenities, high transportation cost, and high marketing cost. Therefore, the government should develop market-related infrastructure facilities in the potential locations. Besides, the government should extend financial help in terms of

Dry Fish Market at Birbhum, West Bengal

credit at low-interest rates and subsidies to interested entrepreneurs. The lack of land at strategic locations for the development of modern fish markets is a big challenge. The fisheries department should consult the municipal bodies and other local authorities to find out appropriate land in suitable locations. Figure 7.5 summarizes the problems faced by the stakeholders.

Figure 7.5: Problem Faced by Stakeholders at All-India Level
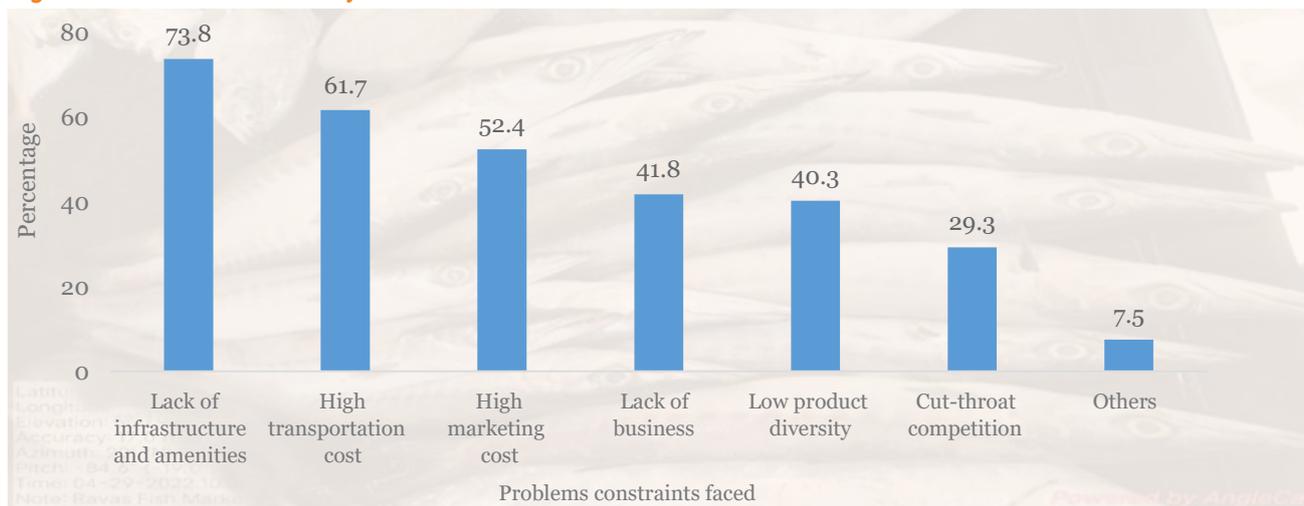
Source: NCAER's calculations based on Primary Survey, 2022 data collected for this study.
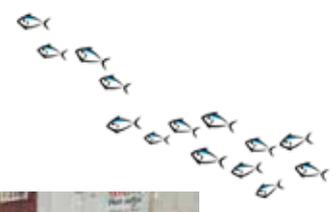
7.8. REGION-WISE REPRESENTATION OF THE PROBLEMS FACED BY THE STAKEHOLDERS

The previous section presents an all-India-level discussion on the problems faced by the stakeholders. This section further decodes the discussion to indicate problems in the stakeholders in different regions of the country (Table 7.15).

Fish Market, Tamil Nadu

Table 7.15: Region-wise Representation of Problems/Constraints Faced

Region	High marketing cost (%)	Lack of infrastructure and amenities (%)	Lack of business (%)	High transportation cost (%)	Cut-throat competition (%)	Low product diversity (%)
Northern	61	67	22	28	17	22
Southern	63	69	21	100	45	0
Eastern	50	93	57	64	26	57
Western	43	50	71	43	14	71
Central	20	80	40	100	60	60
North-East	50	43	43	43	43	43

Source: NCAER's calculations based on Primary Survey, 2022 data collected for this study.

According to the data, fishermen in the Northern States experience a high level of difficulty with marketing costs. This is likely due to a lack of proper market structure and infrastructure such as storage facilities and parking areas. Additionally, these States have low levels of business and product diversity and lack guidelines for sanitisation and fish handling. The low level of competition in these States, resulting from a small number of fishermen in the market, may also contribute to the high marketing costs. Further research is needed to understand the specific challenges faced by fishermen in the Northern States and to identify potential solutions to address these issues.

The Southern States face significant challenges in the fishing industry, including high transportation costs due to high registration fees for fishermen from other regions, and marketing and infrastructure difficulties such as a lack of storage space, power backup systems, and live fish-keeping facilities. Additionally, there is intense competition among fishermen in the region.

In the Eastern States, traders in the fish industry face challenges related to inadequate infrastructure, such as a poorly developed road network and inadequate water supply and security services in fish markets. There is also a lack of awareness among consumers regarding the nutritional benefits of fish compared to other meat products.

The Western States face significant challenges in the fish industry, including a lack of adequate businesses and product diversity, as well as a lack of infrastructure such as ice factories, live fish-keeping facilities, and storage facilities. Additionally, the production base in this region is low, leading to low levels of competition.

The Central States face several challenges in the fish industry, including high transportation costs and a lack of infrastructure facilities such as office space and water supply (Figure 7.6).

The North-East States face fewer challenges in the fish industry compared to other regions, but still face some difficulties related to poor infrastructure, including a lack of ice factories, power backup systems, drinking water and live fish keeping facilities.

Figure 7.6: Region-wise Representation of Problems/Constraints Faced by Fish Markets
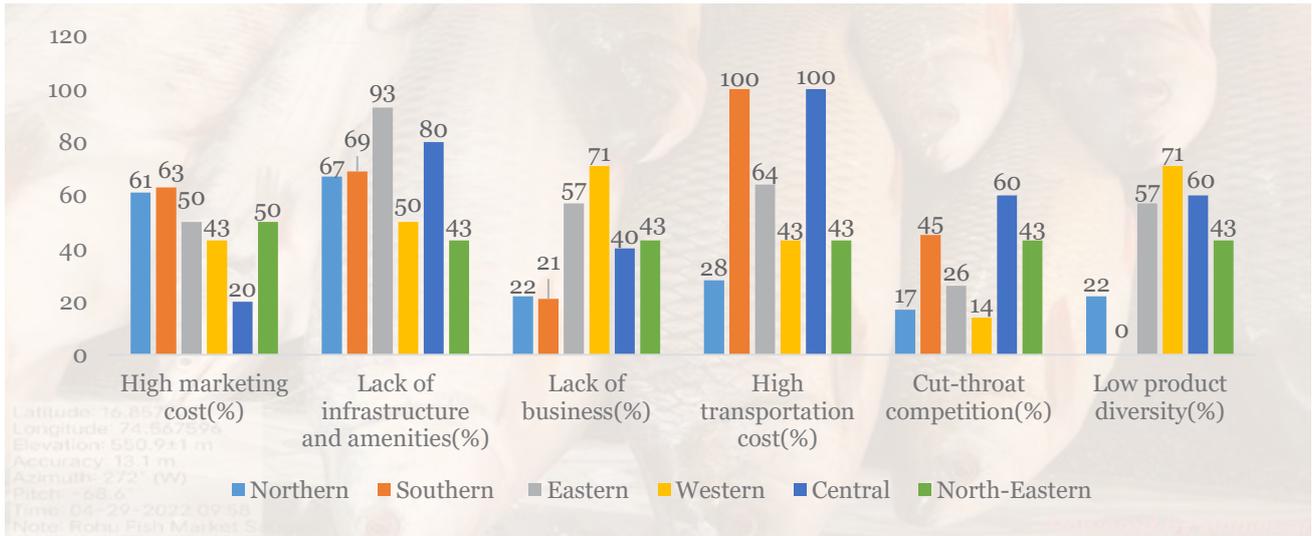
Source: NCAER's calculations based on Primary Survey, 2022 data collected for this study.

The survey found that stakeholders in the Northern States experience significant challenges related to high marketing costs and poor infrastructure, while those in the Southern States face high transportation costs and no issues with product diversity. In the Eastern States, the main challenges are a lack of infrastructure, while the Western States struggle with a lack of business and poor product diversity. The Central States face numerous problems, including transportation and infrastructure issues, high levels of competition, and a lack of product diversity. The North-Eastern States face fewer challenges than other regions, with their main issues being poor infrastructure.

7.9. REGION-WISE CHALLENGES AND SUGGESTIONS

The findings in this section are based on focus group discussions (FGDs) conducted by the NCAER team at wholesale fish markets in 24 selected States in India. Participants in these FGDs identified the major challenges they face in the fish industry. These challenges, which are common across States, were grouped by region to provide a comprehensive overview. Additionally, the respondents provided suggestions and recommendations for addressing these challenges. The table 7.16 presents a summary of the challenges and suggestions identified in the FGDs.
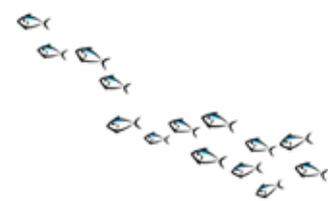
Table 7.16: Region-wise Challenges and Suggestions to Improve Them

Regions and States Contained in the Respective Regions	Challenges	Suggestions
NORTHERN REGION Rajasthan Punjab Haryana Jammu & Kashmir Uttar Pradesh Himachal Pradesh Delhi	The respondents reported the lack of storage facilities, parking area, and office space. Unless they have enough provisions to generate adequate business, they will not be able to increase their revenue base. Due to the lack of adequate credit facilities and funding support in the sector. Non-adoption of guidelines issued by the government on sanitation, market layout and structure.	There is a need for the development of adequate infrastructure facilities for the fish markets like storage facility, parking area, office space, and drainage and water-disposal facilities. The stakeholders should be trained on hygienic fish handling and processing. More technical and financial support to increase fish production and socio-economic status of the fish farmers and fisherfolk.
SOUTHERN REGION Kerala Karnataka Andhra Pradesh Telangana Tamil Nadu	The respondents reported the lack of storage facilities, parking area, and office space. Without sufficient resources to generate revenue, it is difficult for them to increase their income. Insufficient banking facilities and a lack of funding for fishermen have hiHndered development in the fisheries sector. The fishermen called for the provision of seed in June-July and life jackets to support their work. The fisherman also expressed a need for a live fish keeping and power back-up facilities.	There is a need to create adequate resources such as storage facilities, parking area, office space, drainage and water-disposal facilities. Fishermen should be educated on the proper handling of fish and made aware of the facilities available in the fisheries sector, such as access to markets. To improve the socio-economic conditions in the fisheries sector, the government should work to increase the production of fish and make a wider variety of fish available in the market.
EASTERN REGION Jharkhand Bihar West Bengal Odisha	The fishermen identified a need for hygienic markets, parking area, office space, transportation roads, water supply and security facilities. They also called for the availability of funding at lower interest rates. The fishermen also reported that the market is located in a very congested area due to which they face transportation issues.	Examining the role of union leaders in representing the interests of fishermen and exploring ways to better support this group. Investigating methods for increasing awareness among the fishing population about available facilities and resources, such as training on fish handling and access to markets. Studying the benefits of aiding with fish culture to local communities and how it can lead to increased local production. Analysing the impact of improved transportation on the business prospects of fishermen and exploring ways to make this a reality. Investigating the potential benefits of providing retailors with cycle facilities and fishermen with plastic/thermal containers, and examining any potential challengers or obstacles to implementing these initiatives.

(Contd.)

CENTRAL REGION Madhya Pradesh Chhattisgarh	The fishermen reported a need for office space, transportation roads, and water supply and cold storage facilities. They also called for the availability of funding at lower interest rates. The fishermen also reported that the market is located in a very congested area due to which they face transportation issues.	Examining the effectiveness of government efforts to provide market support for the fishery sector Investigating ways in which the government can encourage the development and growth of the fish business within the State. Analysing the relationship between taxes paid to Nagar Palika and the State of cleanliness, and exploring potential solutions for improving cleanliness in the region.
WESTERN REGION Gujarat Goa Maharashtra	The fishermen reported a need for office space, water supply and cold storage facilities.	Investigating the expectations of fishermen regarding access to financial resources, with a focus on the availability of funds at lower interest rates.
NORTH-EAST REGION Assam Tripura -	The fishermen identified a need for an ice factory, power back-up system and live fish keeping facility.	Provision of good hygienic market facilities. Installation of a water drinking facility.

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.
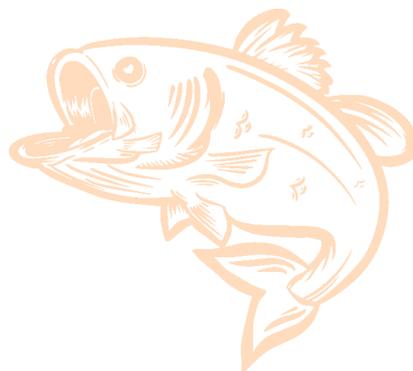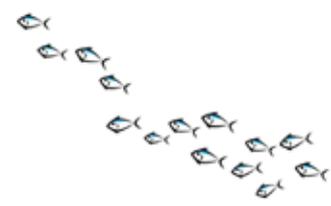
DEMAND-SUPPLY GAP AND ACTION PLAN NEEDED TO BOOST THE CONSUMPTION FOR FISH AMONG HOUSEHOLDS IN INDIA

8.1. INTRODUCTION

Based on the field experience and the detailed viewpoints received from the resource persons in the districts of various States, the NCAER study noted a few action points that are important in penetrating fish as part of the consumption habit in sizeable sections of non-vegetarian households in India.

8.2. GAP ANALYSIS AND IMPERATIVES TO BOOST CONSUMPTION

India is a fish surplus country, in which production exceeds household demand. There are States, where

production within States outweighs demand that comes from the household sector. However, there are other demands as well from industry and hotels & restaurants. The 'positive gap States' are the States where production exceeds demand, while the 'negative gap States' are those States where consumption exceeds production. Table 8.1 narrates the State-wise scenario.

Table 8.1: State-wise Annual Production-consumption Gap (Lakh Tons)

States/UTs	Production (lakh ton)	Yearly Consumption (lakh ton) NCAER	GAP (Prodn.-Consump.)	Remarks
Andhra Pradesh	41.74	3.48	38.26	Surplus State
Assam	3.73	6.24	-2.51	Deficit State
Bihar	6.41	8.71	-2.30	Deficit State
Chhattisgarh	5.72	0.89	4.83	Surplus State
Delhi	0.01	0.30	-0.29	Deficit State
Goa	1.05	0.19	0.86	Surplus State
Gujarat	8.59	0.58	8.01	Surplus State
Haryana	1.91	0.28	1.63	Surplus State
Himachal Pradesh	0.14	0.06	0.08	Surplus State
Jammu & Kashmir	0.21	0.27	-0.06	Deficit State
Jharkhand	2.23	2.83	-0.60	Deficit State
Karnataka	6.32	3.94	2.38	Surplus State
Kerala	6.8	13.50	-6.70	Deficit State
Madhya Pradesh	2.0	1.37	0.63	Surplus State
Maharashtra	5.86	3.05	2.81	Surplus State
Odisha	8.18	6.32	1.86	Surplus State
Puducherry	0.51	0.24	0.27	Surplus State
Punjab	1.51	0.55	0.96	Surplus State
Rajasthan	1.16	0.98	0.18	Surplus State
Tamil Nadu	7.57	9.44	-1.87	Deficit State
Telangana		1.29	-1.29	Deficit State
Tripura	0.78	0.75	0.03	Surplus State
Uttar Pradesh	6.99	3.40	3.59	Surplus State
West Bengal	17.82	23.29	-5.47	Deficit State
Total	**177.64**	91.93	85.71	Surplus Country

Source: Fishery Statistics and NCAER survey data (annualised).

The production-consumption gap is noted to be positive in many of the major States, spreading across regions. A huge gap is noted in Andhra Pradesh, while a consumption-production gap is noted to be high in Kerala, West Bengal, Assam, etc. The ranking of fish surplus and the fish deficit States are provided in the following Tables 8.2A and 8.2B.

Madhya Pradesh	11	0.63
Puducherry	12	0.27
Rajasthan	13	0.18
Himachal Pradesh	14	0.08
Tripura	15	0.03

Source: Fishery Statistics and NCAER survey data (annualised).

Table 8.2A: Ranking of Fish Surplus States

States/UTs	Rank	Surplus Amount (Lakh metric tonnes)
Andhra Pradesh	1	38.26
Gujarat	2	8.01
Chhattisgarh	3	4.83
Uttar Pradesh	4	3.59
Maharashtra	5	2.81
Karnataka	6	2.38
Odisha	7	1.86
Haryana	8	1.63
Punjab	9	0.96
Goa	10	0.86

Table 8.2B: Ranking of Fish Deficit States

States/UTs	Rank	Deficit Amount (Lakh metric tonnes)
Kerala	1	6.70
West Bengal	2	5.47
Assam	3	2.51
Bihar	4	2.30
Tamil Nadu	5	1.87
Telangana	6	1.29
Jharkhand	7	0.60
Delhi	8	0.29
Jammu & Kashmir	9	0.06

Source: Fishery Statistics and NCAER survey data (annualised).

The possibilities that emerge are the following:

First, the positive consumption gap critically points out the need for intervention in terms of boosting consumption demand among households to narrow the gap within the State where production surpassed consumption.

Second, the supply chain needs to be strengthened and sustainable to balance high demand with adequate availability and to balance the deficient and surplus States in terms of demand. In this context, inter-State movement of fish as a commodity from surplus State to deficit State is the crucial imperative.

Third, there is an opportunity to supply fish in the external market, provided all the standard international norms are maintained.

8.3. PRICE AS A RESTRICTING FACTOR AND INEQUALITY OF CONSUMPTION OF FISH IN INDIA

The nutritional value of fish is enormously important. However, a large number of households remained bereft of fish consumption just because of affordability. There are States where fish demand is more, whereas there are States where production far surpasses consumption as noted in Figure 8.1. A high price is a critical restricting factor for the consumption of fish by fish-eating households in several States.

Transportation Management of Fisheries, Kerala

It may be noted that States where high price deters consumption of fish are the ones having a high propensity to consume. At all-India levels, 73 per cent of the households observed high prices as the steepest restricting factor. It may be noted that States with less per capita income are the ones which impacted their consumption more due to prices. High-income States like Delhi, Goa, Tamil Nadu, and Karnataka are far below the national average, reflecting better affordability. The State-level distribution is important to gauge the level of consumption which shows the inequality of consumption of fish. Therefore, proper distribution from the surplus production area to the ones where consumer demand is more should be the priority to lower the price constraint and enhance the level of fish consumption. This will, in turn, help enhance the per capita consumption of fish to a higher trajectory. Moreover, there is a very poor mechanism for the preservation and transportation of fish to bridge the supply-demand gap.

