REPORT OF THE WORKING GROUP
on
Development and Management of Fisheries and Aquaculture

XIIth FIVE-YEAR PLAN
(2012 – 2017)

PLANNING COMMISSION
JANUARY 2012

Report of the Working Group on

DEVELOPMENT AND MANAGEMENT OF FISHERIES AND AQUACULTURE

For the XII Five Year Plan: 2012-17

Planning Commission
Government of India

December, 2011
New Delhi

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PREFACE

Fisheries and aquaculture complements other food farming sectors, promotes rural livelihoods, food and nutritional security, contributes to GDP and earns foreign exchange through export of fish and fishery products. The fisheries sector has been growing steadily from the First Plan onwards, reaching a production level of 8.30 million tonnes (mt) during 2010-11 (P). While marine fish production has increased from 0.53 mt in 1950-51 to 3.22 mt (P) in 2010 - 11, production from inland sector has also grown steadily from 0.218 mt during 1950-51 to about 5.08 mt in 2010-11 (P). Contribution of fisheries sector to agriculture and national GDP has also been significant, touching Rs. 67,913 crore during 2009-10 from about Rs. 245 crore in 1970-71. Similarly, the annual export earnings have achieved a record US $ 2.9 billion mark, contributing about 17 percent to the national agricultural export.

The Working Group on Development and Management of Fisheries and Aquaculture constituted by the Planning Commission met on three occasions to discuss various issues and potentialities of fisheries and aquaculture development. To provide a comprehensive coverage to the sector, the Working Group constituted three Sub-groups to include Marine Fisheries (including mariculture and brackish water aquaculture), Inland Fisheries (including freshwater aquaculture and coldwater fisheries) and Fisheries Policies and HRD. These Sub-groups were chaired by the Directors of CMFRI, CIFRI and CIFE and included fisheries managers and policy makers, scientists, representatives of fish farmers and fisher associations, industry, financial institutions and NGOs. The Working Group also constituted a Drafting Committee to prepare the final report.

This report provides the key objectives and the proposed programmes/activities for fisheries and aquaculture development during the Twelfth Five-Year Plan. The report has also succinctly discussed the issues before the sector and outlines strategies for fisheries development while keeping sustainability into focus. We hope that the recommendations made in the report will be useful for development of the fisheries sector during the ensuing Plan period through the active involvement of all stakeholders. We are grateful to the members of the Working Group and the Sub-groups for their valuable contributions. Thanks are also due to the Planning Commission and all other organisations that have provided necessary support and logistics for successful conduct of the meetings and for their help in preparation of the report.

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REPORT OF
THE WORKING GROUP ON

FISHERIES

FOR
THE TWELFTH - FIVE YEAR PLAN
(2012 – 2017)

GOVERNMENT OF INDIA
PLANNING COMMISSION
DECEMBER 2011

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LIST OF ACRONYMS

APFIC	Asia Pacific Fisheries Commission
ARs	Artificial Reefs
ATMA	Agriculture Technology Management Agencies
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BoB	Bay of Bengal
BOBP-IGO	Bay of Bengal Programme Inter-Governmental Organisation
BOBLME	Bay of Bengal Large Marine ecosystem
CAGR	Cumulative Annual Growth Rate
CBD	Convention on Biological Diversity
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCRF	Code of Conduct for Responsible Fisheries
CIBA	Central Institute of Brackishwater Aquaculture
CIFE	Central Institute of Fisheries Education
CIFRI	Central Inland Fisheries Research Institute
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMFRI	Central Marine Fisheries Research Institute
CMFP	Comprehensive National Marine Fishing Policy, 2004
EEZ	Exclusive Economic Zone
DAHD&F	Department of Animal Husbandry, Dairying and Fisheries
DARE	Department of Agriculture Research and Education
DoF	Department of Fisheries
EAFM	Ecosystem Approach to Fisheries Management
EEZ	Exclusive Economic Zone
FAD	Fish Aggregating Devices
FADA	Fisheries and Aquaculture Development Agency
FAO	Food and Agriculture Organization of the United Nations
FFDAs	Fish Farmers' Development Agencies
FISHCOPFED	National Federation of Fishermen Co-operatives Limited
FLC	Fish Landing Centre
FRP	Fibre-reinforced Plastic
FSI	Fishery Survey of India
GATT	General Agreement on Trade and Tariff
GEF	Global Environment Facility

