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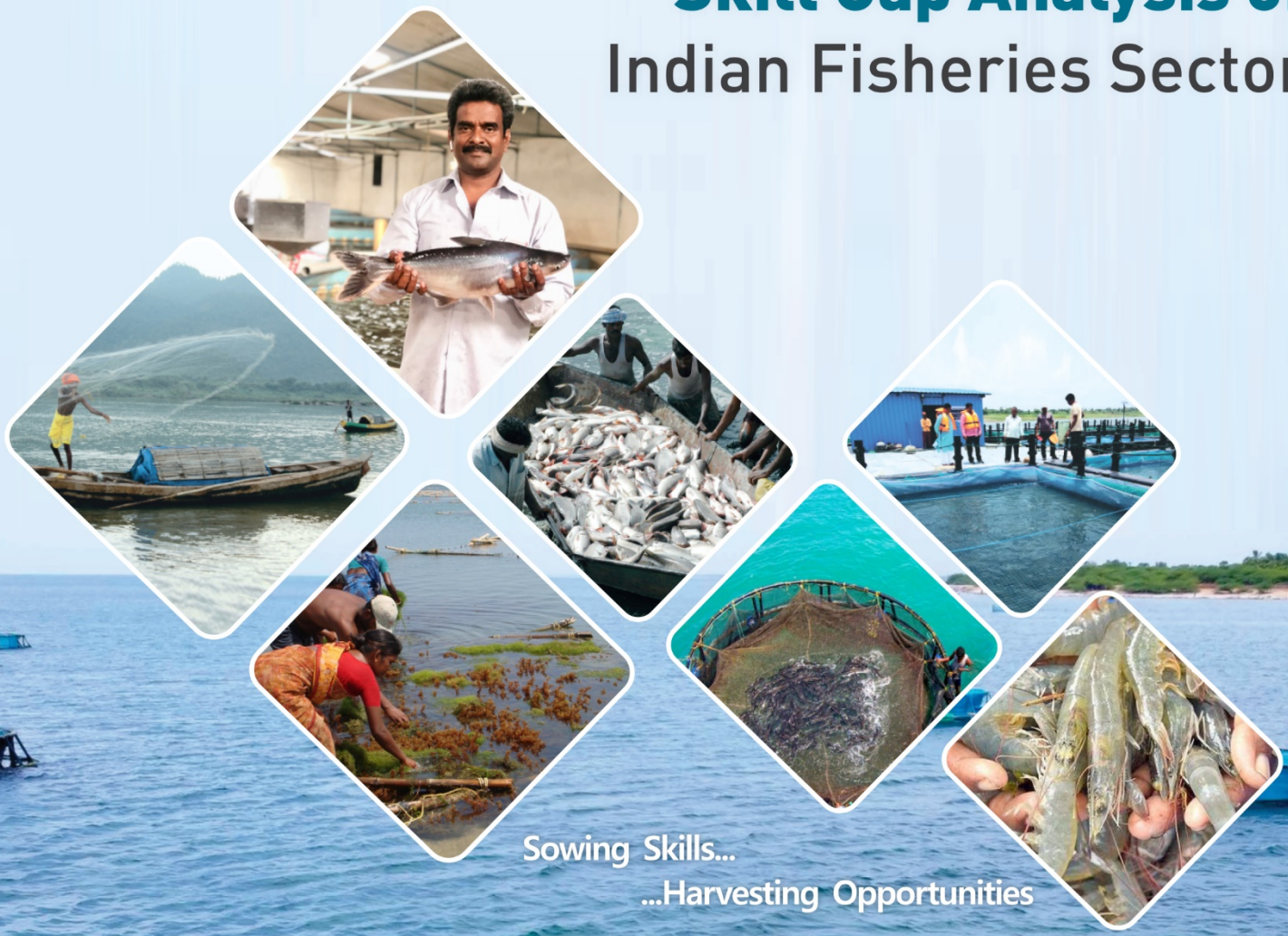
Skill Gap Analysis of Indian Fisheries Sector



Sowing Skills...
...Harvesting Opportunities

AGRICULTURE SKILL COUNCIL OF INDIA (ASCI)
GURUGRAM, HARYANA

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Foreword

Skill development is of paramount importance for economic development of any nation. Skilled workforce is undoubtedly the key to our country's holistic growth and stability and is one of the important determining factors for bringing in investments. The real challenge lies in meeting the human resource demand supply gap in each sector, not only in terms of quantity but also quality.

Today, like most other sectors, the Indian agriculture and allied sector including fisheries is in need of skill development as one of the most critical enabling factor. Agriculture holds strategic significance for the country's growth and economic development as well provides support to resource dependent industries. The National Institution of Transforming India (NITI Aayog) had envisioned that by 2020 less than 40% of India's workforce will be employed in agriculture. This declining workforce and increasing pressure on available land necessitates efficient usage of manpower in this sector. Analysing the current status of employment in Fishery sector where most people have received no formal education or training, and aquaculture farmers / fishermen willing to shift to other non-fishery occupations, it is imperative for the industry to develop skills and resources swiftly to adapt, mitigate and grow.

Augmenting knowledge and skill levels of the fishery sector workforce and youth in particular is essential to enhance productivity, boost innovation, manage resources, mitigate risks and improve decision making ability. With a renewed focus on skill development in agriculture and allied sectors various initiatives in public as well as the private sector have already been taken up to harness the advantage of 'demographic dividend' in India. I am confident that the implementation of the three tiered structure envisaged by the Government of India for skill development will ensure that we meet our skilling target as planned by departments, missions and institutions relevant to skill building across India.

The Skill Gap Report 2021 developed for Indian Fisheries Sector by Agriculture Skill Council of India (ASCI) and National Fisheries Development Board (NFDB) analyses gaps in "Skill Development in Indian Fisheries' and outlines the skill development scenario in India and its renewed significance in fisheries. The publication examines the huge untapped potential and highlights the intervention areas for skill development in the sector. It also gives an insight into various initiatives taken up by the government and private sector to augment skill development at the grass root level. I am sure that this report shall give all the stakeholders a fresh perspective on skill building in Fisheries Sector of India.

Thanking you

Dr Nirmaljeet Singh Kalsi, IAS (Retd.)
Chairperson, NCVET

Acknowledgment

We are grateful to the Ministry of Skill Development and Entrepreneurship and Ministry of Fisheries, Animal Husbandry and Dairying, Government of India for their contribution and support towards the successful completion of the study.

Our special thanks to Dr Suvarna C., IFS Chief Executive, and Team, National Fisheries Development Board, Government of India for providing us with valuable comments, suggestions and timely guidance.

We are obliged to Shri Sagar Mehra, Joint Secretary, Ministry of Fisheries, Animal Husbandry and Dairying who has always encouraged us to take and come forward with new initiatives for skilling in Fisheries.

Its pertinent to mention the vital role played by Dr Anupam Sarkar, Ex Head- Research, Agriculture Skill Council of India to bring in Research thrust in Sector Skill Council activities have authored the first draft of this study. Special thanks to all the colleagues at Agriculture Skill Council of India for their valuable contributions for the publication.

We take this opportunity to convey our gratitude to all those who have, in some way or other, contributed towards the successful completion of this Skill Gap Analysis 2021 for the Indian Fisheries Sector.

AGRICULTURE SKILL COUNCIL OF INDIA (ASCI)

Agriculture Skill Council of India (ASCI) is the Sector Skill Council for Agriculture and Allied Sectors working under the aegis of Ministry of Skill Development & Entrepreneurship (MSDE). It also works closely with two line ministries, Ministry of Fisheries, Animal Husbandry and Dairying and Ministry of Agriculture and Farmers' Welfare, Government of India. ASCI works towards capacity building by bridging gaps and upgrading skills of farmers, wage workers, self-employed & extension workers engaged in organized / unorganized segments of Agriculture & Allied Sectors.

ASCI is contributing to nation building through Skill Development in Agriculture especially at the times when country's agriculture is experiencing stagnant growth, exodus of quality manpower to other sectors, changing climate with increased variability in production parameters and transformations in international agriculture markets that are especially too much subsidized challenging the competitiveness of Indian Agriculture.

ASCI has taken upon itself the responsibility of transforming Indian Agriculture through developing the skills of country's manpower in emerging areas of agriculture. With the development of 186 Qualification Packs, ASCI is covering following segments:

- Animal Husbandry
- Fisheries
- Dairy Farm Management
- Poultry Farm Management
- Post-Harvest Supply Chain Management
- Forestry & Agro Forestry
- Watershed Management
- Amenity Horticulture & Landscaping
- Production Horticulture
- Seeds Industry
- Soil Health Management
- Commodity Management
- Agri Entrepreneurship & Rural Enterprises
- Farm Mechanization and Precision Farming
- Agri-Information Management
- And other Allied

Objectives:

- Determining skills/competency standards and qualifications and development of National Occupational Standards (NOS).
- Preparation and maintenance of skill inventory to facilitate individual choices.
- Development of sector specific skill development plans.
- Standardization of affiliation and accreditation process.
- Affiliation, accreditation, assessment and certification of Vocational Institutes/Programmes.
- Plan and execute Training of Trainers (ToT).
- Promotion of academics of excellence.
- Establishment of a well-structured, sector specific, Labour Market Information System (LMIS) to assist planning and delivery of training.
- Adoption of global best practices

NATIONAL FISHERIES DEVELOPMENT BOARD

The National Fisheries Development Board (NFDB) was established in 2006 as an autonomous organization under the administrative control of the Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India to enhance fish production and productivity in the country and to coordinate fishery development in an integrated and holistic manner. A wide range of fishery development activities viz., intensive aquaculture in ponds and tanks, culture based capture fisheries in reservoirs, Coastal Aquaculture, Mariculture, Sea Weed cultivation, establishment of infrastructure, fishing harbours and fish landing centres, fishing dressing centres and solar drying of fish, domestic marketing, deep sea fishing and tuna processing, ornamental fisheries, trout culture, artificial reefs technology upgradation and capacity building of fishermen and fish farmers are being supported through the State Governments/Implementing agencies. The activities of NFDB are overseen by a Governing Body under the Chairmanship of the Hon'ble Minister for Fisheries, Animal Husbandry & Dairying. The Governing Body and the Executive Committee consider and decide the activities of the Board and provide periodic guidance. The Executive committee, with the Secretary in charge of Department of Fisheries as its Chairman, provides the general superintendence, direction and the control of the affairs and functions of the Board. The NFDB is headed by a Chief Executive.

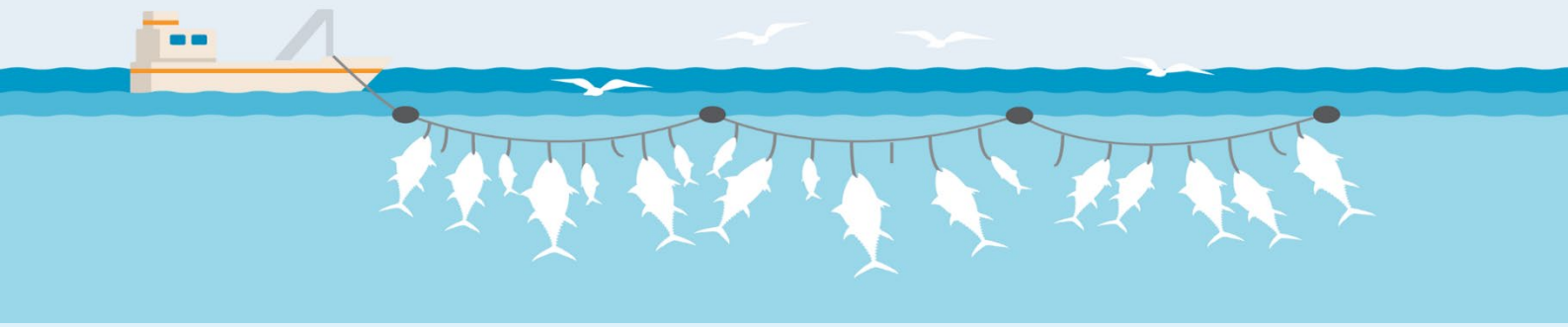
Objectives:

- To bring activities relating to fisheries and aquaculture for focused attention and professional management.
- To coordinate activities pertaining to fisheries undertaken by different Ministries/Departments in the Central Government and also coordinate with the State/Union Territory Governments.
- To improve production, processing, storage, transport and marketing of the products of capture and culture fisheries.
- To achieve sustainable management and conservation of natural aquatic resources including the fish stocks.
- To Apply modern tools of research and development including biotechnology for optimizing production and productivity from fisheries.
- To provide modern infrastructure mechanisms for fisheries and ensure their effective management and optimum utilization.
- To generate substantial employment.
- To train and empower women in the fisheries sector.
- To enhance contribute of fish towards food and nutritional security.

NFDB performs the following activities:

- Providing focused attention to fisheries and aquaculture (Production. Processing, Storage, Transport and Marketing)
- Achieving sustainable management and conservation of natural aquatic resources
- Applying modern tools of research and development for optimizing production and productivity from fisheries.
- Providing modern infrastructure mechanisms for effective fisheries management and optimum utilization
- Training and empower women in the fisheries sector and also generate substantial employment
- Enhancing the contribution of the fish toward food and nutritional security

Contents



1. Executive Summary:

Fisheries is one of the rapidly growing sub-sectors of Indian agriculture. In recent years the fisheries sector has witnessed many transformational changes in technology use; production, processing, and marketing; sectoral composition of the output and labour force. The fisheries sector has also been affected by the impacts of climate change, increasing stress on marine and inland water resources and shrinking water bodies. The Central and State governments have taken several progressive policy measures to enhance livelihood and capacity building of the fishermen. All this have a deep and far reaching impact on the employment and livelihood of fisheries communities. The flagship programmes of the skill development like Prime Minister's Kaushal Vikas Yojana (PMKVY), Rashtriya Krishi Vikas Yojana (RKVY) have emphasized on skill and capacity building of the fishermen, entrepreneurship development, promotion of employability and soft skills through short term training courses.

In this context, this present exercise has been carried out with the following objectives- to have an overview of the fisheries sector in India and prospects for growth of employment and livelihood generation in different segments of fisheries; analyse the sectoral growth of labour force and skilled labour in fisheries over time and across States; analyse the availability of skilled labour across different occupations in fisheries value chain; analyse government policies and programmes to augment the supply of skilled manpower in fisheries. This study is based on representative all India level secondary databases, inputs and insights received from Ministry of Fisheries, Animal Husbandry & Dairying (MoFAH&D) Government of India, leading fisheries research institutes of Indian Council of Agricultural Research (ICAR) and other fisheries organisations functioning in India.

The fisheries sector in India has shown remarkable dynamism and growth in recent years. It has become one of the fastest-growing sub-sectors in Indian agriculture. The growth in inland fisheries sector has surpassed that of marine fisheries. The sluggish growth of marine capture fisheries has reflected a slow employment generation in this particular segment. At present, more than half of the total fish in India is produced through aquaculture. India is the second-largest country in aquaculture production and third in total fisheries production globally. Many non-conventional States have shown higher growth in fish production and adopted effective policies for expansion of the sector. However, notwithstanding the growth, there exists acute shortage of skilled labour in the fisheries sector. According to PLFS 2017-18, there are around 10.2 lakh workers in the age group of 15-59 years whose primary or secondary occupation is fisheries and aquaculture. Only 15 percent of them or around 1.6 lakh workers are skilled. But a high share of these skilled workers received only informal Vocational Education and Training (VET). This means an uphill task to bring all the unskilled and informally skilled workers under formal skill coverage. Also, there exists high inter-State disparities in the access to skilled education. Skilled trained man power is needed in deep sea fishing of tuna resources and squid jigging, training in boat building, training in fish based value added products, training in Implementation of advanced aquaculture technologies to increase fish production. The gender gap in access to formal VET is also very high.

Currently 65,000 fishermen have been trained under the Central schemes since year 2017 to year 2020. There is an urgent need to step up skill development efforts and cover more fishermen under need-based and market-linked formal short term training. Particular focus on skill upgradation of aquaculture and marine fishermen is required for raising productivity and livelihood protection. We need to encourage female participation in fisheries through skill development. As a vast number of fishermen has acquired skills through traditional ways like learning and gathering experience in the job, we need to formally recognize their skill competencies through short term bridge courses and formal skills certification.

2. Introduction:

The Indian fisheries sector has witnessed unprecedented growth in recent years. Production and export of fish have peaked at 141.64 lakh tonnes (2019-20) and 13.93 lakh tonnes (2018- 19) respectively (Handbook of Fisheries Statistics, 2020 with 37.27 lakh tonnes for marine and 104.37 lakh tonnes for inland fisheries in FY 2019-20. As per the National Accounts Statistics (2019), the growth rate of output of the fisheries sector between 2011-12 and 2017-18 at constant 2011-12 prices has been highest (8.6 percent) among all subsectors of agriculture and much higher than the overall growth rate of the agricultural sector. The Doubling of Farmers' Income (DFI 2017) committee found fisheries as the most profitable among livestock activities. According to the estimates of DFI committee based on the NSS 70th round Situation Assessment Survey of Agricultural Households average income from fish cultivation per agricultural household that has undertaken this activity was Rs. 68951 per household during January- June 2013 and Rs. 125646 per household from July- December 2013 which are much higher than any other livestock activities. The closest to these figures are average income from wool (Rs. 38948 per household) between January and June 2013 and income from trading of live animals (Rs. 37967 per household) from July- December 2013. Thus, the cultivation of fish is remunerative and can be an important source of livelihood diversification of the farmers.

The Indian fisher community, marine or inland could perhaps be the poorest of the poor and most disadvantaged amongst all rural communities in the country. As required by their profession, their habitations are close to water bodies like rivers, reservoirs, estuaries, backwaters, oceans and are mostly away from the normal bounds of civic amenities. Often cited as the 'last mile', many schemes/programmes of the Government either fail to reach these communities located in remote localities or their implementation remains as a symbolic gesture.

In recent years Government of India has focused on modernized integrated agriculture so that income from farming can be supplemented with that from livestock, fisheries, and social forestry, all of which are less vulnerable to weather variations and degrading natural resource base. The Doubling of Farmers' Income (DFI 2017) committee has emphasized on raising the productivity of the fisheries sector through technological up-gradation, fostering group-based activities, and skill up-gradation.

In its recommendations DFI committee has highlighted that:

- Marginal fishermen should be mobilized into farmer producer organizations (companies, cooperatives, or societies) to promote cluster-based farming.
- The efficiency of existing fishing fleets requires to be enhanced through need-based up-gradation, such as improved navigation and shoal locating systems, fishing gear and fuel-efficient power operated vessels.
- Mari-culture activities, including the farming of seaweed, mussel, pearl, and others, should be encouraged through small entrepreneurs by providing technological, financial, marketing, and logistical support.
- It would do well to establish a Division of Non-Farm Enterprise Activities in DAHDF to bring focus on fishery-related non-farm income generation. For the success of such enterprises, it would be necessary to facilitate market links between the village entrepreneurs and the larger industry. (Production Enhancement through Productivity Gains, Volume 8D, DFI 2017)

Fisheries and marine products are major contributors to foreign exchange earnings. According to the Ministry of Fisheries, Animal Husbandry & Dairying the Fisheries Industry generates export earnings of Rs 43717 crore (2020-21) The recent Agricultural Export Policy (2018) of the Ministry of Industry and Commerce has set an ambitious target to improve the export of fisheries products. In its recommendation, the Export Policy has highlighted the need for support infrastructure to promote export which includes the creation of State of the Art Fish Landing Centre, the high-quality fishing harbour, pre-processing facilities in the coastal States. It further puts thrust on identifying strategically important clusters (including fisheries and other agricultural products), development of product-specific and export centric clusters, and transition to Agri Export Zones in the future. It is estimated that through the implementation of Centrally Sponsored and central sector schemes, the export is expected to increase by Rs 1 lakh crore in FY 2025.