Figure 8.1: High Price is the Restricting Factor in Most Low Per Capita Income States, Leading to Inequality of Consumption of Fish Among States
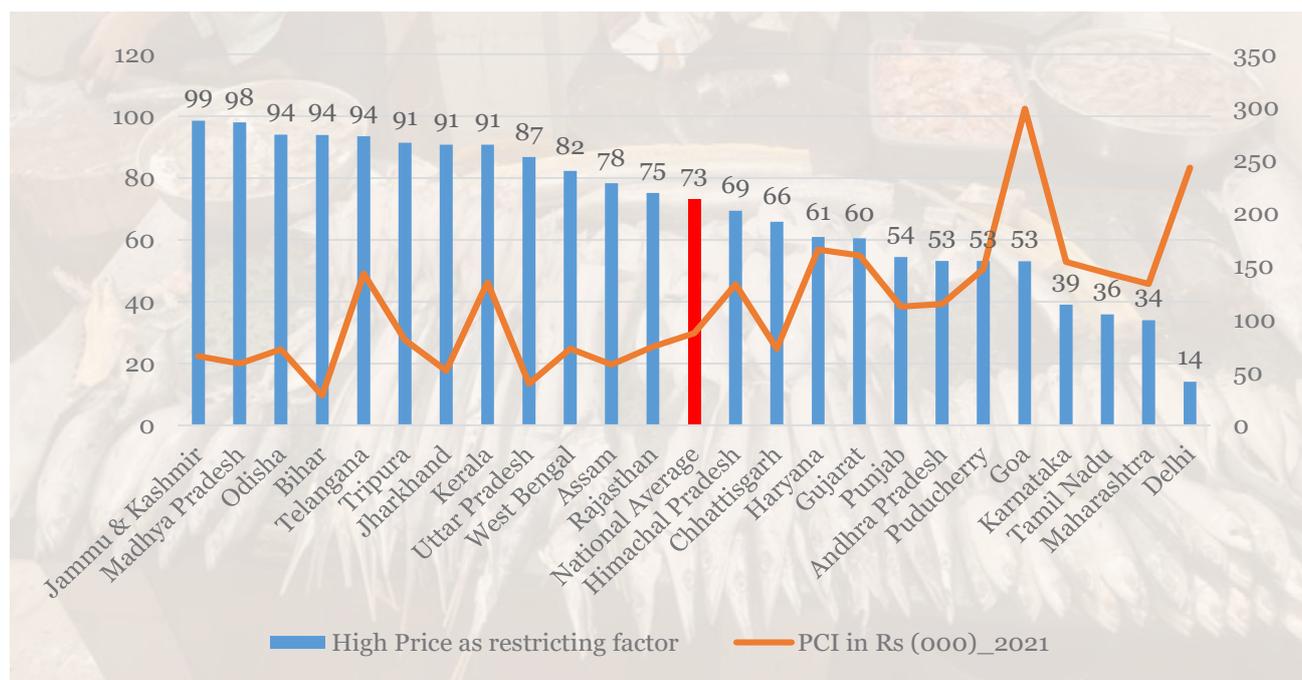
Source: NCAER Primary Survey, Per Capita Income of States is sourced from Reserve Bank of India.
Note: PCI=Per Capita Income at Constant 2011-12 prices.
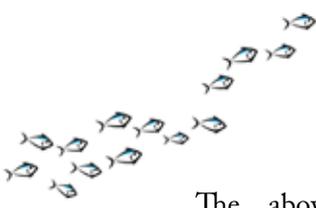
The above-mentioned price factor among State households critically points out the inequality of consumption of fish among quintiles of the expenditure groups. The Figure 8.2 below shows that fish consumption among various expenditure quintiles is linearly distributed, in which the richest households in expenditure quintiles consume more and the poorest households consume less fish compared to the richest. The distribution of household expenditure groups and the consumption of fish (in kg) in a 30-day reference period is shown in Figure 8.2.

Figure 8.2: Consumption Inequality of Fish Among Household Expenditure Groups in Quintiles (30 Days Reference Period in Kg)
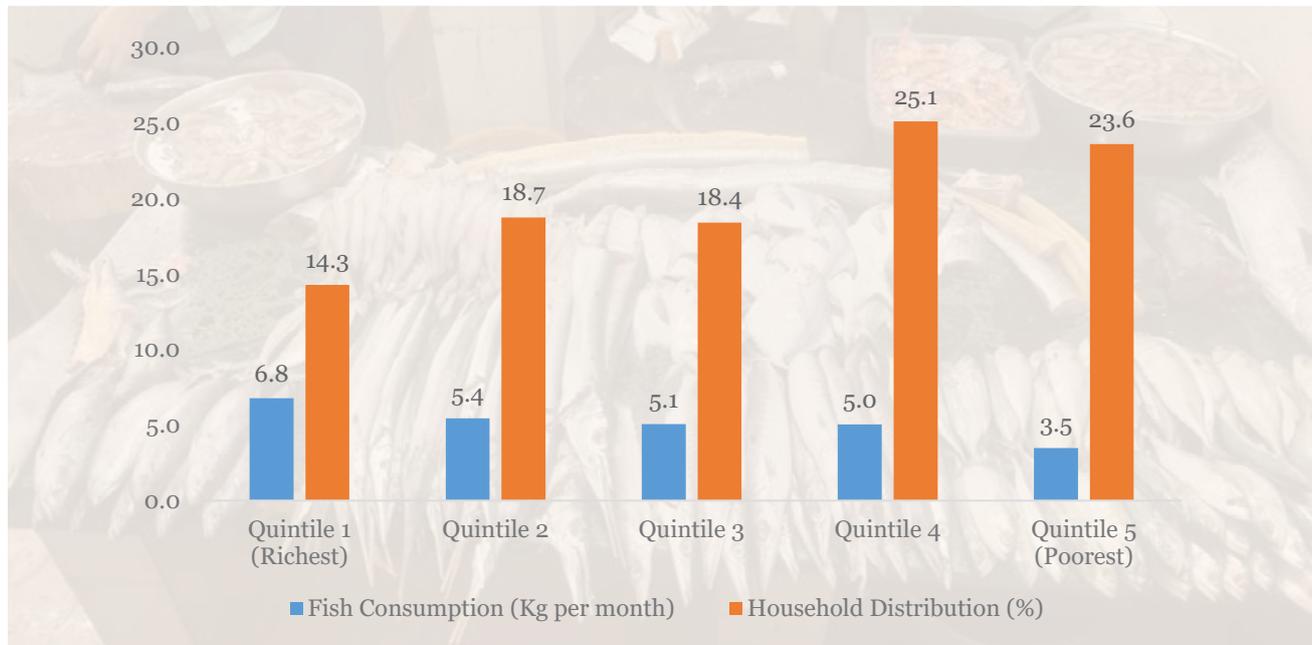
Source: NCAER Primary Survey.

8.4. ACTION PLAN REQUIREMENT

The positive production gap certainly needs several actions to boost the consumption of fish. Table 8.3 describes action plan and the imperatives linked to the same.

Table 8.3: Action Plan to Boost Consumption Demand and Create a Necessary Condition for Enhancing Consumption of Fish in India

S. No.	Action plan	Requirements
1.	Generating awareness of the general public on the nutritional benefits of eating fish	Consumer awareness about the health benefits of fish and fish products is very much lacking in large sections of society. Though some attempts have been made in the recent past, it has not been effective to have a nationwide impact due to a lack of appropriative scale and level. Concerted efforts and coordinated strategies should be put in place to create consumer awareness of the health benefits of fish and fish products which in turn will boost fish consumption in the country. Advertisements may be done through professional agencies in print and electronic media highlighting the nutritional qualities and health benefits of fish. This may be done on the lines of the National Egg Coordination Council (NECC) in which producers, processors, transporters/packers, govt. officials, private traders, etc. are to be made members. An entire spectrum of eye-catching signage and advertisements may be produced on the benefits of fish eating may be displayed in busy places like bus stands, railway stations, airports, markets, etc.

(Contd.)

2.	Consumer-centric extension strategy to boost fish-sourced food (FSF) consumption	India is among 88 countries likely to miss global nutrition targets by 2025, according to the Global Nutrition Report 2020. The report identified India as one of the countries with the highest rates of domestic inequalities when it comes to malnutrition. The FSF can help by designing suitable interventions to effectively meet these challenges. The consumer-centric extension (CCE) strategies could be spread by radio and TV programmes, extension literature and social media channels in spreading nutrition awareness on FSF consumption targeting consumers alongside producers.
3.	Focusing more on attractive packaging for traditional fish products	Many States of India are endowed with a rich culinary tradition of fish consumed through numerous local recipes. The major secondary value addition of fish having commercial significance are dry fish, pickled fish, etc. It is expected that such types of products, if prepared scientifically, with attractive packaging for retail sale, will attract the attention of consumers who may even pay a premium price for ensuring the viability of the respective enterprises. Small-scale enterprises for such traditional fish products are important both for stimulating women-run enterprises.
4.	Making fish available in convenient forms (minimally processed fish)	Many Indian households find dressing fish, cutting to a suitable size, washing, cleaning, portioning, etc. as cumbersome activities and tend to avoid them. If fish is made available in convenient forms like dressed, packed and frozen in retail packets (minimally processed); the households will find them attractive to purchase and consume. Efforts to make fish available in the above convenient forms through local grocery/*kirana* stores (in separate deep freezers like the freezers used for dairy products) will be the icing on the cake.
5.	Sensitizing stakeholders on hygienic fish handling and good practices	Hygiene and goods are of great concern in a highly perishable product like fish. The general hygienic status of fish markets and the people associated with the supply chain network across India is not satisfactory. Contamination of the aquatic ecosystem and unhygienic handling practices along the fish supply chain can lead to the supply of contaminated fish which will have serious consequences on public health. The major stakeholders in the fish supply chain consist of a network of fishermen/farmers, retailers, distributors, transporters, storage facilities and the sale of a product to the consumer. Capacity building training programme (skill training, up-skilling and re-skilling) may be imparted to farmers, fishers, traders and all other stakeholders on the development of skill set related to hygienic post-harvest handling and transportation of fish, adoption of improved sanitary and good handling practices, and other specialised skill sets. Visits may be arranged to modern production and marketing centres, dissemination of knowledge and information, and sharing of case studies and success stories in support of wider dissemination and adoption.
6.	Harnessing ready-to-cook (RTC) and ready-to-eat (RTE) consumer base	The consumption of value-added fish products in the form of ready-to-cook (RTC) and ready-to-eat (RTE) food has witnessed a surge in demand in the last few years in India. This takes care of customers who have less time to spend in the kitchen or just simply those who lack the skill to cook cumbersome dishes regularly. Working parents prefer the easy cooking method. Working mothers seek healthy and tasty options for their children. Higher disposable incomes have led to the demand for RTC and RTE products. There is no doubt that not only RTE and RTC food is going to stay in India but also going to continue to grow with more women joining the workforce, increasing consumer demands and market trends. Currently, there are a few RTE and RTC products in the markets which are fish-based. Efforts should be made to develop a whole range of fish-based RTC and RTE products like fish biryani, Bengali fish curry, Goan fish reparation, fish tikka masala, etc., customised to match the regional taste and preference.

(Contd.)

7.	Including fish in mid-day school meals and ICDS	Incorporating fish as a nutritional supplement in Government-aided schemes including Integrated Child Development Services (ICDS) and Mid-day school meals may be promoted. In 2020, WorldFish with financial support from USAID implemented a project in Odisha which involved adding the dried fish powder to hot cooked meals and including dried fish in take-home rations distributed through the Supplemental Nutrition Program of the Integrated Child Development Services (ICDS). The project achieved grand success and has so far delivered fish products to 1,200 children and 800 pregnant women and adolescent girls1. This type of programme implementation will provide a way forward for scaling the inclusion of fish in the Anganwadi ICDS Supplementary Nutrition Programme of the Government and benefit vulnerable community members like children, adolescent girls, and pregnant and lactating women.
8.	Promoting the hub-and-spoke model to increase fish consumption	The Department of Fisheries, Andhra Pradesh has started to implement the 'Hub-And-Spoke Model' that aims to increase fish consumption, develop hygienic sale conditions, support fish farmers/fishermen and their organisations, and reduce export dependency. The key element of this model is an aqua hub (with restaurants, retail shops and other services) connecting fish farmer organisations with consumers. The model is pushed by the Andhra Pradesh State Fishery Department as a flagship project. Twenty-five aqua hubs have been sanctioned already (each around Rs 6 crores) with two of them being close to the operation. Social features of the model are the Minimum Support Price (MSP) for fish farmers, the strengthening of Fish Farmer's Producer Organisations (FFPOs) and social inclusiveness. The Hub (Aqua-Hub) is operated by Aqua Farmers Societies with centralised facilities. The role of Aqua-Hub is aggregation, value addition, supply chain management and quality assurance. Spokes are run by entrepreneurs who are engaged with running retail outlets, online sales, live-fish vending, fish kiosks, fish and food vending vehicles, etc. The raw material for the centralised Aqua-Hub is supplied by farmers/fishermen, FFPOs, and private players.
9.	Promoting fish as a substitute for chicken	Amongst the non-vegetarian population in India, chicken is a very popular meat due to its easy availability and affordability. From a nutritional point of view, fish has an edge over chicken. But many non-vegetarians, besides the eastern region of the country, prefer chicken over fish due to the presence of small spines in fish and some households find difficulties in dressing small fish. While price-wise main fish varieties such are carp, tilapia, pangasius, etc. are very much competitive with chicken, there are some high-priced species of fish and prawn varieties that are very expensive as compared to chicken. Though for many die-hard fish lovers in middle to high-income groups, the price of fish is not at all a limiting factor for its consumption; amongst the low and low-middle-income class people, the price of fish plays a decisive role. Representing the fish in fillet and other boneless forms, increasing their availability through cold chain, disseminating a few recipes of fish dishes, etc. will go long way in developing the preference for fish amongst not-so-frequent fish eaters and more people will consider fish as a substitute to chicken. This will boost the demand for fish to a great extent.

(Contd.)

10.	Conducting regular fish festivals to boost consumption	The national average annual consumption of fish and fish products in India is very less compared to the global average. A large number of the non-vegetarian population does not eat fish or eat fish occasionally. Therefore, there is a need to popularize fish as a palatable food. This can be done by creating awareness among the people on the health benefits of fish and presenting them with various mouth-watering dishes by conducting regular fish festivals across the country. This will help in developing the taste for fish amongst a sizeable section of the population. In this context, the efforts of British India in popularizing tea may be recalled. Earlier, the royals and aristocrats used to consume tea occasionally in India. It began to be consumed commercially only after the arrival of the British in India. The tea-drinking habit slowly trickled down from elite circles of society to the common people through a massive campaign like the distribution of free cups of prepared tea to the public at railway stations, demonstrating the right methods of brewing tea, distribution of small packets of tea, etc. As a result, now India is the second-largest producer and consumer of tea in the world.
11.	Promoting GI tagging and branding in fish and fish products	Geographical Indication (GI) and Brand are the protective tools which ensure the premium value of any product in a market and can be extended for fish and fish products. GI signifies quality and uniqueness, which is a fundamental characteristic of their origin in a distinct geographical locality or area. Indian GI outputs like Basmati rice and Darjeeling tea are gaining attention and acceptance from a wider set of customers. Efforts may be made to get GI tags for fish like Sundarban fish of West Bengal, Ganga Fish, Himalayan Trout, Beel Fish of Assam, etc. Bangladesh has received a GI tag for Hilsa fish in 2017. The Bihar government is now contemplating approaching the Central government to get a GI tag for Mithila's famous Rohu fish. Rohu fish of the Mithila region, especially in the Darbhanga and Madhubani districts, is known for its taste. Branding, on the other hand, extends some unique benefits to both the producer and the consumer through trademarks. The producers obtain an identity for the product through a brand that is legally protected, conveys quality and attributes, fosters loyalty among consumers and allows them to charge a premium. Likewise, for customers, brands make choices simpler, assure a certain quality, lessen risk and/or stimulate trust. Amul milk is a successful brand for dairy and dairy products in India. Efforts should be made for branding fish and fish products in India.

8.5. SUGGESTION FOR INCREASING ACCESS TO THE MARKET

Physical accessibility and economic accessibility of fish to consumers need to be addressed to boost the demand. In some rural areas, fish is available only in the weekly market and not available daily, thereby limiting its consumption. Mobile fish vending vehicles, introducing fish retailing in rural areas, etc. will improve the accessibility of fish to consumers. Mobile fish vending should be promoted by extending financial support for cycles with ice boxes, motorcycles with ice boxes, and three-wheeler with ice boxes including e-rickshaws. Beneficiaries will ensure that the fish transport vehicles/facilities

procured under the scheme will be used only for the transportation and marketing of fish and not for any other purposes. Therefore, the demand-side aspects need complementary support from the supply-side aspects to enhance the access to market.

The fisheries sector is contributing significantly to both domestic and export trade in spite of numerous infrastructure challenges, especially as it lacks an extensive cold chain (temperature-controlled supply chain) from harvest to consumption. The challenge is more so in the domestic sector, where the marketing of fish and fish products is highly unorganised and unregulated. Further, fish production is not evenly spread across the country, and major production is limited to some States. Hygienic distribution of fish

and fish products (chilled fresh, dried or processed) across the States to meet the growing demand of fish deficit States including those in the NE region where fish is a predominant source of protein continues to be a challenge.

In India, the general acceptability of frozen fish amongst consumers is poor as compared to fresh fish. Consumers often suspect the quality of frozen fish and it is somewhat true as India lacks a robust integrated cold chain supply system for fish and fish products. The government should prioritize the promotion of integrated cold chains (ICCs) by extending financial assistance and facilitation for the establishment of key cold chain infrastructure facilities such as chilled storage facilities, ice plants, cold rooms, freezing units, value addition unit operations, reefer transportation, modern air-conditioned retail outlets and implementation of modern sanitary and hygienic practices, etc. This initiative has the potential to improve efficiency in handling, storage, transportation and marketing of fish and fish products besides reduction in post-harvest losses and meet growing and continued demand for the supply of safe and nutritious fish to consumers at reasonable prices. Overall, it can lead to enhanced per capita fish consumption contributing to the nutritional security of the country. There are a few more critical aspects that need special attention to improve market access (Table 8.4).