GoI	Government of India
HRD	Human Resource Development
IBM	Inboard Motors
IAY	Indira Awas Yojana
ICAR	Indian Council of Agricultural Research
ICG	Indian Coast Guard
IOR-ARC	Indian Ocean Rim Association for Regional Cooperation
IOTC	Indian Ocean Tuna Commission
IPOA	International Plan of Action
IUU	Illegal, Unreported and Unregulated Fishing
KVK	Krishi Vigyan Kendra
LoA	Length Overall
LOP	Letter of Permit
LSA	Life Saving Appliances
MCS	Monitoring, Control and Surveillance
M&E	Monitoring & Evaluation
MFRA	Marine Fishing Regulation Act
MFV	Mechanized Fishing Vessel
MGNERGA	Mahatama Gandhi National Rural Employment Guarantee Scheme
MHA	Million Hectare
MPA	Marine Protected Areas
MPEDA	Marine Products Export Development Authority
MoU	Memorandum of Understanding
MoA	Ministry of Agriculture
MoCI	Ministry of Commerce and Industry
MoD	Ministry of Defence
MoEA	Ministry of External Affairs
MoEF	Ministry of Environment & Forests
MoES	Ministry of Earth Sciences
MoFPI	Ministry of Food Processing Industries
MoS	Ministry of Space
MoSRTH	Ministry of Shipping, Road Transport and Highways
MMD	Mercantile Marine Department
MMT/MT	Million Metric Tonnes/Metric Tonnes
NACA	Network for Aquaculture Centres in Asia-Pacific
NFDB	National Fisheries Development Board
NIC	National Informatics Centre
NM	Nautical Miles

NMFC	National Marine Fisheries Census, 2005
OBM	Out Board Motors
PFZ	Potential Fishing Zone
RFB	Regional Fisheries Body
RKVY	Rajiv Gandhi Krishi Vikas Yojana
SACEP	South Asia Cooperative Environment Programme
SOFIA	State of the World Fisheries and Aquaculture
SPF	Specific Pathogen Free
SPS	Sanitary and Phytosanitary
SSF	Small-scale Fisheries
TAC	Total Allowable Catch
TBT	Technical Barriers to Trade
UT	Union Territory
UNCLOS	United Nations convention on the Law of the Sea
WTO	World Trade Organization
VMS	Vessel Monitoring System

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EXECUTIVE SUMMARY

1.0 Indian Fisheries: An overview

1.1 The fisheries sector is an important player in the overall socio-economic development of India. Starting from a purely traditional activity in early fifties when India commenced with the First Five-Year Plan, fisheries and aquaculture have now transformed into a significant commercial enterprise, contributing to employment generation, food and nutritional security and foreign exchange earnings.

1.2 The fisheries sector contributed Rs 67 913 crores to the GDP (at current prices) during 2009-2010, which is 0.96 percent of the total GDP at factor cost[1] and 5.41 percent of the GDP at factor cost from agriculture, forestry and fishing. During 2010-11 the export of marine products reached 813 091 tonnes valued at Rs. 12 901.47 crore and US $ 2.857 billion[2].

1.3 The marine resources of the country comprise an Exclusive Economic Zone (EEZ) of 2.02 million sq. km, a continental shelf area of 530 000 sq. km and a coastline of 8 118 km. The inland resources include a maze of rivers, canals, estuaries, floodplain lakes and the ponds and tanks. With a combined length of 45 000 kms, the riverine resources provide one of the richest fish germplasm in the world. Further, the reservoir resources cover more than 3.0 million ha (mha) water spread area and are mostly distributed in favourable climatic environment. India is the third largest producer of inland fish in the world (after China and Bangladesh) and the second largest producer of farmed fish, after China.

1.4 Fish production in India has shown an increasing trend from 0.72 million metric tonnes (mmt) in 1950-51 to reach 8.288 mmt in 2010-11(P). This comprises 3.220 mmt from marine sources and 5.068 mmt from inland fisheries (including aquaculture). With a vast production potential, particularly in inland fisheries (mainly reservoirs) and aquaculture, the sector has shown an average growth of about 6 percent over the Five-Year Plan periods.