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Thus, apart from the recent growth in fisheries, the sector has been given importance in several policy recommendations. However, for sustainable growth of the sector in the face of technological advancements, climate change and depleting quality of water resources, a rise in the aquaculture fisheries capacity building and human resource development has assumed critical importance. In India skill training of the fishermen was done mostly through informal, hereditary, and learning on-the-job ways. In recent years government of India has undertaken a slew of measures that have expanded the opportunities of skill development of fishermen in a number of job roles. The present study has undertaken an exercise to study the trends in employment in this sector and estimate the gap in the availability of skilled personnel. Such an exercise as this will help in future planning for the efforts and resources required to improve the skill base in the industry.

India is one of the youngest nations in the world with more than 62% of its population in the working age group (15-59 years), and more than 54% of the population below 25 years of age. It is estimated that at least for the next three decades, India will continue to enjoy this demographic advantage. This advantage is further accentuated by the fact that the labor force in the developed countries of the world will decline by 4% in next 20 years, while in India it will increase by 32%. Australia, Japan, Canada and other countries from Europe are already experiencing ageing of their population.

While a number of countries are experiencing ageing of their population, India is among the very few countries that enjoys a faster rate of growth of working age group population than the rate of growth of its population as a whole. This demographic phenomena gives India a distinct advantage of becoming a source of skilled work force, especially for those countries that are witnessing ageing and hence have an increasingly lower proportion of their population to support the economic activities being undertaken locally. However, I**ndia's formally skilled workforce (4.69%)** is dismally low compared to countries such as China (47%), Japan (80%), South Korea (96%), Germany (75%), and United Kingdom (68%). Thus, our ability to take benefit of this demographic advantage is limited by our ability to skill our existing and the new entrants to our workforce. Further, India also faces the challenge of supplying its own industries with skilled manpower to fuel the economic growth as planned. As per the National Skill Development Policy 2015, it is expected that an additional skilled workforce of 109.93 million will be required in the country by 2022 in about 24 sectors analysed by the National Skill Development Corporation.

It is estimated that **12 million people enter the workforce in India every year** who not only need to gain employment, but who also need to have the required skills for different job roles. While this is a large number in itself, added to this, is the complexity that **about 93% of workers are in the informal sector** which is transient in nature.

Apart from the challenge of training a large pool of untrained workforce and preparing the new entrants for jobs, India also faces the challenge of creating adequate additional jobs for its young workforce. It is estimated that between 2004-05 and 2009-10, only 2.7 million net additional jobs were created in the country. With this in mind, the Government of India has developed a number of strategic interventions. Sagarmala is one such initiative undertaken by the Ministry of Shipping to promote port led development and job creation in the country by developing Coastal Economic Zones (CEZs).

3. Objectives:

The main objectives of this study are as follows-

- To have an overview of the fisheries sector in India and prospects for growth of employment and livelihood generation in different segments of fisheries
- To analyse the sectoral growth of labour force and skilled labour in fisheries over time and across States
- To analyse the availability of skilled labour across different occupations in fisheries value chain
- To analyse government policies and programmes to augment the supply of skilled manpower in fisheries

4. Database:

This study is based on representative all India level secondary databases and inputs received from Ministry of Agriculture and Farmers' Welfare. The secondary data for this study has been collected from various issues of the Handbook of Statistics on Fisheries, Employment and Unemployment Survey (EUS 2011-12), Census of Marine Fisheries (2010 & 2016), and micro- level data from Annual Period Labour Force Survey (PLFS 2017-18).

***Handbook on Fisheries Statistics*:**

Handbook on Fisheries Statistics is an annual publication of the Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying (earlier department of Animal Husbandry, Dairying, and Fisheries under Ministry of Agriculture, Cooperation and Farmers Welfare). This is one of the authentic sources for up to date information on production, and trading of fish, fishing infrastructure and resources, and other related variables. We have used this database for the projection of future production of fish. The latest edition we have used for this report belongs to the year 2018.

***Marine Fisheries Census*:**

Marine Fisheries Census is a five-yearly exercise conducted by Central Marine Fisheries Research Institute (CMFRI) covering mainland and Fishery Survey of India ,Department of Fisheries covering both Andaman & Nicobar Islands and Lakshadweep Islands to collect socio-economic data on marine fisher folk communities, information on existing infrastructure facilities, information on fishing vehicles and equipment owned by the marine fishermen, and information on other utilitarian aspects and social aspects. We have used State-level data from Census 2010 and 2015 for analysis of changes in the population of marine fishermen.

***Periodic Labour Force Survey, Annual Report 2017-18*:**

Periodic Labour Force Survey 2017-18 conducted by the National Statistical Organization is a nationwide survey to collect information on employment and earnings of the current labour force. It collects data up to 5 digit level of National Industries Classification (NIC 2008) and 3 digit level of National Occupational Classification (NCO 2004). For this report, we have used two concepts of employment usual principal status and usual subsidiary status.

Under the usual principal status, the principal activity of the person for the major part of the reference period is considered. In the case of subsidiary status the subsidiary occupation of the persons whose principal status is 'unemployed' is considered.

Annual Survey of Industries:

Annual Survey of Industries is an annual publication of the Central Statistical Organisation (CSO). It is a country wide survey of registered manufacturing units in India. It collects data on operational aspects of the units including employment of manpower. We have used recent rounds of this dataset to study employment in fish processing sector.

5. Methodology:

This analysis is primarily descriptive in nature. As we have discussed, it uses statistical data from major official data sources and inputs received from sectoral experts and scientists of Ministry of Agriculture and Farmers' Welfare. We have studied the availability of skilled labour in different segments of fisheries industry, skill gaps among male and female fisheries workers, trends in employment creation and labour absorption, state-wise employment scenario and availability of skilled labour, projections for labour requirements in the new and emerging areas of the fisheries sector. Inputs and insights received from the scientists and experts of the Ministry of Animal Husbandry, Dairying and Fisheries and research institutes of Indian Council of Agricultural Research in the field of fisheries constitute an important part of the analysis, especially to understand the employment potential in emerging areas of the fisheries sector and the associated new job roles.

The availability of skilled labour is given both in absolute terms as well as a proportion of total labour engaged in the industry. We have considered the major activities in the fisheries industry ranging from production to processing and retail and wholesale activities. In fisheries, as well as in other sectors of agriculture, a large section of the workforce acquires skills and knowledge through traditional and informal ways- hereditary, self-learning, learning on job, and other informal ways. In this document we have provided separate estimates of the labour skilled in different methods, both formal and informal.

The secondary data has been used to estimate employment generation and skilled labour availability in broad sectors of the fisheries. Secondary data, published in different reports is useful in getting an overview and aggregate picture of the trends and pattern of the labour market indicators. To get a more disaggregated picture, to gain a deeper understanding of the future course, and for planning and policy formulations we need a firm grip on the situation at the contemporary ground level situation. Hence, to get a disaggregated picture We analysed more detailed picture of labour absorption per hectare in different occupations and sub- sectors in the fisheries sector after holding several rounds of intensive discussions with scientific officers and research staff of the fisheries research institutes under the Ministry of Animal Husbandry Dairying and Fisheries.

Fisheries sector, like any other sub-sectors of agriculture, has witnessed some transformational changes in the use of technology, organization of production and manpower, composition and relative importance of different segments in total output of the sector which have far-reaching impact on the employment and livelihood potential of the fisheries sector. We have hold intense discussion with fisheries experts of ICAR and incorporated their inputs in this report.

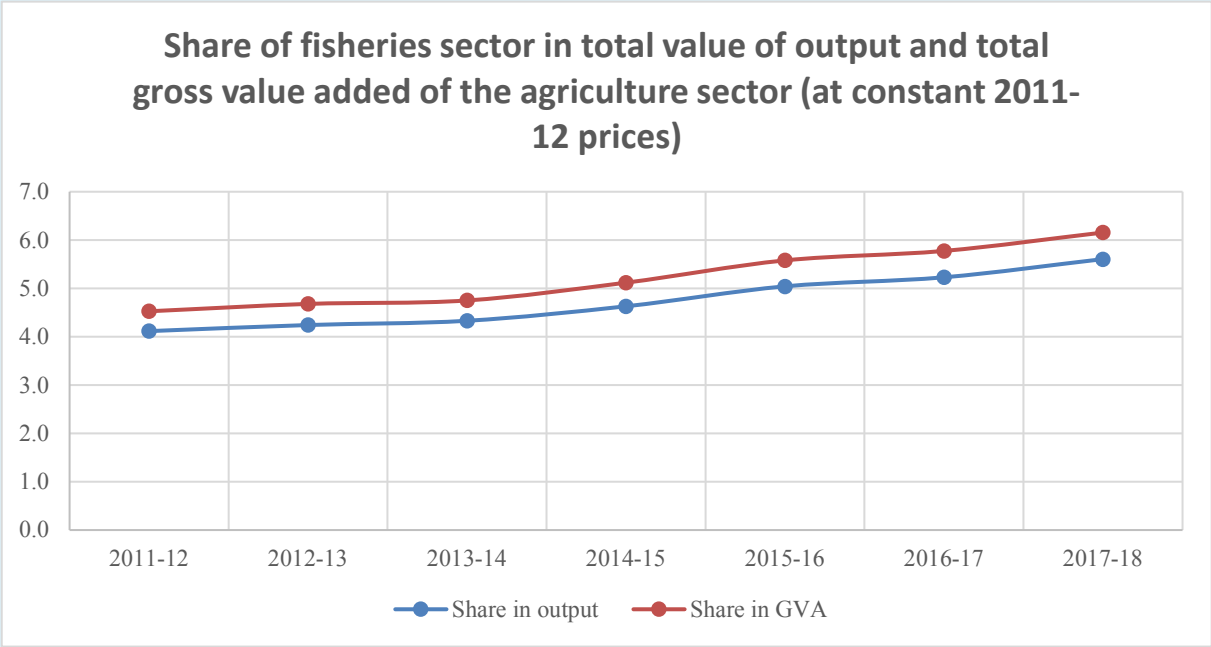
6. The fisheries sector in India: An Overview

India is the second-largest fish producing country in the world accounting for 7.73 % global production and contributing about 1.24 % of the country's gross value added (GVA) and 7.8 % of agricultural GVA in 2018-19 and 1.07% of the Total GDP of India. It is to be mentioned that the share of the fisheries sector in agricultural output has increased from 4 percent to 7.8 % between 2011-12 and 2017-18.

Skill Analysis Framework

Skill demand analysis | Gap analysis | Skill Supply analysis

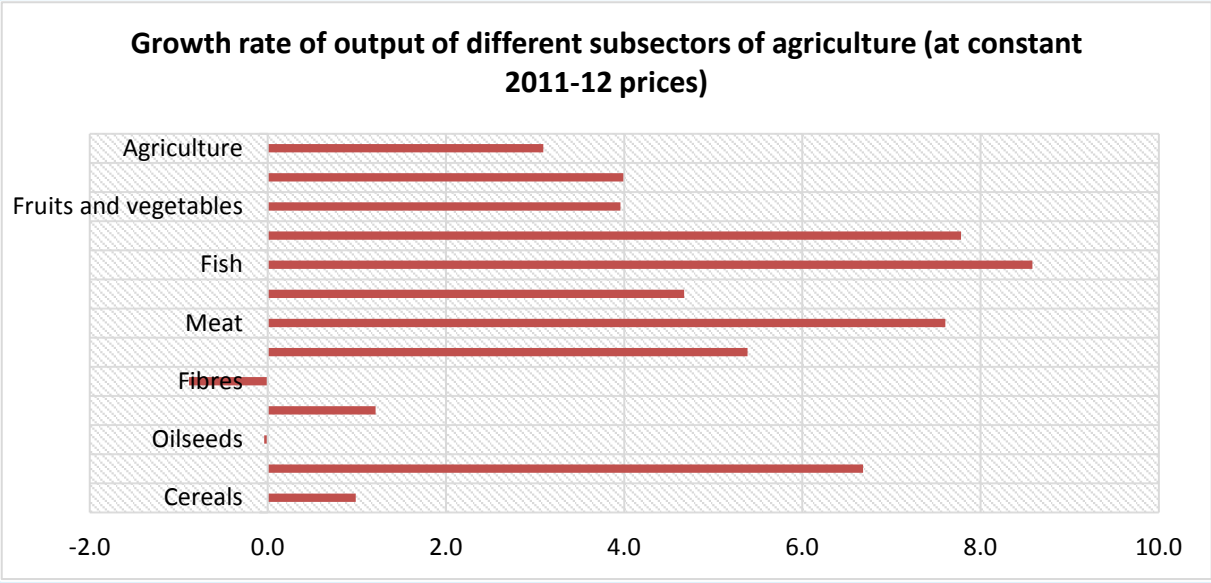
What	How	Output		Output	How	What	
Market driven skill demand	District level economic analysis	Employment market analysis	Anticipated skill demand in the future	Labor supply and preference analysis	Analysis of current skill inventory	Skill sets with existing workforce	Recommendations and Action Plan
Policy driven skill demand	State an National level Development policy analysis				Primary data analysis	Perception and aspirations of youth & Parents	
Skill for traditional livelihood	Community level anlaysis				Analysis of age specific demographic data	Demographic divident	
Skills in demand at state, national and internarional levels	National/International and state level policy and data anlysis		Current supply of skill training		Assessing capacity of vocational training institutions (ITIs/Polytecnic/VTPs, etc.)	Current skilling capacity to provide trainings in Shipping and Maritime Sector	



Source: *National Accounts Statistics (2019)*

The Indian fisheries sector has witnessed unprecedented growth in recent years. The production and export of fish have peaked at 13.923 lakh tonnes in 2017-18 and 3.73 million metric tonnes for marine and 10.43 million metric tonnes for inland fisheries respectively in 2017-18. Production of inland fish accounted for two-thirds of total fish production and marine fish contributes the rest. Between 2005 and 2016, production of inland water capture fisheries has expanded from 1.08 million tonnes to 1.46 million tonnes per annum.

As per the National Accounts Statistics (2019), the growth rate of output of the fisheries sector between 2011-12 and 2017-18 at constant 2011-12 prices has been highest (8.6 percent) among all subsectors of and much higher than the overall growth rate of the agricultural sector.



Source: *National Accounts Statistics (2019)*

6.1. Indian Fish Market: Drivers:

- **Increasing Per Capita Consumption:** The per capita consumption of fish has been continuously increasing over the past few decades. As a result of increasing disposable incomes and changing food habits, we expect the consumption of fish to continue increasing in the coming years.

- **Growth of Organized Food Retail:** The growth of the organized food retail market is expected to increase the accessibility of processed fish, particularly, canned and frozen fish products for consumers. This is expected to create a positive impact on market growth.

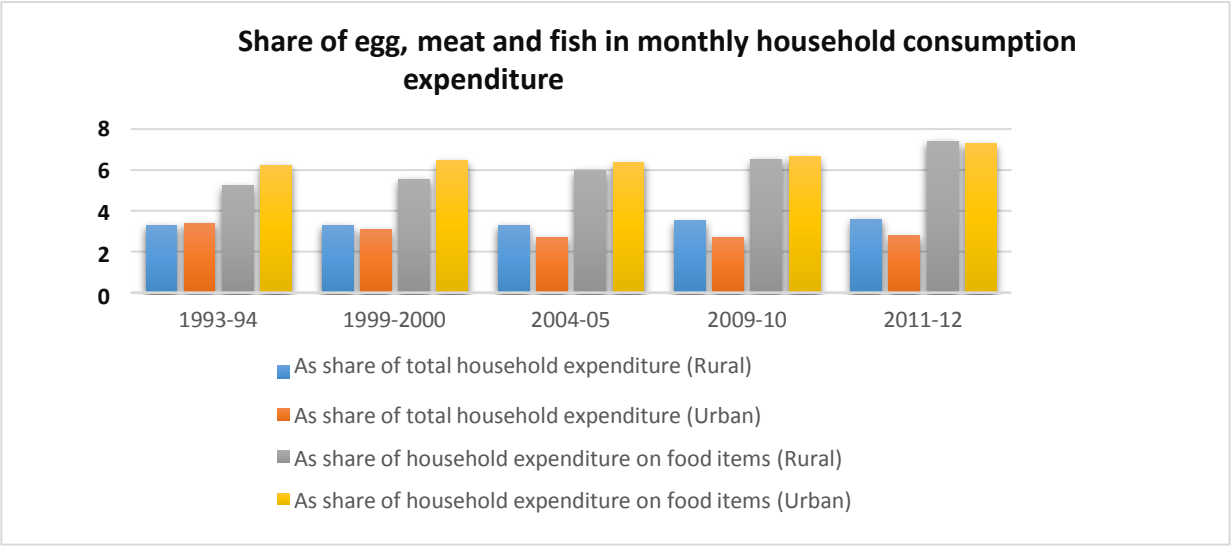
- **Increasing Awareness on the Health Benefits of Fishes:** The market for health and wellness foods in India is currently exhibiting strong growth. As previously discussed, fishes are perceived as a healthy food containing high levels of digestible protein, PUFA and cholesterol lowering capability. Increasing awareness of fish as a food associated with health and wellness is expected to create a positive impact on its consumption in the coming years.

- **Growth in Exports:** India is also emerging as a leading exporter of fishes with export values exhibiting double digit growth rates. The country is currently one of the key suppliers of frozen shrimp and frozen fish in various international markets.

6.2. Changing food habits and fish as a source of nutrition:

The importance of fish in the household diet has been increasing over the years. The latest all India data on household consumption of different food items shows the share of egg, meat and fish as a share of household consumption expenditure on food items per month had increased from 5.2 percent in 1993-94 to 7.4 percent in 2011-12 in rural areas and 6.3 percent to 7.3 percent in urban areas.

Mobile retail fish marketing - Uttar Pradesh



Source*: *NSS Report No. 555: Level and Pattern of Consumer Expenditure, 2011-12

Data shows, there has been an increase in the share of households who reported consumption of egg, meat, or fish in the last 30 days in both rural and urban areas. In the case of rural areas, this percentage had increased from 58.5 percent in 2004-05 to 63.4 percent in 2011-12 and in urban areas from 57.7 percent to 59.7 percent during the same time period.