Table 8.4: Imperatives for Improving Market Access

S. No.	Condition	Requirements
1.	Maintaining the quality across the supply chain	The supply chain in the fisheries sector heavily relies on proper cold chain management practices to ensure quality and safety during storage and transportation. From aquaculture production or wild catch, post-harvest handling, receiving, processing, packing, and transport, to retail, it is essential to ensure there is no breakage in the cold chain to main the high qvtality and safety of the fish and fish products. In November 2020, FSSAI has released the Draft Food Safety and Standards (Licensing and Registration of Food Businesses) Amendment Regulation, 2020 outlining hygiene condition practices for Food Business Operators (FBOs) engaged in the fish supply chain. Furthermore, FSSAI has once again released the Draft Food Safety and Standards (Food Products Standards and Food Additives) Amendment Regulation, 2021 specifying the limit of natural formaldehyde in freshwater and marine fish with immediate effect for the FBOs in September 2021. Likewise, in 2018, the Bureau of Indian Standards (BIS) formulated standards for the handling of fish along the supply chain, *viz.* IS 14520:2018 Fish industry - Operational cleanliness and layout of the market - Guidelines (First Revision). Central Institute for Fisheries Technology (CIFT), National Institute of Fisheries Post Harvest Technology and Training (NIFPHATT), and FSSAI are important resources and training organisations for all food safety-related aspects of fish and fish products.
2.	Promotion of economic rearing in aquaculture areas towards sourcing fresh fish at cheaper rates	There is a need to identify water bodies under aquaculture that are unsuitable for intensive cultivation and guide them towards optimizing their production for producing fresh fish in an economic manner for the domestic market. Contract farming models may be promoted to achieve better integration among fish farmers and processors. Contract fish farming is a type of aquaculture where a company contracts the farmers to raise fish for them. The company provides the farmers with fingerlings, feed, and technical assistance. The farmers are responsible for raising the fish to market size and delivering them to the company. It can be seen as a way for small-scale farmers to get involved in aquaculture without making a large investment. The feasibility of contract farming and buyback arrangements should be explored in aquaculture wherever appropriate and feasible. It will ensure an assured market for the producer as well as better quality products for the consumers. To refine this concept, the production models in poultry farming may be studied.

(Contd.)

3.	Identification and introduction of suitable processing technologies that achieve a balance between production expenses and quality maintenance	Where the cost of raw fish is high, the need for efficient processing technologies is of utmost importance for a commercially viable enterprise model. Therefore, efficient systems supported by financial initiatives need to be developed. However, all such technologies and systems need to be vetted for their quality control capabilities keeping in line with FSSAI / HACCP regulations.
4.	Building consumer trust through necessary certification, accreditation, traceability, and labelling	Building the need-based activity and infrastructure related to certification, accreditation, traceability and labelling in fish and fish products should be supported. Certification of fish and fish products is seen as a tool to promote trust amongst high-end consumers. It is a procedure to recognize that a product, process or service conforms to specified standards or regulations. There are two broad types of fish certification schemes, non-organic and organic. The various schemes differ in the species they cover, their geographical range, and the use of an ecolabel aimed at consumers. The schemes also vary greatly in the way they focus on one or more of five main issues—the environment, social and community impacts, food safety, traceability and animal welfare. The aspects of accreditation in India are dealt with by National Accreditation Board for Certification Bodies (NABCB).
5.	Promoting marketing of live fish	The demand for the live fish is catching up fast in India. Live fish always commands premium prices as customers are assured of freshness and quality. As a thumb rule, live fish generally fetches 20-30 per cent higher prices than dead fresh fish. Hence, some farmers and traders prefer to sell live fish. But transportation of live fish and selling them in the markets require specialised facilities. With funding support from NFDB, the ICAR- Central Institute of Post-Harvest Engineering & Technology (CIPHET) has developed the Live Fish Carrier System having automatic aeration, filtration and evaporative cooling system. CIPHET has been also patented the same. Such a system ensures continuous availability of good quality water to the live fish transported in the system proving a healthy environment to fish and ensuring animal welfare. Further, while planning for modern fish markets, the conventional designing aspect should be modified to create separate facilities dedicated to the storage, display and sale of live fish.
6.	E-Marketing of fish and fish products	E-marketing often referred to as "online marketing", "internet marketing" or "web marketing", is gained popularity in urban areas of India for fish and fish products. However, fish being a highly perishable product, the implementation of the concept is a bit difficult, unlike other consumables where online marketing rules the roost. The challenges are to maintain the freshness and the quality of fish, to offer the consumers the options for a wide range of products and to accomplish quick home delivery. With unmatched consumer accessibility through web, mobile and social media platforms, e-marketing of fish is here to stay and prosper.

Source: NCAER's descriptions based on Primary Survey, 2022 data collected for this study.

8.6. MOOTING 'ONE-STATE-ONE-FISH' INITIATIVE TO SELECT, CONSERVE AND PROMOTE ONE FISH FROM EACH STATE

A total of 18 States/UTs of India have selected one fish as the State fish of that State/UT. That particular fish is either endemic or has some unique significance to the concerned State/UT like culinary heritage, culture, mythology, etc. The objective of mooting the 'State Fish' concept is to let the State/UT adopt the concerned fish, conserve the biodiversity and enhance its availability. Efforts have been made to integrate the key stakeholders towards the implementation of strategies for achieving real-time success. Once this is achieved and results are visible, the next step would be to develop different business plans around that fish. After the success of the 'One-State-One-Fish' initiative, the concept of 'One-District-One-Fish' may be considered. The list of State fishes with scientific names is furnished in Table 8.5.

NCAER Officials discussing with the stakeholders at Jammu & Kashmir

Table 8.5: One-State-One Fish Format

S. No.	States/UTs	Common name & scientific name	S. No.	States/UTs	Common name & scientific name
1.	Andhra Pradesh	Striped Murrel *(Channa straitus)*	10.	Manipur	Pengba *(Osteobrama belangeri)*
2.	Arunachal Pradesh	Golden Mahseer *(Tor putitora)*	11.	Mizoram	Ngahvang/ Burmese Kingfish *(Semiplotus modestus)*
3.	Bihar	Magur *(Clarias batrachus)*	12.	Nagaland	Chocolate Mahseer *(Neolissochilus hexagonolepis)*
4.	Haryana	Kalbasu *(Labeo calbasu)*	13.	Odisha	Mahanadi Mahseer *(Tor mahanadicus)*
5.	Himachal Pradesh	Golden Mahseer *(Tor putitora)*	14.	Telangana	Striped Murrel *(Channa straitus)*
6.	Jammu & Kashmir	Golden Mahseer *(Tor putitora)*	15.	Tripura	Pabda *(Ompok bimaculatus)*
7.	Karnataka	Carnatic Carp *(Puntius carnaticus)*	16.	Uttarakhand	Golden Mahseer *(Tor putitora)*
8.	Kerala	Karimeen/Pearlspot *(Etroplus suratensis)*	17.	Uttar Pradesh	Chital *(Chitala chitala)*
9.	Lakshadweep	Butterfly fish *(Chaetodon decussatus)*	18.	West Bengal	Hilsa *(Tenualosa ilisha)*

8.7. FISH MARKET PRICE INFORMATION SYSTEM (FMPIS) & ITS EFFECTIVENESS

Fish Market Price Information Systems (FMIPS) is designed to collect, analyze and disseminate data on the status and the dynamics of fish market prices. Though in the agricultural sector, it is well established, in the fisheries sector the concept is relatively new. All actors involved in fish value chains can theoretically benefit from FMIPS. Farmers can use market information to decide to whom to sell and at what price, plan their production and harvest and, in some cases, select the optimal market channel. The availability of market information should facilitate negotiations with traders. Early attempts at operating a market information system (MIS) in India followed a fairly standard format. Government bodies would collect information (usually only prices) and arrange for this to be disseminated through newspapers and radio. The early MIS suffered from several problems and the data quality was usually poor. By the end of the 1990s, the diffusion of cell phones and the
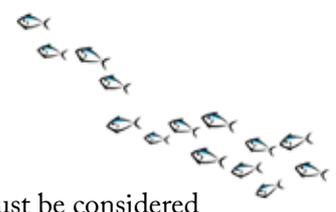
Internet led to the possibility of a new generation of MIS. These improvements in the ICT sector made it possible to shorten both the time lag in transmitting price data from collection points to central processing units, and in disseminating information to the intended recipients.

To plan a service, an MIS must implement the following sequence of activities: identify potential customer & their needs

→   plan services to be offered to those customers

→   develop a sustainable business model

→   choose appropriate partners.

From their very inception, MIS (including those using modern ICTs) is likely to face several technical difficulties relating to the reliability of the information disseminated, the timeliness and speed of dissemination, the need to generate feedback on how the information is used, and the importance of ensuring adequate data analysis. Therefore, the design of an efficient, relevant and sustainable MIS is a complex effort, and several issues must be considered carefully.

8.7.1. Features of FMPIS Being Implemented by NFDB

NFDB is implementing Fish Market Price Information System (FMPIS) as a flagship project for analysing fish price information at fish markets from major cities and towns through a mobile-based software application (both Android and iOS) by collecting the prices of commercially important inland and marine fish species.

8.7.2. Fish Price Data Collection

The daily fish price information is collected by the designated enumerators from States/UTs from wholesale fish markets/retail fish markets across the country. Fish price information of 138 fish species (95 Marine fishes and 43 inland fishes) is presently captured under FMPIS through its software APP. The APP provides details like scientific name, common

NCAER Research Team along with the Networking Agencies' Officials

name, picture, length and sizes of fish species. In addition to the above taxonomical features of fish species, the vernacular names of fishes in 10 major local languages are also available in the APP for easy understanding by the enumerators for data entry. The marine fish price data pertaining to Fishing harbours and Fish landing centres is received offline from NETFISH-MPEDA and integrated with FMPIS online system. Thus, the present market prices of commercially important fish are made available on a single web platform.

8.7.3. States/UTs, Fish Markets, Fishing Harbours and Fish Landing Centres Covered

Currently, FMPIS is capturing data on fish prices from 43 retail fish markets and 40 wholesale fish markets functioning in 24 States and 4 UTs of our Country. NETFISH- MPEDA shares information with respect to 18 fishing harbours and 17 fish landing centres from Coastal States/UT viz., Gujarat, Maharastra, Goa, Karnataka, Kerala, Tamil Nadu, Puducherry, Andhra Pradesh, Odisha, West Bengal.

8.7.4. Fish Price Analysis

 The fish prices of these commercially important fish species are analysed for the trend and demand. The analysed fish price information will be available on the FMPIS website on a real-time basis. FMPIS would act as a decision support system regarding price of fish species, price trends, availability and variability of fish across wholesale/retail fish markets, fishing harbours and fish landing centres throughout

the country. It also enables different stakeholders mainly fishers in identifying affordable fish markets/prices and facilitate better marketing efficiency for traders of fish commodities throughout the country.

 The analytical weekly reports of FMPIS focus on the following features:

- Average retail/wholesale market price (Rs per kg) of popular freshwater/marine fish species within different States
- Average retail/wholesale market price (Rs per kg) of popular freshwater fish species across the North Eastern States
- Average retail/wholesale market price (Rs per kg) of popular freshwater/marine fish species across the country.
- Average retail/wholesale price (Rs per kg) of popular freshwater/marine fish species across major States/UTs.
- Average marine fish price in fish landing centres/fishing harbours (Rs per kg) across coastal States of India.

8.8. CONCLUDING REFLECTIONS

The fisheries sector has emerged as the "Sunrise Sector" and it has immense potential in India to contribute to the economy in terms of value addition by bridging the gap between supply and demand for fish among States and among expenditure strata. There is enormous scope of transformation through infusing modern technology in terms of preservation, transportation of fish and unifying market access which would bring in multiplier effect in its contribution towards gross value added in agriculture and in the national economy.
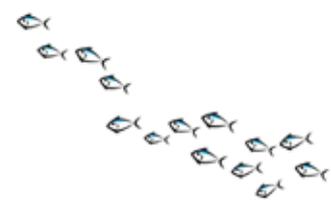
GLOBAL DEMAND FOR THE FISHERIES SECTOR

9.1. AN OVERVIEW

Fish comes from two main modes of production systems: capture fishery (capturing of wild fish from marine and freshwater) and culture fishery (farming fish, also known as aquaculture). Globally, fish and fish products are increasingly recognised for their key role in food security and nutrition, not just as a source of protein, but also as a unique and diverse provider of essential fatty acids and bioavailable micronutrients. World fish production has grown steadily in the last five decades, with total fisheries and aquaculture production reaching a record 214 million tonnes in 2020, largely due to the growth of aquaculture, particularly in Asia. (SOFIA, 2022). It comprised 178 million tonnes of fish (finfish and shellfish) and 36 million tonnes of algae (sea weed). Fish supply as human food has been increasing at an average annual rate of 3.0 per cent, outpacing world population growth at 1.6 per cent. World per capita fish consumption increased from an average of 9.9 kg in the 1960s to 20.2 kg in 2020 (FAO, 2022). Rising incomes and urbanisation, improvements in post-harvest practices and changes in dietary trends are projected to drive a 15 per cent increase in fish consumption, to supply on average of 21.4 kg per capita in 2030.

In 2020, an estimated 58.5 million were engaged as full-time, part-time, occasional or unspecified workers in fisheries and aquaculture, and of these approximately 21 per cent were women. By sector, 35 per cent were employed in aquaculture and 65 per cent in capture fisheries. Total employment in the aquaculture sector has been flattening in recent years, while the global number of fishers has contracted,

Fish Marketing Centre, Andhra Pradesh

particularly driven by trends in Asia. The impact of the COVID-19 pandemic on employment was felt throughout the value chains of fisheries and aquaculture. Fishing and aquaculture were disrupted by restrictions on mobility, non-essential activities and trade, causing disruption and shifts in markets and distribution. However, FAO's outlook for fisheries and aquaculture to 2030 projects an increase in production, consumption, and trade. The total

production of fish is expected to reach 202 million tonnes in 2030, mainly due to the sustained growth of aquaculture.

COVID-19 pandemic has had a profound impact on fisheries and aquaculture globally, driven by changes in consumer demand, market disruption and the logistical difficulties of ensuring stringent containment measures. In some countries, lockdowns caused drops in demand with a consequent decline in the prices of fisheries and aquaculture products. Many fishing fleets or aquaculture operations stopped running or reduced their activities, as their work became unprofitable (Table 9.1).

Table 9.1: World Fish Production, Utilisation and Trade (Million Tonnes)

	1990s	2000s	2010s	2018	2019	2020
Fish Production						
Capture Fishery						
Inland	7.1	9.3	11.3	12.0	12.1	11.5
Marine	81.9	81.6	79.8	84.5	80.1	78.8
Total capture	88.9	90.9	91.0	96.5	92.2	90.3
Culture Fishery						
Inland	12.6	25.6	44.7	51.6	53.3	54.4
Marine	9.2	17.9	26.8	30.9	31.9	33.1
Total culture	21.8	43.4	71.5	82.5	85.2	87.5
Total Production (Capture + Culture)	110.7	134.3	162.6	178.9	177.4	177.8
Fish Utilisation						
Human fish consumption	81.6	109.3	143.2	156.8	158.1	157.4
Non-food uses	29.1	25.0	19.3	22.2	19.3	20.4
Human population (*billions*)	5.7	6.5	7.3	7.6	7.7	7.8
Per capita food fish supply (*kg*)	14.3	16.8	19.5	20.5	20.5	20.2
Fish trade						
Exports – in quantity	39.6	51.6	61.4	66.8	66.6	59.8
Share of exports in total production	35.8%	38.5%	37.7%	37.3%	37.5%	33.7%
Exports – in value (USD 1 billion)	46.6	76.4	141.8	165.3	161.8	150.5

Source: FAO (2022). The State of World Fisheries and Aquaculture 2022, Towards Blue Transformation. Rome, FAO. https://doi.org/10.4060/cc0461en.

Note: Excluding aquatic plants. Totals may not match due to rounding. Fish utilisation data for 2018 and 2020 are provisional.

9.2. SHIFTING OF FOCUS TO AQUACULTURE FOR INCREASE IN PRODUCTION

Globally, over the years, for increasing fish production, the focus is gradually shifting from capture fishery to culture fishery. The culture fishery (aquaculture) has grown faster than capture fisheries. Of the 178 million tonnes produced in 2020, 51 per cent (90 million tonnes) was from capture fisheries and 49 per cent (88 million tonnes) from culture fisheries. This represents a major change from the 4 per cent share of aquaculture in the 1950s, 5 per cent in the 1970s, 20 per cent in the 1990s and 44 per cent in the

2010s. The expansion of aquaculture in the last few decades has boosted the overall growth of production in inland water sources. In 1950, production in inland waters represented only 12 per cent of the total fisheries and aquaculture production and, with some fluctuations, this share remained relatively stable until the late 1980s. Then, with the growth of aquaculture production, it gradually increased to 18 per cent in the 1990s, 28 per cent in the 2000s and 34 per cent in the 2010s. Despite this growth, capture fisheries in marine waters still represent the main source of production (44% of total aquatic animal production in 2020, compared with about 87 per cent in the 1950–1980 period) and the dominant method of production for several species. Following several decades of sustained growth, marine capture fisheries have remained fairly stable since the late 1980s, at around 80 million tonnes, with some interannual fluctuations in the range of 3-4 million tonnes.

This general trend does not reflect the considerable variations between continents, regions and countries. In 2020, Asian countries were the main producers, accounting for 70 per cent of the total fisheries (culture and capture production), followed by countries in the Americas (12%), Europe (10%), Africa (7%) and Oceania (1%). Overall, total fish production has seen important increases in all the continents in the last few decades. In 2020, China continued to be the major producer with a share of 35 per cent of the total, followed by India (8%), Indonesia (7%), Vietnam (5%) and Peru (3%). These five countries were responsible for about 58 per cent of the world fish production in 2020.

Despite the great diversity in farmed species, only a small number of "staple" species dominate aquaculture production. With 5.8 million tonnes produced in 2020, grass carp accounted for around 12 per cent of global inland aquaculture. Together with a further 23 individual species, they contributed 78.7 per cent to total finfish production from inland aquaculture. Atlantic salmon and 21 other dominating species, such as milkfish, made up 75.6 per cent of all finfish species of mariculture and coastal aquaculture. Atlantic salmon, with its production of 2.7 million tonnes in 2020, accounted for a high 32.6 per cent of marine and coastal aquaculture of all finfish species. About 30 different air-breathing fishes and their hybrids are raised in inland aquaculture worldwide. Global production of air-breathing fish

seldom exceeded 3 per cent in total production of inland finfish farming until the mid-2000s when the share started to rise to reach about 13 per cent in recent years. In 2020, the production of air-breathing fish was 6.2 million tonnes and the share was 12.6 per cent.