1.5 As per the Indian Livestock Census, 2003, 14.49 million people were engaged in various fisheries related activities. About 75 percent of the fishers are engaged in inland fisheries and about 25 percent in marine fisheries. One of the most significant characteristics of Indian fisheries sector is its small-scale nature. Besides being a source of protein rich nutritious food, income and livelihood to poor fishers, the fisheries sector is important for engaging the rural population in a number of ancillary activities- *i.e.* marketing, retailing, transportation, etc.

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[1] Ministry of Statistics and Programme Implementation: Annual and Quarterly Estimate of GDP at Current Prices, Base Year 2004-05 (http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=82) (http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=82)

[2] MPEDA, 2011 (http://www.mpeda.com/inner_home.asp?pg=trends)

2.0 Indian Fisheries: Opportunities for development

2.1 The fisheries sector in India is passing through a watershed period. The crisis before the sector is partly due to the problems created by the sector itself and partly from external factors that are beyond its control. In marine fisheries, uncontrolled fishing capacity has led to over-exploitation of the coastal resources. While the estimated potential of the offshore waters offers opportunities for increase in production, the fishing fleet has limited capacity to harness the deep sea resources. This calls for up- gradation of the fleet as well as skills and capacities of the fishers and incentives to promote diversified fishing in the offshore waters. Use of Fish Aggregating Devices (FADs) and Artificial Reefs (ARs) for stock enhancement and promotion of mariculture could enhance production. Implementation of Monitoring, Control and Surveillance (MCS) as a new programme in the ensuing Plan is expected to bring more discipline and orderliness in the sector and regulate the activities so as to maintain the growth rate in a sustainable manner.

2.2 While inland fisheries have grown in absolute terms, the rate of growth in terms of potential is not yet achieved. This can be attributed to less focus on sustainable development of inland capture fisheries in the past Plans; increasing pressure on the resources, including habitat degradation; and multiple-use of inland water-bodies with least priority to fisheries requirements. In the inland sector, while reservoirs and freshwater aquaculture would be the two main pillars of growth, other resources such as upland water bodies, floodplain lakes and wetlands, irrigation canals, saline and waterlogged areas also need to be gradually mainstreamed to start contributing to the production.

2.3 Freshwater aquaculture, which contributed to the 'Blue Revolution' in the country in late seventies, is now almost stagnating in terms of species diversification and yield rates. The average yield rates for the country as a whole (excluding the ponds under the Freshwater Fish Farmer's Development Agencies or FFDAs) are around 1 000 kg/ha/yr, whereas production can be increased to 4-5 thousand kg/ha/yr. Indian aquaculture, especially freshwater farming, in the past two decades has grown with little scientific inputs and is also lacking good inputs in terms of seed, feed, health management and marketing support. Programmes aimed at production and distribution of quality seed and feed for aquaculture and also culture-based-capture fisheries, husbandry of farmed species and availability of quality water would be essential to optimize production and productivity from inland fisheries and aquaculture in the country.

2.4 The gradual decline of FFDAs and Brackish water Farmer's Development Agencies (BFDAs) and their resultant poor performance coupled with weak extension services has impacted the overall growth of aquaculture in the country. Therefore, rejuvenation and consolidation of the two field-level agencies (FFDA and BFDA) into a single agency – Fisheries and Aquaculture Development Agency or FADA is expected to catalyze the process and strengthening of extension services system to a large extent. These agencies can undertake extension of technologies, promote networking of farmers and

fishers (mainly from reservoirs) and provide effective liaison between the farmers and developmental and other extension agencies such as the Krishi Vigyan Kendras (KVKs) and the Agriculture Technology Management Agencies or the ATMAs. They can also assist these primary producers in sourcing public finance, which is otherwise is becoming difficult for them. Further, the mandate of these agencies can be extended to cover fisheries development in reservoirs and floodplain lakes and promotion of ornamental fisheries, etc and thus provide a single-window support to fisheries and aquaculture in the inland fisheries sector.