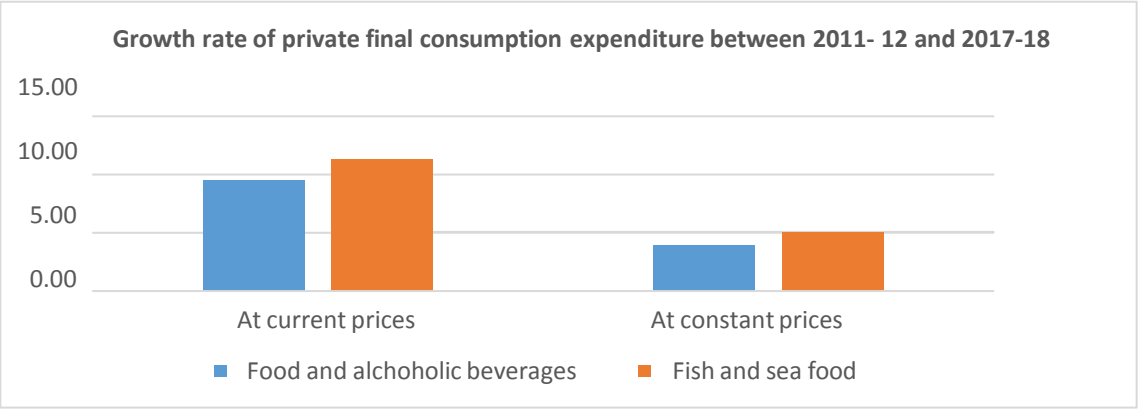
Table 1 Estimated percentage of households reporting consumption of egg, meat, and fish in the last 30 days

Sector	2004-05	2009-10	2011-12
Rural	58.5	61.9	63.4
Urban	57.7	56.5	59.7

Source: *NSS Report No. 555: Level and Pattern of Consumer Expenditure, 2011-12*

However, although there has been an increase in the consumption of fish has increased there exists a wide gap in per capita consumption of fish in India vis-à-vis the global average. According to the OECD-FAO outlook for agriculture (2019), the average per capita consumption of fish between 2016 and 2018 was just 7.2 kg in India as compared to the global average of 20.3 kg per capita. The same report shows total domestic consumption fish and seafood is likely to increase from 560 kt per annum between 2016-18 to 690 kt in 2028.

Domestic demand for fish has increased more rapidly than the overall demand for food and alcoholic beverages. Between 2011-12 and 2017-18 final consumption expenditure on fish and seafood at current prices has grown at the rate of 11 percent per annum, while that on food and alcoholic beverages has grown at 9 percent. When measured at constant prices expenditure on fish and seafood recorded a growth rate of 5.5 percent between 2011 and 2018. During the same period expenditure on food and beverages has increased at around 4 percent per annum. This shows fish and seafood is gradually gaining importance among domestic consumers as a source of protein as part of a nutritious meal.



Source*: *National Accounts Statistics 2019

6.3. Market Summary:

- Based on the fish type, the market has been segmented as inland fishes, marine fishes, shrimps and scampi. Currently, inland fishes dominate the market, holding the largest share.
- Based on the product type, the market has been segmented as fresh, frozen, canned and others.
- On the basis of end-user, the market has been segmented as retail and institutional sectors.
- On the basis of distribution channel, the market has been segmented as organized and unorganized sectors.
- The market has also been segmented on the basis of various states.
- The competitive landscape of the market has also been examined in the report and the profiles of key players have also been provided.

7. The segment-wise potential of fisheries sector:

Inland fisheries and aquaculture constitute the main components of the fisheries sector in India from production point of view. The inland fishery has grown in absolute terms, but the development in terms of its potential is yet to be realized as the sector is extremely diverse and dynamic. Freshwater consists of about 73 % of total fish production. The inland resources are in the form of rivers and canals, floodplain lakes, ponds and tanks, reservoirs and brackish water resources offer great opportunities for livelihood development. The sector plays a great role in nutritional security and employment potential. Inland aquaculture have grown in absolute terms, the development in terms of its potential is yet to be realized. The vast and varied resources, that are 2.36 million ha of ponds and tanks and 1.24 million ha of brackishwater resources offer great opportunities for livelihood development.

The sector is also an important source of ancillary jobs for rural population, especially in marketing, retailing, transportation etc. However, the sector remains largely un-organized even today mainly due to scattered and diffused nature of activities.

Marine Fisheries contributes to food security and provides direct employment to over 1.5 million fisher people besides others indirectly dependent on the sector. The marine sub-sector has experienced three recognized phases of development. Phase I was a pre-development stage (up to 1965) where fishing was still largely dominated by small indigenous craft and gear and mechanization was in the very early stages. Phase II (from 1965- 1986) reflected a major expansion in the use of synthetic gear, focus on exports, increases in the number of larger mechanized boats, government investment in new fishing harbours, the introduction of purse seine harvesting and the start of motorizing smaller, artisanal boats, that could now extend further their range offshore. Phase III (1986-2000) was characterized by rapid growth in motorizing artisanal fleet, further extension of fishing offshore and extended voyage fishing, and introduction of seasonal closures of selected fisheries as concerns developed over depleting fish stocks, increasing conflict over fish resources, and mounting investment needs. At the same time, however, the country is trying to expand fishing activities in its coastline of about 8118 km and 2.02 million square km offshore Exclusive Economic Zone (EEZ), where there may be scope for further growth.

7.1. Aquaculture:

Aquaculture farm

At present, nearly half of the total fish in India is produced through aquaculture. India is the second-largest country in aquaculture production. There are two types of inland aquaculture in India- freshwater and brackish water. Freshwater aquaculture constitutes 95 percent of aquaculture production in the country. Freshwater consists of about 73 % of total fish production and major species cultivated under freshwater aquaculture are- Indian major carps- rohu (*Lobeo rohita*), catla (*Catla catla*) and mrigala (*Cirrhinus mrigala*). The rest 5 percent of aquaculture production comes from brackishwater aquaculture.

Major species are shrimp, especially giant tiger shrimp (*Penaeus monodon*) and white leg shrimp (*Penaeus. vannamei*). Over time aquaculture has become a sustainable source of income for the farmers. The share of aquaculture is expected to rise to more than two-third by 2030. Thus, future jobs in the fisheries sector are likely to be created more in the aquaculture segment.

7.2. Mariculture:

Open sea cage culture

Sea weed farming on Bamboo nets in Tamil Nadu

Sea weed cultivation by women folk in Tamil Nadu

Mariculture is a specialised branch of aquaculture involving the cultivation of economically important marine plants and animals in the sea or any other water bodies having tidal influence and includes on-shore facilities like hatcheries, nursery rearing, and grow-out system using seawater. According to many experts, given the stagnation in capture fisheries production (3.63 million tonnes in 2016, 3.40 million tonnes in 2015, and 3.53 million tonnes in 2014), the area under capture fisheries could be profitably utilised for mariculture by adopting sustainable and socially acceptable methodology (Kumar 2017).

Sea weed harvesting

7.3. Ornamental Fish farming:

Ornamental fish farmer

Further, the cultivation of ornamental fisheries has gained importance with expansion of the export potential and also growing popularity in the domestic market that no more limited only in big cities but also in small towns. India's great bio-diversity offers huge scope for ornamental fisheries. Over 2500 species of ornamental fishes are traded in the markets globally, of which 60 percent is freshwater origin and rest are marine (Raja et. al. 2019). Around 90 percent of Indian ornamental fish trade are of freshwater origin (NFDB n.d.). Remaining 10 percent of ornamental fish trade is accounted for by the marine fisheries (*ibid*.).

Almost 98 percent of the ornamental fishes, be it freshwater or marine origin, are cultured and rest 2 percent captured from the wild (*ibid*.). North East and Western Ghat regions are bio-diversity hotspots and have high growth potential. A wide variety of marine ornamental fishes are available in Andaman & Nicobar Islands, Lakshadweep, and the Gulf of Munnar (James 2005). There is scope for entrepreneurship development around culturing and breeding of ornamental fishes (Ninawe n.d.). The opportunities for ancillary activities like running pet shops are also expanding steadily (*ibid*.). National Mariculture Policy (2018) identifies that marine ornamental fisheries have a market globally. It aims to promote hatchery production of ornamental species and pearl oysters for which technologies are available.

7.4. Capture Fisheries

***Inland Capture fisheries*:**

India has witnessed an impressive growth of inland capture fisheries in recent years. There has been an 8.6 percent increase in total production of inland capture fish from 2015 to 2016 which is one of the highest growth rates among major producers of inland fisheries, just after Mexico (31.9 percent) and Nigeria (11.8 percent).

Table 1 Inland waters capture production: major producing countries

Country	Production (tonnes)			% Variation		Variation, 2015 to 2016 (tonnes)
	Average 2005-14	2015	2016	2005-14 (average) to 2016	2015 to 2016	
China	2252368	2277299	2318046	2.9	1.8	40747
India	1088082	1346104	1462063	34.4	8.6	115959
Bangladesh	1018987	1023991	1048242	2.9	2.4	24251
Myanmar	745483	863450	886780	19.0	2.7	23330
Cambodia	422801	487905	509350	20.5	4.4	21445
Indonesia	346722	472911	432475	24.7	-8.6	-40436
Uganda	417016	396205	389244	-6.7	-1.8	-6961
Nigeria	287937	337874	377632	31.2	11.8	39758
United Republic of Tanzania	305635	309924	312039	2.1	0.7	2115
Russian Federation	243337	285065	292828	20.3	2.7	7763
Egypt	248141	241179	231959	-6.5	-3.8	-9220
Democratic Republic of the Congo	224263	227700	229300	2.2	0.7	1600
Brazil	243212	225000	225000	-7.5	0.0	0
Mexico	113854	151416	199665	75.4	31.9	48249
Thailand	211927	184101	187300	-11.6	1.7	3199
Philippines	182205	203366	159615	-12.4	-21.5	-43751
Total of 16 major countries	8351970	9033490	9261538	10.9	2.5	228048
Total of Other 136 countries	2172222	2374585	2371482	9.2	-0.1	-3103
World Total	10524192	11408075	11633020	10.5	2.0	224945
Share of 16 major countries	79.4%	79.2%	79.6%			

Source: *The State of World Fisheries and Aquaculture 2018*

Marine Capture Fisheries

Traditional Fishermen carrying fish catch

India is also a major producer of marine capture fisheries. Marine Fisheries contributes to food security and provides direct employment to over 1.5 million fisher people besides others indirectly dependent on the sector. Marine products are one of the major sources of export earnings in India. In recent years, while many of the countries have experienced negative growth of output (including China, the highest producer of marine capture fisheries), India has registered around 3 percent growth between 2015 and 2016, contributing to nearly 4.5 percent of the world production of marine capture fisheries.

Outrigger trawler -Deep sea fishing vessel

Table 2 Marine waters capture production: major producing countries

Country	Production (tonnes)			% Variation		Variation, 2015 to 2016 (tonnes)
	Average 2005-14	2015	2016	2005-14 (average) to 2016	2015 to 2016	
China	13189273	15314000	15246234	15.6	-0.4	-67766
Indonesia	5074932	6216777	6109783	20.4	-1.7	-106994
United States of America	4757179	5019399	4897322	2.9	-2.4	-122077
Russian Federation	3601031	4172073	4466503	24	7.1	294430
Peru	6438839	4786551	3774887	-41.4	-21.1	-1011664
India	3218050	3497284	3599693	11.9	2.9	102409
Japan	3992458	3423099	3167610	-20.7	-7.5	-255489
Vietnam	2081551	2607214	2678406	28.7	2.7	71192
Norway	2348154	2293462	2033560	-13.4	-11.3	-259902
Philippines	2155951	1948101	1865213	-13.5	-4.3	-82888
Malaysia	1387577	1486050	1574443	13.5	5.9	88393
Chile	3157946	1786249	1499531	-52.5	-16.1	-286718
Morocco	1074063	1349937	1431518	33.3	6	81581
Republic of Korea	1746579	1640669	1377343	-21.1	-16	-263826
Thailand	1830315	1317217	1343283	-26.6	2	26066
Mexico	1401294	1315851	1311089	-6.4	-0.4	-4762
Myanmar	1159708	1107020	1185610	2.2	7.1	78590
Iceland	1281597	1318916	1067015	-16.7	-19.1	-251901
Spain	939384	967240	905638	-3.6	-6.4	-61602
Canada	914371	813155	831614	-9.1	1	8459
Taiwan	960193	989311	750021	-21.9	-24.2	-239290
Argentina	879839	795415	736337	-16.3	-7.4	-59078
Ecuador	493858	643176	715357	44.9	11.2	72181
United Kingdom	631398	65451506	701749	11.1	-0.4	-2753
Denmark	735966	868892	670207	-8.9	-22.9	-198685
Total of 25 major countries	65451506	66391560	63939966	-2.3	-3.7	-2451594
Total of Other 170 countries	14326675	14856282	15336882	7.1	3.2	480600
World Total	79778181	81247842	79276848	-0.6	-2.4	-1970994
Share of 25 major countries	82%	81.70%	80.70%	0	0	0

Source: *The State of World Fisheries and Aquaculture 2018*

8. Major fisheries activities under ongoing Pradhan Mantri Matsya Sampada Yojana (PMMSY)

- Intensive Aquaculture in ponds and tanks
- Fisheries development in reservoirs
- Deep sea fishing and Tuna Processing
- Development of Domestic fish marketing
- Infrastructure development for Harbours and landing centres
- National policy of marine fisheries 2017
- Schemes for Coastal Aquaculture
- Schemes for Mariculture
- Schemes for Ornamental Fisheries
- Seaweed Culture

Blue revolution:

Blue Revolution, the Neel Kranti Mission has the vision to achieve economic prosperity of the country and the fishers and fish farmers as well as contribute towards food and nutritional security through full potential utilization of water resources for fisheries development in a sustainable manner, keeping in view the bio-security and environmental concerns. And its vision is to Create an enabling environment for integrated development of the full potential of fisheries of the country, along with substantially improvement in the income status of fishers and fish farmers keeping in view the sustainability, bio-security and environmental concerns and fully tap the total fish potential of the country both in the inland and the marine sector and triple the production by 2020. The restructured Plan Scheme on Blue Revolution - Integrated Development and Management of Fisheries has been approved at a total central outlay of Rs 3000 crore for implementation during a period of five years (2015-16 to 2019-20).

Pradhan Mantri Matsya Sampada Yojana (PMMSY):

The Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India is implementing Pradhan Mantri Matsya Sampada Yojana – A scheme to bring about Blue Revolution through sustainable and responsible development of fisheries sector in India at an estimated investment of Rs. 20050 crores for holistic development of fisheries sector including welfare of fishers. PMMSY is being implemented in all the States and Union Territories for a period of 5 years from FY 2020-21 to FY 2024-25.

PMMSY is designed to address critical gaps in the fisheries value chain from fish production, productivity and quality to technology, post-harvest infrastructure and marketing. It aims to modernize and strengthen the value chain, enhance traceability and establish a robust fisheries management framework while simultaneously ensuring the socio-economic welfare of fishers and fish farmers.

9. Major domestic policies likely to affect employment generation and skill development in the fisheries sector:

9.1. National Policy on Marine Fisheries (2017):

- The National Policy on Marine Fisheries recognised that marine fisheries are an important source of food, nutrition, employment, and income generation.
- The Policy further notes that "apart from the prime consideration of securing food and nutritional requirements of the population, fisheries sector plays an important role in trade and commerce, and in the process promotes employment and livelihood of coastal communities."
- Indian Fishers are widely recognised in other countries in the region for their skills, industrious nature, and the ability to work under challenging conditions. As a result, more and more fishers from India are now finding employment in fishing fleets of other countries. The Government will ensure that fishers who are willing to take employment in the fisheries sector in other countries have adequate skills and knowledge of working in alien seas and go through formal Government approvals.
- The government will initiate steps towards training, capacity building as well as up-gradation of technological skills of traditional fishers in moving from artisanal fishing to more economic and efficient means of fishing.
- The government will introduce a new scheme(s) for enhancing the skills and capabilities of the traditional fishermen to undertake and popularise deep sea fishing.
- The government will facilitate and strengthen fisheries cooperatives through skill development and technical and financial support.

9.2. Draft National Inland Fisheries and Aquaculture Policy (2019):

One of the objectives of the draft National Inland Fisheries and Aquaculture Policy (2019) is to create additional gainful employment opportunities through marketing trade, and export of globally competitive fish and value-added fish products. The policy also seeks to strengthen training and skill development infrastructure including e-courses in DoFs and Fisheries colleges, and mandate regular and compulsory capacity building of the staff and faculty on technical knowhow, societal skills, and development management.

The government will also provide skill development training on best management practices/good aquaculture practices and recent technologies, exposure visit for the farmers, development, and dissemination of farmer-friendly extension literature and effective use of Information and Communication Tools (ICT).

9.3. Draft National Policy on Mariculture (2018, revised draft in 2019):

The draft National Policy on Mariculture, 2018 has two major objectives of enhancing mariculture production in the country and increase income and employment opportunities sustainably, and to promote entrepreneurship in mariculture by facilitating technical and financial inputs. The Policy also states that the government will take initiatives for capacity building and extension in mariculture:

- The government will introduce new schemes for enhancing the skills and capabilities of traditional fishers, and other potential stakeholders to undertake mariculture and popularise the vocation in India.
- The government will facilitate the formation of mariculture cooperatives through skill development and technical/ financial support, wherever necessary.

- Recognizing the active role of coastal women and enterprising family members of the coastal fishers in taking up mariculture of oysters, mussel, and seaweeds in South India, and demonstrating the potential of mariculture for alternative income and social empowerment, financial and technical support will be provided for these activities.
- Planned and concerted efforts will be undertaken under the aegis of Skill India Mission, to develop adequate manpower with necessary skills and entrepreneurship to meet the skilled manpower requirements for the potentially expanding sector.
- A tailor-made capacity building module will be developed involving the Agricultural Skill Council of India (ASCI) and other expert academic bodies to impart core knowledge related to the mariculture operations and governance to functionaries of the fisheries department from the coastal States and UTs.
- To provide thrust and impetus to new candidate species/ technologies/ areas of mariculture, frontline participatory demonstrations will be taken up with full financial support and handholding until it is getting established.

9.4. Draft National Fisheries Policy 2020:

The Draft National Fisheries Policy (NFP 2020) has proposed some measures for upskilling of the fishermen:

- Institutions of central and state governments associated with fisheries sector will be strengthened for advancement of learning and dissemination of knowledge, entrepreneurship and skill training to meet the growing demands of the sector.
- The Government will ensure that fishers who are willing to take employment in fisheries sector in other countries have adequate skills and knowledge of working in alien seas and go through formal Government approvals.
- Department of Fisheries will develop linkages for effective convergence with other agencies to upscale skills of fishery personnel and workers in the context of emerging technologies, fisheries management and national and international developments. NFP will generate gainful employment and promote community partnerships, private participation and effective cooperative movement in fisheries sector.
- Upscale and improve the skill sets of the workers in post-harvest segment programmes will be implemented separately under **SKILL INDIA** initiative.

10. Technological growth, changes in farming practices, and major areas for future job creation:

Technological advances create new jobs, improve productivity, of workers, and reduce risks. This often calls for training in new methods of production. Technologies also offer a new broader and cheaper leaning process. Some of the technologies that are taking off in Indian fisheries or will become important is discussed below:

10.1. Fish feed industry:

As a result of efforts and excellent participation by private companies and entrepreneurs in the fish-farming sector, India has emerged as a significant producer of soy-based extruded, floating feeds, as well as sinking pellets for fish. The industry has invested in imported extrusion machinery to produce the floating fish feeds.