9.3. NUTRITIONAL VALUE OF FISH AND TRENDS IN GLOBAL CONSUMPTION

Fish and fish products play a critical role in the global food security and nutritional needs of people in developing and developed countries. The consumption of fish provides energy, protein and a range of essential nutrients. Furthermore, fish has a particular role as a source of long-chain omega-3 fatty acids e.g., eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are important for optimal brain and neural system development in children. Fish consumption also has health benefits for the adult population. Strong evidence underlines how the consumption of fish, and in particular oily fish, lowers the risk of death due to coronary heart disease (CHD). Coronary heart disease is a global health problem affecting more and more populations in developing countries. Fish is also an excellent source of micronutrients such as vitamins and minerals. This is particularly true for small-sised species consumed whole with heads and bones, which can be an excellent source of many essential minerals such as iodine, selenium, zinc, iron, calcium, phosphorus and potassium, and also vitamins such as A and D, and several vitamins from the B group. There can be significant variations between species and between different parts of the fish. It is sometimes suggested that farmed fish is a less healthy food than wild-caught fish. At times, claims are made regarding the quality of water, feed or the alleged misuse of veterinary drugs. In most cases, these are shown not to be true. Wild fish usually have a higher proportion of EPA and DHA in their lipids compared with farmed fish. However, as the total fat content in farmed fish is often higher, the total amount of these fatty acids could be higher in the farmed counterpart in some cases.

Global consumption of fish has increased significantly, with the world now consuming more than five times the quantity consumed nearly 60 years ago. In 2019, global aquatic food consumption was estimated at 158 million tonnes, up from 28 million tonnes in 1961. Of the 158 million tonnes
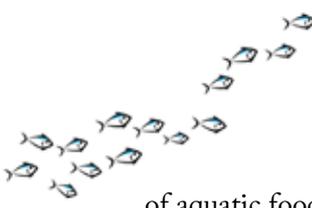
of aquatic foods available for human consumption in 2019, Asia accounted for 72 per cent of the total while its population represented 60 per cent of the world population. As a comparison, in 1961, Asia consumed 48 per cent of the total fish available for human consumption. In parallel, the proportion of fish consumed in Europe and the USA decreased over time. The respective shares of Europe and the USA went from 32 per cent and 9 per cent in 1961 to 10 per cent and 5 per cent in 2019. The growing importance of Asian countries as consumers of fish and fish products is the result of a combination of factors. First, Asia became the largest producer of fish globally in 1993, mainly due to the development of aquaculture production. Second, the continent experienced significant economic growth in recent decades, which resulted in income growth, a larger middle class and the migration of rural populations to the cities where fish are more accessible.

Over the years, half or more of the aquatic food produced has been consumed by only a small number of countries. In 1961, the five largest consuming countries of aquatic foods (Japan, former Soviet Union, China, the USA and the UK) accounted for half of global consumption. However, in 2019, the share of the five largest consuming countries (China, Indonesia, India, the USA and Japan) rose to 59 per cent. This concentration reflects the emergence of India as a major fish-consuming country (Table 9.2).

Table 9.2: Total and Per Capita Consumption of Fish by Region and Economic Class in 2019

Region/economic class	Total fish consumption (*million tonnes*)	Per capita fish consumption (*kg/capita/year*)
Region		
Asia	113.1	24.6
Europe	15.8	21.1
North America	8.3	22.7
South America	6.4	9.9
Africa	13.1	10.0
Oceania	1.0	23.2
World	157.7	20.5
Economic class		
High-income countries	32.0	26.5
Upper-middle-income countries	72.2	28.1
Lower-middle-income countries	50.0	15.2
Low-income countries	3.5	5.4

Source: FAO (2022).

9.4. GLOBAL FISH TRADE

Fish and fish products are extensively traded commodities in the food sector. The trade has expanded considerably in recent decades, as the fisheries sector operates in an increasingly globalised environment. Fish can be produced in one country, processed in a second country and consumed in a third country. Among the driving forces behind this globalised fisheries and aquaculture value chain are dramatic decreases in transport and communication costs; outsourcing of processing to countries where comparatively low wages and production costs provide a competitive advantage; increasing consumption of fishery commodities; favourable trade liberalisation policies; more efficient distribution and marketing; and continuing technological innovations, including improvements in processing, packaging and transportation.

In 2020, world exports of fish totalled 59.8 million tonnes (live weight), worth USD 151 billion. The value of traded aquatic products accounted for 11 per cent of total agricultural trade and for about 1 per cent of total merchandise trade in 2020. These shares are much higher in many countries, exceeding 40 per cent of the total value of merchandise trade in Cabo Verde, Iceland, Kiribati or the Maldives, for example. In 2020, the value of trade in fish (aquatic food products) was comparable to the total value of trade in all terrestrial meats. From 1976 to 2020, the value of trade in aquatic products increased at an average annual rate of 6.9 per cent in nominal terms and 3.9 percent in real terms. The nominal value of exports of aquatic products was nearly 20 times higher in 2020 compared with 1976. This is comparable to the expansion of the value of global merchandise trade, which increased at a rate of 6.8 per cent per year in nominal terms between 1976 and 2020 and by 3.7 per cent in real terms (World Trade Organisation, 2022). Meanwhile, the total quantity of fish exported has increased at an average rate of 2.9 per cent per year. The faster rate of growth in the value of trade of fish relative to the quantity reflects the increasing proportion of trade volumes comprising high-value species and products undergoing processing or other forms of value addition. Other contributors include inflation and growth in demand, leading to price increases in the long term.

Historically, an important feature of trade flows in fish and fish products has been the role of non-high-income nations as suppliers to high-income
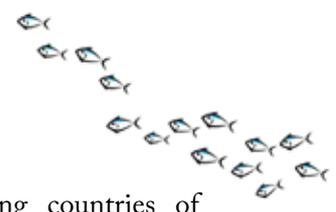
countries. More developed economies have large populations of the urbanised middle class with high levels of disposable income and insufficient domestic supply. This has historically meant that high-income countries have accounted for a large share of world imports of aquatic products. As far as import is concerned, the European Union was the largest single market, accounting for 34 per cent of the global value of fish imports in 2020. In terms of individual countries, the largest importing country in 2020 was the USA, accounting for 15 per cent of the world import value of aquatic products, followed by China (10%), Japan (9%), Spain (5%) and France (4%). However, it is worth mentioning that, in terms of volume (live weight), China is the top importing country of fish, far ahead of the USA. China imports large quantities of species not locally produced, not only for domestic consumption but also as raw material to be processed in China and then re-exported.

Among the top five exporting countries of aquatic products in 2020, two were high-income countries (Norway and Chile), and the remaining were non-high-income countries (China, Vietnam and India). China has risen to become the world's largest producer, exporter and processor of aquatic products. In 2020, China exported USD 18 billion worth of aquatic products, accounting for 12 per cent of the global total. Norway has been the second-largest exporter of aquatic products since 2004. In 2020, Norway exported USD 11 billion worth of aquatic products, accounting for 7.4 per cent of the global total. Norway is the world's largest producer of farmed Atlantic salmon. Vietnam has been the third-largest exporter of aquatic products since 2014 and has become by far the world's leading producer and exporter of farmed pangasius. Chile is the fourth largest exporter of fish and in 2020, Chilean exports of fish totalled USD 5.9 billion, accounting for 3.9 per cent of the global value. Supported by strong shrimp production growth, India had become the fourth major exporter in 2017. However, India was overtaken by Chile in 2020 as the value of India's exports has been on a downward trend since 2018. Other major exporters include the European Union, Thailand, Ecuador, Canada, and Indonesia.

9.5. WAY FORWARD

In India, fisheries emerging as vibrant sector in which about 28 million people are engaged in fishing activities in 2019-20, which has increased from 14.5 million in 2003-04 for their livelihood and giving boost to export earnings. The export earnings, which was little over 2 billion USD in 2009-10 has increased to around 6 billion USD in 2019-20, whereas import has decreased significantly during these periods. There has been a huge net trade surplus in case of fishery sector (Fig 9.1). India exports fish to more

A view of an organised Fish Market for the retailers, Jammu & Kashmir

than 100 countries. The top five countries are China, South East Asia, European Union, USA and Japan, Shrimps, crabs, lobsters, squids and finfishes constitute major items of India's export; these were previously sent dried and canned but presently in frozen form; increasingly, live fishes are being now exported. Strategies for increasing fisheries export, processed at a cheaper cost, in a value-added form, for a higher unit price are recommended. Scope for expanding capture (offshore and deep-sea) fisheries, and intensive but eco-friendly culture fisheries including exotic fishes are important. As repeatedly mentioned in this report on the importance of maintaining high standards of hygiene at the collection and processing centres is the need of the hour. For the quantum export earning, budget allocation by the Central Government for fisheries development and for research should be the prime focus.
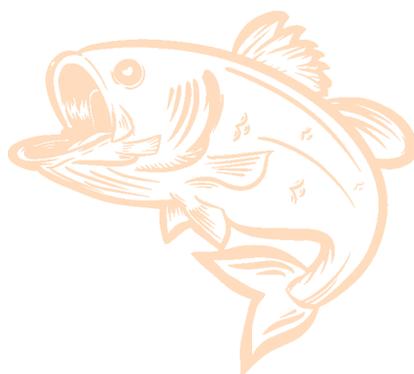
ANNEXURE A

A.1: Share (%) of HH Expenditure on Food

States	Total	Rural	Urban
Andhra Pradesh	43.62	42.57	45.56
Assam	46.20	49.34	36.72
Bihar	45.92	47.09	37.72
Chhattisgarh	58.82	57.34	64.00
Delhi	30.73	50.70	30.63
Goa	53.54	47.95	55.48
Gujarat	38.14	44.26	34.22
Haryana	33.96	47.75	21.37
Himachal Pradesh	43.66	43.16	47.19
Jammu & Kashmir	40.85	42.96	35.83
Jharkhand	43.18	44.40	39.80
Karnataka	47.38	55.86	42.11
Kerala	29.21	29.94	28.85
Madhya Pradesh	44.18	45.44	40.67
Maharashtra	36.90	33.81	39.92
Odisha	44.87	45.31	42.56
Puducherry	30.96	38.36	28.96
Punjab	32.84	37.00	27.73
Rajasthan	51.17	46.33	64.28
Tamil Nadu	37.20	35.65	38.50
Telangana	27.66	26.54	28.69
Tripura	59.15	65.18	52.99
UP	36.37	38.87	30.15
West Bengal	54.38	59.11	48.60
Total	42.94	45.29	39.37

Source: NCAER computation from primary field survey.

A.2: Share (%) of HH Expenditure on Fish, Meat/Chicken, Egg, Milk and Milk products and other Food Items to Total Food Expenditure (Total)

States	Fish	Meat/chicken, etc.	Egg	Milk and other dairy products like curd paneer ghee, etc.	Other food items (cereals/ pulses/fruits & vegetables, edible oil spices, etc.)
Andhra Pradesh	9.95	11.88	4.29	6.61	67.26
Assam	18.11	26.36	5.77	9.88	39.88
Bihar	12.93	10.81	2.73	21.58	51.96
Chhattisgarh	9.21	5.34	1.38	3.02	81.05
Delhi	12.69	6.55	4.64	9.31	66.81
Goa	18.84	12.50	2.40	13.41	52.85
Gujarat	11.01	5.24	5.00	20.70	58.05
Haryana	9.47	20.37	1.88	13.02	55.26
Himachal Pradesh	16.76	23.00	7.36	19.93	32.94
Jammu & Kashmir	13.47	13.82	6.60	13.49	52.62
Jharkhand	15.49	13.35	3.81	23.49	43.86
Karnataka	11.39	23.39	2.03	9.10	54.09
Kerala	25.41	18.03	3.73	9.91	42.92
Madhya Pradesh	11.28	26.67	4.91	16.60	40.53
Maharashtra	16.12	16.00	3.33	14.43	50.11
Odisha	20.77	11.65	4.05	7.59	55.94
Puducherry	19.92	18.67	6.55	21.05	33.81
Punjab	16.36	21.78	3.62	14.34	43.91
Rajasthan	16.76	8.40	1.55	6.41	66.89
Tamil Nadu	20.41	18.24	3.40	13.09	44.87
Telangana	10.30	13.57	1.12	29.04	45.97
Tripura	22.32	17.69	2.35	5.67	51.97
UP	9.49	33.47	2.38	32.79	21.88
West Bengal	21.25	20.19	4.20	9.80	44.57
Total	16.77	17.04	3.52	14.17	48.49

Source: NCAER computation from primary field survey.
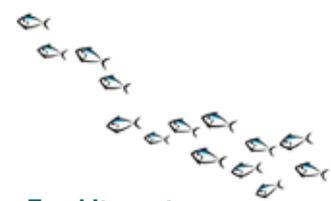
A.3: Share (%) of HH Expenditure on Fish, Meat/Chicken, Egg, Milk and Milk products and other Food Items to Total Food Expenditure (Rural)

States	Fish	Meat/chicken, etc.	Egg	Milk and other dairy products like curd paneer ghee, etc.	Other food items (cereals/ pulses/fruits & vegetables, edible oil spices, etc.)
Andhra Pradesh	10.24	10.27	4.29	3.28	71.91
Assam	18.78	27.77	5.58	9.52	38.35
Bihar	12.56	10.81	2.69	21.65	52.28
Chhattisgarh	9.57	5.58	1.44	3.60	79.81
Delhi	10.68	7.50	3.96	13.15	64.72
Goa	21.18	13.10	3.18	13.10	49.45
Gujarat	11.65	5.77	5.28	21.45	55.84
Haryana	6.50	16.78	1.53	9.63	65.55
Himachal Pradesh	17.83	23.11	7.53	18.10	33.43
Jammu & Kashmir	10.59	11.40	5.95	10.59	61.47
Jharkhand	16.44	13.57	3.90	22.68	43.41
Karnataka	11.24	22.05	1.60	6.96	58.15
Kerala	22.58	17.50	2.73	7.96	49.23
Madhya Pradesh	12.60	26.30	4.86	13.96	42.27
Maharashtra	13.70	15.75	3.26	13.49	53.79
Odisha	21.48	11.66	4.18	7.98	54.70
Puducherry	23.36	16.19	7.65	22.06	30.74
Punjab	15.84	20.58	4.52	12.16	46.90
Rajasthan	17.12	8.93	1.52	5.47	66.96
Tamil Nadu	20.09	22.89	4.81	15.79	36.42
Telangana	12.12	12.74	1.08	28.36	45.71
Tripura	21.22	18.95	2.19	4.61	53.03
UP	9.15	32.59	2.39	33.72	22.15
West Bengal	22.83	19.59	4.26	9.21	44.11
Total	16.53	16.77	3.60	14.45	48.66

Source: NCAER computation from primary field survey.

A.4: Share (%) of HH Expenditure on Fish, Meat/Chicken, Egg, Milk and Milk Products and Other Food Items to Total Food Expenditure (Urban)

States	Fish	Meat/chicken, etc.	Egg	Milk and other dairy products like curd paneer ghee, etc.	Other food items (cereals/ pulses/fruits & vegetables, edible oil spices, etc.)
Andhra Pradesh	9.45	14.67	4.30	12.37	59.21
Assam	15.39	20.67	6.53	11.33	46.09
Bihar	16.10	10.80	3.05	20.93	49.11
Chhattisgarh	8.07	4.55	1.21	1.23	84.94
Delhi	12.70	6.55	4.64	9.28	66.83
Goa	18.13	12.33	2.17	13.50	53.87
Gujarat	10.48	4.80	4.77	20.07	59.88
Haryana	15.52	27.69	2.58	19.94	34.28
Himachal Pradesh	9.88	22.27	6.30	31.72	29.83
Jammu & Kashmir	21.71	20.74	8.45	21.82	27.28
Jharkhand	12.53	12.69	3.53	25.99	45.25
Karnataka	11.51	24.50	2.39	10.85	50.75
Kerala	26.85	18.30	4.24	10.90	39.72
Madhya Pradesh	7.16	27.84	5.06	24.84	35.11
Maharashtra	18.14	16.21	3.38	15.22	47.06
Odisha	16.75	11.58	3.36	5.39	62.92
Puducherry	18.69	19.56	6.16	20.68	34.90
Punjab	17.21	23.75	2.14	17.91	38.99
Rajasthan	16.04	7.35	1.62	8.24	66.75
Tamil Nadu	20.66	14.61	2.29	10.98	51.46
Telangana	8.77	14.28	1.15	29.61	46.19
Tripura	23.70	16.11	2.55	7.00	50.65
UP	10.55	36.27	2.34	29.80	21.04
West Bengal	18.89	21.08	4.11	10.67	45.25
Total	17.21	17.52	3.38	13.70	48.19

Source: NCAER computation from primary field survey.
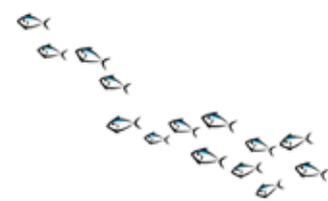
States	Fresh	Frozen	Others
Andhra Pradesh	88.77	6.27	0.12
Assam	69.96	26.24	3.77
Bihar	85.89	0.75	13.36
Chhattisgarh	69.93	14.21	1.30
Delhi	99.92	0.00	0.00
Goa	9.25	0.06	0.00
Gujarat	92.41	7.54	0.05
Haryana	61.86	36.37	1.76
Himachal Pradesh	99.93	0.07	0.00
Jammu & Kashmir	86.76	11.04	2.20
Jharkhand	84.02	0.03	15.95
Karnataka	90.91	0.00	0.00
Kerala	24.76	5.16	0.10
Madhya Pradesh	100.00	0.00	0.00
Maharashtra	88.41	6.86	0.50
Odisha	97.49	0.65	0.06
Puducherry	16.01	44.83	1.59
Punjab	69.43	29.20	1.37
Rajasthan	83.64	12.22	4.14
Tamil Nadu	66.67	4.71	0.04
Telangana	99.68	0.18	0.14
Tripura	52.24	44.62	3.14
UP	95.86	2.58	1.56
West Bengal	74.18	25.77	0.01
Total	79.31	9.32	2.95

Source: NCAER computation from primary field survey.