2.5 Reservoir fisheries, as the second major source of fish production in the Twelfth Plan, would need support for supplementary stocking of quality seed in appropriate numbers. Many medium and large-sized reservoirs where auto-stocking is feasible would need sound management norms to allow the fishes to breed in the reservoirs and contribute to fish production. Besides, such reservoirs would also need appropriate post-harvest support and capacity building of the fishermen to maximize their income and ensure optimum utilization of the resources.

2.6 In the ensuing Plan it is also necessary to develop fisheries and aquaculture in upland lakes and streams, saline and water logged areas and irrigation canals. In the non-food sector, due attention is required on ornamental fisheries to generate employment in both rural and urban areas.

2.7 The inadequacies in infrastructure for landing and berthing facilities of marine fishing fleet and for domestic marketing have been the main reasons for post-harvest losses, which are estimated around 15-20 percent. Creation of additional infrastructure for landing and berthing of fishing vessels and also up-gradation of the existing facilities and development of infrastructure for domestic marketing can reverse the situation. The reduced post-harvest losses can augment the supplies available for human consumption and fish marketed in good condition can also fetch better remuneration for the fishers, who are otherwise finding it difficult to make both ends meet.

2.8 The fisher community in India can be termed as the poorest of the poor. Living in inaccessible and remote coastal areas or along the riparian tracts and reservoir catchment area, the fisher communities are largely bereft of the schemes/programmes of the Government aimed at uplifting the socio-economic conditions of the poor rural communities. The welfare programmes implemented by the Department of Animal Husbandry, Dairying and Fisheries (DAHD&F), Ministry of Agriculture for fisher communities have been extremely useful and their continuation in the Twelfth Plan can further improve the socio-economic conditions of the poor fisher folk.

2.9 The fisheries sector needs to avail the benefits under the welfare and developmental programmes of other Ministries/Departments such as Indira Awas Yojana (IAY), Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), etc. Wherever possible, a convergence could be brought in between the existing schemes of the fisheries sector with these larger programmes to maximize the benefits to poor fishers and their families.

2.10 Besides laying adequate attention to the socio-economic upliftment of the fisher community and providing long-lasting benefits to build-up their resilience and improve their safety nets, the sector as a whole also needs sound and need-based programmes for Human Resources Development (HRD). It is expected that the HRD programmes will cover a wide range of stakeholders (fishers to extension personnel and sector managers) to ensure that the skills and capacities are built at all levels to ensure sustainable development of the resources.

2.11 The weak information base in the fisheries sector is a matter of great concern. The inadequacies in the database and lack of knowledge on important attributes of the sector can lead to faulty planning. It is also seen that in many areas data has been generated but has remained in unprocessed form and inaccessible to the user groups. This critical area needs to be carefully reviewed and efforts made to plug the gaps, strengthen the data collection and processing mechanism and to ensure that the information flow is timely and seamless.

2.12 On the institutional front, it is essential to strengthen the National Fisheries Development Board (NFDB) and bring all development-related schemes under the Board, the purpose for which it was created. The DAHD&F may handle welfare programmes, strengthening of fisheries data base, implementation of the proposed scheme on MCS, fisheries policy, regulatory and legal matters, coordination with the sister Ministries/Departments at the Centre and the States to make the sector's foundation more robust and sustainable and build stronger linkages between research and development. The NFDB can also offer a platform for pooling of technologies and good management practices from research institutes and channeling these to the end users through piloting demonstration projects. This clear demarcation of work between the DAHD&F and the NFDB will remove duplication of work, if any. Further, the four institutions under the DAHD&F also need restructuring and if required consolidation to meet the requirements of the sector. For all practical purposes, these institutions should also be placed under the NFDB so that they provide the much-needed technical support to the Board.

2.13 On the policy and legal front, the DAHD&F may focus more on normative activities, formulation of policies and legislation to meet the growing needs of fisheries and aquaculture in the country. To make the fisheries sector competitive and emerge as a viable economic enterprise, good governance and management of the sector is essential. In this regard a sound MCS system should be in place at the earliest. The fisheries sector is also in the need of development enabling policies and effective governance through institutional strengthening and bringing reforms in the existing fisheries legislation or enactment of new laws to plug the gaps. Besides, DAHD&F may also provide guidance and support to States for developing and reforming their own policies and improving overall governance including strengthening of their institutional and organizational setup.

