# Impact of Technologies and Policies on Marine and Inland Fish Culture Systems in India

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CHAPTER-2

# Fisheries and Aquaculture in India: Recent Trends, Development Priorities and Policy Context

**Anuja AR, Shinoj Parappurathu and Suresh A**

## 1. Background

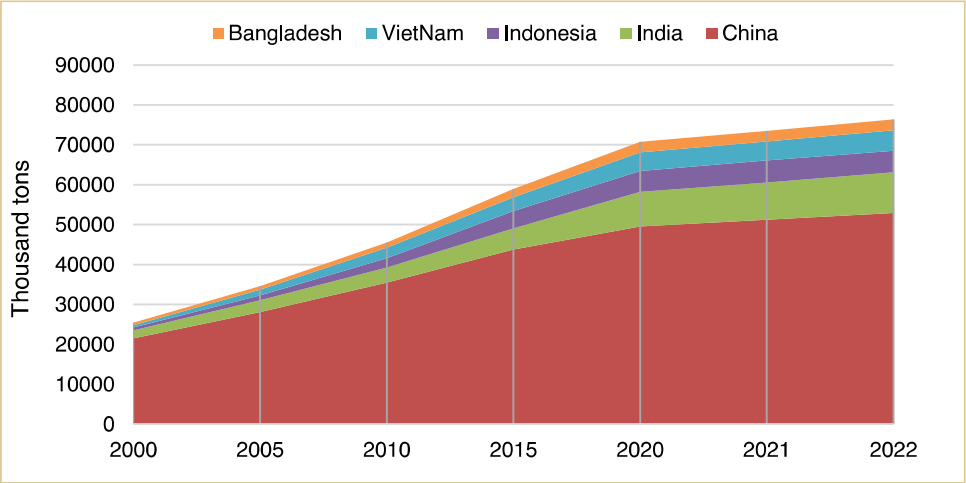
This chapter, conceived as a prologue to the overall compilation, provides a comprehensive overview of the nation's fisheries and aquaculture sector. The overview encompasses India's global standing in the sector, the demographic and socio-economic profile of the associated workforce, production and trade growth trends, demand-supply and value chain dynamics, and the role of institutions and government in fostering sustainable development. Such a contextual understanding will not only provide valuable insights into the current state and recent developments within the sector but will also facilitate a deeper appreciation of the evolving dynamics and the critical role of technologies and policies in propelling further growth.

Ranking second globally, India accounts for about 8% of global fisheries and aquaculture production, though China leads by a significant margin (FAO, 2024). In capture fisheries, India ranks third globally, producing 6% of the total global output in 2022, trailing behind China and Indonesia (FAO, 2024). India ranks sixth in marine capture fisheries, with a share of 4.5% of global production. The country is also a global leader in inland fisheries, holding the largest share of inland aquaculture production worldwide (FAO, 2024). Figure 1 illustrates the growth in aquaculture production over the past two decades (2000 to 2022) among major global producers, including China, India, Indonesia, Vietnam, and Bangladesh. India's aquaculture, particularly in freshwater species like carp, continues to expand rapidly, strengthening its leadership in global aquaculture production.

India has rich marine and aquatic resources that support a diverse fisheries sector, including marine capture fisheries, mariculture, coastal aquaculture, inland fisheries, freshwater aquaculture, cold-water fisheries and ornamental fisheries. Table 1 highlights the fisheries sector's growing contribution to the Gross Value Added (GVA) in India's agricultural and allied sectors as well as the overall economy. In 2022-23, the sector contributed 7.2% to the total

GVA from agriculture and 1.32% (at current prices) to the overall national GDP (MOSPI, 2024). Beyond these contributions, the sector plays a vital role in employment generation, livelihood support, and foreign exchange earnings. These contributions highlight its considerable significance, with the 'Blue Economy' framework offering pathways to build on this foundation for future growth (Gopalakrishnan et al, 2024).

**Fig. 1. Aquaculture production by major global producers**




*Source: FAO. 2024.*

**Table 1. Contribution of fisheries sector to agriculture GDP/GVA (at current prices) India**

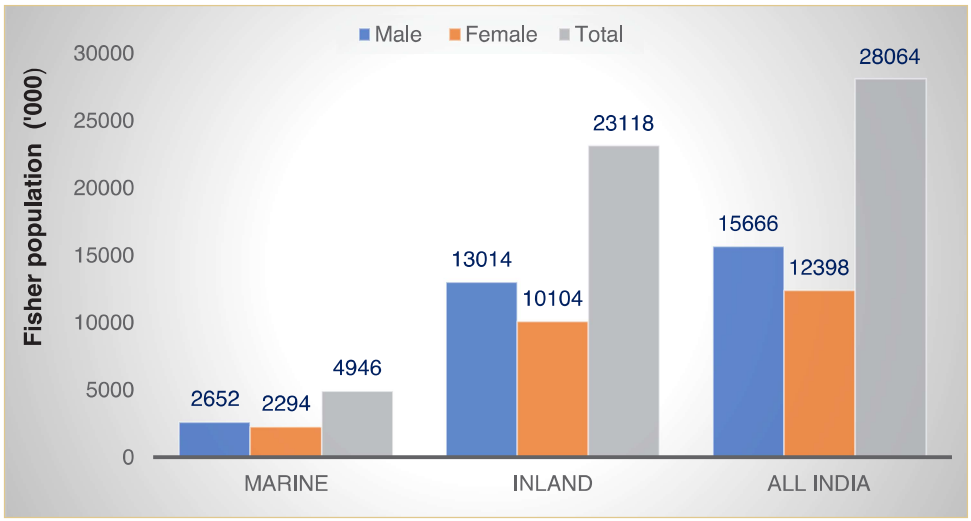
| Year | GDP/GVA at current prices (million) | | | % Share of Fisheries & Aquaculture to Agriculture and allied sector GDP/GVA | % Share of Fisheries & Aquaculture in total GDP/ GVA |
|---|---|---|---|---|---|
| | Fisheries and Aquaculture | Agriculture, Forestry, and Fishing | All | | |
| 1960-61 | 820 | 70900 | 165120 | 1.2 | 0.50 |
| 1970-71 | 2450 | 181920 | 429810 | 1.3 | 0.57 |
| 1980-81 | 9170 | 473120 | 1325200 | 1.9 | 0.69 |
| 1990-91 | 46310 | 1508000 | 5150320 | 3.1 | 0.90 |
| 2000-01 | 114060 | 2866660 | 11985920 | 4.0 | 0.95 |
| 2011-12 | 680270 | 15019470 | 81069460 | 4.5 | 0.84 |
| 2015-16 | 1327200 | 22275330 | 125744990 | 6.0 | 1.06 |
| 2022-23 | 3250070 | 44842680 | 246590410 | 7.2 | 1.32 |

*Source: National Statistics Office, Ministry of Statistics & Programme Implementation, Government of India (MoSPI, various years)*

## 2. Demographics and Workforce Engagement

Ensuring sustainable employment opportunities for resource-poor masses is utmost important for countries and regions where opportunities for alternate employment is scarce. Coastal and inland water bodies act as lifeline for the people inhabiting their shores with ample opportunities to engage in wild fishing and aquaculture, both of which can offer remunerative employment and 'decent work' (Bavinck et al, 2024). Fisheries and aquaculture provide livelihood support to over 28 million people, highlighting their critical socio-economic role in a developing tropical country like India. Inland fisheries accounts for approximately 82% of the fisher population, and the rest constituted by the marine counterpart. Gender divide in occupation is apparent in both inland and marine sub-sectors due to the inherent differences in the nature of work and societal preconceptions regarding job-roles. Males constitute 53.6% of the population in marine fisheries and 56% in inland fisheries (Fig. 2). In the marine sector, men predominantly engage in fishing activities, while women contribute significantly to post harvest operations and marketing (CMFRI-FSI-DoF,2020).