The growing popularity of feed-based fish farming in recent years is likely to create more job opportunities in the fish feed industry (Anand 2019). According to one estimate, only 10-15 percent of India's freshwater fish have been brought under feed based farming and thus there is vast scope for converting to this system. With about 30 high tech feed mills currently operating for feed production, the sector has high employment potential in the coming years for both skilled as well as non-skilled workers. Allied businesses like feed equipment manufacturers, feed additive, and raw material suppliers are likely to flourish.

10.2. The growing importance of enclosed culture:

Cage culture in reservoir- Maharashtra

Cage culture in reservoir- Jharkhand

National Fisheries Development Board under the Department of Fisheries has been actively promoting the culture of growing fish in cages and pens in reservoirs, lakes, and open sea as part of aquaculture activities. The Guidelines for Cage Culture in Inland Open Water Bodies of India (2016) states that in view of dwindling production from natural waters, both inland and marine, any substantial increase in production has to come either from inland aquaculture or mariculture. The National Inland Fisheries and Aquaculture Policy (2019) also emphasises on the measures for promotion of cage culture in reservoirs based on recommendations of scientific organisations like ICAR institutes, universities, etc. and the department of fisheries government of India. The Central Marine Fisheries Research Institute (CMFRI) has kick-started a major project for boosting open sea cage farming in Indian waters (Kumar 2018). As part of this project, an ambitious target has been set to train 5000 fishermen and establish brood bank of high-value marine fish suitable for cage farming (*ibid*.). According to scientists, cage fish farming technology is 70 times more productive than normal methods of farming in ponds. Among the many other advantages of the enclosed culture system is the considerable amount of direct and indirect employment opportunities.

10.3. Recirculatory aquaculture system:

Recirculatory Aquaculture System (RAS)- Pangasius Fish

Recirculatory Aquaculture System (RAS)- Hyderabad

Recirculation/ flow-through system is one of the latest technological interventions in culture fisheries in a controlled indoor environment. It is an intensive approach (higher densities and rigorous management) than other aquaculture production systems. Instead of the traditional method of growing fish outdoors in open ponds and raceways, this system rears fish in indoor tanks. Recirculating systems filter and clean the water for recycling back through fish culture systems. Various benefits include a low requirement of land and water, reduction in water wastage, and high output of fish from the minimal area. (DAHDF 2017)

Recirculatory Aquaculture System (RAS) – Sultan Fish, Haryana

10.4. Development of square mesh net fishing:

Training on Fishing gear fabrication

The use of square mesh nets for fishing is replacing the traditional nets fast and this has improved the income of fishermen, reduced damage of the ecosystem, and made fishing environmentally sustainable.

The traditional diamond-shape nets get compressed in water making it difficult for juvenile fish to escape and thus killing thousand of marine fishes before they mature and reproduce. In contrast, the square mesh nets retain its shape in the water allowing smaller fishes that are less than 10 centimeters in size to escape. It also saves diesel as the fish trawlers use less diesel for being less heavy under square mesh nets.

10.5. Digital technology:

Digital technologies such as big data, Internet of things, sensors, robotics, now allow innovative monitoring and better management of fish stocks (IoT), (Girard & Payrat 2017). Some of the technologies developed in this field are:

a. **Automatic Identification System (AIS):** AIS is a ship reporting system based on messages broadcasted by vessels carrying transponders. By sending and receiving regular communications about their identity and course, vessels and avoid collisions, and navigate safely in low visibility.

b. **Electronic logbook or ERS:** E-logbook data (log records) contributes to better management of fish stocks by keeping track of catches, (origin and volume) and gear used.

c. **Big data technologies:** The fisheries sector has witnessed a tremendous increase in data for monitoring, control, and surveillance. Big data technologies for sorting the information correctly help detect suspect fishing activity.

d. **Blockchain technologies:** The first implementation of blockchain technology for the seafood industry was initiated in 2017. A blockchain is a continuously growing list of records, called blocks, which are linked and secured using cryptology. Each block typically contains a hash pointer as a link to a previous block, a timestamp, and transaction data. This technology helps increase the traceability of fish products.

e. **Drones:** The growing use of fully or partly unmanned vehicles, or drones, is one of the prominent fields of application of new technology for sustainable fisheries. Drones can be used at a much cheaper cost for fish stock assessment, monitor and control marine protected areas, the information in illegal fishing vessels, etc. One challenge for the development of drones is that autonomous (unmanned) vehicles/ vessels (flying or floating objects) are not mentioned in maritime international codes and conventions.

Use of GPS, GIS technology:

The advancements in the Geographical Positioning System (GPS) help fisherfolk navigate and optimally use satellite data by showing exact latitude and longitude locations of fishing grounds. The daily updates on weather, wind velocity, water current, temperature, chlorophyll distribution as captured through satellites, and reaches regularly to fishermen2. The Indian National Centre for Ocean Information Services (INCOIS) has also launched a device called GEMINI that uses the application of GAGAN (GPS-aided Geo- augmented Navigation System) to provide timely information and warnings to marine fishermen in the range of as far as 150 kilometers[3].

Navigation of Fishing vessel for fishing

This helped to reduce the cost of fishing by saving, ensured a higher catch, also reduced the loss of lives of fishermen in the deep sea. GPS can be applied to almost all aspects of aquaculture, such as site surveys, river mapping, species studies, water quality monitoring, fish ecology.

1. *Sengupta, A. (2017). Square Mesh Nets Help Fishermen Save Money, Marine Animals. Hindustan Times, April 09, 201*
2. *Jaisinghani, B. (2012). New Technology Directs Fishermen Towards Catch, Time of India, March 12, 2012*
3. *Devraj, R. (2019). Space Tech as Inexpensive as a Smartphone will Now Help Indian Fishermen Navigate Cyclones, Quartz India, October 25, 2019*

11. Skill Development in the Fisheries Sector:

A continuous growth of 5 to 6% over the years in Fisheries sector. A terrible need for skilling in this sector is observed for doubling the production and farmers' income. As this sector is moving from subsistence farming to commercial activities, skilled manpower is unavoidable. Over the past decades, the fisheries and aquaculture industry were practiced traditionally in nature. The last two or three decades have witnessed a lot of scientific and technical developments, giving it the commercial status, particularly in Aquaculture. Even though, the fishing efforts have increased but fish production has remained have remained constant over the years and the situation is same throughout the world. As fish is fast becoming a healthy alternative and a cheap source of protein for many, the need to produce more fish to meet the increasing demand for human consumption has increased. Nonetheless, production from the traditional fishing practices remains the same and therefore the need for the fish production mainly through farming practices called Aquaculture is seen to be increasing.

11.1. Top job roles for skilling in Fisheries and Aquaculture sector

In the changing scenario of fisheries and aquaculture, ASCI has identified 26 job roles in consultation with industry and institutions.

- In Aquaculture, we have job roles such as Aquaculture Technician, Aquaculture Worker, Freshwater Aquaculture Farmer, Hatchery Manager, Hatchery Production worker, Fish seed grower, Brackish water Aquaculture Farmer,
- Shrimp Farmer, Feed Technician, Aquarium Technician, Mariculture Operator, etc.
- In Capture Fisheries, we have job roles like Marine fisherman, Inland fisherman, Fishing Boat Driver, Fishing Boat Deckhand, Fishing Boat Maintenance Worker, Fishing Boat Mechanic and other support services.

We have so far conducted two stakeholders' meetings called Fisheries Skill Advisory Board Meetings; one at Hyderabad and another one in Cochin. We are also adding two more job roles, based on the current industry demand, namely Deep-Sea Fisherman and Seaweed Cultivator. For the 26 job roles, ASCI has prepared the QPs and NOS and we are getting the curriculum approved by NSDC as well as we are in the process of content development. ASCI is also in the process of implementing the RPL (Recognition of Prior Learning) programme in fisheries sector with the support of Central and state governments.

11.2. Institutions capacity building for training programs:

While initiating the skilling programs in fisheries one of the challenges is that unlike in Agriculture and Animal Husbandry, we don't have many training partners in this sector. Traditionally, all fisheries capacity building and extension programs were handled either by the state fisheries' departments or through the eight ICAR institutions, which include, Central Institute of Freshwater Aquaculture, Odisha; Central Inland Fisheries Research Institute at Barrackpore; Central Institute of Brackish water Aquaculture at Chennai; Central Marine Fisheries Research Institute, Cochin; Central Institute of Fisheries Technology (CIFT), Cochin; Central Institute of Fisheries Education in Mumbai, National Bureau of Fish Genetic Resources, Lucknow and Directorate of Cold Water Fisheries, Bhimtal and Fisheries Universities and Colleges under the SAUs.

Central Institute of Fisheries Nautical & Engineering Training (CIFNET) is one of the training Institute which caters to the training requirements of technical and certified personnel to man the ocean going fishing vessels and other fishery establishments. Hence a brief on CIFNET may be included here.

We are in the process of entering into MoUs with ICAR Institutions, State Agricultural and Fisheries Universities to take forward the skill development programs in fisheries sector. Already entered into an MoU with the Tamil Nadu Fisheries University. Since we do not have many private players as training partners, we are in the process of opening up to the NGOs and corporates having presence in fisheries and aquaculture.

11.3. Challenges in skilling in Fisheries industry:

It is a challenge to convert the mindset of the institutions and capacity building providers to bring them to a skill-based training program. As of now, they indulge only in knowledge-based, theoretical learning with minimum focus on skills. Most of the institutions lack quality trainers, infrastructure and environment for long-term skill-based training. We are planning to take help from the industry and private sector for this purpose. We are in the process of identifying potential training partners, training the trainers, master trainers, curriculum and content development, etc. to speed up skilling programmes in fisheries sector to meet the skilled manpower requirement.

11.4. Entrepreneurship opportunities in the Fisheries Sector:

Largescale Shrimp farms (Brakishwater)

Harvested shrimp from farm

There are lot of entrepreneurship opportunities in the emerging Aquaculture sector, though in initial stages. However, entrepreneurship development requires a push from the government and other institutions and it is encouraging to see some incubation centres coming up in this sector since the last five years. Though there is provision for technical support from the industry, we need financial support to sustain incubation of start-ups and help them accelerate and grow. When it comes to handling risks in this sector, if the business becomes sustainable, the risks get mitigated. Unlike what happened to Shrimp Farming in the 1990s with the occurrence of diseases, leading a setback to investments, inland aquaculture has remained sustainable over many decades. Nevertheless, they need insurance coverage since they are prone to losses during natural calamities like floods and cyclones.

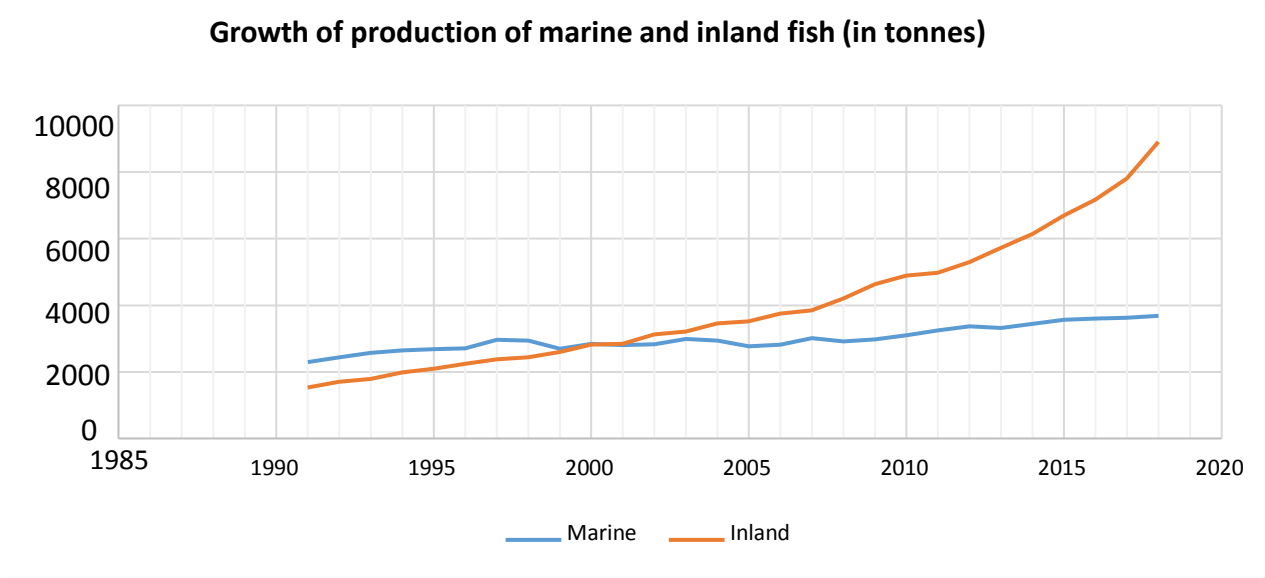
Fish market managed by Women folk

11.5. Skilling as a catalyst for Blue Revolution:

The major aim for skill development in agriculture and allied sectors is to double the farmers' income by doubling the production. In fisheries sector, Government of India has implemented the Blue Revolution Scheme, a flagship programme to increase the fish production to 15 MMT by 2020., out of India's production of 10 million metric tonnes, marine fisheries produce around 3 to 4 million metric tonnes. So, doubling the production is not possible through marine fisheries sector alone. It is here that Aquaculture can be potentially used to increase fish production. We have to sustain the livelihood of the fishermen and also maintain the targeted production. For this we need huge infrastructure and skilled workforce.

12. Future projections of growth in fisheries output:

In India, a steep rise in the production of inland fish has been observed in the last two decades. Annual production of inland fish has increased from around 1.5 million tonnes to 8.9 million tonnes between 1990-91 and 2017-18. The marine fish sector, however, has remained stagnant or shown a timid growth rate over the same period with the production of fish increasing from 2.3 million tonnes in 1990 to 3.7 million tonnes in 2017-18.



Source: *Handbook of Fisheries Statistics 2017-18*

Looking at the growth rates at different phases, we can see inland fisheries have grown at a rate of 6 percent per annum between 1991 and 2018. But its performance has substantially improved after 2011- from 5.7 percent during 2001-2010 to 8.1 percent during 2011-18.

As against this, the production of marine fisheries has grown at a rate of 1.37 percent between 2011 and 2018. Its growth rate between 2011 and 2018 at 1.82 percent, although improved from the previous decade, but still lower than the growth rate achieved during 1991- 2000 (2.20 percent).

Table 3 Growth rate of production of marine and inland fisheries:

Period	Marine	Inland
1991- 2000	2.20 (0.005) [4.37]	6.40 (0.003) [23.9]
2001-2010	0.74 (0.003) [2.20]	5.68 (0.003) [19.6]
2011-2018	1.82 (0.002) [9.32]	8.06 (0.003) [25.25]
All	1.37 (0.001) [13.07]	5.91 (0.0009) [63.00]

Source: *Calculated from Handbook of Fisheries Statistics, 2017-18*

Looking at the State level figures, among major fish producing States, Andhra Pradesh has the highest growth rate between 2001 and 2018 (9.77 percent). The growth rate of fish production in the State has been faster between 2011 and 2018. Among other major fish producing States, however, except for Goa and Tripura, the growth rate has declined in Tamil Nadu, Gujarat, West Bengal, Kerala, and Odisha between 2011 and 2018. Kerala has witnessed a negative growth rate between 2011 and 2018. In northeast States as well, significant improvement in the growth of fish production has been experienced in the second decade of the century i.e. between 2011-18. On the other hand, there has been an impressive growth rate of production in some of the non-traditional fish producing States. Significant among them are Chhattisgarh (10.8 percent), Haryana (10.11 percent), Rajasthan (8.46 percent), Sikkim (8.26 percent).

Table 4 ***Growth rate of export of marine fisheries***

Period	Quantity	Value
1991- 2000	22.7 (0.084) [2.71]	19.1 (0.024) [8.00]
2001-2010	5.07 (0.009) [5.70]	4.92 (0.009) [5.57]
2011-2018	6.18 (0.012) [5.27]	17.1 (0.021) [8.11]
All	8.72 (0.012) [7.45]	11.8 (0.006) [19.30]

Source: *Calculated from Handbook of Fisheries Statistics, 2017-18*

Table 5 ***Projected fish production in 2023-24 and 2027-28 (in 000 tonnes)***

Type	2023-24	2027-28
Inland fish	8489.08	9411.31
Marine fish	3802.95	3968.42
Total	12292.04	13379.74

Source: *Calculated from Handbook of Fisheries Statistics. Note: All coefficients are significant at 1% level*

The projected figures for fish production in 2023-24 and 2027-28 at the State level are shown in the following Table. It can be seen that fish production in Andhra Pradesh would exceed 4 million tonnes and 2 million tonnes in West Bengal by 2027-28. If the present momentum is maintained, then Uttar Pradesh, Bihar, Karnataka, Gujarat will become a major producer of fish.

Table 6 ***Growth rate of fish production (marine+ inland) across States***

States	2001-2010	2011-2018	All
Andhra Pradesh*	7.40	13.40	9.77
Arunachal Pradesh	1.10	5.64	1.49
Assam	3.23	5.37	4.27
Bihar	3.18	8.90	5.24
Chhattisgarh	11.18	9.37	10.83
Goa	-0.23	5.33	2.79
Gujarat	1.32	0.07	1.10
Haryana	12.25	7.72	10.11
Himachal Pradesh	1.31	8.92	3.77
Jammu & Kashmir	0.18	0.59	0.57
Jharkhand	**1.59**	**0.11**	**7.55**
Karnataka	3.51	1,74	5.99
Kerala	0.36	-2.25	-0.18
Madhya Pradesh	4.90	12.6	6.44
Maharashtra	0.57	0.93	0.97
Manipur	2.00	7.31	4.59
Meghalaya	-3.87	16.13	3.86
Mizoram	0.98	15.36	5.44
Nagaland	1.83	4.72	3.35
Odisha	7.46		4.68
Punjab	7.03	5.52	4.68
Rajasthan	7.45	4.99	8.46
Sikkim	2.81	8.55	8.26
Tamil Nadu	2.21	2.01	2.68
Tripura	4.41	6.23	7.79
Uttarakhand	-0.73	2.67	0.15
Uttar Pradesh	6.41	6.07	6.20
West Bengal	4.29	2.87	2.86
Andaman & Nicobar Islands	1.05	2.01	2.84
Chandigarh	17.96	-29.28	5.27
Daman & Diu	1.15	6.43	3.17
Lakshadweep	1.47	7.75	3.37
Puducherry	-1.65	3.55	1.30

Source: *Calculated from Handbook of Fisheries Statistics.*

Note: *All coefficients are significant at 1% level. *Includes Telangana*

We have calculated the projected production of inland and marine fisheries in 2023-24 and 2027-28. For this purpose, we have extrapolated the simple growth rate of these two sectors between 1991 and 2018 up to these two years i.e. 2023-24 and 2027-28. The results are shown in the following Figures. It is expected that the production of inland fish would reach 8.5 million tonnes in 2023-24 and to 9.4 million tonnes in 2017-28 from the present 8.9 million tonnes in 2017-18. On the other hand, the production of marine fish would expand to 3.8 million tonnes in 2023-24 and further to 3.9 million tonnes in 2027-28 from the current level of 3.7 million tonnes in 2017-18.