2.14 Policies that would contribute to development of aquaculture would include treating aquaculture at par with agriculture to avail the benefits of taxation, water and power tariff, allocation of resources; conservation of riverine

stretches for protection of germplasm; leasing of water bodies for aquaculture and mariculture purposes, etc. The policies should also aim at protection of livelihoods of fishers from various other economic and conservational activities. In the area of legislation, the existing Marine Fishing Regulation Act (MFRA) of the coastal States/Union Territories (UTs) needs revision to incorporate the requirements of MCS, Code of conduct for Responsible Fisheries (CCRF), etc. Similarly, a model bill is needed for inland fisheries and aquaculture and a Central Act is required to regulate fishing by wholly Indian-owned fishing vessels in the EEZ.

3.0 Growth projections and proposed outlay for the Twelfth Five- Year Plan

3.1 In the Tenth and Eleventh Plan periods, fish production registered a steady growth and it is expected that this growth would continue in the Twelfth Plan also, albeit with appropriate incentives and checks and balances. With the scenarios for inland and marine fisheries described in the foregoing paragraphs, the fisheries sector is likely to grow around 6.0 percent on an average per year during the Twelfth Five-Year Plan. With this growth rate, the total fish production is targeted at 11.58 mmt by the end of the Twelfth Plan Period (2016-17). To achieve this growth, it is estimated that the sector would require Rs. 6 000 crores for the Twelfth Plan period. The proposed programmes for HRD, institutional strengthening, policy reforms and overall improvement in the management and governance aspects during the Twelfth Plan period will also have spill over positive impacts on the output and performance of the fisheries sector during the subsequent Plans.

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CHAPTER 1.0

1.0 Working Group and Terms of Reference

1.1 Working Group

In pursuance of the Planning Commission's Letter No Q.12043/2/2010-Agri dated March 03, 2011; the Working Group on Development and Management of Fisheries and Aquaculture for the Twelfth Five-Year Plan was constituted. Subsequently additional members were co-opted in the group based on their expertise for specialized inputs. The Working Group comprised the following:

1.1.1 Members of the Working Group

Sl. No.	Name	Address/Tel/Fax/Mobile
1.0	**Dr Dilip Kumar** **Chairman**	Former Vice Chancellor & Director, Central Institute of Fisheries Education, C-9/9698, Vasant Kunj, New Delhi- 110 070. *Tel:+11 26899185; Mobile:+9560455702* *Email: dk.dilipkumar@gmail.com*
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6.0	**Fisheries Development Commissioner** **Member**	Department of Animal Husbandry, Dairying & Fisheries, Room No: 242-C, Krishi Bhavan, New Delhi-110 001. *Tel/Fax:+11 23386379; Mob:+9868203214*
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1.1.2 Co-opted Members of the Working Group

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5.0	**Dr S D Tripathi**	Former Director, Central Institute of Fisheries Education, Mumbai-400 061, Maharashtra.
6.0	**Shri Suresh Kumar**	Chairman-12th Plan Working Group on Extension.
7.0	**Dr R S Biradar**	Joint Director, CIFE, Versova, Andheri (West), Mumbai- 400 061, Maharashtra.
8.0	**Dr S C Mukherjee**	Former Joint Director, CIFE, Mumbai, 187 A, Sahid Nagar, P.O. – Bhubaneswar-751 007,

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1.2 Terms of Reference (Specific)

The Terms of Reference (Specific) of the Working Group are given below:

(i) To assess the extent achieved by the programmes/schemes in meeting their objectives during XI Plan both in terms of physical and financial parameters and the extent contributed by the States in furthering the process of development of fisheries in terms of financial allocation and deployment of qualified technical manpower.

(ii) To recommend modifications for improvement in such of those schemes which have a potential of increasing fish production in the country, and also recommend doing away with those schemes which have made no significant impact so far.

(iii) To recommend leasing policy of fisheries and other water bodies suitable for fisheries in the country, including suggestions for implementation mechanisms.

(iv) To address constraints faced by aquaculture in terms of inputs, technology, disease control, basic infrastructure and marketing.