A.5.2: Consumption Pattern: Marine Fish by Fish Condition (% Share)

States	Fresh	Frozen	Dry	Canned	Others
Andhra Pradesh	5.87	0.55	0.08	0.00	0.00
Assam	22.18	30.97	8.62	0.07	1.36
Bihar	0.23	0.01	0.01	0.00	0.05
Chhattisgarh	13.33	29.23	0.09	0.00	0.05
Delhi	0.05	0.00	0.00	0.00	0.00
Goa	3.19	85.37	1.00	0.00	0.00
Gujarat	0.00	0.00	0.00	0.00	0.00
Haryana	38.43	27.42	0.00	0.00	0.00
Himachal Pradesh	0.00	0.00	0.00	0.00	0.00
Jammu & Kashmir	13.39	5.13	1.21	0.82	0.95
Jharkhand	0.00	0.00	0.00	0.00	0.00
Karnataka	8.51	0.02	0.56	0.00	0.00
Kerala	58.97	29.91	4.79	0.08	0.10
Madhya Pradesh	0.20	0.00	0.00	0.00	0.00
Maharashtra	14.91	9.39	0.91	0.87	0.16
Odisha	12.74	0.11	0.39	0.00	0.00
Puducherry	32.33	60.58	1.89	0.88	0.63
Punjab	24.78	14.57	0.34	0.23	0.09
Rajasthan	0.34	0.30	0.00	0.00	0.00
Tamil Nadu	25.66	22.88	2.98	0.03	0.00
Telangana	0.08	0.01	0.00	0.00	0.00
Tripura	12.18	38.12	49.43	0.00	0.00
UP	0.00	0.00	0.00	0.00	0.00
West Bengal	20.44	50.44	0.48	0.00	0.00
Total	14.05	16.62	1.60	0.07	0.10

Source: NCAER computation from primary field survey.
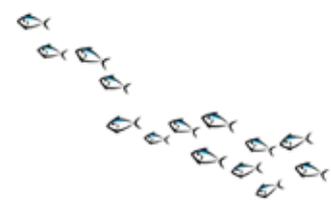
A.5.3: Consumption Pattern: Prawn by Fish Condition (% Share)

States	Fresh	Frozen	Dry	Others
Andhra Pradesh	0.87	0.31	0.06	0.00
Assam	8.23	1.31	7.11	0.13
Bihar	2.50	0.51	1.02	0.26
Chhattisgarh	2.74	1.99	0.09	0.49
Delhi	0.00	0.00	0.00	0.00
Goa	0.04	13.56	0.05	0.00
Gujarat	0.00	0.00	0.00	0.00
Haryana	0.46	1.07	0.00	0.00
Himachal Pradesh	0.00	0.00	0.00	0.00
Jammu & Kashmir	4.77	1.95	1.11	0.93
Jharkhand	0.30	0.00	0.00	0.00
Karnataka	0.00	0.00	0.00	0.00
Kerala	10.18	2.02	3.39	0.01
Madhya Pradesh	0.20	0.00	0.00	0.00
Maharashtra	1.73	1.06	0.61	0.20
Odisha	8.99	0.14	0.30	0.00
Puducherry	4.79	1.26	1.08	1.56
Punjab	0.05	0.04	0.06	0.04
Rajasthan	0.00	0.00	0.00	0.00
Tamil Nadu	5.49	1.60	0.31	0.00
Telangana	0.03	0.01	0.00	0.00
Tripura	33.95	10.52	6.05	0.00
UP	0.00	0.00	0.00	0.00
West Bengal	33.29	33.85	0.21	0.00
Total	8.83	6.63	0.88	0.07

Source: NCAER computation from primary field survey.

A.5.4: Consumption Pattern: Other (Like Crab, Lobster, Squid, Mussel, etc.) by Fish Condition (% Share)

States	Fresh	Frozen	Dry	Canned	Others
Andhra Pradesh	0.37	0.01	0.02	0.00	0.04
Assam	19.68	4.04	1.01	0.01	1.49
Bihar	36.64	0.03	0.04	0.32	6.89
Chhattisgarh	0.00	0.00	0.00	0.00	0.00
Delhi	0.03	0.00	0.00	0.00	0.00
Goa	0.98	20.96	1.33	0.00	0.00
Gujarat	0.00	0.00	0.00	0.00	0.00
Haryana	0.00	0.00	0.00	0.00	0.00
Himachal Pradesh	0.00	0.00	0.00	0.00	0.00
Jammu & Kashmir	4.24	1.53	0.86	0.83	0.85
Jharkhand	27.53	0.11	0.00	0.00	10.91
Karnataka	0.00	0.00	0.00	0.00	0.00
Kerala	12.46	2.34	0.56	0.01	0.09
Madhya Pradesh	0.00	0.00	0.00	0.00	0.00
Maharashtra	0.48	0.23	0.14	0.25	0.10
Odisha	0.36	0.04	0.00	0.00	0.00
Puducherry	3.38	1.02	1.04	1.13	0.60
Punjab	0.06	0.09	0.04	0.00	0.00
Rajasthan	0.00	0.00	0.00	0.00	0.00
Tamil Nadu	2.00	0.12	0.01	0.00	0.00
Telangana	0.05	0.00	0.00	0.00	0.00
Tripura	49.18	1.91	0.19	0.00	0.00
UP	0.00	0.00	0.00	0.00	0.00
West Bengal	18.79	2.78	0.02	0.00	0.00
Total	11.69	0.94	0.11	0.06	1.48

Source: NCAER computation from primary field survey.
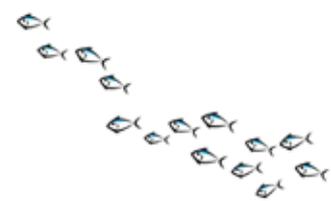
A.5.5: Consumption Pattern: Processed/Preserved Fish by Fish Condition (% Share)

States	Frozen	Dry	Canned	Others
Andhra Pradesh	0.00	0.00	0.04	0.02
Assam	2.98	1.81	0.00	1.81
Bihar	0.17	0.12	0.04	0.09
Chhattisgarh	0.00	0.00	0.00	0.00
Delhi	0.01	0.00	0.00	0.01
Goa	0.04	3.09	0.00	0.00
Gujarat	92.62	6.68	0.00	0.10
Haryana	0.00	0.00	0.00	0.00
Himachal Pradesh	0.00	0.00	0.00	0.00
Jammu & Kashmir	4.85	1.68	0.92	1.39
Jharkhand	0.23	0.00	0.00	0.00
Karnataka	0.00	0.00	0.00	0.00
Kerala	4.21	0.43	0.04	0.01
Madhya Pradesh	0.00	0.00	0.00	0.00
Maharashtra	0.27	0.36	0.20	0.20
Odisha	0.17	0.00	0.00	0.00
Puducherry	1.26	1.18	1.07	1.52
Punjab	0.00	0.00	0.00	0.00
Rajasthan	0.00	0.00	0.00	0.00
Tamil Nadu	0.15	0.03	0.04	0.00
Telangana	0.00	0.00	0.00	0.00
Tripura	0.00	0.00	0.00	0.00
UP	0.00	0.00	0.00	0.00
West Bengal	11.40	0.31	0.00	0.00
Total	3.81	0.32	0.03	0.14

Source: NCAER computation from primary field survey.

A.6 .1: Preference for Animal Products (Total)

States	No Preference	Milk	Fish	Egg	Chicken	Meat (other than Chicken)
Andhra Pradesh	0	48.55	18.41	1.63	31.37	0.04
Assam	0.14	42.17	33.32	6.71	14.9	2.75
Bihar	0	34.71	52.74	6.34	6.04	0.17
Chhattisgarh	0	2.77	51.77	7.65	37.3	0.52
Delhi	0	45	54.89	0.1	0	0
Goa	0.04	1.38	61.89	0.37	36.2	0.12
Gujarat	0	57.55	42.45	0	0	0
Haryana	1.1	58.72	27.83	1.25	3.02	8.08
Himachal Pradesh	0	21.15	36.4	1.18	21.8	19.47
Jammu & Kashmir	0	91.73	7.84	0.43	0	0
Jharkhand	0	33.8	53.96	4.07	7.11	1.05
Karnataka	0	56.97	9.44	0.48	18.12	15
Kerala	0.1	21.44	65.47	1.31	8.8	2.88
Madhya Pradesh	0.34	1.16	41.88	0.4	26.87	29.34
Maharashtra	0	55.58	6.45	2.87	27.57	7.53
Odisha	7.4	8.1	71.5	6.97	5.03	1
Puducherry	0	22.94	68.59	6.12	2.11	0.24
Punjab	1.1	57.23	39.14	1.33	1.2	0
Rajasthan	2.24	49.53	43.45	0.28	3.84	0.66
Tamil Nadu	0	62.79	26.39	2.24	6.09	2.5
Telangana	0	86.52	1.15	0	8.49	3.83
Tripura	0	0.24	73.28	4.7	18.88	2.89
UP	0	36.55	19.08	8.34	28.92	7.12
West Bengal	0.13	1.68	75.95	2.76	8.46	11.02
Total	0.55	34.06	43.31	3.66	13.23	5.18

Source: NCAER computation from primary field survey.
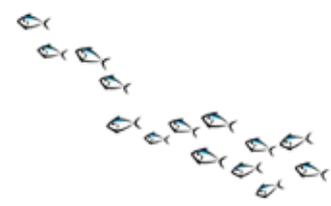
A.6.2: Preference for Animal Products (Rural)

States	No Preference	Milk	Fish	Egg	Chicken	Meat (other than Chicken)
Andhra Pradesh	0	53.07	21.78	0.55	24.53	0.06
Assam	0.17	42.17	32.89	7.78	14.91	2.08
Bihar	0	32.6	54.81	6.03	6.39	0.16
Chhattisgarh	0	3.42	48.78	5.26	41.97	0.57
Delhi	0	56.32	43.68	0	0	0
Goa	0	0.03	60.58	0	38.95	0.44
Gujarat	0	66.46	33.54	0	0	0
Haryana	2.14	50.43	35.64	0	5.85	5.94
Himachal Pradesh	0	22.25	35.15	1.34	20.61	20.65
Jammu & Kashmir	0	94.67	4.64	0.69	0	0
Jharkhand	0	34.27	51.71	3.94	8.66	1.42
Karnataka	0	34.34	2.23	0.3	34.76	28.36
Kerala	0.35	19.77	71.6	1.54	6.14	0.6
Madhya Pradesh	0.43	0.99	41.34	0.25	29.64	27.34
Maharashtra	0	52.96	2.39	3	34.19	7.46
Odisha	6.81	8.07	71.88	7.66	4.37	1.21
Puducherry	0	4.56	87.54	7.9	0	0
Punjab	0	58.75	39.64	1.31	0.29	0
Rajasthan	3.24	36.96	54.97	0.41	3.47	0.96
Tamil Nadu	0	79.16	10.12	2.94	7.78	0
Telangana	0	91.43	1.09	0	6.52	0.96
Tripura	0	0.35	71.88	2.51	21.65	3.6
UP	0	38.96	21.74	7.84	26.04	5.42
West Bengal	0.2	0.6	79.11	2.03	6.83	11.22
Total	0.67	32.05	44.66	4.01	13.61	5

Source: NCAER computation from primary field survey.

A.6.3: Preference for Animal Products (Urban)

States	No Preference	Milk	Fish	Egg	Chicken	Meat (other than Chicken)
Andhra Pradesh	0	39.88	11.96	3.68	44.48	0
Assam	0	42.16	35.6	1.14	14.83	6.28
Bihar	0	52.04	35.68	8.85	3.18	0.24
Chhattisgarh	0	0.76	60.96	14.99	22.93	0.35
Delhi	0	44.93	54.97	0.1	0	0
Goa	0.06	1.91	62.39	0.51	35.13	0
Gujarat	0	49.69	50.31	0	0	0
Haryana	0	67.54	19.52	2.59	0	10.35
Himachal Pradesh	0	13.15	45.5	0	30.47	10.88
Jammu & Kashmir	0	86.86	13.14	0	0	0
Jharkhand	0	32.48	60.3	4.45	2.78	0
Karnataka	0	78.1	16.16	0.64	2.58	2.52
Kerala	0	22.08	63.11	1.23	9.82	3.76
Madhya Pradesh	0	1.79	43.86	0.95	16.73	36.67
Maharashtra	0	57.83	9.94	2.76	21.89	7.58
Odisha	10.26	8.25	69.66	3.66	8.17	0
Puducherry	0	30.21	61.1	5.41	2.95	0.33
Punjab	2.61	55.16	38.46	1.35	2.42	0
Rajasthan	0	77.52	17.82	0	4.66	0
Tamil Nadu	0	50.22	38.87	1.71	4.78	4.42
Telangana	0	81.51	1.21	0	10.52	6.77
Tripura	0	0.06	75.46	8.12	14.56	1.79
UP	0	28.07	9.75	10.09	39.01	13.07
West Bengal	0	3.48	70.67	3.99	11.18	10.68
Total	0.34	37.68	40.89	3.04	12.54	5.51

Source: NCAER computation from primary field survey.
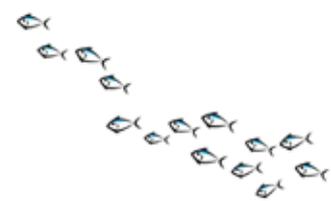
A.7.1: Five Most Preferred Freshwater Fish

States	1	2	3	4	5
Andhra Pradesh	Rohu	Shol	Catla	Boal Fish	Sankara
Assam	Puthi	Rohu	Goroi	Minor	Catla
Bihar	Rohu	Basa	Catla	Mangur	Puthi
Chhattisgarh	Rohu	Tilapia	Catla	Basa	Tuna
Delhi	Rohu	Mangur	Saur	Tuna	Basa
Goa	Mackerel	Mrigal	Musushi	Pomfret	Tuna
Gujarat	Rohu	Catla	Gold Fish	Mackerel	Morgan
Haryana	Rohu	Prawn	Aar/Singara/Catfish	Mangur	Catla
Himachal Pradesh	Mahaseer	Silver Carp	Rohu	Aar/Singara/Catfish	Catla
Jammu & Kashmir	Schizothor	Common Carp	Brown Trout	Rainbowfish	Silver Carp
Jharkhand	Rohu	Basa	Catla	Mangur	Puthi
Karnataka	Rohu	Catla	Sardine	Mackerel	Tilapia
Kerala	Tilapia	Murrel	Rohu	Shol	Boal Fish
Madhya Pradesh	Rohu	Catla	Silver Carp	Grass Carp	Chapati
Maharashtra	Catla	Rohu	Tilapia	Shol	Pabda
Odisha	Rohu	Catla	Mohurali	Salmon	Mangur
Puducherry	Grass Carp	Sardine	Catla	Aar/Singara/Catfish	Shol
Punjab	Rohu	Catla	Mangur	Silver Carp	Pomfret
Rajasthan	Rohu	Catla	Prawn	Mrigal	Mangur
Tamil Nadu	Catla	Murrel	Rohu	Mackerel	Silver Carp
Telangana	Shol	Rohu	Bombay Duck	Common Carp	Catla
Tripura	Rohu	Catla	Silver Carp	Grass Carp	Tilapia
UP	Mangur	Tilapia	Rohu	Saur	Basa
West Bengal	Rohu	Catla	Bata	Tilapia	Mangur
India	Rohu	Catla	Basa	Mangur	Tilapia

Source: NCAER computation from primary field survey.

A.7.2: Five Most Preferred Marine Fish

States	1	2	3	4	5
Andhra Pradesh	Gorasalu	Bhetki	Mackerel	Sardine	Salmon
Assam	Pomfret	Bombay Duck	Hilsa		
Bihar	Basa				
Chhattisgarh	Mrigal	Tilapia			
Delhi	0	0	0	0	0
Goa	Mackerel	Surmai	Silver Carp	Lepo	Silver Belly
Gujarat	0	0	0	0	0
Haryana	Hilsa	Silver Carp			
Himachal Pradesh	0	0	0	0	0
Jammu & Kashmir	Marine Fish	Grass Carp	Brown Trout	Schizothor	Silver Carp
Jharkhand	0	0	0	0	0
Karnataka	Sardine	Mackerel	Surmai	Pomfret	0
Kerala	Sardine	Mackerel	Tuna	Nethili	Kozhuva
Madhya Pradesh	0	0	0	0	0
Maharashtra	Surmai	Shol	Pomfret	Salmon	Mackerel
Odisha	Hilsa	Pomfret	Sardine	Mackerel	Tuna
Puducherry	Sardine	Sankara	Mackerel	Surmai	Parai
Punjab	Silver Pomfret	Surmai	Basa	Pomfret	Rohu
Rajasthan	Rohu	Mrigal	Basa	Silver Carp	Mangur
Tamil Nadu	Sardine	Surmai	Pomfret	Tuna	Silver Pomfret
Telangana	0	0	0	0	0
Tripura	Hilsa	Surmai	Bine	Rani	Shol
UP	0	0	0	0	0
West Bengal	Bhetki	Hilsa	Amadi/Amudi	Bombay Duck	Pomfret
India	Sardine	Bhetki	Hilsa	Pomfret	Mackerel

Source: NCAER computation from primary field survey.
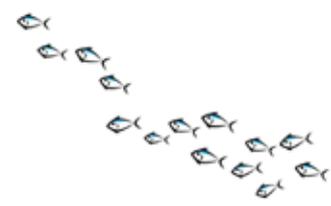
A.7.3: Five Most Preferred Processed Fish

States	1	2	3	4	5
Andhra Pradesh	0	0	0	0	0
Assam	Chitol	Goroi	Roopchanda	Shrimp	0
Bihar	Rohu	Prawn	0	0	0
Chhattisgarh	0	0	0	0	0
Delhi	0	0	0	0	0
Goa	Bombay Duck	Dry Fish	Marine Fish	0	0
Gujarat	Aar/Singara/ Catfish	Rohu	Surmai	Tilapia	0
Haryana	0	0	0	0	0
Himachal Pradesh	0	0	0	0	0
Jammu & Kashmir	Marine Fish	Schizothor	Dry Fish	Brown Trout	Silver Carp
Jharkhand	Rohu	Basa	0	0	0
Karnataka	0	0	0	0	0
Kerala	Tuna	Kingfish	Mackerel	Pomfret	Sardine
Madhya Pradesh	0	0	0	0	0
Maharashtra	Rohu	Pomfret	0	0	0
Odisha	Catla	Rohu	0	0	0
Puducherry	0	0	0	0	0
Punjab	0	0	0	0	0
Rajasthan	0	0	0	0	0
Tamil Nadu	Rohu	Surmai	Common Carp	0	0
Telangana	0	0	0	0	0
Tripura	0	0	0	0	0
UP	0	0	0	0	0
West Bengal	Rohu	Catla	Hilsa		
India	Tuna	Rohu	Kingfish	Catla	Mackerel

Source: NCAER computation from primary field survey.