**Fig. 2. Marine and inland fisher population of India by gender (2020-21)**

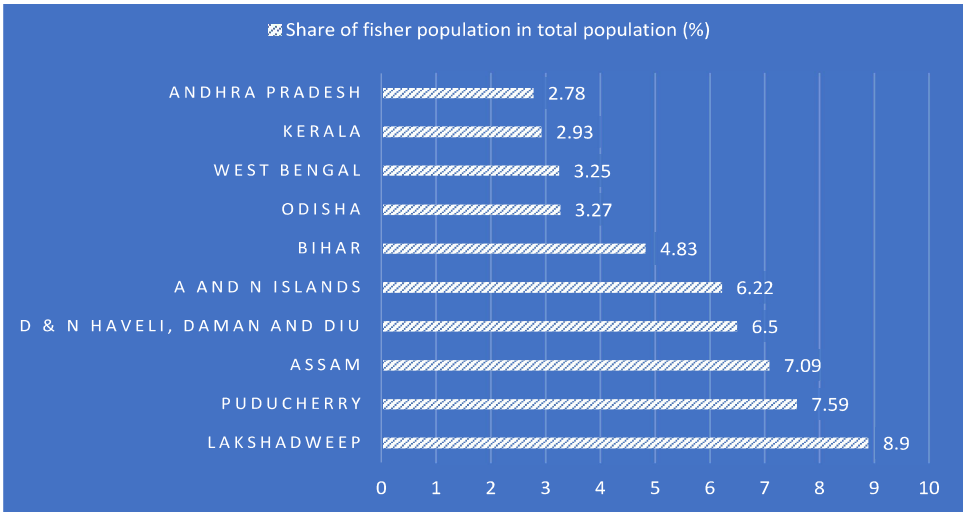



*Source: GoI DoF, 2023*

Regional variations in fisher demographics are evident, with certain states and union territories exhibiting a high concentration of fisher populations relative to their overall population. Coastal and island regions such as Lakshadweep (8.9%), Puducherry (7.6%), and the Andaman and Nicobar Islands (6.2%) have high proportions of their populations engaged in fisheries, reflecting their heavy dependence on fisheries resources for livelihood. Inland states like Assam (7.1%), and Bihar (4.8%) also show a substantial share of fisherfolk, indicating the significance of inland aquaculture in these regions. (Fig. 3).

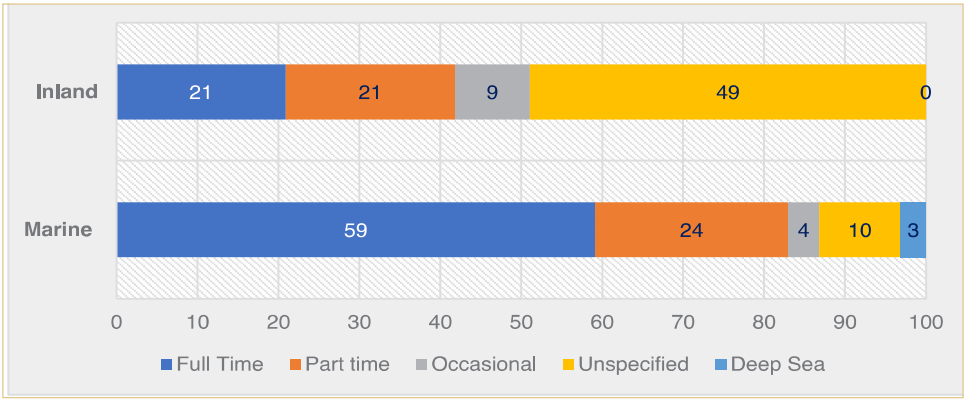
The extent of occupational engagement among fishers shows notable differences between the inland and marine sectors, reflecting the distinct nature of their operations (Fig. 4). In the marine sector, 59% of fishers are engaged full-time in fishing activities, 24% work part-time, and 4% are occasional fishers, with 3% involved specifically in deep-sea fishing. The inland sector exhibits a broader range of engagement, with 21% each working full-time and part-time, 9% as occasional fishers, and 49% classified as unspecified. These differences highlight the varying nature of fishing activities across different regions and types of fisheries. The above data, however, do not present any clear distinction between activities such as marine and inland fishing, fish seed collection, inland aquaculture, mariculture, etc. for detailed assessment.

**Fig. 3. States/UTs with the highest proportion of fisher population, 2020-21**




*Source: GoI DoF, 2023*

**Fig. 4. Distribution of workforce by extent of engagement in fishing activities (2020-21)**

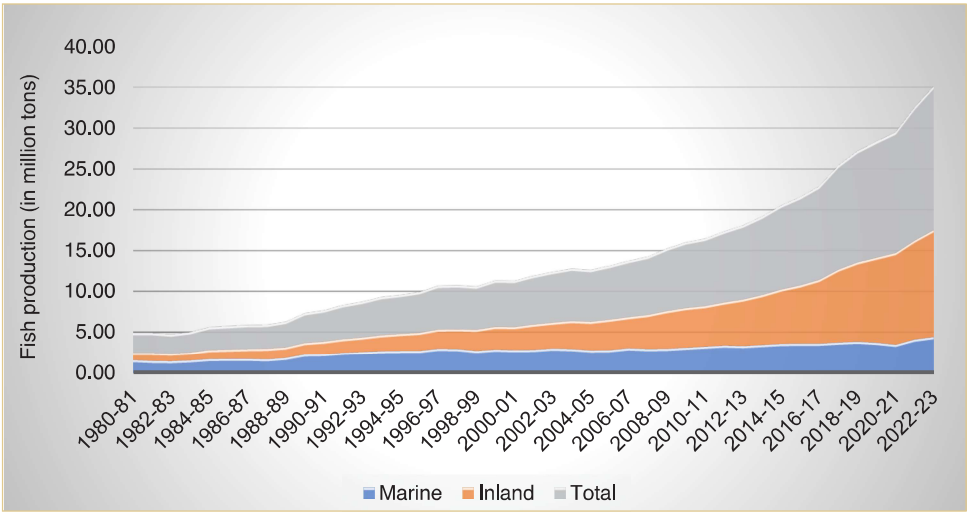



*Source: GoI DoF, 2023*

## 3. Production Trends and Sectoral Composition

India's fisheries sector is broadly classified into marine fisheries and inland fisheries, with the latter gaining increasing prominence over recent years. Fig. 5 portrays the trends in marine and inland fish production in India during the period 1980-81 to 2022-23. Since the early 2000s, the inland fisheries sector has overtaken marine fisheries in terms of production volume, marking a significant shift in the sector's composition. While both segments have experienced consistent growth, inland fisheries have outpaced marine fisheries, reflecting a Compound Annual Growth Rate (CAGR) of 6.44%, compared to 2.30% for marine fisheries during the period 1980-81 to 2022-23. Overall, the country's total fish production grew at a CAGR of 4.58% during this period, reflecting sustained growth in the sector. Looking at recent trends, the fisheries sector (inclusive of aquaculture) has grown at an average annual rate of 8.63% during the past decade (2011-12 to 2022-23).