(v) To recommend measures for sustainable exploitation of marine fishery resources, especially of deep sea resources and suggest concrete measures to supplement the fish catch from marine resources through sea farming, mariculture, biotechnology, resource replenishment programmes like setting up of artificial reefs, reduction of by- catch, *etc*.

(vi) To make a critical assessment of the infrastructure facilities for fishing harbours, fish landing centers, processing and marketing network in the country and suggest measures to fill up the gaps for effective utilization of projected fish catch.

(vii) To recommend steps for wide expansion of non-food fisheries for pearl culture, ornamental fisheries, etc. as an alternative source of income and export earnings.

(viii) To assess likely impact on fish production due to climate change and suggest measures to be adopted by the fishermen/fish farmers in order to counter any likely adverse effect due to climate change.

(ix) To review the delivery mechanisms for development of fisheries, especially in aquaculture and suggest convergence of efforts among the existing organizations like ATMA, KVK, ICAR, Universities and other research organizations. Other innovative and non-traditional delivery mechanisms may be suggested.

(x) To enhance and strengthen welfare measures for the fishermen both inland and marine and augment the measures by converging with similar programmes of other Departments like IAY of Rural Development and other schemes of the Ministry of Social justice.

(xi) To facilitate larger private participation in the development of fisheries in the country.

1.3 Terms of Reference (General)

(i) The Chairman of the Working Group may co-opt any other official/non/official expert/representative of any organization as a member(s), if required.

(ii) The Working Group may also examine and address any other issue which is important though not spelt out in the ToRs. The Working Group may also devise its own procedures for conducting its business/meetings/field visits/constitutions of Sub-Groups, etc.

(iii) The expenditure of the members on TA/DA in connection with the meetings of the Working Group or any work incidental to the functions of the Working Group/Sub-Group will be borne by the parent Department/Ministry/Organization for official members and by the Planning Commission for non-official members.

(iv) The Working Group will submit its draft report to the Planning Commission by June 2011 and final one in September 2011.

(v) Shri C Haridas, Consultant (Fisheries), Planning Commission, Room No 421-B, Yojana Bhavan, New Delhi – 110 001, Tel No. 011 23042422,

email: c_haridas@rediffmail.com, Fax No.011 23327703 will be the Nodal officer for this Group in the Planning Commission. Any further query/correspondence in this regard may be made with him, and also with the Member Secretary of the Working group. The National Fisheries Development Board (NFDB), Hyderabad will extend the requisite secretariat assistance in the preparation of the report and bring out copies (100) of the same.

Sd/-
(G Rajeev)
Under Secretary to the Government of India

1.4 Constitution of Sub-Groups

In the first meeting of the Working Group on Development and Management of Fisheries and Aquaculture for the Twelfth Five-Year Plan (2012 – 2017), the following three Sub-Groups were constituted:

Sub Group-I: Marine Fisheries		
1.0	Dr G Syda Rao	Director, Central Marine fisheries Research Institute (CMFRI), Kochi, Kerala.
2.0	Dr Y S Yadava	Director, Bay of Bengal Programme Inter-Governmental Organisation, Chennai – 600 018, Tamil Nadu.
3.0	Dr Sebastian Mathew	Programme Adviser, ICSF, 27, College Road, Chennai-600 006, Tamil Nadu. *Tel:+ 91 44 28275303; Fax:+ 91 44 28254453* *Mob:+ 09444065433* *E-mail: sebastian1957@gmail.com*
4.0	Dr R Paul Raj	Member Secretary, Coastal Aquaculture Authority, Chennai-600 006, Tamil Nadu.
5.0	Dr A G Ponnaiah	Director, Central Institute of Brackishwater Aquaculture Chennai-600 028, Tamil Nadu.
6.0	Shri Thampi Samraj	Joint Director (Training & Aqua), Marine Products Export Development Authority, Kochi, Kerala.
7.0	Member	Managing Director, Matsyafed, Thiruvananthapuram, Kerala.
8.0	Shri K Sellamuthu	Commissioner, Department of Fisheries, Government of Tamil Nadu, Chennai–600 006, Tamil Nadu.
9.0	Dr Manmohan Singh	Commissioner of Fisheries, Government of Andhra Pradesh, Hyderabad– 500 028, Andhra Pradesh.
10.0	Dr Manoj Sharma	Shrimp Farmer, Surat-395005, Gujarat,
11.0	Dr Ajit Sinha Patil	Aqua-farmer, Mumbai-400 021, Maharashtra.
12.0	Dr Sandeep Kumar Mandal	Deputy Director of Fisheries, Government of West Bengal, Kolkata, West Bengal.
13.0	Shri C T Betgeri	Director, Central Institute of Coastal Engineering for Fishery, Bangalore – 560 013, Karnataka.
14.0	Dr Boby Ignatius Member	Sr. Scientist, CMFRI, Kochi-682 018, Kerala.
15.0	Shri Y Prakasha Rao Member Secretary	Executive Director, NFDB, Hyderabad- 500 038, Andhra Pradesh.