Table 7 Projected fish production state-wise (in 000 tonnes)

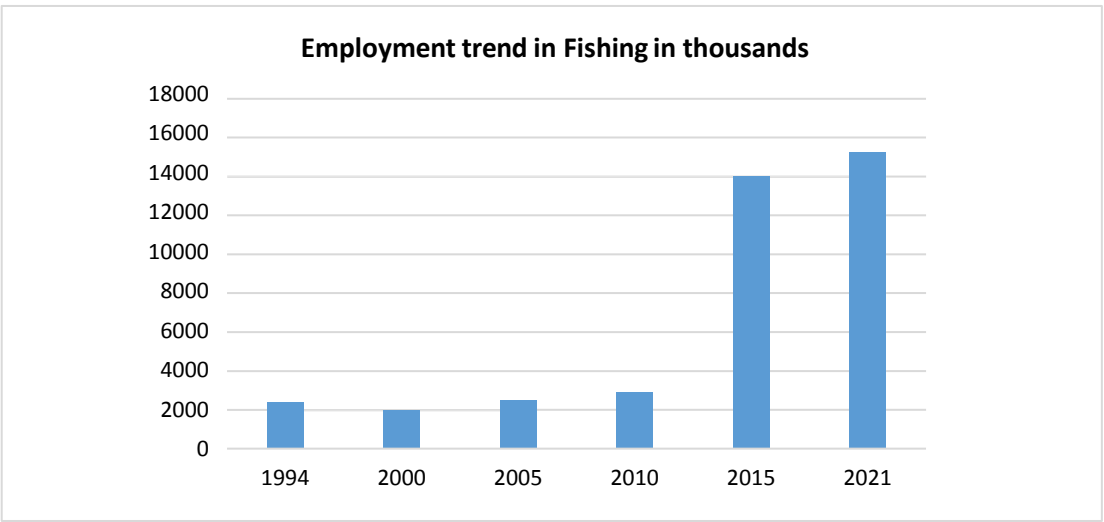
State	2023-24	2027-28
Andhra Pradesh	3722.01	4326
Arunachal Pradesh	4.04	4.34
Assam	364.07	402.8
Bihar	625.09	701.25
Chhattisgarh	503.46	585.31
Goa	129.52	139.72
Gujarat	865.4	886.26
Haryana	199.98	231.65
Himachal Pradesh	13.71	15.11
Jammu & Kashmir	21.02	21.46
Jharkhand	171.07	195.41
Karnataka	773.18	870.84
Kerala	659.24	655.59
Madhya Pradesh	153.29	174.19
Maharashtra	652.65	674.89
Manipur	37.76	42.04
Meghalaya	10.57	11.79
Mizoram	8.38	9.47
Nagaland	9.84	10.74
Odisha	675.04	752.42
Punjab	155.73	172.63
Rajasthan	66.32	76.06
Sikkim	0.12	0.11
Tamil Nadu	793.42	854.67
Tripura	93.13	106.59
Uttarakhand	3.28	3.09
Uttar Pradesh	721.44	814.72
West Bengal	1985.89	2143.82
Andaman & Nicobar Islands	44.44	47.85
Chandigarh	0.04	0.02
Daman & Diu	27.74	30.15
Lakshadweep	20.29	22.2
Puducherry	50.35	52.46

Source: *Calculated from Handbook of Fisheries Statistics. Note: All coefficients are significant at 1% level*

Despite the decline in the production of marine fisheries, there has been a spurt in the export of marine products which has grown at the rate of 17.1 percent per annum in terms of value and 6.18 percent in terms of quantity between 2011 and 2018.

13. Employment and Availability of Skilled Labour in the Fisheries Sector:

The fisheries sector has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries and is a source of cheap and nutritious food, at the same time it is an instrument of livelihood for a large section of economically backward population of the country. Both direct and indirect employment in entire fisheries sector in India is likely to reach 15.25 million in 2021-2022 from an estimated 14 million in 2014-15. Below is the employment trend in fishery sector.



Source: *ILO*

According to the CMFRI Census 2010, there are 3,477 marine fishing villages and 1,547 marine fish landing centres in 9 maritime states and 2 union territories. The total marine fisher folk population was about 4 million comprising in 893258 families. Nearly 61% of the fishermen families were under BPL category. The average family size was 4.63 and the overall sex ratio was 928 females per 1000 males. About 38% marine fisher folk were engaged in active fishing with 85% of them having full time engagement. About 63.6% of the fisher folk were engaged in fishing and allied activities. Nearly 57% of the fisher folk engaged in fish seed collection were females and 43% were male.

It is true that in wake of globalization, liberation & privatization, flow of technologies has increased. Fisheries & allied sectors are also transforming into industry at a faster pace. Therefore, there is demand for knowledgeable and skilled human resource for the development of standard products & services in the sector. Presently skilled workforce to undertake these operations is developed on-the-job by the industries & farms involved in fisheries related enterprises. The skilled workforce/ human resource need to be prepared through Vocational Education & Training system. To sustain fisheries in the new millennium, the quality, technical skills and management of fisheries manpower in the country will have to improve in consonance with the rapidly changing needs of our society. Human resources development (HRD) for raising a cadre of experts at various levels to support research and vindicate a sustained development of the fishery sector is critically important.

13.1. Status of Human Resource at Present:

Table 8 Status of Fishing Farmer Development Agencies

Total no of Fishing Farmer Development Agencies	Total Water Area Covered In Hectare	Total no of Fish Farmer Trained	Total no of Beneficiaries
429	832161	959843	1422237

Source: *State govt and UTs. (2010)*

Table 9 Status of State Federations

Total no of State Federation	Total no of Central Societies	Total no of Primary Societies	Total no of Membership
28	167	21741	3353115

Source: *FISHCOPFED 2010-11*

13.2. Fish Processing:

Value addition to fish

Domestic Fish market

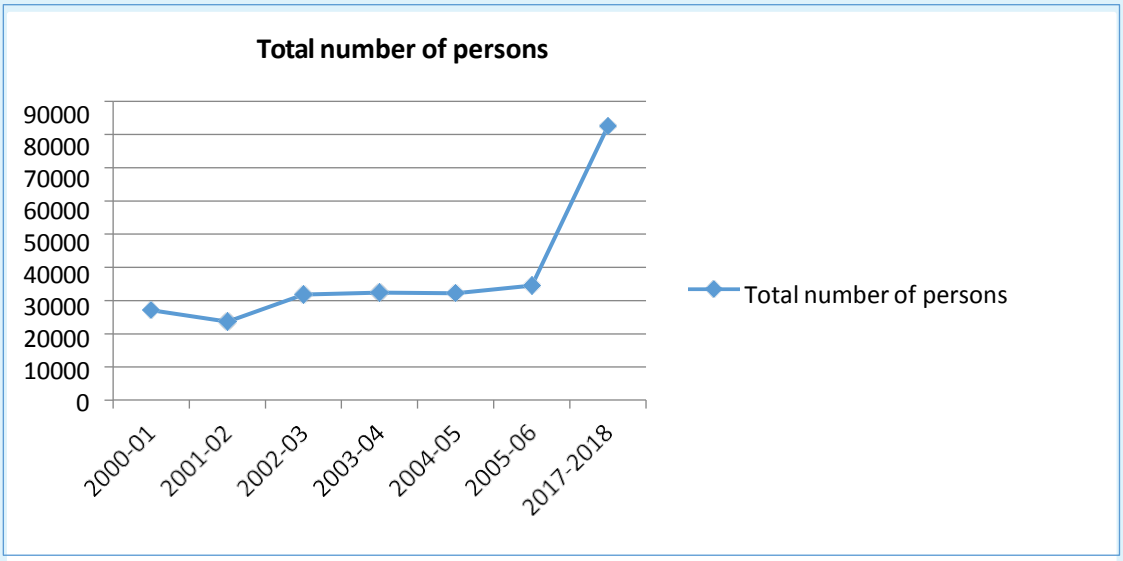
There are 551 processing plants with an installed capacity of 27813.81 MT, of which 313 plants are EU approved plants. Besides, there is a total storage capacity of 366315 MT, which included cold storage, chilled storage, dry fish storage and other storage

Table 10 Status of Fish Processing in India

Year	No of working Factories	Total number of persons	Average no of persons
2000-01	260	27065	104
2001-02	256	23649	92
2002-03	264	31844	121
2003-04	281	32426	115
2004-05	283	32240	114
2005-06	318	34496	108
2017-2018	551	82650	150

Source: *Annual surveys of industries (CSO)*

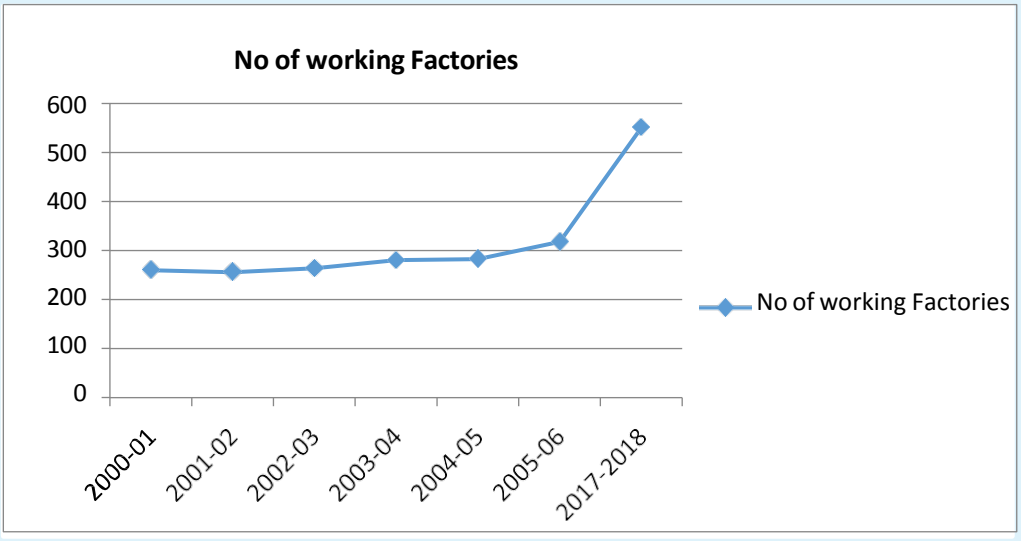
Fish vending on Two wheeler with icebox



Source: *Establishment Survey IAMR*

Mobile retail fish Marketing-Tamil Nadu

Hygienic fish market



Source: *Establishment Survey IAMR*

13.3. Area of employment:

- Fish Breeder
- Fisheries Biologist
- Hatchery manager
- Fisheries technician
- Chemist
- Fishery Observer
- Fisheries Extension Officer (AEO)
- Aquaculture engineer
- Instrument technician
- Fisheries Officer
- District Fisheries Development Officer (DFDO)
- Engine/Motor/Electrical technician
- Hatchery technician
- Farm technician
- Fishery Manager
- Feed Technician
- Water system technician
- Gear/Harvesting Technician
- Skilled farmers
- Assistant Fisheries Development Officer (AFDO)

13.4. Sectors for employment:

Many career options exist in this field in both public and private sectors in aquaculture to sea farming of fish, shellfish and marine organisms. Career for fisheries and aquaculture graduates are available with a variety of employers, which includes state and central government agencies, academic institutions and fish farms. Government agencies and industry organizations recruit positions like aquaculture farmer, shellfish culturist, hatchery technician, biological science technician, fish research assistant etc. In State Governments, job opportunities exist in fisheries department for fisheries graduate for the post of Assistant Fisheries Development Officer (AFDO)/ Fisheries Extension Officer (FEO) and District Fisheries Development Officer. Career opportunities also exist for high school diploma holders in aquaculture farming. However, an increasing number of employers in this industry prefer job candidates with some post secondary education. Certain aquaculture careers even require a graduate-level education and higher degree programs for research and teaching at many colleges and universities.

In foreign countries associate's and bachelor's degrees in fisheries or aquaculture provide the skills and knowledge needed to pursue a variety of aquaculture careers. Apart from scope for higher education in fisheries in countries such as USA, Canada, Australia, Japan, China and European countries, there are demands for fisheries professionals in the aquaculture and processing sectors in Gulf and African countries also. There are number of fisheries graduates doing business in foreign countries in field of aquaculture, export & import. The fisheries graduates and higher qualified personnel gets good job opportunities with attractive salary and perks. The government sectors offer a pay which is less compared to the private sector, but is stable. In private sector, a post graduate in fisheries sciences has lots of opportunities to work as Quality Control Officer, Fish Processor, Aqua culturist, Farm Assistant/ Manager etc. The pay varies according to the type of job and specialization of the candidate.

This section discusses trends in employment in the fisheries sector and availability of skilled labour. State-wise employment scenario is presented in the following Table 9. We have also presented State-wise availability of skilled (VET qualified) workers in the same Table 9. The PLFS 2017-18 under-estimates the total population of the country by nearly 20 percent. Hence, NSO estimates were multiplied by 1.24 to arrive at the number of fishermen in 15-59 years of age. At the all India level 10.2 lakh workers have taken-up fisheries as their principal or subsidiary activity. It is clear from the Table that few States- West Bengal, Odisha, Maharashtra, Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu account for the major chunk of employment in the fisheries sector. Together these States cover nearly 87 percent of the employment in the fisheries sector.

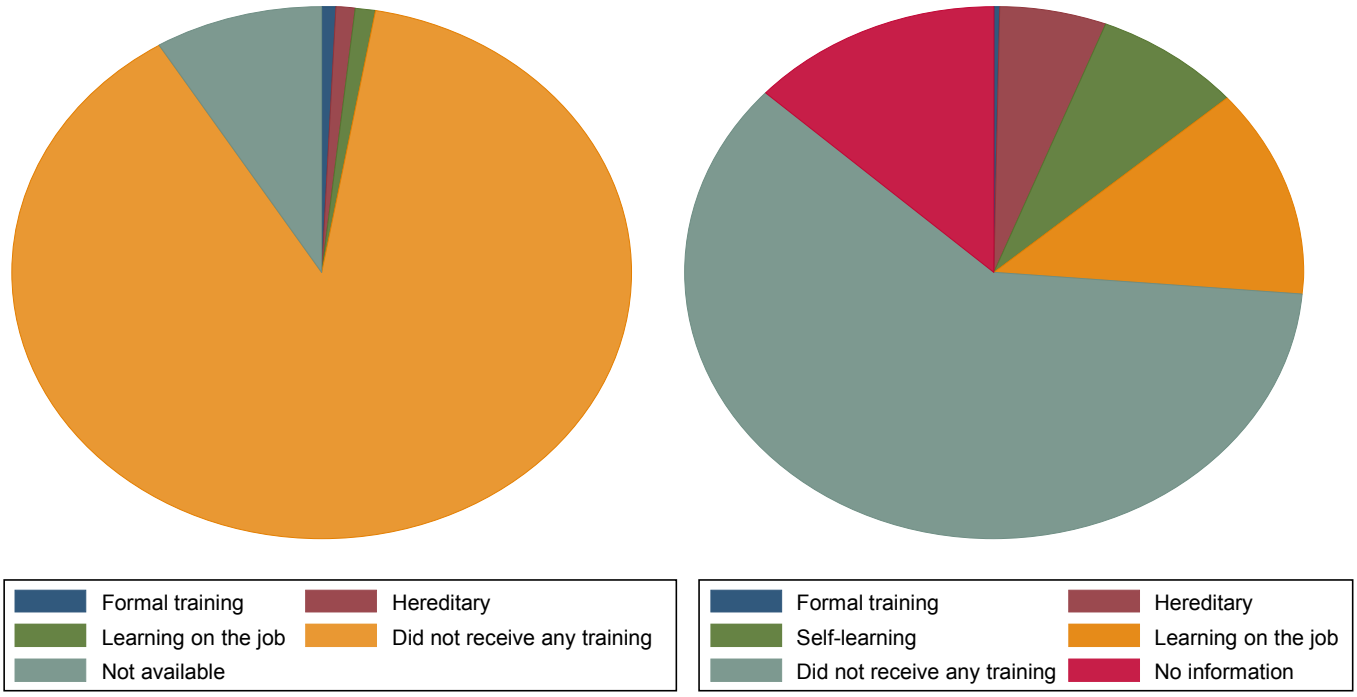
Availability of skilled labour in the fisheries sector in extremely concentrated in the country. The highest number of skilled fishermen is available in West Bengal. Interestingly, although Uttar Pradesh is not a major fish producing State, as per NSO data a large proportion of fisheries workers in the State has received Vocational Education and Training. As against this, in three major fish producing States of Kerala, Karnataka, and Maharashtra the availability of skilled workers in fisheries in nil or negligible.

Table 11 State-wise number of workers in fishing and aquaculture and availability of skilled workers (ps+ ss), 15-59 years

States	Total Workers	Skilled workers (formal+ informal VET)
Jammu & Kashmir	2839	0
Himachal Pradesh	872	873
Uttar Pradesh	45860	35127
Bihar	11316	0
Manipur	4806	1541
Tripura	1574	0
Assam	2121	0
West Bengal	200603	104657
Jharkhand	740	0
Odisha	59436	0
Chhattisgarh	28216	1559
Gujarat	1254	0
Daman & Diu	1283	825
D & N Haveli	3487	3486
Maharashtra	114727	0
Andhra Pradesh	154990	4466
Karnataka	83908	0
Goa	307	0
Lakshadweep	2226	0
Kerala	149605	0
Tamil Nadu	129039	4900
Puducherry	15971	0
A & N Island	4227	355
Telangana	2046	0
All India	1021459	157790

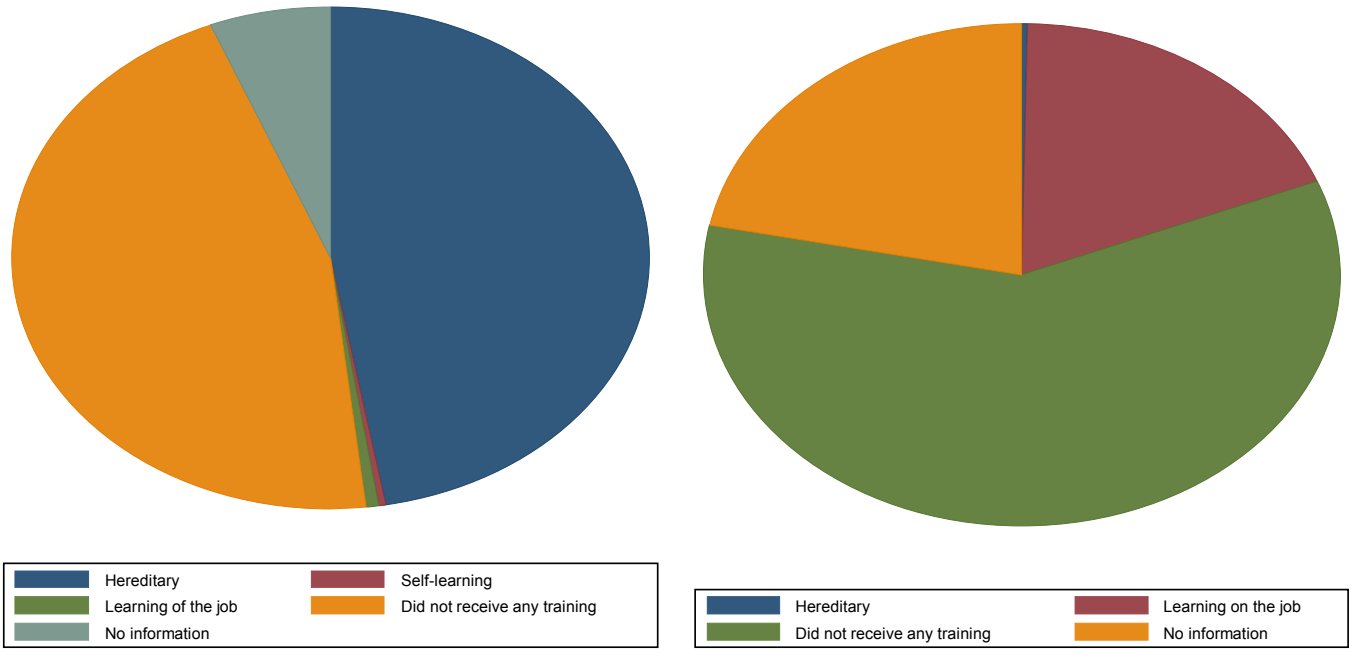
Source: *PLFS 2017-18*

NSO data provides break-up of skilled workers based on whether they have received formal or informal vocational education and training (VET). Informal VET is further divided into hereditary, learning on job, self-learning, and others. Following Figures show distribution of workers in the fisheries sector by their access to vocational education and training (VET). It can be seen that a very less proportion of the fishermen have received formal vocational education or training.