**Fig. 5. Trends in marine, inland and total fish production in India (1980-81 to 2022-23)**

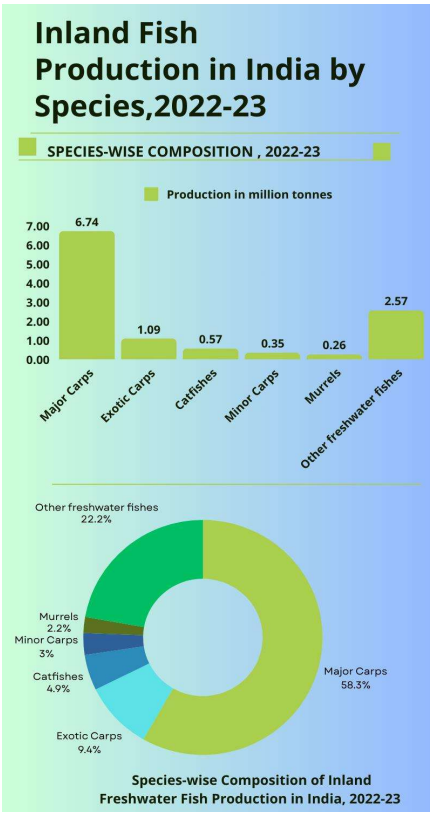



*Source: GoI DoF, 2023*

In 2022-23, India's fish production reached 17.55 million tons (GoI DoF, 2023), with three-fourths of this coming from the inland sector. Based on the quinquennial average from 2017-18 to 2022-23, Andhra Pradesh, West Bengal, Uttar Pradesh, Odisha, and Bihar were the leading states, accounting for more than two-thirds of the country's total inland fish production. Simultaneously, major maritime states such as Gujarat, Andhra Pradesh, Tamil Nadu, Kerala, and Karnataka contributed approximately three-fourths of the total marine capture fish production.

Notwithstanding the technology-driven surge in India's capture fisheries during the mid-1980s and early 2000s (Ghosh, 1998; Salagrama, 2004), persistent economic and operational challenges in offshore and deep-sea fishing constrained the sector's ability to meet rising fish demand (James, 2014; Parappurathu et al., 2020). At the same time, the remarkable success of large-scale freshwater carp (Ayyappan and Gopalakrishnan, 2008) and brackish water shrimp farming redirected focus toward aquaculture, a shift that has driven inland aquaculture production to nearly triple over the past two decades. This transformative growth underscores the pivotal role of aquaculture in ensuring sustainable fisheries development and advancing India's blue economy objectives (GoI DoF, 2024a). Mariculture, a growing sector, bridges capture fisheries, which rely on wild fish stocks, and culture-based fisheries, focusing on controlled farming to supplement supply without depleting natural stocks. Through sea-cage farming of species like cobia and sea bass, and seaweed cultivation, the sector aims to achieve its estimated potential of over 4 tonnes, though current production remains below 0.1 million tonnes (Gopalakrishnan et al., 2022).

**Fig. 6. Species-wise composition of inland freshwater fish production in India, 2022-23**

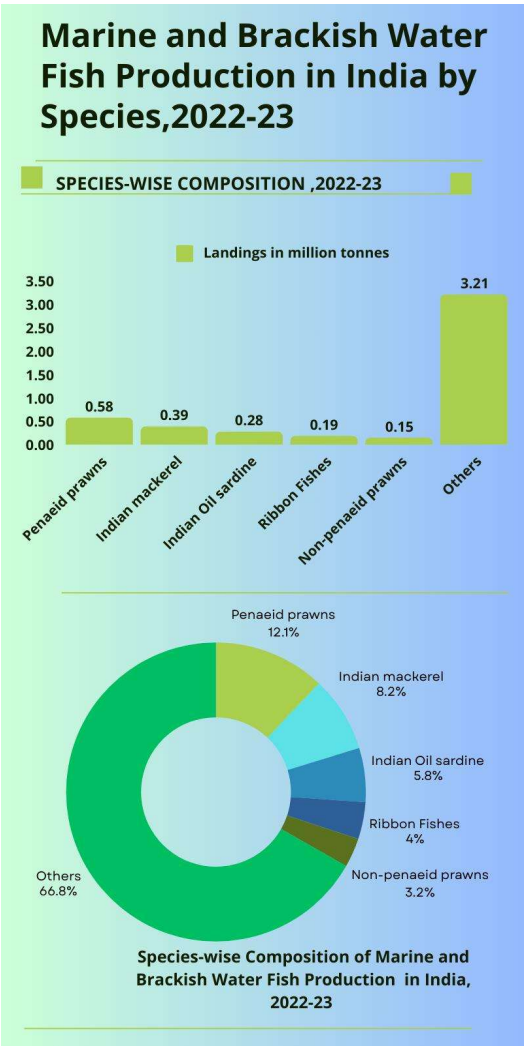



*Source: GoI DoF, 2023*

Inland fisheries, too, hold immense potential, with resources such as 3,41,907 km of rivers and canals, 2.84 million hectares of reservoirs, 2.75 million hectares of tanks and ponds, 0.61 million hectares of brackish water, and 1.45 million hectares of beels/oxbow lakes and derelict water bodies (GoI DoF, 2023). Tanks and ponds contribute 8.5 million metric tons annually through culture-based fisheries, while brackish water aquaculture, primarily focused on shrimp farming, produced 0.75 million metric tons in 2020 (GoI DoF, 2024a). This sector has significant potential for expansion in Gujarat and Odisha due to the high tidal amplitude in this region. Brackish water shrimp aquaculture has been a major driver of India's export growth, accounting for approximately 80% of the country's total shrimp exports. Additionally, saline water aquaculture is being promoted to transform wastelands into productive wetlands, focusing on states like Haryana, Punjab, Rajasthan, and Uttar Pradesh with high soil salinity. Ornamental fisheries and cage culture in reservoirs represent further growth opportunities, with reservoirs seen as "sleeping giants" due to their unexplored potential. Cold-water fisheries in the Himalayan states mainly target high-value trout production, while riverine fisheries focus on river ranching and species conservation. Species composition in the inland freshwater sector is dominated by major carp like Catla, Rohu, and Mrigal, with additional contributions from exotic carp, catfishes, and murrels (Fig. 6).

In 2023, the major marine fish resources landed in India included Indian mackerel, oil sardine, ribbonfish, and non-penaeid prawns. In the marine sector, species vary by coast: the east coast features Penaeid prawns, Indian Oil sardines, and catfish, while the west coast is dominated by Indian mackerel, Ribbonfish, Bombay duck, and croakers. Penaeid prawns are especially vital for exports, significantly contributing to economic returns (Fig. 7). During the 1990s and early 2000s, shrimp aquaculture was dominated by tiger shrimp (*Penaeus monodon*) and Indian prawn (*P. indicus*). However, production suffered a significant setback due to white spot syndrome (WSS) outbreaks. The introduction of Pacific white shrimp (*Litopenaeus vannamei*), an exotic species, in 2009 revitalized the sector (Salunke et al., 2020), with the species now accounting for approximately 96% of total cultured shrimp production in 2020-21, followed by the tiger shrimp (*Penaeus monodon*) (MPEDA, 2024b). The focus on species diversification and productivity enhancement across all fisheries sectors is key to the sustainable development of India's fisheries.