A.8.1: Distribution of HHs by Important Physical Factors Considered While Buying Fish – States

States	No Preference	Colour of Skin	Colour of Eyes	Colour of Gills	Firmness of body	Less spine in Flesh	Odor of Fish	Live Fish (Freshness)	Presentation of fish on the display shelf
Andhra Pradesh	0.03	57.25	3.38	4.77	5.2	3.4	0.23	25.74	0
Assam	0.46	57.91	11.09	5.21	18.48	1.78	1.28	3.79	0
Bihar	0.46	70.49	12.54	7.18	6.45	1.38	0.28	0.75	0.47
Chhattisgarh	0	51.18	4.41	4.69	22.65	0.04	1.96	15.07	0
Delhi	0.01	73.33	14.29	4.26	0.43	0.84	0	6.84	0
Goa	0	57.55	18.89	22.99	0.47	0.04	0.06	0	0
Gujarat	0	49.04	23.82	18.03	7.04	2.02	0.05	0	0
Haryana	0	89.1	5.14	1.07	2.86	0	0	1.83	0
Himachal Pradesh	0	86.87	2.52	4.07	3.71	0.27	0.53	2.03	0
Jammu & Kashmir	0.01	63.04	6.71	3.77	8.84	15.1	0.55	1.25	0.73
Jharkhand	0.12	81.64	4.62	3.21	9.12	0.99	0	0	0.3
Karnataka	0.36	7.5	0.16	15.51	9.77	11.48	13.98	41.24	0
Kerala	0.01	66.08	10.51	13.13	2.67	0.33	2.61	4.41	0.25
Madhya Pradesh	0	42.83	6.63	29	20.59	0.95	0	0	0
Maharashtra	0.42	41	19.3	31.12	4.88	2.23	0.24	0.81	0
Odisha	7.82	39.49	5.24	32.86	1.2	1.12	3.45	8.82	0
Puducherry	0.9	39.91	40.13	2.18	1.06	1.14	6.49	6.69	1.5
Punjab	0	84.59	2.1	2.07	3.66	5.92	0	1.66	0
Rajasthan	1.56	75.49	6.65	3.23	3.29	1.08	7.11	1.59	0
Tamil Nadu	0.02	65.33	6.28	2.32	4.89	4.82	2.29	7.76	6.29
Telangana	3.8	7.55	15.62	22.2	0.16	10.32	0.13	40.22	0
Tripura	0	86.45	3.96	4.13	4.5	0.62	0	0.34	0
Uttar Pradesh	0.22	98.99	0.21	0.23	0	0	0	0.35	0
West Bengal	0.02	75.11	6.55	12.49	1.92	0.07	0.73	3.11	0
Total	0.8	61.13	8.01	11.47	5.66	2.37	1.74	8.09	0.73

Source: NCAER computation from primary field survey.
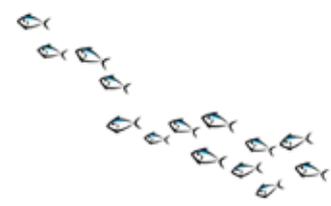
A.8.2: Distribution of HHs by Factors that Restrict Buying Fish - States

States	High Price	Preference of Chicken/ Mutton over Fish	Fish Odor	Difficulty in Eating due to Fine Bones	Fish Taste and Texture	Don't Know How to Buy and Cook Fish	Fish is Cumbersome to Prepare and Cook	Unhygienic Conditions of Fish Markets	Medical Reasons	Others
Andhra Pradesh	4.62	53.2	24.21	12.45	2.11	1.74	0.03	0	0.02	1.62
Assam	11.63	78.3	3.23	1.76	0.67	3.59	0	0	0.08	0.74
Bihar	1.55	93.94	0.84	2.06	0.08	0.3	0	0.11	0.3	0.82
Chhattisgarh	7.56	65.85	1.03	25.38	0.11	0	0.07	0	0	0
Delhi	2.19	14.11	12	14.8	14.7	36.76	0.27	0	1.59	3.58
Goa	0	53.02	31.35	0	7.61	3.42	1.73	2.63	0.24	0
Gujarat	3.11	60.45	8.67	18.73	2.07	6.38	0.33	0.1	0.16	0
Haryana	7.06	60.89	19.45	0.76	4.71	5.39	1.35	0.07	0	0.32
Himachal Pradesh	0	69.41	13.57	2.46	3.08	1.57	1.01	2.45	4.94	1.51
Jammu & Kashmir	0	98.53	0.8	0.09	0.58	0	0	0	0	0
Jharkhand	2.13	90.77	1.27	5.7	0	0	0	0.05	0.08	0
Karnataka	1.86	39.05	29.12	4.43	0.45	23.85	0	1.09	0.14	0.01
Kerala	0.01	90.72	3.22	3.65	0	1.24	0.13	0.26	0.77	0
Madhya Pradesh	0	98.03	0.89	1.08	0	0	0	0	0	0
Maharashtra	0.15	33.98	30.49	2.97	18.17	1.43	7.39	2.38	3.04	0
Odisha	4.56	94.01	0.5	0	0.3	0	0	0.53	0.1	0
Puducherry	0.38	53.13	10.78	24.86	0.58	1.88	0.29	0.3	6.46	1.34
Punjab	0	54.44	38.76	1.15	0.19	0	5.46	0	0	0
Rajasthan	1.66	75.16	8.64	14.09	0	0	0.45	0	0	0
Tamil Nadu	0.41	35.92	40.64	5.18	6.36	2.49	1.65	1.69	4.78	0.88
Telangana	0	93.52	1.6	0	4.6	0.04	0	0	0	0.24
Tripura	0.22	91.35	4.12	3.85	0	0	0.46	0	0	0
Uttar Pradesh	12.7	86.8	0.5	0	0	0	0	0	0	0
West Bengal	10.42	82.25	4.68	0.85	0.83	0.47	0.04	0.17	0.2	0.09
Total	4.57	73.18	11.26	3.91	2.36	2.34	0.69	0.47	0.83	0.39

Source: NCAER computation from primary field survey.

A.8.3: Distribution of HHs by Factors that Help them Buy More Fish

States	No Preference	More variety of Fish sold by the Local Retailer	More variety of Fish sold by the online Retailer	Doorstep Delivery	More Frozen Products	Lower Price Range	Good Hygienic Condition of Retail Markets
Andhra Pradesh	47.02	29.79	2.16	1.83	0.01	19.17	0.02
Assam	7.63	61.84	4.38	17.69	1.26	5.69	1.51
Bihar	0.75	94.71	0.66	0.48	0.42	1.81	1.17
Chhattisgarh	5.43	33.48	4.69	33.49	0.02	21.85	1.04
Delhi	3.41	20.57	17.06	13.45	3.97	41.12	0.42
Goa	0	60.52	2.48	18.96	10.23	5.48	2.33
Gujarat	34.67	39.76	1.37	0.27	0.76	23.01	0.16
Haryana	0.23	72.03	11.22	3.18	0.72	12.6	0.02
Himachal Pradesh	0	67.41	2.62	10.14	0.49	13.72	5.62
Jammu & Kashmir	0	70.17	3.72	1.71	11.93	11.93	0.54
Jharkhand	0	88.11	1.09	6.11	0	4.31	0.38
Karnataka	0.31	42.42	5.12	15.32	1.12	31.75	3.96
Kerala	0.84	49.57	2.08	14.88	0.35	27.46	4.82
Madhya Pradesh	0.33	95.57	0.04	0.65	0	3.41	0
Maharashtra	1.18	36.68	1.94	22.22	7.09	21.54	9.35
Odisha	2.07	24.05	0	39.23	1.24	33.41	0
Puducherry	0.24	47.91	13.22	15.71	4.44	12.71	5.77
Punjab	2.59	72.85	1.77	1.69	1.93	19.17	0
Rajasthan	1.1	84.05	9.14	2.48	0.22	3.01	0
Tamil Nadu	0	41.92	11.69	5.05	2.15	35.46	3.73
Telangana	0.01	21.08	0.27	64.97	0	9.65	4.02
Tripura	0	98.01	1.06	0.57	0.36	0	0
Uttar Pradesh	10.57	89.19	0	0.12	0	0.12	0
West Bengal	0.07	50.94	0.44	12.38	1.51	34.17	0.49
Total	5.17	56.4	2.71	12.71	1.29	19.8	1.92

Source: NCAER computation from primary field survey.
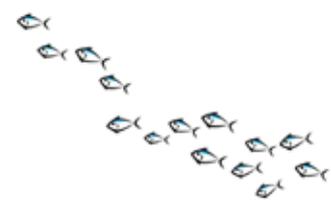
A.8.4: Distribution of HH by Preference for Online Fish Purchase

States	Online	Market-based
Andhra Pradesh	8.69	91.31
Assam	27.77	72.23
Bihar	10.26	89.74
Chhattisgarh	5.08	94.92
Delhi	81.86	18.14
Goa	55.33	44.67
Gujarat	0	100
Haryana	42.29	57.71
Himachal Pradesh	3.33	96.67
Jammu & Kashmir	100	0
Jharkhand	13.93	86.07
Karnataka	0.09	99.91
Kerala	14.3	85.7
Madhya Pradesh	0.27	99.73
Maharashtra	27.28	72.72
Odisha	2.48	97.52
Puducherry	32.36	67.64
Punjab	73.97	26.03
Rajasthan	63.5	36.5
Tamil Nadu	55.66	44.34
Telangana	21	79
Tripura	0	100
Uttar Pradesh	5.3	94.7
West Bengal	0.26	99.74
Total	15.92	84.08

Source: NCAER computation from primary field survey.

A.8.5: Distribution of HH by Preference for Fish Dishes

States	No Preference	Fish Curry	Fish Cutlets	Smoked Fish/ Tandoori Fish	Baked Fish	Fried Fish	Fish Tikka
Andhra Pradesh	1.56	94.81	1.93	0.29	0.24	0.78	0.39
Assam	3.33	74.31	3.79	1.55	1.27	15.33	0.42
Bihar	5.52	55.56	2.48	20.94	0.73	13.74	1.03
Chhattisgarh	2.12	67.89	0	0	1.34	28	0.65
Delhi	2.2	60.65	10.24	21.22	3.05	0.63	2.01
Goa	0	71.85	0.57	0	0	27.58	0
Gujarat	0.94	52.1	19.35	13.96	11.32	0.91	1.42
Haryana	0.78	88.85	4.49	2.67	0.79	1.51	0.91
Himachal Pradesh	0	92.6	0.58	0.53	0	4.81	1.48
Jammu & Kashmir	0	53.44	6.24	8.36	15.98	10.94	5.04
Jharkhand	18.82	44.04	2.45	9.94	0	24.75	0
Karnataka	0.03	64.64	0	0	27.49	7.84	0
Kerala	1.31	81.37	3.97	0.14	0.14	12.38	0.69
Madhya Pradesh	0	96.74	1.06	0.78	0.82	0.39	0.21
Maharashtra	3.88	65.35	3.69	0.25	3.29	20.96	2.58
Odisha	0.18	94.89	0.07	0.14	0.8	3.92	0
Puducherry	4.07	69.9	14.03	1.4	2.65	4.57	3.38
Punjab	0.76	87.52	3.55	3.23	1.98	2.7	0.26
Rajasthan	7.64	86.74	2.29	0	0.42	0.77	2.14
Tamil Nadu	2.6	63.15	12.4	5.5	3.16	4.93	8.26
Telangana	3.92	95.79	0	0	0	0.29	0
Tripura	28.88	64.49	2.53	1.13	0	2.97	0
Uttar Pradesh	4.11	94.29	0.93	0	0.21	0.29	0.17
West Bengal	8.87	80.1	4.18	1.89	0.06	4.7	0.2
Total	4.77	74.64	3.74	4.55	2.48	8.47	1.35

Source: NCAER computation from primary field survey.
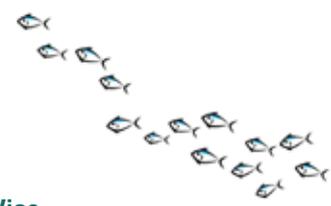
Solutions	Central	East	North	North-East	South	All
Conducting a mass awareness campaign on the health benefits of Fish	100	100	100	100	100	98
Conducting fish festivals at the district level offering fish dishes of various species and cuisine to customers to help develop their taste for fish	100	100	75	100	100	92
Constructing hygienic retail fish markets and fish kiosks at strategic locations	100	78	83	100	100	84
Strengthening mobile fish marketing facilities and online fish delivery system	100	89	58	60	100	80
Encouraging sales of preserved and processed fish in domestic market	100	50	25	100	86	63
Promoting sale of live fish and creating facilities for transportation and storage	100	100	91	100	100	100
Developing appropriate packaging materials for fish and fish products	100	90	83	80	86	88
Emphasis on the branding of fish like "Ganga water fish", "Himalayan Trout", "Sundarban fish", "Chilka Crab", etc.	100	83	75	40	57	71

Source: NCAER computation from primary field survey.

(Contd.)

S. No.	States	Districts	Needs
1.	Assam	Nagaon, Darang, Golaghat,Sonitpur, Tinsukia	Renovation of existing fish ponds. Wetland development scheme. Beel Fisheries Development Scheme. Breeding unit for locally important fish species-Singhi, Mandur. Inputs for fish growers-fish seed, feed, etc. Input assistance to fish farmers in their existing ponds. Development of inland fishing ports at river Brahmaputra. Development of beel fisheries in a sustainable manner. Organising frequent River Ranching programmes. Value addition in fish. Mobile fish vending centres. Installation of fish processing plants. Construction of hygienic fish marketing infrastructure. Making available ready to eat fish products. Wide publicity through electronic and social media regarding health benefits of consuming fish. Mobile live fish vending centre (Three-wheeler/ Four-Wheeler). Flags, banners, hoardings be displayed depicting nutritional value of fish in major market places. Mass awareness programme in Blocks, Panchayats & Village level. Encouraging Paddy- cum-Fish culture. Renovation of existing ponds and input distribution. Establishment of hatcheries is required
2.	Bihar	**Muzzafarpur, Madhubani, Kaimur, Patna**	Subsidy on input items should be continued. Supply of quality seed. Vehicle for fish selling / transportation. Renovation of govt. ponds. Renovation of fish seed hatchery. Construction of hygienic retail fish market. Home for fishermen. Regional training in fisheries. Awareness generation on nutritive values and health benefits of eating fish. Providing three-wheelers to the fish suppliers and traders. Mobile fish kiosks in each Panchayat and word level be created. Providing hygienic kits to fish sellers, retailers and wholesalers. Create well developed live fish wholesale market at Block level. Specific training programme on fish processing, cooking for women. To provide well equipped shops on rental basis for poor sellers at prime locations.
3.	Gujarat	**Anand, Vadodara**	Thrust towards enhancement of fish production. Standards and traceability in fisheries sector from "Catch to Consumers". Establishing a robust fisheries management frame work. Fisheries welfare, enhancement of fisheries export competitiveness. Construction of Fish Seed Hatchery. Web development and e-commerce.
4.	Jammu & Kashmir	**Jammu**	Awareness programme on health benefits of fish protein. Upliftment of socio-economic conditions of fishermen.

(Contd.)

5.	Jharkhand	**Ranchi, Hazaribagh**	Infrastructure creation for selling live fish. Infrastructure for marketing processed products. Infrastructure to promote Research on Fisheries. Infrastructure to promote quality seed production of various species. Infrastructure creation in Reservoirs sites like landing sites, handling sites, etc. Value addition in fish products. Modern and hygienic fish market. Fish kiosks in the city. Diversification of Fish species. Demonstration of newly introduced fish species culture like Pabda, Bhetki, etc. Centralised fish market. Easy credit facilities for inputs. Hatchery for Pangeium / MST or seed production facility at local level.
6.	Kerala	Idukki	Strengthening Cold Chain and fish storage facilities. Facilities for live fish marketing. Various ready to eat and ready to cook value added products of fresh water fish like Tilaspia, carps, etc.
7.	Madhya Pradesh	**Titamgarh, Narsinghpur, Tatalam**	Establishment of retail fish kiosk and live fish vending centre. Information on protein and nutritional values of fish and which protein and which vitamins are available be disseminated. Small shops should be set up for sale of different types of fish species.
8.	Odisha	**Koraput, Bhadrakh, Ganjam**	More and more supply of fresh/live fish at a low price to increase consumption. Awareness of govt. sponsored schemes for increasing fish production through SHGs. To generate awareness among people on the nutritional value of fish consumption. Increase the network of seed production. Aqua lab needed in the district to improve production and consumption. Hygienic fish retail market through govt. initiative.
9.	Rajasthan	Ajmer	Construction of hygienic retail fish markets and fish kiosks. Mobile fish marketing facilities and on-line fish delivery system. Develop post-harvest and processing units. Provision for transportation of live fish and storage. Construction of fish landing centres on leased water bodies. Provide transportation facility to lease of said water bodies.
10.	Tripura	**Dhalai**	Potential to increase Mini Barrage/ New water bodies to create. Storage transportation facilities. Farmers should be given more training in Fish culture.
11.	Uttar Pradesh	Kushi Nagar, Pratapgarh, Saharanpur, Etawah, Hardoi, Raebareli	To impose tax on fish coming from outside the district. Regular fish market place should be provided. Need to arrange technical trainings to Fish Farmers in local areas to develop skills in terms of Bio flocks and other new fisheries related schemes. Government should start a scheme related to fish insurance. Creating awareness to increase fish consumption.
12.	West Bengal	**North 24-Parganas, Barddhaaman, South 24-Parganas**	At least one Hygienic fish market in every word of municipal body. Fish stalls/ Kiosks at every prime location i.e. busy railway stations/ bus stands, etc. with processed/ packaged fish items including live fish run by SHG/ FPG& FCS with technical support. Regular non-stop publicity in various media regarding the health benefits of fish consumption. Imposing restrictions on the use of toxic/ banned chemicals for fish preservation. Need to organise more awareness on pisciculture techniques and scientific implementation of govt. schemes.