Source: *PLFS 2017-18*

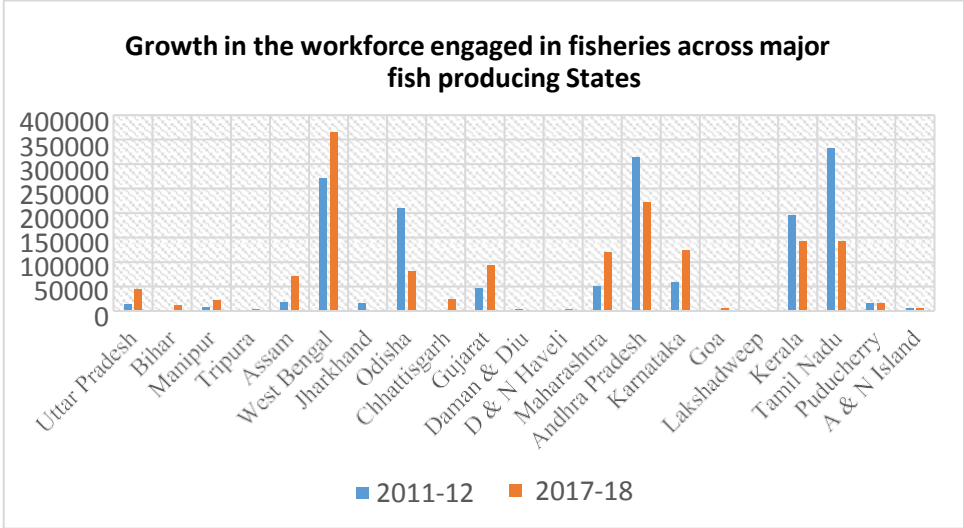
Figure Distribution of workers engaged in fisheries by skill training- Left panel: Marine Fisheries, Right panel: Fresh water fisheries



Source: *PLFS 2017-18*

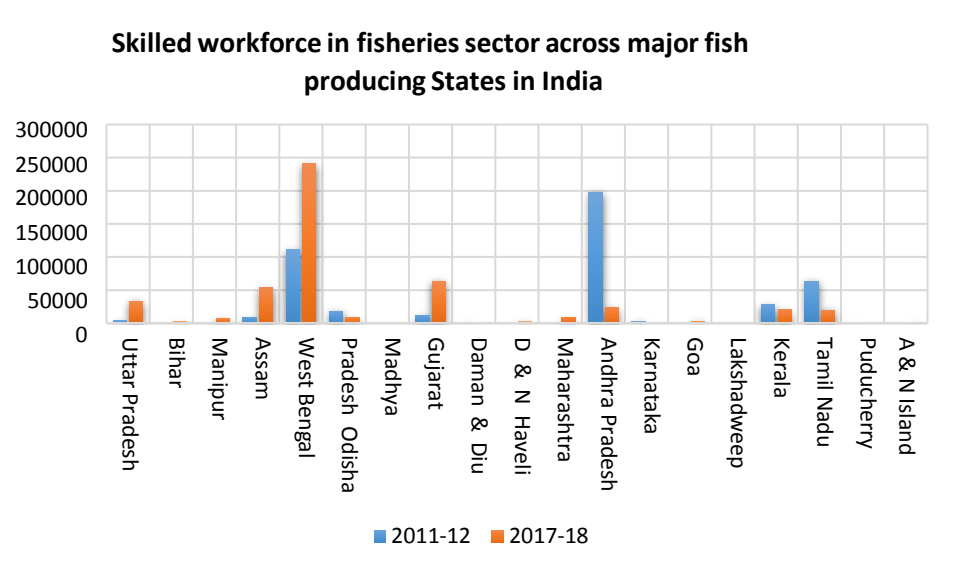
13.5. Changes in employment over time:

The following figure shows the total number of workers engaged in the fisheries sector across major fish producing States in 2011-12 and 2017-18 considering the principal status only. It can be seen that except for a few States the number of workers in the fisheries sector has declined everywhere. A major contraction in the number of workers has taken place in Odisha, Andhra Pradesh (includes Telangana), Kerala, and Tamil Nadu. The exception to this trend is West Bengal, Gujarat, and Goa.



Source: *Calculated from micro-level data of EUS 2011-12 and PLFS 2017-18*

Besides contraction in the number of total workers engaged in the fisheries sector, there has also been a steep decline in the number of skilled workers in many States. Important among them are the coastal States of Kerala, Tamil Nadu, Odisha, and Andhra Pradesh. Major exceptions are again Gujarat, Assam, and West Bengal.



Source: *Calculated from micro-level data of EUS 2011-12 and PLFS 2017-18*

Data from the Marine Fisheries Census conducted by the Central Marine Fisheries Research Institute (CMFRI) and Fishery Survey of India in every five years' shows the fisher folk population is higher in Tamil Nadu, Andhra Pradesh and Orissa where as the lowest is in Goa, Daman & Diu and Lakshadweep. The fishing villages and fish landing centres has been increased from 3422 and 1511 from the CMFRI census 2010 to 3477 and 1577 from the CMFRI census 2016, and proportionately the fishermen families and the fishermen folk population has also been increased from the past. The traditional fishermen are mostly from the higher populated states of fishermen are mostly belonging to the Below poverty line (BPL) which is around 65% of the traditional population and except for Goa and Gujarat number of workers engaged in marine fisheries has declined between 2010 and 2016. This decline in the population of marine fishermen is commensurate with the slow growth rate of production in the marine fisheries sector.

Among all the coastal States of India Goa has the highest growth rate of production of marine fish and fishermen population.

Table 12 State-wise population (total household members including dependants) of marine fisheries

State	2010	2016	Growth rate
Andhra Pradesh	605428	514735	-15
Goa	10545	12651	20
Gujarat	336181	354992	5.6
Kerala	610165	563903	-7.6
Maharashtra	386259	364899	-5.5
Odisha	605514	517623	-14.5
Tamil Nadu	802912	795708	-0.9
West Bengal	380138	368816	-3
Andaman & Nicobar	NA	26521	-
Daman-Diu	40016	15836	-60.2
Lakshadweep	NA	27934	-
Puducherry	54627	50270	-7.98
All India	3999214	3774577	-5.62

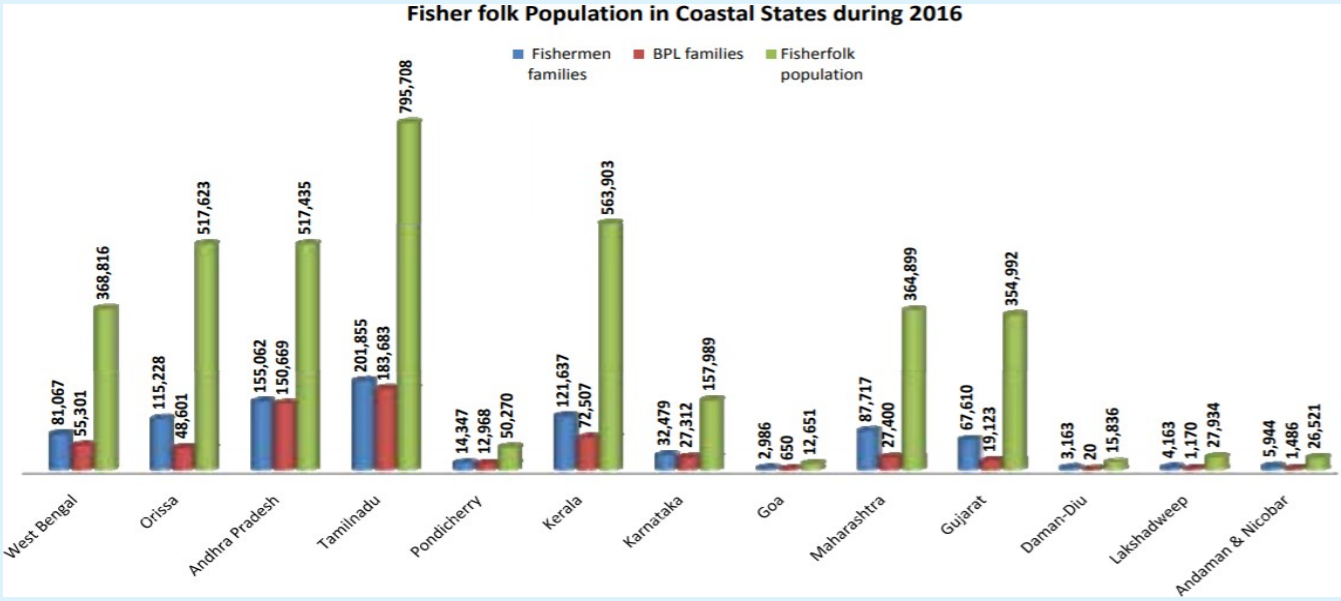
Source: *Marine Fisheries Census 2010 and 2016, CMFRI*

Marine fisheries is recognized as a sunrise sector and the prospects of foreign exchange earnings and employability is attracting more and more people into active fishing and allied sectors. The marine fisheries census of CMFRI has estimated coastal population and manpower employed in active fishing and related sectors from time to time.

Table 13 State-wise statistics of Marine Fisherman

S. No.	District	Coastal length (km)	Landing centres	Fishing villages	Fisherman families	Traditional fisherman families	BPL families	Fisherfolk population
1	Andaman & Nicobar	1912	51	169	5944	4486	1486	26521
2	Andhra Pradesh	974	350	533	155062	155062	150669	517435
3	Daman & Diu	27	12	12	3163	3094	20	15836
4	Goa	104	34	41	2986	2922	650	12651
5	Gujarat	1600	107	280	67610	64395	19123	354992
6	Karnataka	300	115	162	32479	30897	27312	157989
7	Kerala	590	204	220	121637	116598	72507	563903
8	Lakshadweep	132	20	10	4163	3003	1170	27934
9	Maharashtra	720	173	526	87717	80906	27400	364899
10	Orissa	480	73	739	115228	92569	48601	517623
11	Pondicherry	45	41	39	14347	14328	12968	50270
12	Tamil Nadu	1076	301	575	201855	196784	183683	795708
13	West Bengal	158	66	171	81067	56447	55301	368816
Total		8118	1547	3477	893258	818491	600890	3774577

Source: *Marine fisheries census (2016)*



Source: *Marine fisheries census (2016)*

Human resource utilization in marine fisheries covers not only the coastal fisher folk but also the adjacent and sometimes distant residents also. On an average, 5 kg of marine fish produced gives employment to one in harvesting and 1.2 persons in post-harvest sector. (Source: CMFRI). The sectoral distribution of employment pattern of active fishers over the years is presented in below table. There is a clear shift of employment pattern towards mechanized and motorized sectors. Marine fisheries sector also provides employment to nearly 32 lakh people in fishing and allied activities.

The decline in the population of marine fishermen as reported in the Marine Fisheries Census in the years 2010 and 2016 has been corroborated by National Statistical Office (NSO). In the following Table, we present the combined number of workers in both marine and inland sub- sectors engaged in different occupations in 2011-12 and 2017-18. Between these two years, there was a 26.17 percent decline in the number of fishery workers. On the other hand, the number of subsistence fishery workers has increased manifold during the same period. This implies that a significantly large number of fisheries workers has fallen to subsistence level between 2011-12 and 2017-18.

Table 14 ***No. of workers engaged in different occupations in the fisheries sector, up to 3-digit level, NCO 2004 (principal status only)***

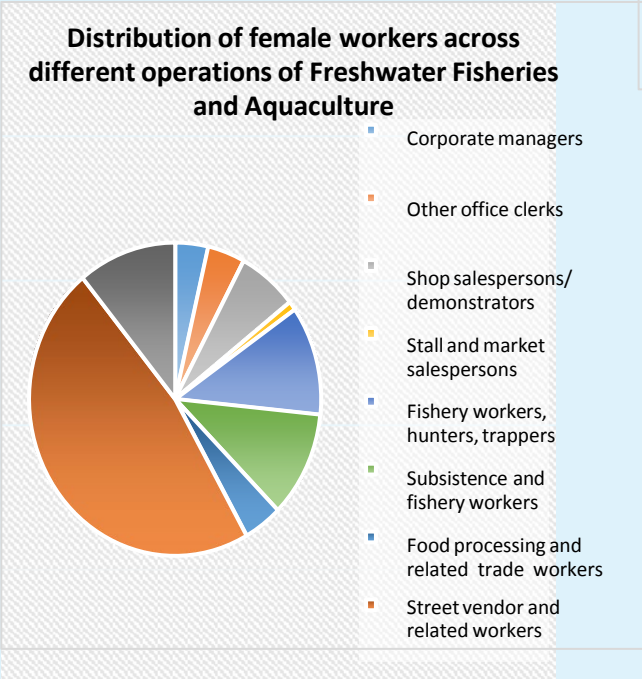
Occupations (3 digit NCO 2004)	Description	2011-12	2017-18	Growth rate
112	Administrative and Executive Officers	NA	1012	-
121	Directors and chief executives	50175	42641	-15.02
214	Architects, engineers, and related professionals	NA	4112	-
221	Life science professionals	NA	9445	-
241	Business professionals	5884	8481	44.13
311	Physical engineering service and technicians	NA	2867	-
314	Ship and Aircraft Controllers and technicians	4842	NA	-
342	Business services agents and trade brokers	NA	2803	-
419	Other office clerks	2456	8452	244.14
522	Shop salespersons and demonstrators	NA	4042	-
523	Stall and market salespersons	NA	8906	-
612	Market-oriented animal producers and related workers	NA	3516	-
615	Fishery workers	1067978	788438	-26.17
620	Subsistence fishery workers	9265	76798	728.9
832	Motor vehicle drivers	NA	6068	-
834	Ship deck crew and related workers	948	1198	26.37
911	Street vendor and related workers	NA	24331	-
920	Fishery related labourers	205035	145381	-29.09
933	Transport labourers and freight handlers	NA	3625	-

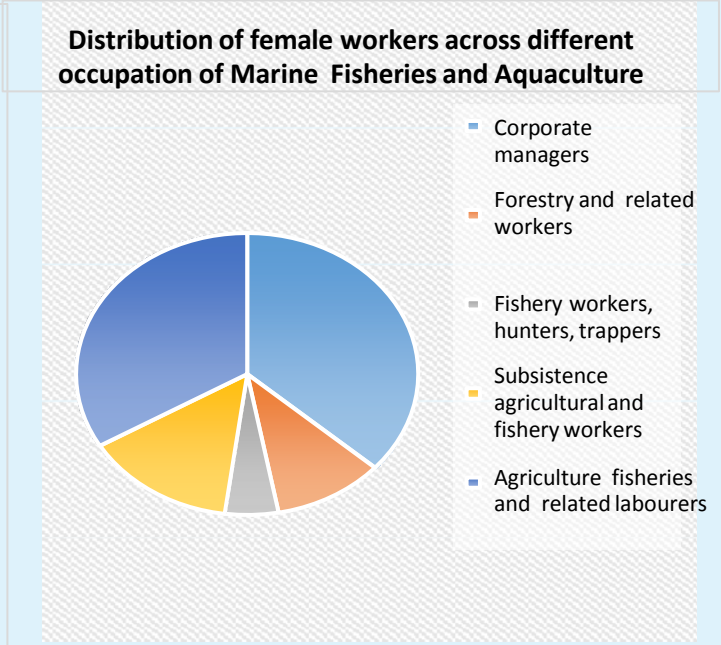
Source: *EUS 2011-12 & PLFS 2017-18*

Employment and skill gap among female workers:

The participation of females in the fisheries sector as the principal worker is much less than males. Female engagement in agriculture is mostly limited to a few occupations. In the case of freshwater fisheries and aquaculture nearly half (47 percent) of the female workers work as street vendors and related workers. If we consider all the women who are engaged in sales and commerce activities in fisheries (shop salespersons/ demonstrators, stall and market salespersons, a street vendor, and related workers) there are more than 55 percent of females who have engaged in these occupations altogether in freshwater fisheries and aquaculture.

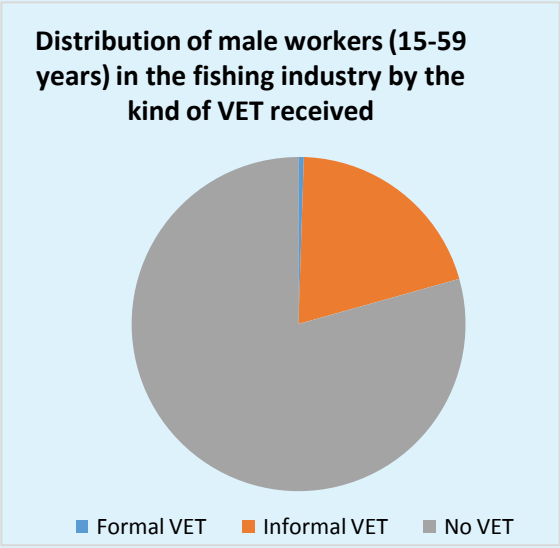
The participation of women in marine fisheries and aquaculture as principal workers is even less than their participation in freshwater fisheries and aquaculture. Quite a high proportion of women are working as corporate managers (36 percent). The next important occupation in terms of high female participation is labourers (33 percent). As compared to that, their engagement is significantly less in occupations such as fisheries workers (5 percent) or subsistence workers in fisheries (14 percent). Interestingly, the survey (PLFS 2017-18) did not find any females who are engaged in commerce or selling activities of marine fisheries.