**Fig. 7. Species-wise composition of major marine and brackish fish production in India in 2022-2023**



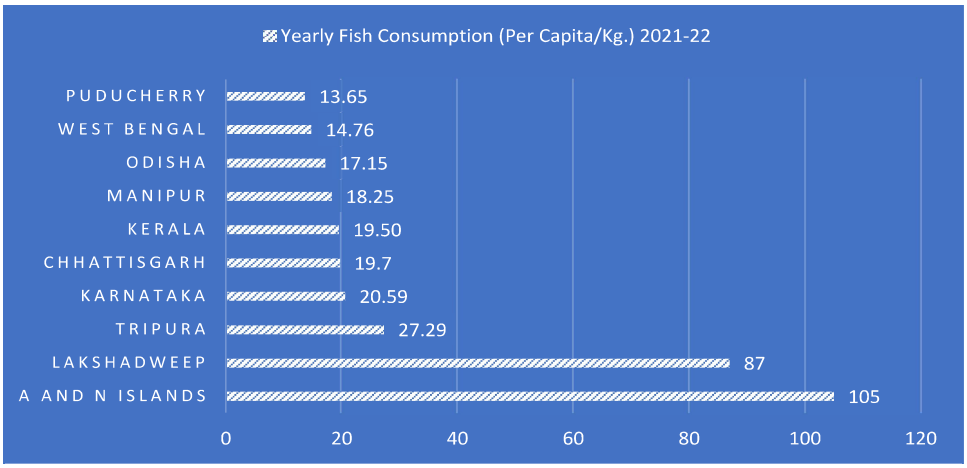

*Source: GoI DoF, 2023*

## 4. Fish Consumption and Demand-Supply Dynamics

India, a largely vegetarian nation, exhibits significant regional variation in fish consumption. The estimates of the National Statistical Office based on its 68$^{th}$ round of nationwide surveys on household consumer expenditure show that the annual fish consumption in India was around 3.24 and 3.07 kg respectively for rural and urban areas (MoSPI, 2014). There has been a transformation in fish consumption since then, driven by a surge in inland aquaculture production, mainly freshwater species. Fig. 8 illustrates the annual per capita fish consumption in the major fish-consuming states and

union territories of India for 2021-22. It highlights the regional variations, with coastal and island territories leading in fish consumption, underscoring the significant role of fish in their diets. The top three major fish-consuming states/UTs for 2021-22 are the Andaman and Nicobar Islands, Lakshadweep, and Tripura followed by coastal states such as Karnataka, Kerala, and Odisha and inland states like Chhattisgarh and Manipur.

**Fig. 8. Major fish consuming states and UTs of India (2021-22) based on annual per capita consumption**




*Source: GoI DoF, 2023*

India's fish demand is projected to rise due to shifting dietary preferences toward animal-source proteins and growing export markets. Currently, over three-fourths of the fish produced is consumed domestically. According to NITI Aayog projections, household fish demand will reach 11 million tons by 2030 and escalate to 20-23 million tons by 2047 (NITI Aayog Working Group report, 2024). When factoring in additional uses such as seed, feed, and wastage, total demand could rise to 37 million tonnes under a Business-As-Usual (BAU) scenario and to 41-48 million tons under a High-Income Growth (HIG) scenario by 2047. Table 2 indicates the fish demand projections and supply growth required to meet the expected demand. Meeting these targets will require sustained growth in fish production, with Compound Annual Growth Rates (CAGRs) ranging from 3.62% to 4.63%, depending on the scenario. Export targets further increase the challenge, demanding an additional surplus of fish production, with a required CAGR of 5.0% in the HIG scenario. Strategic investments in infrastructure, cold chains, sustainable fishing, and aquaculture practices, as well as tapping into non-conventional resources like seaweed and other marine products, will be crucial in meeting both domestic and export demand.

**Table 2. Fish demand projections and supply growth required to meet the expected demand**

| Particulars | Business-as-Usual (BAU) scenario | | High-Income growth (HIG) scenario | |
|---|---|---|---|---|
| | Target (2029-30) | Target (2046-47) | Target (2029-30) | Target (2046-47) |
| Baseline demand (2019-20) (in million tons) | 12 | | | |
| Demand projections* (in million tons) | 20.0 | 37.0 | 21.0 | 48.0 |
| Demand projections including trade (assuming 10% to be exported) | 22.0 | 40.7 | 23.1 | 52.8 |
| Estimated annual growth rate (%) in production to meet the target demand | 3.51 | 3.62 | 4.05 | 4.63 |
| Estimated annual growth rate (%) in production to meet the target demand (assuming 10% to be exported) | 4.50 | 4.05 | 5.01 | 5.0 |

**Source: Author's estimation. Demand projections are taken from the NITI Aayog working group report (NITI Aayog, 2024);*

*Note: Fish production in the baseline year 2019-20: 14.16 million tons*

## 5. Value Chain Dynamics and Market Infrastructure

India's fisheries sector value chain is diverse and complex, covering all stages from capture/production to consumption across marine and inland fisheries. The structure ranges from simple chains, where suppliers connect directly with consumers, to more intricate systems involving multiple actors, such as fishers/fish farmers, auctioneers, input vendors, traders, retail fish vendors, processors, and consumers.

India's marine capture fish value chain begins at landing centers along the coast, where fishers bring in their catch. Initial handling and sales occur here, typically through informal auctions managed by intermediaries, charging pre-determined commission charges. Larger government-managed harbors provide comprehensive services, while smaller, community-managed centers lack essential infrastructure, like cold storage, leading to post-harvest losses (Siddique and Aktar, 2011). After harvesting, fish move through a layered domestic marketing system, including primary wholesale markets near the coast and secondary markets in inland regions, both of which suffer from inadequate cold storage and sanitation. Retail channels are diverse, ranging from supermarkets to local wet markets, with most consumers still relying on wet markets. In southern regions, mobile vendors deliver directly to households, while online platforms are emerging as alternative retail channels, offering convenience and reducing reliance on intermediaries. The value chain for inland capture fish in India typically involves small-scale fishers

who harvest from rivers, lakes, and reservoirs, with products moving through local markets, wholesalers, and retailers before reaching consumers, often in fresh, dried, or minimally processed forms. The value chain for cultured or farmed fish in India generally involves hatcheries, fish farmers, feed suppliers, processors, and distribution networks, with a focus on controlled production environments that enhance quality, reduce supply variability, and improve profitability through efficient farming practices.

India's post-harvest infrastructure associated with marine capture fisheries is extensive, with 1,457 notified fish landing centres spread across the country. The major fishing harbors—Visakhapatnam, Chennai, Kochi, Mangalore, Kolkata, Paradip, Mumbai, Veraval, and Petuaghat—serve as key hubs for the disposition of fish catches. These harbors are critical in facilitating both domestic distribution and international exports. Despite these resources, the industry faces challenges related to post-harvest losses, particularly due to inadequate cold-chain logistics.

Post-harvest losses, estimated at about 20% (GoI DoF, 2024b), mainly arise from inefficiencies in handling, transportation, and inadequate cold chain facilities which cause quality degradation leading to reduced profitability for small-scale fishers and traders. Infrastructure improvements at landing sites and wholesale markets are essential to address these issues and enhance the sector's economic potential. Modernization efforts under the Pradhan Mantri Matsya Sampada Yojana (PMMSY) a flagship government scheme focus on addressing these challenges by developing robust infrastructure, enhancing cold storage, and implementing traceability systems for quality control. The PMMSY also supports digital platforms for auctions and online marketplaces, providing fishers with direct consumer access and reducing intermediary dependency.

Landed fish catch is primarily disposed off through various methods, including fresh marketing, freezing, curing, reduction, and canning. Fig. 9 illustrates the various methods of fish catch disposition in India for 2022-23. Fresh marketing remains the dominant method, accounting for approximately 78% of the total fish catch in 2022-23, reflecting the high domestic demand for fresh fish. The remaining 22% of the catch is distributed between different modes of processing. Frozen fish account for around 12% of the catch, with a steadily increasing share due to advancements in freezing technologies and rising export demand. On the other hand, curing and reduction together make up about 5%, while canning is less common. Curing, which historically played a larger role, is now in decline. It includes traditional preservation methods such as salting, smoking, drying, and fermentation. Reduction, another post-harvest process, converts whole fish into fishmeal and fish oil,

valuable by-products used in livestock feed and other industries. The growing trend toward freezing, coupled with the declining use of curing, indicates a shift in consumer preferences toward more convenient and higher-quality preservation methods.