Source: NCAER computation from primary field survey.
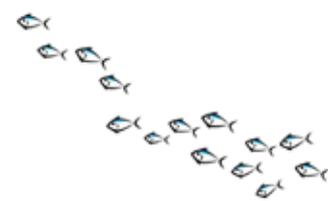
A.8.8: Considering the Potential and Need of the District, Proposed Schemes and Activities for Govt. to Implement in Order to Increase the Demand for Fish Amongst the Consumers – District-wise

S. No.	States	Districts	Needs
1.	Assam	**Nagaon**	Renovation of existing fish ponds. Wetland development scheme. Beel Fisheries Development Scheme. Breeding unit for locally important fish species-Singhi, Mandur. Inputs for fish growers-fish seed, feed, etc.
		Darrang	Inputs assistance to fish farmers in their existing pond. Development of inland fishing ports at river Brahmaputra. Development of beel fisheries in a sustainable manner. Organising frequent River Ranching programmes. Value addition in fish. Mobile fish vending centres.
		Golaghat	Installation of fish processing plant. Construction of hygienic fish marketing infrastructure. Making available ready to eat fish products. Mass awareness regarding the health benefit of fish.
		Sonitpur	Wide publicity through electronic and social media regarding health benefits of consuming fish. Mobile live fish vending centre (Three-wheeler/ Four-Wheeler). Mass awareness programme in Blocks, Panchayats & Village level. Encouraging Paddy-cum-Fish culture. Renovation of existing ponds and input distribution. Flags, banners, hoardings to be displayed depicting nutritional value of fish in major market places.
		Tinsukia	Establishment of hatcheries is required
2.	Bihar	**Muzzafarpur**	Fish market is needed. Subsidy on input items should be continued.
		Mudhubani	Supply of quality seed. Vehicle for fish selling / transportation. Renovation of govt. ponds. Renovation of fish seed hatchery. Construction of hygienic retail fish market. Home for fisherman.
		Kaimur	Regional training. Awareness generation.
		Patna	Providing three-wheelers. Mobile fish kiosks in each Panchayat and word level. Providing kit of hygienic fish sellers, retailers and wholesalers. Base kitchen concept for mobile fish kiosks. Well-developed live fish wholesale market at Block level. Specific training programme on processing, cooking for women. To provide well equipped shops on rental basis for poor sellers at prime locations.
3.	Gujarat	**Anand**	Thrust towards enhancement of fish production. Standards and traceability in fisheries sector from "Catch to Consumers". Establishing a robust fisheries management frame work. Fisheries welfare, enhancement of fisheries export competitiveness (Contd.)
		Vadodara	Construction of Fish Seed Hatchery. Web development and e-commerce.

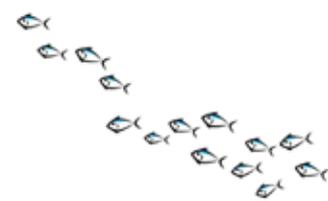|			
4.	Jammu & Kashmir	**Jammu**	Awareness programme on health benefits of fish protein. Upliftment of socio-economic conditions of fishermen.
5.	Jharkhand	**Ranchi**	Infrastructure for selling of live fish. Infrastructure for processed products. Value addition of fish products. Modern and hygienic fish market. Fish kiosks in the city. Infrastructure to promote Research on Fisheries. Infrastructure to promote quality seed production of various species.
		Hazaribagh	Fish species diversification. Demonstration of newly introduced fish species culture like Pabda, Bhetki, etc. Infrastructure creation in Reservoirs sites like landing sites, handling sites, etc. Centralised fish market. Easy credit facilities for inputs. Hatchery for Pangeium / MST or seed production facility at the local level.
6.	Kerala	**Idukki**	Strengthening Cold Chain and fish storage facilities. Facilities for live fish marketing. Various ready-to-eat and ready-to-cook value-added products of fresh water fish like Tilapia, carps, etc.
7.	Madhya Pradesh	**Titamgarh**	Establishment of the retail fish kiosks and live fish vending centre.
		Narsinghpur	Information on protein and nutritional values of fish and which protein and which vitamins are available to be disseminated. Small shops should be set up for the sale of different types of fish species.
		Ratlam	Information on protein and nutritional values of fish and which protein and vitamins are available to be disseminated. Small shops should be set up for the sale of different types of fish species
8.	Odisha	**Koraput**	Increasing supply of fresh/live fish, low price to increase consumption. Awareness of government sponsored schemes for increasing fish production through SHGs. Increase the network of seed production.
		Bhadrakh	Aqua lab needed in the district to improve production and consumption. Hygienic fish retail market through govt. initiative.
		Ganjam	To generate awareness among people on nutritional value of fish consumption.
9.	Rajasthan	**Ajmer**	Construction of hygienic retail fish markets and fish kiosks. Mobile fish marketing facilities and online fish delivery system. Develop post-harvest and processing units. Provision for transportation of live fish and storage. Construction of fish landing centres on lease water bodies. Provide transportation facilities to lease water bodies.
10.	Tripura	**Dhalai**	Potential to increase Mini Barrage/ New water bodies to create. Storage transportation facilities. Farmers should be given more training in Fish culture.

(Contd.)

11.	Uttar Pradesh	**Kushinagar**	To impose a tax on fish coming from outside the district
		Pratapgarh	Regular fish market place should be made
		Saharanpur	Need to arrange technical training for Fish Farmers in local areas to develop skills in terms of Bio flocks and other new fisheries- related schemes. Government should start a scheme related to fish insurance also. Creating awareness to increase fish consumption.
12.	West Bengal	**North 24-Parganas**	At least one Hygienic fish market in every word of municipal body. Fish stalls/ Kiosks at every prime location i.e. busy railway stations/ bus stands etc. with processed/ packaged fish items including live fish run by SHG/ FPG& FCS with technical support. Regular publicity in various media regarding health benefits of fish consumption. Imposing fruitful restrictions on use of toxic/ banned chemicals for fish preservation.
		South 24-Parganas	Need to organize more awareness on pisciculture techniques and scientific implementation of govt. schemes

Source: NCAER computation from primary field survey.
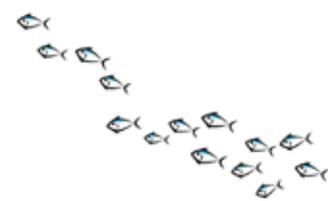
ANNEXURE B

B.1: List of District Fisheries Offices Furnished Data on the Structured Questionnaire

S. No.	States	Districts	Type of Districts
1.	Assam	Darrang	Inland
2.	Assam	Tinsukia	Inland
3.	Assam	Golaghat	Inland
4.	Assam	Nagaon	Inland
5.	Assam	Sonitpur	Inland
6.	West Bengal	Birbhum	Inland
7.	West Bengal	Coochbehar	Inland
8.	West Bengal	Purba Medinipur	Coastal
9.	West Bengal	Uttar Dinajpur	Inland
10.	West Bengal	Jalgaipuri	Inland
11.	West Bengal	Darjeeling	Inland
12.	Tripura	Dhalai	Coastal
13.	Tripura	South Tripura	Inland
14.	Tripura	West Tripura	Inland
15.	Madhya Pradesh	Tikamgarh	Inland
16.	Madhya Pradesh	Ratlam	Inland
17.	Madhya Pradesh	Narsimhapur	Inland
18.	Maharashtra	Raigad	Coastal
19.	Maharashtra	Thane-Palghar	Coastal
20.	Jammu & Kashmir	Jammu	Inland
21.	Jammu & Kashmir	Kupwara	Inland
22.	Himachal Pradesh	Solan	Inland
23.	Himachal Pradesh	Mandi	Inland
24.	Andhra Pradesh	Kakinada	Coastal
25.	Andhra Pradesh	Kurnool	Inland
26.	Andhra Pradesh	East Godavari	Inland
27.	Chhattisgarh	Narayanpur	Inland
28.	Chhattisgarh	Bastar	Inland
29.	Telangana	Adilabad	Inland
30.	Telangana	Nizamabad	Inland
31.	Telangana	Warangal	Inland
32.	Pondicherry	Puducherry	Coastal
33.	Gujarat	Navsari	Coastal
34.	Gujarat	Vadodara	Coastal

Source: NCAER computation from primary field survey.

B.2: Ranking of Five Major Fish Species Produced in the Districts

States	Districts	Inland Fish					Marine Fish				
		1	2	3	4	5	1	2	3	4	5
Assam	Darrang	Catla	Rohu	Mrigal	Silver carp	Grass carp					
Assam	Tinsukia	Catla									
Assam	Golaghat	Rohu	Catla	Mrigal	Grass carp	Rupchanda					
Assam	Nagaon	Catla	Rohu	Mrigal	Silver carp	Grass carp					
Assam	Sonitpur	Rohu	Catla	Mrigal	Silver carp	Grass carp					
West Bengal	Birbhum	Catla	Rohu	Mrigal	Silver carp	Common carp					
West Bengal	Cooch Behar	Boroli	Catla	Rohu	Pabda	Common carp					
West Bengal	Purba Medinipur	Catla	Rohu	Mrigal	Grass carp	Silver carp	Hilsa	Pomfret	Bombay duck	Ribbon fish	Thread fish
West Bengal	Uttar Dinajpur	Catla	Rohu	Mrigal	Bata	Telapia					
West Bengal	Jalgaipuri	Catla	Rohu	Mrigal	Rega	Common carp					
West Bengal	Darjeeling	Catla	Rohu	Mrigal	Tilapia	Bata					
Tripura	Dhalai	Rohu	Catla	Mrigal							
Tripura	South Tripura										
Tripura	West Tripura	Rohu	Catla	Mrigal	Cyprinus carpio	Silver carp					
Madhya Pradesh	Tikamgarh	Rohu	Catla	Mrigal	Common carp	Grass carp					
Madhya Pradesh	Ratlam	Catla	Rohu	Mrigal	Cyprinus carpio	Idila					
Madhya Pradesh	Narsimhapur	Catla	Rohu	Mrigal	Cyprinus carpio	Idila					
Maharashtra	Raigad	Catla	Rohu	Cyprinus	Tilapia	Mrigal	Seer fish	Pomfret	Tuna	Acetus shrimp	Bombay duck
Maharashtra	Thane-Palghar	Catla	Rohu	Cyprinus	Tilapia	Mrigal	Seer fish	Pomfret	Bombay duck	Acetus shrimp	Tuna
Jammu & Kashmir	Jammu	Malli	Catla	Mrigal	Common carp	Rohu					
Jammu & Kashmir	Kupwara		Brown Troat	Rainbow Troat	Common Carp	Silver Carp					
Himachal Pradesh	Solan	Cyprinus carpio	Rohu	Mrigal	Catla	Idila					
Himachal Pradesh	Mandi	Common carp	Rohu	Mrigal	Mahasheer	Rainbow trout					
Andhra Pradesh	Kakinada	Rohu	Catla	Mrigal	Cyprinus carpio	Freshwater prawn					
Andhra Pradesh	Kurnool	Catla	Rohu	Mrigal	Cyprinus carpio	Roop chand					
Andhra Pradesh	East godavari	Rohu	Catla	Mrigal	Cyprinus carpio	Freshwater prawn					
Chhattisgarh	Narayanpur	Catla	Rohu	Mrigal	Grass carp						
Chhattisgarh	Bastar	Catla	Rohu	Mrigal	Common carp	Grass carp					
Telangana	Adilabad	Catla	Rohu	Common carp	Mrigal						
Telangana	Nizamabad	Catla	Rohu	Mrigal	Common carp	Murrel					
Telangana	Warangal	Catla	Rohu	mrigal	Common carp	Grass carp					
Puducherry	Puducherry	Catla	Rohu	Mrigal	Grass carp	Common carp	Oil soadines	Mackerels	Seer fish	Tunnies	Perches
Gujarat	Navsari	Katlasa	Rohu	Brisal			Bombay duck	Malet	Lobster		
Gujarat	Vadodara	Katlasa	Rohu	Mrigal							

Source: NCAER computation from primary field survey.

B.3: Selected Self-Sufficient, Surplus and Deficit in Respect of Freshwater Fish Production and Consumption Patten

S. No.	States	Districts	Type	Fresh Water Fish			Marine Fish		
				Self-sufficient	Surplus	Deficit	Self-sufficient	Surplus	Deficit
1.	Assam	Darrang	Inland			1			
2.	Assam	Tinsukia	Inland			1			
3.	Assam	Golaghat	Inland			1			
4.	Assam	Nagaon	Inland	1					
5.	Assam	Sonitpur	Inland			1			
6.	West Bengal	Birbhum	Inland		1				
7.	West Bengal	Cooch Behar	Inland		1				
8.	West Bengal	Purba Medinipur	Coastal		1			1	
9.	West Bengal	Uttar Dinajpur	Inland	1					
10.	West Bengal	Jalgaipuri	Inland			1			
11.	West Bengal	Darjeeling	Inland			1			
12.	Tripura	Dhalai	Coastal			1			1
13.	Tripura	South Tripura	N/A			1			
14.	Tripura	West Tripura	Inland			1			
15.	Madhya Pradesh	Tikamgarh	N/A	1					
16.	Madhya Pradesh	Ratlam	Inland	1					
17.	Madhya Pradesh	Narsimhapur	Inland	1					
18.	Maharashtra	Raigad	Coastal	1				1	
19.	Maharashtra	Thane-Palghar	Coastal	1				1	
20.	Jammu & Kashmir	Jammu	Inland			1			
21.	Jammu & Kashmir	Kupwara	Inland			1			
22.	Himachal Pradesh	Solan	Inland	1					
23.	Himachal Pradesh	Mandi	Inland			1			
24.	Andhra Pradesh	Kakinada	Coastal		1			1	
25.	Andhra Pradesh	Kurnool	Inland	1					
26.	Andhra Pradesh	East Godavari	Inland		1				1
27.	Chhattisgarh	Narayanpur	N/A			1			
28.	Chhattisgarh	Bastar	N/A			1			
29.	Telangana	Adilabad	N/A	1					
30.	Telangana	Nizamabad	Inland		1				
31.	Telangana	Warangal	Inland		1				
32.	Pondicherry	Puducherry	Coastal	1			1		
33.	Gujarat	Navsari	Coastal	1			1		
34.	Gujarat	Vadodara	Coastal	1					
	Total			**13**	**7**	**14**	**2**	**4**	**2**

Source: NCAER computation from primary field survey.

B.4: Appendix to Table 13.2: Matrix – Fish Species vs. States (Freshwater Fish)

S. No.	Fish species	Rajasthan	Haryana	Punjab	Jharkhand	Bihar	Odisha	Uttar Pradesh	Assam	West Bengal	Tripura	Madhya Pradesh	Maharashtra	Jammu & Kashmir	Himachal Pradesh	Andhra Pradesh	Chhattisgarh	Telangana	Puducherry	Gujarat	Kerala	Total
1.	Catla	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
2.	Rohu	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20
3.	Mrigal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	19
4.	Common Carp	0	0	1	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	14
5.	Grass Carp	1	0	0	0	1	0	1	1	1	0	1	0	0	0	0	1	1	1	0	1	10
6.	Silver Carp	0	0	1	0	0	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	6
7.	Tilapia	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0	1	1	6
8.	Basa	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
9.	Roopchanda	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	3
10.	Boal Fish	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	2
11.	Prawn	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
12.	Rainbow Trout	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
13.	Barracuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
14.	Bata	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
15.	Bhangaon	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
16.	Bighead Carp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
17.	Brown Trout	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
18.	Gold Fish	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19.	Karimeen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
20.	Koi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
21.	Mahasheer	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
22.	Murrel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
23.	Pabda	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
24.	Sankara	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
25.	Sardine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
26.	Senegalus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
27.	Shol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
28.	Singhi	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
29.	Tuna	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Source: NCAER computation from primary field survey.

ANNEXURE C
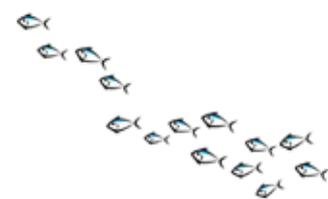
C.1: Comparison of Expenditure on Fish as a Proportion (%) to Total Food Expenditure of the Fish-eating Household

| NSSO 68ᵗʰ Round 2011-12				From NCAER Survey (2022)			
Fish expenditure as a per cent of Food expenditure (only fish eating HHs)							
States	**Rural**	**Urban**	**All**	**States**	**Rural**	**Urban**	**All**
Andhra Pradesh	3.80	3.12	3.59	Andhra Pradesh	10.24	9.45	9.95
Assam	9.07	9.39	9.12	Assam	18.78	15.39	18.11
Bihar	4.47	4.25	4.45	Bihar	12.56	16.1	12.93
Chhattisgarh	4.44	4.52	4.46	Chhattisgarh	9.57	8.07	9.21
Delhi	1.98	2.78	2.64	Delhi	10.68	12.7	12.69
Goa	15.10	16.59	15.91	Goa	21.18	18.13	18.84
Gujrat	3.81	3.95	3.88	Gujarat	11.65	10.48	11.01
Haryana	3.76	5.67	5.32	Haryana	6.5	15.52	9.47
Himachal Pradesh	5.11	3.26	4.89	Himachal Pradesh	17.83	9.88	16.76
Jammu & Kashmir	3.38	3.22	3.31	Jammu & Kashmir	10.59	21.71	13.47
Jharkhand	4.67	3.75	4.37	Jharkhand	16.44	12.53	15.49
Karnataka	6.43	5.85	6.19	Karnataka	11.24	11.51	11.39
Kerala	14.97	14.68	14.89	Kerala	22.58	26.85	25.41
Madhya Pradesh	3.58	3.20	3.48	Madhya Pradesh	12.6	7.16	11.28
Maharashtra	4.71	4.46	4.53	Maharashtra	13.7	18.14	16.12
Odisha	5.83	6.14	5.89	Odisha	21.48	16.75	20.77
Puducherry	6.67	6.32	6.43	Puducherry	23.36	18.69	19.92
Punjab	5.23	5.43	5.31	Punjab	15.84	17.21	16.36
Rajasthan	4.18	2.89	3.71	Rajasthan	17.12	16.04	16.76
Tamil Nadu	6.08	4.71	5.30	Tamil Nadu	20.09	20.66	20.41
Telangana				Telangana	12.12	8.77	10.3
Tripura	15.32	16.77	15.62	Tripura	21.22	23.7	22.32
Uttar Pradesh	4.21	3.77	4.14	Uttar Pradesh	9.15	10.55	9.49
West Bengal	9.72	12.85	10.80	West Bengal	22.83	18.89	21.25
Total	7.59	7.70	7.63	Total	16.53	17.21	16.77

Source: NCAER computation from primary field survey.