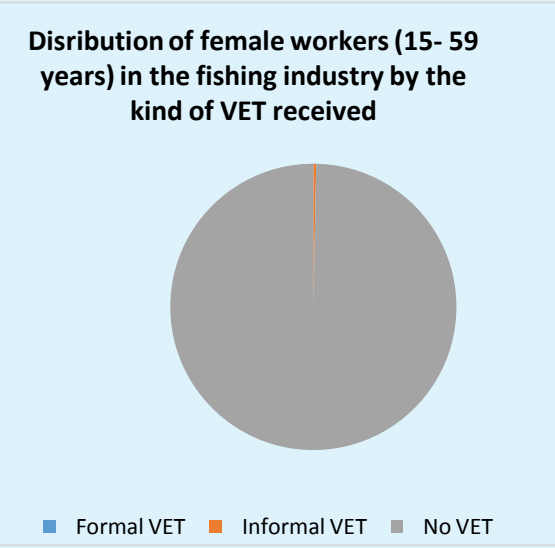




Source: *ASCI calculation from unit level data of PLFS 2017-18*

Along with low participation as a principal activity, access to formal skill development training is almost nil for women. Opportunities for skill training is low for both males and females alike, but while few male fisheries workers have received formal or informal VET, no women working in the fisheries sector was found to hold a formal VET degree.





Source: *ASCI calculation from unit-level data of PLFS 2017-18*

Employment in fish processing sector:

Next, we look at the employment of labour in fish processing sector, especially in the registered manufacturing sector. It can be seen that most employment opportunities have been created in two industries- processing and preserving of fish crustacean and similar foods which employs around 24 thousand workers in 2014-15 and processing and canning of fishmeal for human consumption or animal feed.

Table 15 Total employment in different fish processing industries

Industry	2010-11	2011-12	2012-13	2013-14	2014-15
Sun drying of fish	292	0	0	0	0
Artificial dehydration of fish and seafood	0	186	6	108	124
Radiation preservation of fish and similar food	308	16	18	388	0
Processing and preserving of fish crustacean and similar foods	14188	19631	12405	19886	23789
Processing and canning of fish	18093	17219	20991	20717	17511
Production of fishmeal for human consumption or animal feed	220	1053	1157	366	251
Production, processing, and preservation of other fish products n. e. c	4692	3975	2195	2712	2001
Building of fishing boats and fish processing factory vessels	48	414	126	106	99
Total	37841	42494	36898	44283	43775

Source: *Annual Survey of industries, various years*

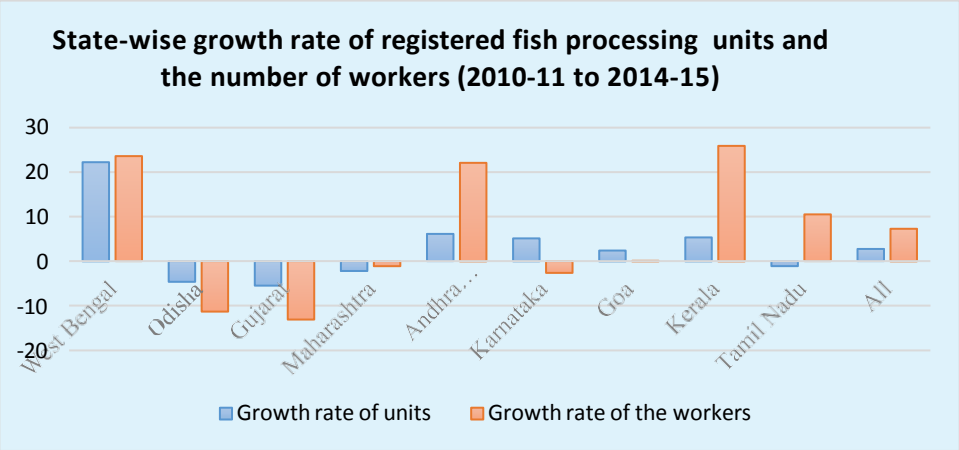
If we look at the State-level figures, it can be seed that registered fish processing units have flourished most in the southern States of Andhra Pradesh and Kerala. In both these States there has been a large expansion of the labour force in registered fish processing units. In Andhra Pradesh fish processing workers has increased from 6726 in 2010 to 18241 in 2014-15. In Kerala, it has increased from 3629 in 2010-11 to 11488 in 2014-15. However, the fish processing sector has seen a downturn in two western States of Gujarat and Maharashtra where the number of registered fish processing units and the workers involved has declined during this time period.

Table 16 State-wise distribution of registered fish processing units and number of workers

State	2010-11		2011-12		2012-13		2013-14		2014-15	
	Unit	Number employed	Unit	Number employed	Unit	Number employed	Unit	Number employed	Unit	Number employed
West Bengal	11	849	23	1127	24	1077	31	1196	30	2451
Odisha	19	2439	11	338	18	839	14	977	15	1337
Gujarat	45	11585	29	6541	45	5294	32	5437	34	5756
Dadra & Nagar Haveli	0	0	0	0	1	10	1	8	1	4
Maharashtra	38	6257	34	6092	48	6224	43	5940	34	5913
Andhra Pradesh	43	6726	52	12720	52	9817	77	14851	58	18241
Karnataka	28	1721	32	2182	39	3132	34	1350	36	1507
Goa	8	579	7	357	7	384	8	532	9	583
Kerala	97	3629	107	7699	105	7022	111	8097	126	11488
Tamil Nadu	55	3652	45	5252	48	2953	43	5835	52	6026
All	344	37437	340	42308	387	36752	394	44223	395	53306

Source: *Annual Survey of industries, various years*

The graphical representation of data is shown in the following Figure. The States with positive growth rates in the employment between 2011-12 and 2014-15 are Andhra Pradesh (22), Kerala (26 percent), Tamil Nadu (11 percent), and West Bengal (24 percent). However, during the same period some major fish producing States like Gujarat (-13 percent), Odisha (-11 percent), and Karnataka (-3 percent) have seen a decline in employment. The number of fish processing units have increased in all States except Odisha, Gujarat, Maharashtra, and Tamil Nadu.



Source: *Annual Survey of industries, various years*

14. Projections for Requirement of Future Manpower

In this section we have made a projection for future manpower requirement in the fisheries sector has been made. The assumptions behind the estimates are given the appendix Table 1A. It can be seen from Table 14 that there will be expansion of employment against all job roles, but highest expansion will take place in case of aquaculture worker and aquaculture technician.

Table 17 Projections for future requirement of skilled labour in different occupations in fisheries

Job roles	2020-21	2021-22	2022-23	2023-24	2024-25
Fish seed farm worker	494480	603266	735984	897901	1095439
Fish seed grower	29344	35800	43676	53284	65007
Hatchery Manager	3017	3228	3454	3696	3955
Hatchery Supervisor	6034	6456	6908	7392	7909
Hatchery Production Worker	18102	19369	20725	22176	23728
Freshwater Aquaculture Farmer	3030926	3697730	4511230	5503701	6714515
Shrimp Farmer	103550	109763	116349	123330	130729
Brackishwater Aquaculture Farmer	1704	2028	2413	2872	3417
Crab Fattening Farmer	5945	6183	6430	6687	6955
Aquaculture Technician	62683	75846	91774	111047	134367
Aquaculture worker	1255661	1519350	1838413	2224480	2691621
Aquatic Animal Health Lab Assistant	12555	19711	30947	48587	76281
Mariculture Operator	3213	3277	3343	3410	3478
Feed Technician	5749	6899	8279	9934	11921
Fishing Boat Deckhand	10160	12192	14630	17556	21068
Fishing Boat Driver	2032	2438	2926	3511	4214
Fishing Boat Maintenance Worker	63489	63743	63998	64254	64511
Fishing Boat Mechanic	1785	2053	2361	2715	3122
Fishing Boat Equipment Technician	775	1039	1392	1865	2499
Fish Farm/ Aquaculture Manager	12537	15170	18355	22210	26874
Fisheries Extension Associate	11128	16915	25710	39079	59401

Source: *Calculations based on inputs received from Ministry of Agriculture and Farmers' Welfare*

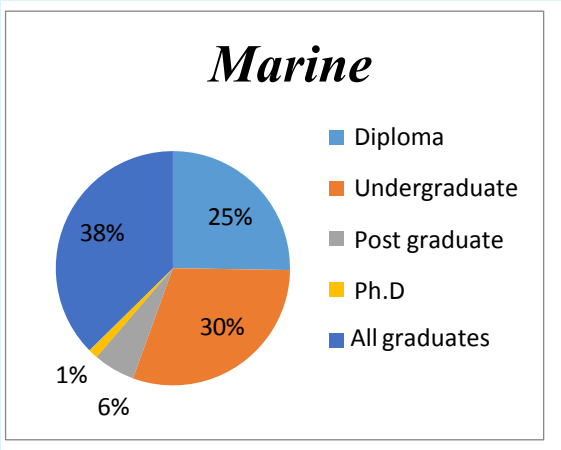
Note: *for assumptions of growth rate of labour in each job role, standard requirement of labour per hectare in each job role, employment of existing labour in 2019-20 see Appendix Table.*

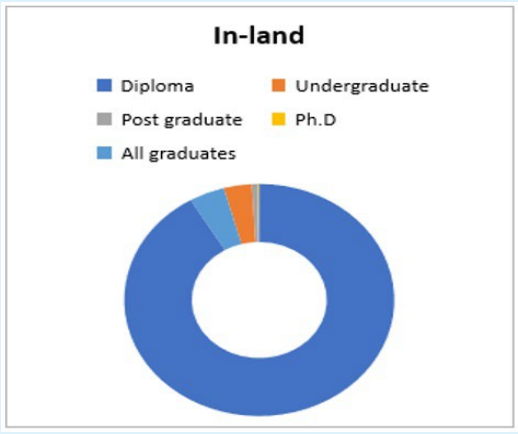
Demand Estimation of Human Resource in Fishery Sector:

Table 18 Requirement of human resources in marine fisheries and inland sub-sectors

Sector	Diploma	Undergraduate	Post graduate	PhD	All graduates
Marine	1088	1304	249	57	1610
In-land	21605	792	169	42	1004

Source: *State Govt and UTs*





Source: *State Govt and UTs*

Fish Seed hatcheries:

For species diversification, the first step required will be for hatcheries to produce seed. As per the CIFE norms, 6 technicians and 4 skilled fish farmers are required for a hatchery with 2-5 million fry per year capacity while a hatchery of 10-50 million fry per year would require 10 skilled fish farmers and 16 technicians. It is assumed that the number of hatcheries of these two types would also grow at 5% annually.

Fish feed industry:

According to CIFE norms major industrial units require 5 fishery professionals and a medium unit require 4 fishery professionals. There are about 40 feed industrial units which have 150000 MT capacities. As per current feed industry requirement 180 professional is required but in 2020 the requirement will reach 500 which needs an annual addition of 25 professional per year.

15. The Indian fish market: Trends and forecast for 2021-2026:

The Indian fish market is expected to reach a volume of 26.6 Million Metric Tons by 2026, exhibiting moderate growth during 2021-2026. Keeping in mind the uncertainties of COVID-19, we are continuously tracking and evaluating the direct as well as the indirect influence of the pandemic on different end use sectors. These insights are included in the report as a major market contributor.

Accounting for nearly 6% of the global fish production, India today represents one of the largest producers of fish in the world. Both, domestic consumption as well as export of fishes have witnessed a strong growth in India over the last few years. The per capita consumption of fish has also shown a continuous growth over the last several years. A number of factors are currently driving the consumption of fish in India. These include life style changes, increasing cost of meat and the perception of fish as a healthy food with high levels of digestible protein, PUFA and cholesterol lowering capability.

16. State Level Scenario:

This Section discusses the State-level scenario of employment in the fisheries sector of major fish producing States and some nonconventional States, the State government policies for infrastructure development and welfare of fisherfolk that are likely to have an impact on employment and livelihood, and the State infrastructure for skill development, training of the fishermen and higher studies in fisheries sciences.

Gujarat:

Nearly 83.03 percent of the total fish production in the Gujarat State comes from the marine sector. The State has one-fifth of the country's coastline and contributes around 20 percent of the total marine production. The State has a good prospect of employment generation in the cultivation of important commercial varieties viz. pomfret, jewfish, Bombay duck, shrimp, lobster, squid, cuttlefish, silver bar, hilsa, shark, catfish, mullets, etc. Besides these, the Gulf of Kuchh has favourable atmosphere that supports livelihood generation through the cultivation of oysters, shellfish, and sea-weeds.

Maharashtra:

Maharashtra has a coastline of 720 km with 173 fish landing centres and 1.12 lakh sq. km. area available for marine fishing. In addition to this there are 3.27 lakh hectares suitable for inland and brackish water fishing. There is a State-funded scheme, Support for Training and Employment Programme (STEP) specially designed for women of 16 years and above for vocational training and increasing competencies.

The growth of fishing and aquaculture in Maharashtra has seen fluctuations in recent years. If we consider the annual growth rate of production of the past few years, the growth rate of gross value added was negative in 2015-16 (-4.2 percent), and in 2017-18 (-3.4 percent) at current prices. The growth rate of GVA increased to 3.4 percent in 2018-19. However, marine fish production has declined from 4.75 lakh metric tonnes in 2017-18 to 4.60 lakh metric tonnes in 2018-19. The production of inland fishes has declined from 2 lakh tonnes in 2016-17 to 1.3 tonnes in 2018-19. The export of fish, although, has increased in terms of value, the quantity has fallen in 2018-19. Inland fisheries get less attention in the State4. There is a lack of basic data about the number of fishermen, species, fish catching, distribution and abundance of fish catch, etc. The aspects related to conservation and preservation of species are also neglected.

There is only one government institute in the entire State that offers graduate or above courses in the fisheries sciences with the intake capacity of 40 seats at graduation level, 28 seats at the post-graduate level, and 11 at the Ph.D. level. No private institute in Maharashtra offers courses in fisheries sciences. However, even the available seats are not filled up- only 28 undergraduate students, 16 post-graduates, and 11 students at the Ph.D. level were studying fisheries sciences in 2018-19. Is this due to lack of interest among the young generation or due to the expansion of employment opportunities for graduate student needs deeper study.

Kerala:

Fisheries and aquaculture is one of the most important sectors of the Kerala economy and contributes about 9.2 percent of the Gross State Value Added (GSVA) from the primary sector. The fisherfolk population of the State is estimated to be around 10.34 lakh in 2017-18. Out of this 7.96 lakh belong to the marine sector and 2.38 belong to the inland sector. Alappuzha (1.92 lakh), Thiruvananthapuram (1.71 lakh), and Ernakulam (1.37 lakhs) are the districts with the largest fisherfolk population, while Wayand has the lowest. Around 88 percent of the active fish workers in Kerala were male. However, women are dominant is allied activities- around 80 percent of the allied workers in fisheries were women in 2017-18.

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[4] *SANDRP (2013). Who Cares for Riverine Fisheries in Maharashtra, South Asia Network on Dams, Rivers, and People, October 9, 2013*

Odisha:

Fisheries in Odisha are one of the important sources of livelihood in Odisha and showing robust growth in the past few years. Odisha has a 480 km long coastline and 24 thousand sq. km. area under marine fisheries. The area under inland fisheries is 11.02 lakh hectares (6.84 lakh hectares under freshwater fisheries and 4.18 lakh hectares under backwaters).

In future there is more potential for job creation in inland aquaculture. There has been a consistent rise in the share of inland fisheries in total fish production in the State. The share of freshwater and brackish water fish production has increased from 58.25 percent and 7.19 percent in 2010-11 to 66.31 percent and 11.67 percent respectively in 2017-18. As against this, the share of marine fisheries has declined from 34.56 percent to 22.02 percent.

According to the Skill Gap study instituted by NSDC in 2012, the districts, Ganjam, Balasore, Bhadrak, Bodh, Cuttack, and Puri are leading districts of fish production and have a high potential for growth and employment. There is a need for skill development in operation, maintenance of fishing boat engines, crab culture, fish feed preparation, fish processing, value-added seafood product.

Andhra Pradesh:

Andhra Pradesh ranks 1st in total fish and shrimp production and contributes more than 65 percent of cultured fish produced in the country. AP contributes 1.61 percent of global and 24 percent of national fish production. The fisheries sector aims to be best utilize the natural resources for generating rural employment, production of protein-rich food, valuation contribution to GSDP, and source of foreign exchange through seafood exports. The State government has taken several steps to boost the fisheries sector and increase the income of the fishermen. Few such measures are exemption of sales tax on HSD oil, accessories and boats/ vessels to marine fishers, the supply of outboard motors and inboard motors to traditional boats, etc.

Assam:

The fisheries sector has been identified in Assam for its role in economic development, income generation, and scope for generation of employment opportunities throughout the State, especially for rural youths through fish production and related activities. State two major rivers Brahmaputra and Barak covering an area of 4820 sq. km, and its 2.86 lakh hectare of waterbodies offers tremendous scope for fisheries based livelihood generation. Although the State has an abundance of water resources, scientific fish production and management is limited to a small area. The State has taken a strategy focused on horizontal (through the creation of new ponds, reclamation, and renovation of old ponds) and vertical (through improved and advanced culture practices) expansion of fish production. The State government has undertaken a number of steps for infrastructure development, enhancing the social security of the fishermen population which may help for the expansion of the sector. The State also provides one-time assistance to fishermen during the lean period of the fishing ban.

Tripura:

There is tremendous potential for the growth of aquaculture in Tripura. The local production could meet only 20 kg against the per capita consumption of 23.48 kgs in 2018-19. In recent years, the State has witnessed more and more waterbodies covered under scientific fish culture and creation of new water areas, the establishment of fish feed manufacturing plant and prawn seed hatchery with financial assistance from banks, the emergence of entrepreneurial fishermen, and also building up of confidence that culture fisheries can be most profitable of all subsectors in agriculture.

Government of Tripura has taken a few important steps to strengthen the fisheries sector that will result in enhancing the livelihood and employment opportunities in this sector. These measures relate to quality fish seed production through eco- hatchery and FRP hatchery, construction of fishery input storage go down, the emphasis of freshwater prawn culture, diversification of aquaculture to high-value species, conservation of indigenous fishes in natural water bodies, assistance to co-operative societies and SHGs in fish culture.

As part of the human resource development of the farmers, the government has been organizing training and motivational campaign in various corners of the State. A total of 17078 numbers were trained for scientific fish culture.

Haryana:

Fish culture is becoming popular as a subsidiary occupation among fish farmers of the State. It has 17307. 75 hectares of rural waterbodies under intensive fish farming and produces 1.84 lakh tonnes of fish annually. It aims to increase the area under fisheries by 200 hectares every year. Haryana is also the only landlocked State that promotes shrimp farming in the waterlogged and underground saline water affected areas. Recognizing the importance of this sector is socio-economic development of the countryside the state government has undertaken a number of ambitious projects to encourage fish production and productivity. To improve incomes from fish farming the State is promoting Re-circulatory Aquaculture System through high stocking rate in indoor tanks with controlled water parameters.

17. Policy implications:

The fisheries sector in India has shown remarkable dynamism and growth in recent years. It has become one of the fastest-growing sub-sectors in Indian agriculture. The growth in inland fisheries has surpassed that of marine fisheries. But the marine fisheries sector still remains one of the major sources of export earnings and has witnessed a sustained improvement in the quantity and value of exports. There are reasons to be optimistic about the future growth of the fisheries sector due to increased domestic consumption and export of marine products, progressive policies, and rapid technology diffusion. However, there exists a wide State-wise variation in performance and employment generation. Many new States have shown high growth rates in production fishes.