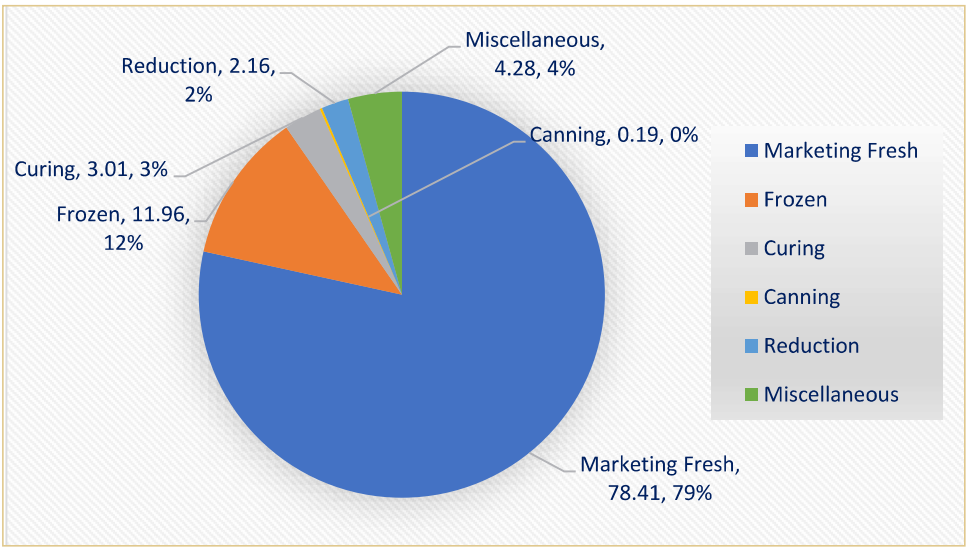



**Fig. 9. Methods of fish catch disposition in India (% share), 2022-23**

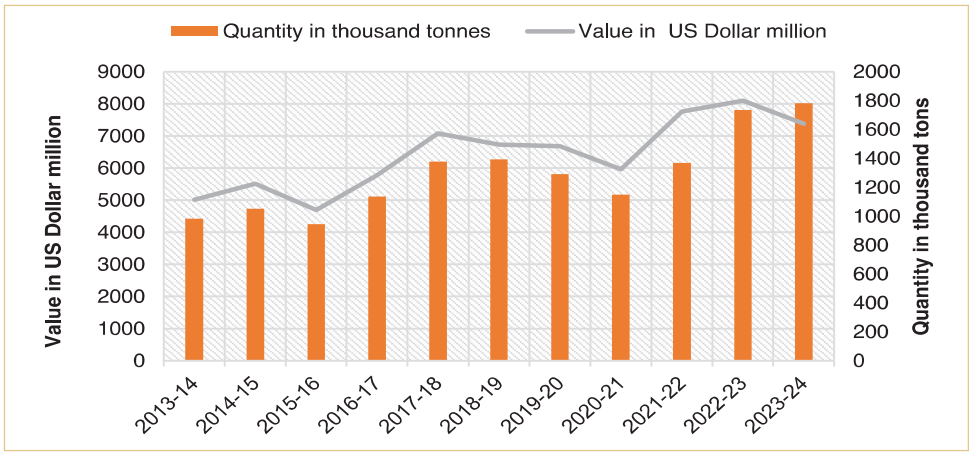
*Source: Department of Fisheries, State / UT Administration, Handbook on Fisheries Statistics, 2023*

## 6. Export Trends and Market Dynamics

India has been a world leader in seafood exports for several decades. Fish and fish products constitute the second largest exported product from India among the primary commodities (Suresh et al, 2023). India's fish products export witnessed a record-breaking year in 2023-24, reaching an all-time high of 1.78 million tonnes of seafood exports, valued at US$ 7.38 billion (₹ 6,05,238.90 million) (Fig. 10) (MPEDA, 2024a).

Frozen shrimp remains the cornerstone of the export basket, contributing about 41% of the total export volume and 66% of the earnings (Fig. 11) (MPEDA, 2024a). This category includes key species such as Vannamei shrimp, Black Tiger shrimp, and Scampi, with the United States, China, and the European Union being the top three importers. Frozen fish ranked second in the export portfolio, contributing approximately 21% of the total volume and 9% of the earnings. Other items in the export basket included fish and shrimp meal and feed, frozen squid, surimi and surimi analogue products, and frozen cuttlefish. The aquaculture sector played a critical role in this growth, contributing 62% of total earnings and 37% of the export volume, while capture fisheries provided 62% of the volume but only 38%

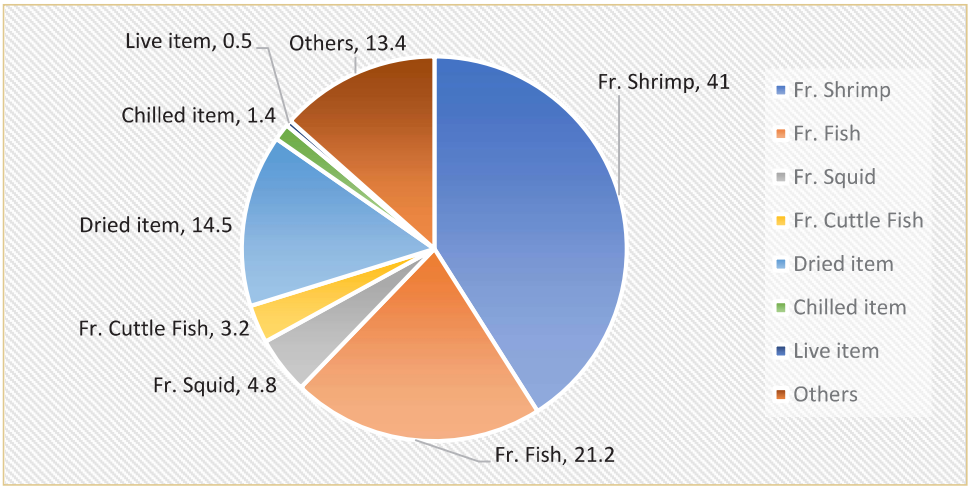
**Fig. 10. Recent trends in export quantity and value of Indian marine products (2013-14 to 2023-24)**




*Source: MPEDA, 2024a*

of the value (MPEDA, 2024a). India's fish products were exported to about 132 countries, with the USA being the largest market, contributing 32.2% of total earnings, largely driven by frozen shrimp (Fig. 12). China followed as the second-largest destination market with 18.8% of earnings, primarily from Vannamei and Black Tiger shrimp. Japan, Vietnam, and Thailand were also major destinations, with Japan focusing on frozen shrimp, Vietnam on shrimp, and Thailand on frozen fish (MPEDA, 2024a). The strategic importance of major Indian ports such as Visakhapatnam, JNPT-Mumbai, Kochi, Chennai, and Kolkata was evident, as these five ports together handled about 65% of India's marine export cargo (MPEDA, 2024b).