C.2: Comparison of Monthly per HH Consumption of Fish in Quantity (kg)

NSSO 68th Round 2011-12				From NCAER Survey (2022)			
Monthly per HH fish consumption in quantity (kg)							
States	Rural	Urban	All	States	Rural	Urban	All
Andhra Pradesh	1.35	1.40	1.37	Andhra Pradesh	2.84	3.10	2.93
Assam	2.38	2.56	2.40	Assam	5.11	11.30	6.11
Bihar	1.38	1.50	1.39	Bihar	3.63	3.80	3.65
Chhattisgarh	1.17	1.45	1.23	Chhattisgarh	2.21	2.07	2.18
Delhi	0.91	1.08	1.06	Delhi	3.80	3.80	3.80
Goa	4.17	5.32	4.77	Goa	4.55	6.25	5.78
Gujarat	1.79	1.43	1.62	Gujarat	1.98	2.45	2.23
Haryana	2.28	2.18	2.19	Haryana	3.19	4.30	3.73
Himachal Pradesh	1.49	1.24	1.46	Himachal Pradesh	5.58	4.11	5.40
Jammu & Kashmir	1.25	1.21	1.24	Jammu & Kashmir	5.60	3.33	4.74
Jharkhand	1.23	1.42	1.28	Jharkhand	3.69	2.98	3.50
Karnataka	3.48	2.41	3.10	Karnataka	3.06	5.23	4.18
Kerala	8.86	8.72	8.82	Kerala	11.94	13.92	13.37
Madhya Pradesh	1.09	1.20	1.11	Madhya Pradesh	3.25	3.48	3.30
Maharashtra	1.46	1.68	1.59	Maharashtra	2.50	3.12	2.83
Odisha	1.42	1.71	1.47	Odisha	5.67	4.51	5.47
Puducherry	1.83	2.33	2.14	Puducherry	4.55	3.07	3.49
Punjab	2.01	1.89	1.95	Punjab	3.42	3.62	3.50
Rajasthan	1.30	0.83	1.16	Rajasthan	3.29	4.70	3.72
Tamil Nadu	1.97	1.78	1.87	Tamil Nadu	4.97	5.21	5.11
Telangana				Telangana		2.02	2.02
Tripura	3.27	4.07	3.41	Tripura	4.82	5.87	5.23
Uttar Pradesh	1.63	1.43	1.60	Uttar Pradesh	2.95	2.96	2.95
West Bengal	2.81	3.98	3.13	West Bengal	7.63	6.40	7.17
Total	2.58	2.89	2.66	Total	4.61	5.66	4.99

Source: NCAER computation from primary field survey.
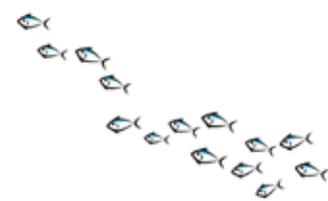
ANNEXURE D

D.1: Regression Results (EViews Output)

Scenario A	Business as Usual Scenario			
Dependent Variable: LOG(TAV)				
Method: ARMA Maximum Likelihood (OPG - BHHH)				
Sample: 2011 2022				
Included observations: 12				
Convergence achieved after 35 iterations				
Coefficient covariance computed using outer product of gradients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.23	0.01	324.05	0.00
T	0.06	0.00	31.04	0.00
AR(1)	0.43	0.39	1.11	0.30
SIGMASQ	0.00	0.00	1.33	0.22
R-squared	0.99	Mean dependent var		4.64
Adjusted R-squared	0.99	S.D. dependent var		0.23
S.E. of regression	0.02	Akaike info criterion		-4.64
Sum squared resid	0.00	Schwarz criterion		-4.48
Log likelihood	31.84	Hannan-Quinn criter.		-4.70
F-statistic	455.20	Durbin-Watson stat		1.74
Prob(F-statistic)	0.00			
Inverted AR Roots	0.43			

Note: TAV=Total Availability of Fish, C=Constant, T=Time Trend, AR=Autoregressive Correction.

Scenario B	Moderately Optimistic Scenario			
Dependent Variable: LOG(TAV)				
Method: Least Squares				
Sample (adjusted): 2012 2022				
Included observations: 11 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.17	1.78	-4.59	0.00
LOG(RELATIVE)	-0.63	0.36	-1.77	0.12
LOG(PCI(-1))	1.40	0.11	12.60	0.00
R-squared	0.95	Mean dependent var		4.67
Adjusted R-squared	0.94	S.D. dependent var		0.22
S.E. of regression	0.05	Akaike info criterion		-2.80
Sum squared resid	0.02	Schwarz criterion		-2.69
Log likelihood	18.39	Hannan-Quinn criter.		-2.87
F-statistic	80.81	Durbin-Watson stat		1.90
Prob(F-statistic)	0.00			

Note: TAV=Total Availability of Fish, C=Constant, Relative=Fish Price (Measured as GVA Deflator) as relative to CPI , PCI (-1) =Lagged Per Capita Income (GVA at Constant Price divided by Population).

| Scenario C	Highly Optimistic Scenario			
Dependent Variable: LOG(TAV)				
Method: Least Squares				
Sample (adjusted): 2011 2022				
Included observations: 12 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.04	1.53	-4.62	0.00
LOG(RELATIVE)	-1.02	0.32	-3.25	0.01
LOG(PCI)	1.45	0.09	16.01	0.00
R-squared	0.97	Mean dependent var		4.64
Adjusted R-squared	0.96	S.D. dependent var		0.23
S.E. of regression	0.05	Akaike info criterion		-3.07
Sum squared resid	0.02	Schwarz criterion		-2.95
Log likelihood	21.40	Hannan-Quinn criter.		-3.11
F-statistic	128.79	Durbin-Watson stat		1.61
Prob(F-statistic)	0.00			

Note: TAV=Total Availability of Fish, C=Constant, Relative=Fish Price (Measured as GVA Deflator) as relative to CPI , PCI = Per Capita Income (GVA at Constant Price divided by Population).
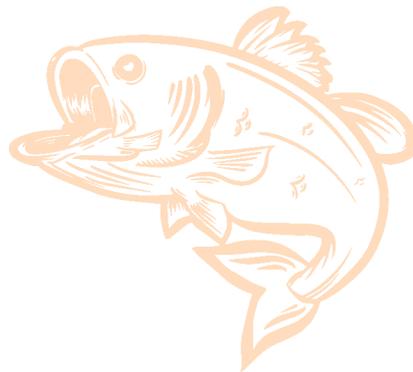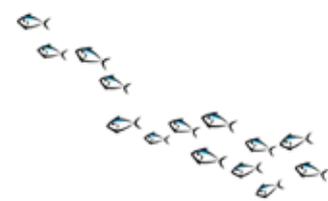
ANNEXURE E: PMSSY

E.1: Beneficiary-oriented Sub-components and Activities Under the Centrally Sponsored Scheme Component of the PMMSY

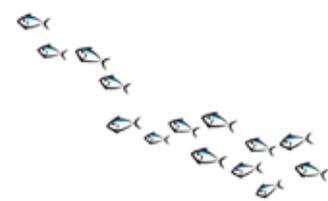| S. No.	Sub-component and Activities	Unit	Unit Cost (Rs lakhs)	Governmental Assistance (Rs lakhs)	
				General (40%)	SC/ST/ Women (60%)
(i)	(ii)		(iii)	(iv)	(v)
A	**Enhancement of production and productivity**				
	Development of Inland Fisheries and Aquaculture				
1.	Establishment of New Freshwater Finfish Hatcheries	Nos.	25.00	10.00	15.00
2.	Establishment of New Freshwater Scampi Hatcheries	Nos.	50.00	20.00	30.00
3.	Construction of New Rearing ponds (nursery/seed rearing ponds)	Ha.	7.00	2.80	4.20
4.	Construction of New Grow-out ponds	Ha.	7.00	2.80	4.20
5.	Inputs for fresh water Aquaculture including Composite fish culture, Scampi, Pangasius, Tilapia, etc.	Ha.	4.00	1.60	2.40
6.	Establishment of need based New Brackish Hatcheries (shell fish and fin fish)	Nos.	50.00	20.00	30.00
7.	Construction of New ponds for Brackish Water Aquaculture In case polythene lining is provided as per specifications, an additional governmental assistance up to Rs 2 lakh per ha may be provided to beneficiaries (General/SC/ST Women). Further, this amount up to Rs 2 lakhs would be shared between Centre and State as per funding pattern under CSS component of PMMSY.	Ha.	8.00	3.20	4.80
8.	Construction of New ponds for Saline/ Alkaline areas In case polythene lining is provided as per specifications, an additional governmental assistance up to Rs 2 lakh per ha may be provided to beneficiaries (General/SC/ST/Women). Further, this amount up to Rs 2 lakhs would be shared between Centre and State as per funding pattern under CSS component of PMMSY.	Ha.	8.00	3.20	4.80

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No.	Description	Unit			
9.	Inputs for Brackish Water Aquaculture	Ha.	6.00	2.40	3.60
10.	Inputs for Saline/Alkaline Water Aquaculture	Ha.	6.00	2.40	3.60
11.	Construction of Biofloc ponds for Brackish water/Saline/Alkaline areas including inputs	0.1 Ha.	18	7.20	10.80
12.	Construction of Biofloc ponds for Freshwater areas including inputs cost.	0.1 Ha.	14.00	5.60	8.40
13.	Stocking of Fingerlings in Reservoirs @1000FL/ha(3.0 lakh/1 lakhFL)	Ha.	Rs 3/ Fingerling	Rs 1.2/ Fingerling	Rs 1.8/ Fingerling
14.	Stocking of Fingerlings in Wetlands @1000FL/ha(3.0 lakh/1 lakhFL)	Ha.	Rs 3/ Fingerling	Rs 1.2/ Fingerling	Rs 1.8/ Fingerling
Development of Marine Fisheries including Mariculture and Seaweed cultivation					
15.	Establishment of Small Marine Finfish Hatcheries	Nos.	50.00	20.00	30.00
16.	Construction of large Marine Finfish Hatcheries	Nos.	250.00	100.00	150.00
17.	Marine Finfish Nurseries	Nos.	15.00	6.00	9.00
18.	Establishment of Open Sea cages (100-120 cubic meter volume)	Nos.	5.00	2.00	3.00
19.	Establishment of Seaweed culture rafts including inputs (per raft).	Nos.	0.015	0.006	0.009
20.	Establishment of Seaweed culture with Monoline/tubenet Method including inputs (one unit is approximately equal to 15 ropes of 25m length)	Nos.	0.08	0.03	0.05
21.	Bivalve cultivation (mussels, clams, pearl, etc.)	Nos.	0.20	0.08	0.12
Development of fisheries in North-eastern and Himalayan States/UTs					
(Besides the below activities, the North-eastern and Himalayan States/UTs will also be assisted under other sub-components/activities envisaged under PMMSY that are common to all States/UTs).					
22.	Establishment of Trout Fish Hatcheries	Nos.	50.00	20.00	30.00
23.	Construction of Raceways of minimum of 50 cum.m	Nos.	3.00	1.20	1.80
24.	Inputs for Trout Rearing Units.	Nos.	2.50	1.00	1.50
25.	Construction of New Ponds.	Ha.	8.40	3.36	5.04
26.	Establishment of medium RAS for Cold water Fisheries. (with 4 tank of minimum 50 m^3/tank capacity and fish production capacity of 4 tonne/crop)	Nos.	20.00	8.00	12.00
27.	Establishment of large RAS for cold water fisheries (with 10 tanks of minimum 50 m^3/ tank capacity and fish production capacity of 10 tonne/crop)	Nos.	50.00	20.00	30.00

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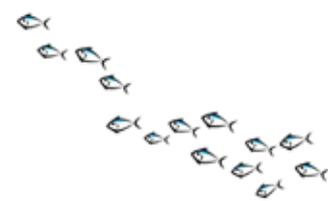|					
28.	Input support for Integrated fish farming (paddy cum fish cultivation, livestock cum fish, etc).	Ha.	1.00	0.40	0.60
29.	Establishment of Cages in cold water regions.	Nos.	5.00	2.00	3.00
Development of ornamental and recreational fisheries					
30.	Backyard Ornamental fish Rearing unit (both Marine and Fresh water)	Nos.	3.00	1.20	1.80
31.	Medium Scale Ornamental fish Rearing Unit (Marine and Freshwater Fish)	Nos.	8.00	3.20	4.80
32.	Integrated Ornamental fish unit (breeding and rearing for fresh water fish)	Nos.	25.00	10.00	15.00
33.	Integrated Ornamental fish unit (breeding and rearing for marine fish)	Nos.	30.00	12.00	18.00
34.	Establishment of Fresh water Ornamental Fish Brood Bank	Nos.	100.00	40.00	60.00
35.	Promotion of Recreational Fisheries.	Nos.	50.00	20.00	30.00
Technology Infusion and Adaptation					
36.	Establishment of large RAS (with 8 tanks of minimum 90 m3/tank capacity and fish production 40 ton/crop)/Biofloc culture system (50 tanks of 4m dia and 1.5 high)	Nos.	50.00	20.00	30.00
37.	Establishment of Medium RAS (with 6 tank of minimum 30m3/tank capacity with fish production capacity of 10ton/crop)/Biofloc culture system(25 tanks of 4m dia and 1.m high)	Nos.	25.00	10.00	15.00
38.	Establishment of small RAS(with 1 tank of 100m3 capacity/Biofloc(7 tanks of 4m dia and 1.5 high) culture system	Nos.	7.50	3.00	4.50
39.	Establishment of Backyard mini RAS units	Nos.	0.50	0.20	0.30
40.	Installation of Cages in Reservoirs	Nos.	3.00	1.20	1.80
41.	Pen culture in open water bodies	Ha.	3.00	1.20	1.80
B	**Infrastructure and Post-Harvest Management**				
	Post-Harvest and Cold Chain Infrastructure				
42.	Construction of Cold Storages/Ice Plants				
(a)	Plant/storage of minimum 10 tonnes capacity	Nos.	40.00	16.00	24.00
(b)	Plant/storage of minimum 20 tonnes capacity	Nos.	80.00	32.00	48.00
(c)	Plant/storage of minimum 30 tonnes capacity	Nos.	120.00	48.00	72.00

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(d)	Plant of minimum 50 tonnes capacity	Nos.	150.00	60.00	90.00
43.	Modernisation of Cold storage/Ice Plant	Nos.	50.00	20.00	30.00
44.	Refrigerated vehicles	Nos.	25.00	10.00	15.00
45.	Insulated vehicles	Nos.	20.00	8.00	12.00
46.	Motor cycle with Ice Box	Nos.	0.75	0.30	0.45
47.	Cycle with Ice Boxes	Nos.	0.10	0.04	0.06
48.	Three wheeler with Ice Box including e-rickshaws for fish vending	Nos.	3.00	1.20	1.80
49.	Live fish vending centres	Nos.	20.00	8.00	12.00
50.	Fish Feed Mills				
(a)	Mini Mills of production Capacity of 2 tonnes/Day	Nos.	30.00	12.00	18.00
(b)	Medium Mills of production Capacity of 8 tonnes/Day	Nos.	100.00	40.00	60.00
(c)	Large Mills of production Capacity of 20 tonnes/Day	Nos.	200.00	80.00	120.00
(d)	Fish Feed Plants of production Capacity of at least 100 tonnes/Day	Nos.	650.00	260.00	390.00
Markets and Marketing Infrastructure					
51.	Construction of fish retail markets including ornamental fish/aquarium markets.	Nos.	100.00	40.00	60.00
52.	Construction of fish kiosks including kiosks of aquarium/ornamental fish	Nos.	10.00	4.00	6.00
53.	Fish Value Add Enterprises Units	Nos.	50.00	20.00	30.00
54.	E-platform for e-trading and e-marketing of fish and fisheries products	Nos.			
Development of Deep-Sea Fishing					
55.	Support for acquisition of deep-sea fishing vessels for traditional fishermen	Nos.	120.00	48.00	72.00
56.	Up gradation of existing fishing vessels for export Competency	Nos.	15.00	6.00	9.00
57.	Establishment of Bio-toilets in mechanised fishing vessels	Nos.	0.50	0.20	0.30
Aquatic Health Management					
58.	Establishment of Disease diagnostic and quality testing labs	Nos.	25.00	10.00	15.00
59.	Disease diagnostic and quality testing Mobile labs/clinics	Nos.	35.00	14.00	21.00

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C	**Fisheries Management And Regulatory Framework**				
	Monitoring, Control and Surveillance (MCS)				
60.	Communication and/or Tracking Devices for traditional and motorised vessels like VHF/DAT/NAVIC/ Transponders, etc.	Nos.	0.35	0.14	0.21
	Strengthening Of Safety And Security Of Fishermen				
61.	Support for providing safety kits for fishermen of Traditional and motorised fishing vessels (other than Communication and/or Tracking Device mentioned at 60 above)	Nos.	1.00	0.40	0.60
62.	Providing boats (replacement) and nets for traditional fishermen	Nos.	5.00	2.00	3.00
63.	Support to Fishermen for PFZ devices and network including the cost of installation and maintenance, etc.	Nos.	0.110	0.044	0.066
	Fisheries Extension And Support Services				
64.	Extension and support Services.	Nos.	25	10	15
65.	Sagar Mitras		The incentive to Sagar mitras will be shared between Centre and States as per the funding pattern of PMMSY.		
	Insurance of Fishing Vessels and Fishermen				
66.	Insurance to fishing vessels	Nos.	Premium subvention. The premium amount will be shared between Centre, States and beneficiaries as per funding pattern of PMMSY		
67.	Insurance to fishers, fish farmers, fish workers and any other category of persons directly involved in fishing and fisheries related allied activities	Nos.	Entire premium amount will be shared between Centre and concerned States as per the funding pattern of PMMSY.		
	Livelihood and nutritional support for fishers for conservation of fisheries resources				
68.	Livelihood and nutritional support for socio-economically backward active traditional fishers' families for conservation of fisheries resources during fishing ban/lean period.	Nos.	Details in Table Below		

D.2: Livelihood and nutritional support

States/UTs	Funding pattern	Contribution
General States	(i) 50:50 Centre and General States	Centre share Rs 1500 + State shares Rs 1500 + Beneficiary share Rs 1500= Rs 4500/-year
North East and Himalayan States	(i) 80:20 Centre and NE & Himalayan States	Centre share Rs 2400 + State shares Rs 600 + Beneficiary share Rs 1500= Rs 4500/-year
Union Territories	100 per cent as Centre share for Uts (with legislature and without legislature)	Centre share Rs 3000 + Beneficiary share Rs 1500= Rs 4500/-year

Source: Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, September, 2020.

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