One of the major challenges that the fisheries sector faces in the lack of availability of skilled labour. Only a small proportion of fisheries workers has received any vocational education and training. However, for sustained growth, enhancement of income, poverty eradication, and faster adoption of technology skill development of workers is a must. Therefore, more efforts should be devoted to the skill development of fisheries workers, especially through short term trainings.

There exists a wide State-wise variation in the availability of skilled workers in the fisheries sector. In prominent fish producing States like Karnataka, Goa, and Kerala there the number of VET trained fishermen is negligible. Urgent attention should be paid for the skill development of large number workers engaged in the fisheries sector in these States along with the States that have shown improved performance in fisheries like Uttar Pradesh and Bihar.

More attention should be paid to the skill development of women workers in the fisheries sector. This is a must for encouraging participation of women in various fisheries activities as also for women empowerment and economic independence of the women. Presently availability skilled female workers in the fisheries sector are almost nil. Special training programmes should be arranged for the capacity of women in various job roles.

The marine fisheries sector has witnessed sluggish growth rates in recent years. This has led many fishermen in this sector to leave the sector as declining productivity, fall in marine resources have caused insecurity in livelihood. However, the latest technological interventions in the form of application of GPS tools, better fish gear, and net holds promises for risk mitigation, better information management, and better catch. Thus skill building of marine fishermen is necessary for sensitization about sustainable fisheries and benefit from technological advances. Also, only short term training will not produce the intended results unless special efforts are made for credit linkage for purchases of equipment, and cooperative/ group farming is encouraged.

A sizeable number of the fishermen are trained via traditional ways, learned skills on the job, and various informal ways. Sufficient arrangements should be made for upskilling/ reskilling of these traditional fishermen for better productivity and incomes.

18. Challenges:

1. Untapped resource
2. Technology upgradation
3. Need for value addition & diversification of sea food products
4. Under utilization of established infrastructure
5. Need for cold chain facilities
6. Quality control/Traceability
7. Integrated development of Infrastructure facilities
8. Effectiveness of insurance schemes
9. Enabling Policy Framework

19.1. ANDAMAN & NICOBAR ISLANDS

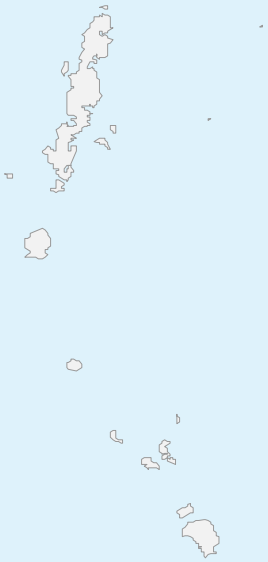
19.1. Andaman & Nicobar -South Anadaman

Fishing is the primary source of economic activity for almost 10,322 fishermen from the South Andaman district. Currently fishing is being done in traditional ways. Deep sea fishing is proposed to be promoted in a planned manner which will require trained manpower to operate the DSFVs. The current fishermen also require training in safe fishing practices and efficient fishing techniques.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Deep Sea Fisherman
2. Fish handler
3. Sorter
4. Spotter
5. Mechanic
6. Captain/boat operator



ANDAMAN & NICOBAR ISLANDS

19.2. ANDHRA PRADESH

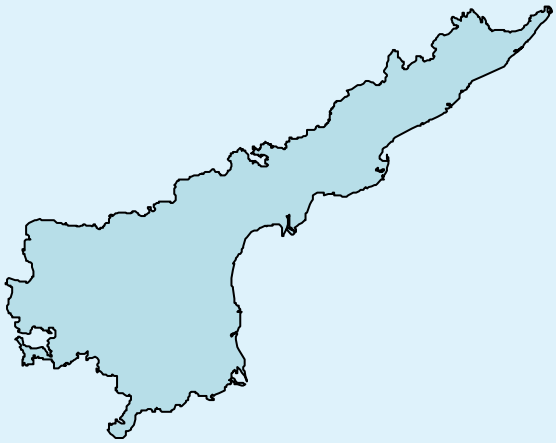
Andhra Pradesh-Visakhapatnam

Trainings imparted in longline fishing and value addition could help the fishing community in increasing the volume of their catch and in getting a better price. Shrimp and fish export houses in Visakhapatnam will demand a skilled workforce.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Longline fisherman
2. Cold Storage Technician
3. Warehouse Manager
4. Mechanic
5. Glass/Tunnel/Trolley Freezer Operator
6. Grading supervisor
7. De-heading supervisor
8. Aquaculture Technician
9. Mariculture Technician



ANDHRA PRADESH

Andhra Pradesh -East Godavari

Trainings imparted in aquaculture could help in providing the fishing community an insight into a more profitable way of doing business and also to properly utilize unutilized land parcels that are unfit for agriculture. Trainings in value addition and better hygiene practices could help the fishermen in getting a better price for their catch.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Cold Storage Technician
2. Warehouse Manager
3. Mechanic
4. Glass/Tunnel/Trolley Freezer Operator
5. Grading supervisor
6. De-heading supervisor
7. Aquaculture Technician
8. Mariculture Technician

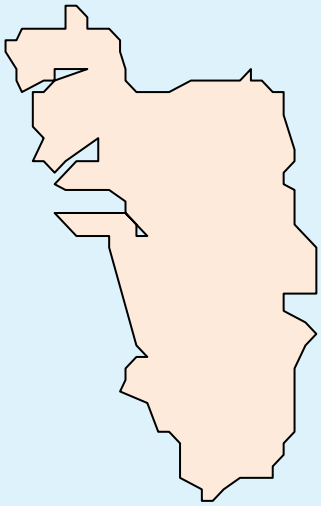
North and South Goa

The presence of the sensitive bio-diversity in the marine eco-system are both an opportunity and challenge in the district. Fisheries sector has reached saturation with traditional sources being used for fishing activities. The seafood processing units usually clean, wash, grade and pack the sea food products. 99% of this is exported to other countries where it is then processed and value addition done.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries & Sea food processing

1. Deep sea fisherman
2. Trawler Driver and Tandel
3. Grading supervisor
4. Cleaning & grading worker
5. Cold storage worker



GOA

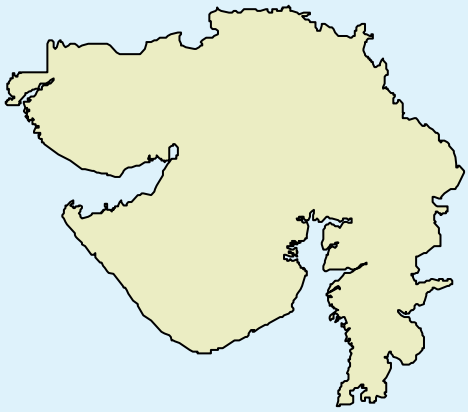
Bhavnagar

Shrimp cultivation in brackish water along the coast of Bhavnagar is picking up pace with 1000 acres having been notified by the Government for this purpose. Priority while allotting the land for carrying out shrimp cultivation should be given to the fishermen as they live in abysmal conditions and way below poverty line. They should be given trainings to teach them how to undertake shrimp cultivation with follow ups to see them through in this venture. Further, shrimp export houses in Bhavnagar area demand skilled workforce.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Cold Storage Technician
2. Warehouse Manager
3. Mechanic
4. Glass/Tunnel/Trolley Freezer Operator
5. Grading supervisor
6. De-heading supervisor
7. Aquaculture Technician



GUJARAT

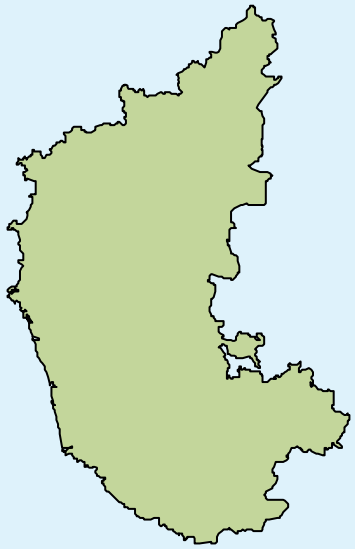
Dakshina Kannada

Value addition programme, training on hygiene and marketing could help the fishing community to increase the volume of their catch and revenue. Further, the processing of fish meal, fish oil and other marine products are undertaken in Dakshina Kannada that demands semi-skilled/skilled workforce. Skilled workforce is in demand for aqua culture and shrimp culture. Marine resources available in the district provide scope for setting up of units based on products such as canning units, processing units, fish net manufacturing, building of fishing boats and equipment. Establishment of Sea Food Park between Mangalore and Udupi district will increase the employment in the next few years.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Cold Storage Technician
2. Supervisors
3. Helpers
4. Quality controller
5. Freezer operator
6. Grading



KARNATAKA

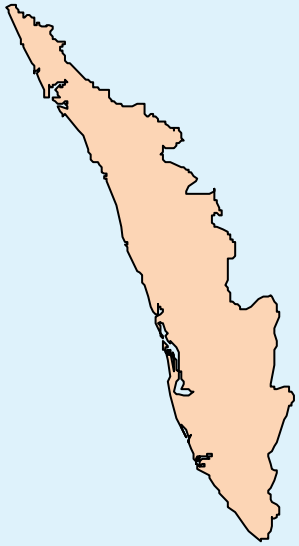
Ernakulam

In the light of reducing marine fish production between 2014-15 and 2015-16, training on sustainable management of fish stock or sustainable aquaculture will be critical. Ernakulam houses various fish processing units. Some of the prominent ones are Baby Marine Pvt. Ltd, Ruby Marine Pvt. Ltd amongst others. These marine processing units demand skilled manpower to undertake production of value-added products in fisheries, quality control, inspection activities and packaging of fishery products.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Production Assistants
2. Quality Control assistants
3. Lab assistants
4. Supervisors in value added
5. fishery products manufacturing units
6. Cold Storage Technician
7. Warehouse Manager
8. Glass/Tunnel/Trolley Freezer Operator
9. Grading supervisor



KERALA

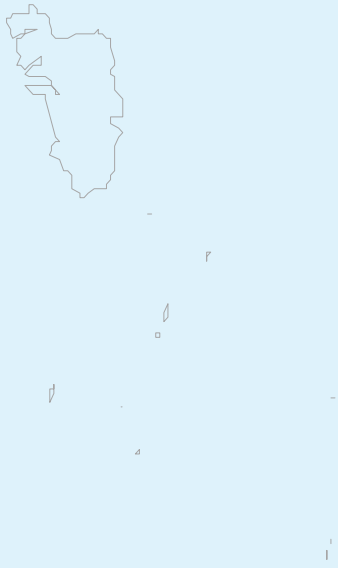
Lakshadweep

Given the abundance of fish in the islands, fishing is one of the most important economic activities of the UTL.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Production Assistants
2. Quality Control assistants
3. Lab assistants
4. Supervisors in value added
5. fishery products manufacturing units
6. Cold Storage Technician
7. Marine processing technicians



LAKSHADWEEP

Mumbai

In Mumbai, most of the good quality fish caught by fishermen are bought by suppliers (agents of exporters and middlemen) or auctioneer (agents of suppliers) at a very cheap rate. The suppliers in turn sell it to third parties who do sorting, grading etc. The third parties in turn sell it to exporters. Fishermen mostly do not get a fair price for their catch. Training programmes that focus on hygiene and value will assist the fishing community in marketing their catch and in getting a fair price for their produce. This sector also offers opportunities in marine food processing units.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Fishermen with value addition skills
2. Cold Storage Technician
3. Engine Mechanic
4. Grading supervisor
5. De-heading supervisor
6. Packers
7. Packaging Supervisor
8. Freezer Operator

Raigad

In Raigad, people have land holdings that could be used for aquaculture and mariculture. Trainings imparted in aquaculture could help in providing the fishing community an insight into a more profitable way of doing business and also to make proper utilization of unutilized land parcels that are unfit for agriculture. Trainings in marine fish farming is necessary to make the fish farmers aware about the scientific procedure of fish farming and thereby improve on the traditional practices. Further, shrimp export houses in Panvel area demand skilled workforce.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Cold Storage Technician
2. Warehouse Manager
3. Mechanic
4. Glass/Tunnel/Trolley Freezer Operator
5. Grading supervisor
6. De-heading supervisor
7. Aquaculture Technician
8. Mariculture Technician

Jagatsinghpur

Paradeep is famous for export of marine products and has the largest number of fish processing industries concentrated in this district. There is a demand for a large number of workers in this sector.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Cold Storage Technician
2. Warehouse Manager
3. Mechanic
4. Glass/ Tunnel/ Trolley Freezer Operator
5. Grading supervisor
6. Be-heading supervisor

ODISHA

Ganjam

Ganjam is one of the major source of marine fishing in the State. The district has a number of waterlogged areas which are proposed to be developed for fish farming both for fresh water as well as shrimp farming. Thus upscaling the skilling requirements of the fishermen and local community is the need of the hour.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Cold Storage Technician
2. Warehouse Manager
3. Mechanic
4. Glass/Tunnel/ Trolley Freezer Operator
5. Grading supervisor
6. De-heading supervisor

Puducherry

The presence of the sensitive bio-diversity in the marine eco-system are both an opportunity and a challenge in the district. Inland fishing and aquaculture hold sizable opportunities. Packaged sea products are also widely exported.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Deep Sea Fisherman
2. Engine & Boat Mechanics
3. Inland Fishing
4. Prawn & Crab Farmer
5. Cold Storage Technician
6. Warehouse Manager
7. Mechanic
8. Glass/Tunnel/Trolley Freezer Operator
9. Grading supervisor
10. De-heading supervisor
11. Aquaculture Technician
12. Mariculture Technician

Puducherry

19.11. TAMIL NADU

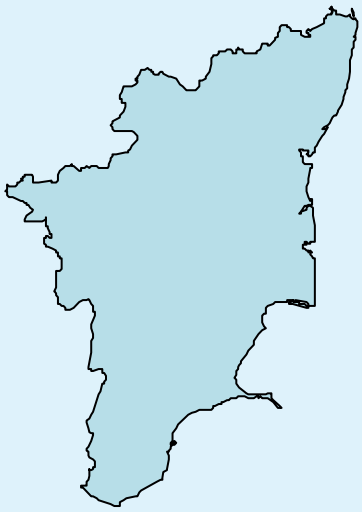
Tiruvallur

Pockets around the coastal areas could be used for aquaculture and mariculture, especially around Ponneri, Poondi and Pazhaverkadu. Trainings imparted in aquaculture could help in providing the fishing community an insight into a more profitable way of doing business and also to make proper utilization of unused land parcels that are unfit for agriculture. Trainings in marine fish farming is necessary to make the fish farmers aware about the scientific procedure of fish farming and thereby improve upon the traditional practices. Further, shrimp and ornamental export houses in Pazhaverkadu, Kolathur area demand skilled workforce.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Cold Storage Technician
2. Warehouse Manager
3. Mechanic
4. Glass/Tunnel/Trolley Freezer Operator
5. Grading supervisor
6. De-heading supervisor
7. Aquaculture Technician
8. Mariculture Technician



TAMIL NADU

Thoothukudi

The presence of the sensitive bio-diversity in the marine eco-system, are both an opportunity and challenge in the district. On the one hand, rich varieties with high demand, both nationally and internationally are available, the threat to endangered species and sustainability due to over fishing are also threats in the foreseeable future. Threats of crossing international boundaries and borders are a constant issue in the northern blocks of the district. Inland fishing and aquaculture hold sizable opportunities. Packaged sea products are also widely exported.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Deep Sea Fisherman
2. Engine & Boat Mechanics
3. Inland Fishing
4. Prawn & Crab Farmer
5. Cold Storage Technician
6. Warehouse Manager
7. Mechanic
8. Glass/Tunnel/Trolley Freezer Operator
9. Grading supervisor
10. De-heading supervisor
11. Aquaculture Technician
12. Mariculture Technician

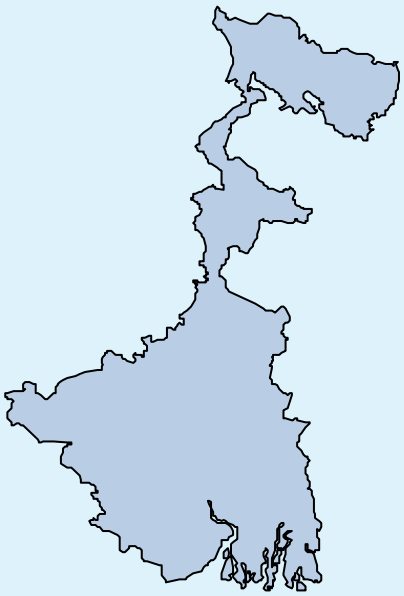
South 24 Paraganas

In South 24 Parganas, there is tremendous prospect for ornamental fish farming especially after the introduction of ornamental fish scheme under F.F.D.A from the 2000-2001 by Fisheries Department. In the year 2015-16, South 24 Parganas received a total of 30.44 ha sanctioned area under FFDA. Under this scheme, around 16080 people were engaged for different activities. There are a total of 19 Block Level Fishery Laboratory and Training Centres in the district up to 2015-16. Trainings in marine fish farming and brackish fish is necessary to make the fish farmers aware about the scientific procedure of fish farming and thereby improving on the traditional practices.

The matrix below captures the jobs roles that are high in demand:

Job Roles: Fisheries

1. Cold Storage Technician
2. Warehouse Manager
3. Mechanic
4. Glass/Tunnel/Trolley Freezer Operator
5. Grading supervisor



WEST BENGAL

Table 1A Assumptions for calculations for future requirement of labour

Job roles	Number of existing labour in 2019-20	Growth rate	Average requirement of labour per hectare
Fish seed farm worker	383634	0.22	8 people/ hectare
Fish seed grower	23978	0.22	1 people/ 2 hectare
Hatchery Manager	2809	0.07	
Hatchery Supervisor	5618	0.07	
Hatchery Production Worker	16954	0.07	
Freshwater Aquaculture Farmer	2477486	0.22	2 people/ hectare
Shrimp Farmer	97081	0.06	
Brackishwater Aquaculture Farmer	1428	0.19	
Crab Fattening Farmer	5709	0.04	1 person/ hectare
Aquaculture Technician	51595	0.21	1 person/ 100 hectare
Aquaculture worker	1033213	0.21	1 person/ 5 hectare
Aquatic Animal Health Lab Assistant	10331	0.57	1 person/500 hectare
Mariculture Operator	2043	0.02	1 person/ cage
Feed Technician	1853	0.2	1 person/ feed mill
Fishing Boat Deckhand	8432	0.2	5 persons/ boat
Fishing Boat Driver	1686	0.2	1 person/ boat
Fishing Boat Maintenance Worker	63240	0.004	1 person/ boat
Fishing Boat Mechanic	1546	0.15	10 people per fish harbour and 3 people per fish landing centre
Fishing Boat EquipmentTechnician	579	0.34	5 people per fish harbour and 1 people per fish landing centre
Fish Farm/ Aquaculture Manager	10319	0.21	1 person/ 500 hectare
Fisheries Extension Associate	7355	0.52	2 persons per tehsil

Source: *Discussion with scientists of Ministry of Agriculture and Farmers' Welfare*

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