**Fig. 11. Item-wise export share (%) of marine products from India in quantity terms, 2022-23**



*Source: MPEDA, 2024a*

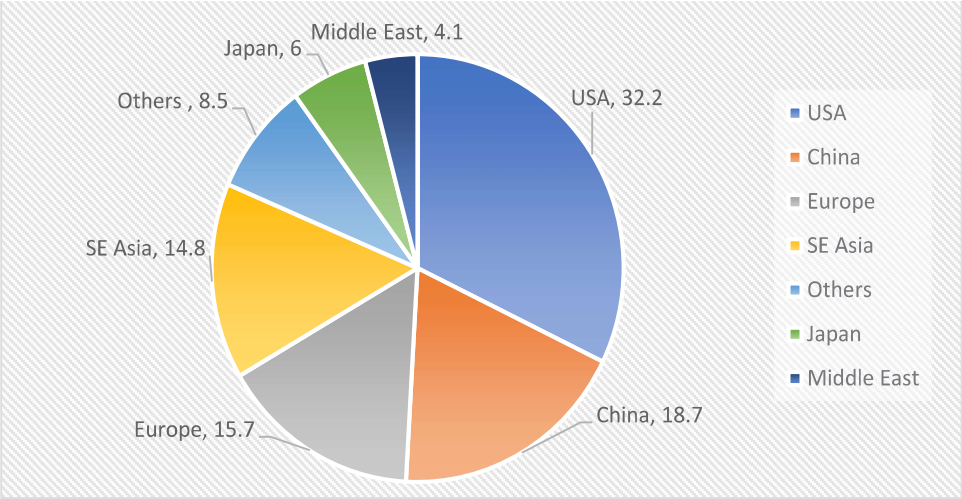



**Fig. 12. Market-wise value share (%) of marine product export from India, 2022-23**

*Source: MPEDA, 2024a*

Improving value addition is one of the key steps for enhancing exports. Currently, over three-fourths of the fish produced in India is marketed fresh, and only about 22 % is processed. Most of the fish processing happens with minimal value addition in terms of products like ready-to-eat or ready-to-cook etc. and different forms of it as is demanded by the importers. A bulk of the products are exported in frozen forms, rather than undergoing advanced value addition, leading to poor unit value realization in export markets. For example, the export of sashimi-grade tuna fetches much higher than that in the domestic markets but needs improved harvest and post-harvest handling methods (Yang and Lin, 2017). India has to promote value addition through technological and policy interventions (Suresh et al., 2023).

The export of marine products attracts stringent quality and safety standards, warranting the exporters to develop such quality assurance systems in the entire value chain. Even though the Codex Alimentarius Commission (CAC) of WTO encourages members to use its common standards to govern food safety and quality, different standards are followed by various countries. For example, the USA follows a system of Hazard Analysis and Critical Control Points (HACCP) while the European Union (EU) follows the Rapid Alert System for Food and Feed (RASFF), which is stricter than HACCP (Suresh et al., 2023). The food safety regulations set by the EU are harmonized, periodically updated, and are based on principles of risk assessment.

Compliance with international Sanitary and Phyto Sanitary (SPS) measures warrants a strong quality assurance system in the domestic markets. While the Export Inspection Council functions as the competent authority for trade compliance to external markets, the Food Safety and Standards Authority of India (FSSAI) oversees the quality assurance system in the domestic market. Due to these stringent interventions, the rejections of Indian consignments in the export markets have reduced drastically in terms of absolute number and unit rejection rates (number of rejections per US$ 1 million of exports). However, given the faster reductions in export rejections by our competing countries, India has to further improve its quality assurance system. Still, sanitary and Phytosanitary measures account for 71% of all export rejections due to non-tariff measures in the year 2022. Bacterial contaminations, unhygienic conditions, and veterinary drug residues continue to be the major specific reasons for rejections. In a nutshell, boosting seafood exports requires investing in modernized processing, implementing stringent quality control and sustainable practices, developing a robust traceability system, fostering stakeholder collaboration, and promoting value addition through supportive policies.

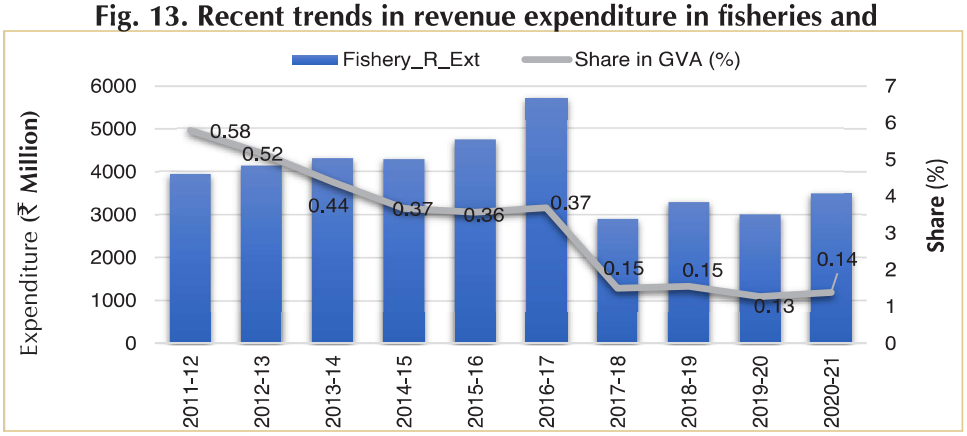
## 7. Investment, Government Expenditure and Capital Formation

Capital formation and investment in India's fisheries sector have been crucial for enhancing productivity, modernizing infrastructure, and supporting long-term sustainability. Both government funding and private investments contribute significantly to the sector's growth. Capital formation in fisheries primarily involves fixed assets such as fishing vessels, aquaculture farms, and processing equipment, all vital for increasing sectoral efficiency and competitiveness. Since the early 1990s, the share of fisheries in agricultural Gross Fixed Capital Formation (GFCF) rose from 3.4% to nearly 10% by 2015, driven by mechanization, modernization, and adoption of capital-intensive technologies in both marine and inland fisheries. Notably, investment growth in fisheries has consistently outpaced agriculture, with the fisheries sub-sector showing a stronger GDP performance relative to agriculture (Suresh and Parappurathu, 2018).

However, rapid capital influx in fishing aquaculture and allied areas has introduced various challenges. Overcapitalization in segments like marine fisheries, where there is an excess of fishing vessels, and brackish water aquaculture, a highly capital-intensive area, has led to resource depletion and efficiency losses. Although government schemes have supported the sector, recent trends indicate that private investment now drives capital formation in fisheries (Suresh and Parappurathu, 2018). Despite this accelerated investment growth, the efficiency gains in GDP from fisheries have not matched, indicating

declining capital productivity in recent years, and highlighting the need for more balanced, sustainable investment strategies.

**Fig. 13. Recent trends in revenue expenditure in fisheries and aquaculture research and extension (inclusive of education and training) and its share in fisheries GVA**




*Data Source: Reports of the Comptroller and Auditor General of India (CAG), Government of India (various years)*

Fig. 13 presents the trends in fisheries and aquaculture research and extension expenditure (inclusive of education and training) and its corresponding share in Gross Value Added (GVA) over the period 2011-12 to 2020-21. The expenditure exhibited a consistent upward trend in the initial years, peaking in 2016-17. Subsequently, it showed signs of stagnation in absolute terms. More strikingly, the share of research and extension expenditure relative to GVA has shown a steady declining trend falling from 0.58% in 2011-12 to 0.14% in 2020-21. While the sector is experiencing robust growth at a steady 8% annually, the diminishing investment in research and extension is a strategic oversight that demands immediate attention. Enhancing the allocation for fisheries research and extension is essential to maintain productivity gains, foster innovation, and ensure the sustainable development of the sector.

## 8. Credit Disbursement

Credit is a vital catalyst for advancing India's fisheries and aquaculture sector, facilitating the shift from traditional practices to capital-intensive operations, with both formal and informal sources playing significant roles. The formal sector is supported by a network of financial institutions, including the National Bank for Agriculture and Rural Development (NABARD), the scheduled commercial banks such as public sector banks, private banks, and Regional Rural Banks (RRBs) as well as cooperative credit institutions, and microfinance entities. NABARD plays a crucial role as a refinancing agency, channelling funds to banks for lending to the fisheries sector. The cooperative sector plays a major role in institutional financing in the Indian fisheries sector.

The recent initiatives of the Government of India have facilitated enhanced flow of formal credit into the sector, especially with the expanded coverage of the Kisan Credit Card (KCC) scheme to include fishers and fish farmers in 2018-19. Since then, the formal credit system for the fisheries sector primarily operates through the KCC scheme. The KCC facilitates loans to meet working capital requirements such as purchasing fishing gear, boat maintenance, pond development, and fish seed and feed requirements. Till December 2024, approximately 440 thousand KCCs have been issued, disbursing about ₹28100 million (Fig. 14) (PIB, 2024b). Additionally, the Modified Interest Subvention Scheme (MISS) provides short-term credit up to ₹0.3 million at 7% interest, with an effective rate of 4% for prompt repayment. Despite these advancements, access to institutional credit remains limited by a lack of awareness, high collateral requirements, poor insurance penetration, and weak loan recovery performance of past lending (Tietze et al., 2007, Parappurathu et al, 2019)

Informal credit sources—including auctioneer-middlemen, private money lenders, and third-party shareholders—dominate due to their flexibility in procedures, though often at high interest rates (Tietze, 2007; Parappurathu et al., 2019; Suresh, 2023). In capture fisheries, market-linked and labour-linked credit contracts often lead to exploitative practices like under-pricing or under-weighing of catch (Parappurathu et al., 2019; Suresh, 2023). However, traditional transactions based on trust and informal societal control are shifting to formal systems due to market integration, occupational diversification, and migrant labour in marine fishing (Suresh, 2023).

Microfinance institutions and self-help groups (SHGs) have emerged as vital players in bridging the credit gap. SHG-bank linkage programs enhance credit flow and encourage community-driven financial inclusion, particularly in aquaculture (Tietze, 2007). To overcome barriers in the existing credit delivery systems, it is essential to simplify loan procedures, expand collateral-free options, raise awareness of existing schemes, strengthen cooperatives, leverage digital technologies, and integrate insurance with credit, thereby fostering equitable growth and sustainable development in India's fisheries sector.

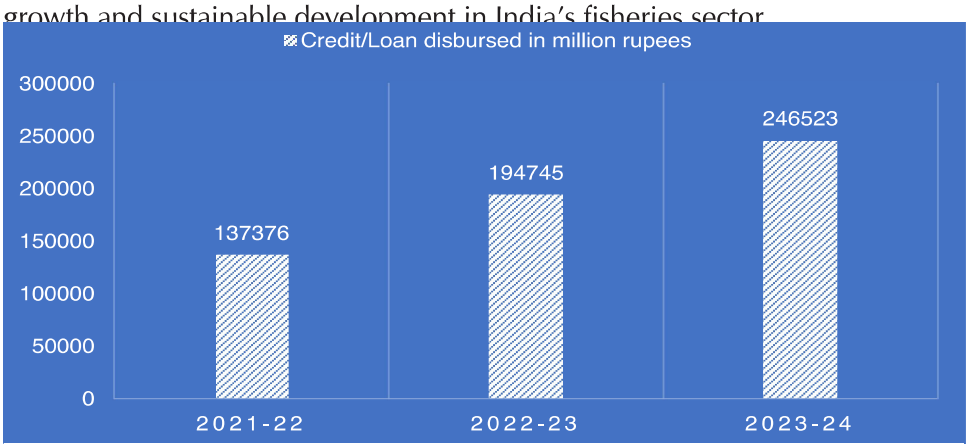



**Fig. 14. Credit disbursement to the fisheries sector, including the KCC**

*Source: Press Information Bureau, 3 December 2024*

## 9. Access to Insurance Coverage

The occupational risks inherent in fishing, exacerbated by frequent extreme weather events, underscore the urgent need for robust insurance systems in India's fisheries and aquaculture sector. Over the past decade, government-administered schemes have predominantly managed capture fisheries insurance, whereas aquaculture insurance has been primarily demand-driven and offered by public insurance companies, with limited involvement from the private sector (Van Anrooy et al., 2022).

One of the most widely available insurance products in the capture fisheries sector is accident insurance, which covers life and disability risks for active fishers during fishing operations. The Group Accidental Insurance Scheme (GAIS) for Active Fishermen, introduced in 1991–92, was later integrated into the Pradhan Mantri Suraksha Bima Yojana (PMSBY) umbrella in 2015. The broader acceptance rate of GAIS schemes was primarily due to their greater flexibility (Van Anrooy et al., 2022). In 2024, these key insurance schemes were consolidated under the Pradhan Mantri Matsya Sampada Yojana (PMMSY), simplifying access and expanding coverage (PIB, 2024a). Under this scheme, fishers receive fully subsidized coverage, which includes compensation of ₹0.5 million in the event of death or total permanent disability, ₹ 0.25 million for partial disability, and ₹25,000 for hospital expenses related to accidents. Vessel insurance, offered by public sector insurers, is often credit-linked as banks insist on insurance cover for the vessels they finance (Van Anrooy et al., 2022). Non-governmental organizations (NGOs) and fisher organizations/societies such as the National Federation of Fishermen Co-operatives Ltd. (FISHCOPFED), Matsyafed, and the South Indian Federation of Fishermen Societies (SIFFS) have been instrumental in extending the reach of these schemes among fishers.

In the aquaculture sector, two major public insurance schemes were introduced in the early 1990s: The Brackish Water Shrimp Insurance Scheme and the Inland Fish Insurance Scheme. Both schemes were demand-driven and administered by public insurance companies. However, after operating successfully during their initial years, they were eventually discontinued due to the excessive risks involved in the sector (Van Anrooy et al., 2022). Nevertheless, the government is re-introducing aquaculture insurance schemes under the PMMSY schemes, for which efforts are currently underway.

Critical gaps persist in India's fisheries and aquaculture insurance sector. Public sector insurance companies have yet to develop viable packages to cover fishing and farming equipment, gear, and infrastructure. Additionally,

the private sector has struggled to establish a stable presence in this domain. Technological and institutional interventions are urgently needed to bridge the trust deficit between service providers and beneficiaries, ensuring better access to and adoption of insurance products.

## 10. Role of Institutions in Fisheries and Aquaculture Development

India's fisheries sector thrives on a collaborative network that includes government bodies, research institutions, cooperatives, Fish Farmer Producer Organizations (FFPOs), Non-Government Organisations (NGOs), private companies, and fisher associations (Rohit et al., 2022). The Department of Fisheries (DoF) under the Ministry of Fisheries, Animal Husbandry, and Dairying leads the sector's development, focusing on inland, marine, and coastal fisheries policy. Supporting organizations under the DoF include the Fishery Survey of India (FSI) for stock assessments, the Central Institute of Fisheries Nautical and Engineering Training (CIFNET) for workforce training, the Central Institute of Coastal Engineering for Fishery (CICEF) for coastal infrastructure development and the National Fisheries Development Board (NFDB) for aquaculture enhancement. The Indian Council of Agricultural Research (ICAR), under the Ministry of Agriculture and Farmers' Welfare, supports these efforts through research and technological advancements across specialized fisheries research institutes. The Marine Products Export Development Authority (MPEDA), under the Ministry of Commerce, promotes the export of fish and fishery products, supporting market development, quality control, and value addition in India's fisheries sector.

State Fisheries Departments play a vital role in fisheries governance and development, implementing central and state schemes tailored to regional needs. They work through dedicated research, extension networks, public sector undertakings, welfare boards, and quasi-government entities such as the Tamil Nadu Fisheries Development Corporation Ltd. (TNFDC) and the Kerala State Coastal Area Development Corporation (KSCADC), to support fishers' welfare, production, and marketing. Additionally, the National Agricultural Research System (NARS), including three Central Agricultural Universities and 63 State Agricultural Universities, bolsters sectoral research, education, and capacity building.

To support the increasingly capital-intensive nature of fisheries and aquaculture, a diverse network of financial institutions, including public and private sector banks, the National Bank for Agricultural and Rural Development NABARD, and cooperative credit institutions, play a crucial role in providing credit and financial services to fishers and fish farmers.

Cooperatives, with roots in India's first fishery cooperative in 1913, have expanded to over 3.35 million members organized in a federated structure (Rohit et al., 2022). Led by the National Federation of Fishers Cooperatives Ltd. (FISHCOPFED), these cooperatives offer credit, insurance, technical resources, and market access, benefiting fishers nationwide.

The FFPOs, designed to strengthen fishers' incomes through organized input and market services, are expanding under the PMMSY, with a target to establish 500 Fish Farmer Producer Organizations. NGOs such as the South Indian Federation of Fishermen Societies (SIFFS), Dakshin Foundation, and Centre for Aquatic Livelihood-Jaljeevika contribute to sustainable practices, conservation, and fisher welfare. The private sector further supports aquaculture by providing quality seeds, feed, and processing equipment, boosting production efficiency. Fishermen and Fish Farmers' Associations, like the National Fish Workers Forum (NFF), advocate for fisher rights and provide resources and bargaining power.

Additionally, international organizations, including the Food and Agriculture Organization of the United Nations (FAO), the Bay of Bengal Large Marine Ecosystem (BOBLME), the World Fish Centre, and the International Fund for Agricultural Development (IFAD), among others, collaborate with India to promote sustainable practices and foster regional cooperation, reinforcing the resilience and productivity of India's fisheries sector.

## 11. Developmental Schemes of the Government

As fisheries are a state subject under the 7th Schedule of the Constitution, their development is the primary responsibility of the state governments. The state governments undertake various schemes to augment fish production and productivity, input supply, credit, and insurance support, as well as to strengthen monitoring, control, and surveillance (MCS). The Union government supports the sector through various development schemes from time to time routed through the Department of Fisheries (DoF), under the Ministry of Fisheries, Animal Husbandry, and Dairying. The flagship schemes implemented by DoF for fisheries development include the PMMSY, the Fisheries and Aquaculture Infrastructure Development Fund (FIDF), the KCC facility for fishers, and integrated insurance schemes under the PMMSY. The PMMSY launched in 2020 with an investment outlay of ₹2,00,500 million over five years, is India's flagship initiative for the "Blue Revolution," targeting holistic development across the fisheries sector. Its comprehensive approach focuses on boosting productivity, modernizing the value chain, enhancing traceability for quality and safety, and prioritizing the welfare of fishers, with strategic support for marine and inland fisheries, post-harvest management, and infrastructure development. In 2022-23, the PMMSY scheme allocated

₹11699.10 million, primarily for upgrading fishing harbors, developing cold storage and processing facilities, and supporting research institutions for innovation in aquaculture and fish health management. Table 3 highlights the key targets of the PMMSY. Launched in 2018-19, FIDF focuses on providing concessional finance for the development of crucial fisheries infrastructure.

**Table 3. Key targets of PMMSY for fisheries sector development**

| Targets | Baseline (2018-19) | Target (2024-25) |
|---|---|---|
| Fish Production (million metric tons) | 13.75 | 22 |
| Aquaculture Productivity (tons per hectare) | 3 | 5 |
| Domestic Fish Consumption (kg per capita) | 5 | 12 |
| Contribution to Agriculture GVA (%) | 7.28 | 9 |
| Export Earnings (million rupees) | 4,65,890 | 10,00,000 |
| Post-Harvest Loss Reduction (%) | 20-25 | 10 |
| Employment Generation (direct and indirect) | - | 5.5 million jobs |
| Income of Fishers & Fish Farmers | - | Double |

*Source: https://pmmsy.dof.gov.in/*

## 12. Key Policy Interventions for Sustainable Fisheries Development and Global Competitiveness

*National Fisheries Policy:* The National Fisheries Policy 2020 (NFP) was drafted to provide a unified framework by consolidating the National Policy on Marine Fisheries (2017), the Draft National Inland Fisheries and Aquaculture Policy, and the Draft National Mariculture Policy (GoI DoF, 2020). This comprehensive policy seeks to enable sustainable fisheries growth while improving incomes for fishers and fish farmers and enhancing consumer choice through responsible resource management. By providing a model for states and Union Territories to develop local policies, the NFP promotes ecosystem-based fisheries management and modernization of fishing practices to align with both national and international standards. Central to the policy is the goal of doubling fishers' incomes, improving export competitiveness, and expanding shelf life and value addition in marine fish products. The policy incorporates elements from the Blue Growth Initiative, Agriculture Export Policy 2018, and Sustainable Development Goals, advocating for community partnerships, cooperative movements, and entrepreneurship. The sixth draft of the policy remains under review, with feedback from key maritime states continuing to shape its direction.

*WTO Fisheries Subsidies and India's Negotiation Position:* The World Trade Organization (WTO) negotiations on fisheries subsidies aim to balance sustainable fisheries management with the needs of fishing communities,

focusing on curbing subsidies that lead to overcapacity and overfishing. Historically, these subsidies enabled developed nations to build large industrial fleets, causing significant environmental impacts and inequalities in resource distribution. India advocates for an approach that protects small-scale and artisanal fishers while encouraging sustainable growth in its fishing sector.

The WTO's framework for fisheries negotiations has three pillars: subsidies for Illegal, Unreported, and Unregulated (IUU) fishing; subsidies for overfished stocks; and subsidies contributing to overcapacity and overfishing (OCOF). Agreements on the first two pillars were reached at the 12th Ministerial Conference (MC12) in 2022, but discussions on the third pillar remain ongoing. At the 13th Ministerial Conference (MC13) in Abu Dhabi in 2024, India continued to push for an inclusive, balanced agreement that ensures sustainability and supports small-scale fisheries. The proposal calls for integrating Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC) and Special and Differential Treatment (S&DT) to address food security, livelihood needs, and sustainability. It also advocates expanding the scope to include non-specific fuel subsidies, government-to-government fishing rights transfers, and subsidies for distant water fishing, which indirectly contribute to overfishing and environmental degradation.

Further, India emphasizes protecting countries' sovereign rights to manage fisheries within their Exclusive Economic Zones (EEZs), as recognized under the United Nations Convention on the Law of the Sea (UNCLOS). A 25-year transition period for developing countries that are not classified as Least Developed Countries (LDCs) or meet the *de minimis* threshold (marine catch below 0.8%) is also proposed. This transition would allow these countries to address policy needs, food security, and fisher livelihoods. This position has gained support from other developing nations and LDCs, who view it as critical to protecting small-scale fisheries while closing gaps in the WTO draft text that might allow industrial fleets to exploit sustainability loopholes.

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