Sub Group-II: Inland Fisheries and Freshwater & Coldwater Aquaculture		
1.0	Dr A P Sharma	Director, CIFRI, Barrackpore-700120, West Bengal.
2.0	Dr M Sinha	Advisor (Fisheries), Government of Tripura, Tripura, Agartala.
3.0	Dr C Vasudevappa	Senior Executive Director, NFDB, Hyderabad-500 038, Andhra Pradesh.
4.0	Director	Department of Fisheries, Govt of Jammu and Kashmir, Srinagar, J&K.
5.0	Dr P C Mahanta	Director, Directorate of Cold Water Fisheries Research, Bhimtal, Uttarakhand.
6.0	Dr M M Goswamy	Prof. of Zoology Guwahati University, Guwahati-781 014, Assam.
7.0	Director	Central Institute of Freshwater Aquaculture, Bhubaneswar-751 002, Odisha.
8.0	Shri Rajiv Kumar	Director of Fisheries, Government of Jharkhand, Ranchi – 834 001, Jharkhand.
9.0	Dr (Ms) M Mukherjee	Director, Department of Fisheries, Government of West Bengal, Kolkata, West Bengal.
10.0	Shri Kanwaljit Singh Sidhu	Chairman, Punjab fish Farmers & Fisher men Association, 237 H. Bhai Randhir Singh Nagar, Ludhiana, Punjab. *Mob:+9815538587*
11.0	Dr G Venugopal	Principal Scientist (Fisheries) National Research Centre on Meat, Uppal Hyderabad-500 039, Andhra Pradesh. *Mob:+9490623322* *Email: venugopal.g.cife@gmail.com*
12.0	Managing Director	KAVIL, Ernakulam, Kerala.
13.0	Dr E V Gopinatha Sai Member Secretary	Executive Director, NFDB, Hyderabad- 500 038, Andhra Pradesh.

Co-opted members of Sub-Group II		
1.0	Dr J K Jena Member	Director National Bureau of Fish Genetics Resources Lucknow-226 002, Uttar Pradesh.
2.0	Prof H R Singh Member	Former Vice Chancellor, Allahabad University Allahabad, Uttar Pradesh.
3.0	Dr A K Roy	Secretary (Fisheries), Government of Assam Secretariat, Dispur, Assam.
4.0	Dr S C Mukherjee	Ex-Joint Director, CIFE, Mumbai, Maharashtra.
5.0	Shri Nishat Ahmed	Director, Department of Fisheries Government of Bihar, Patna, Bihar.
6.0	Dr P Nath	Director, Department of Fisheries, Government of Arunachal Pradesh, Itanagar, Arunachal Pradesh.
7.0	Dr Dipayan De	South Asian Forum for Environment, Kolkata, West Bengal.
8.0	Dr B N Pandey	Former Dean and Prof. of Zoology, Magadh University, Bodh Gaya, Bihar.
9.0	Dr P N Pandey	Former Professor, University of Ranchi, Ranchi, Bihar.
10.0	Dr S Purukaystha	Assam Agricultural Competitive Project,

		Guwahati, Assam.
11.0	Shri Sudhir Pandey	Chaur-based Fisheries Development Group, Village-Balua, Dholi, Muzaffarpur, Bihar.
12.0	Dr P K Katiha	Principal Scientist, CIFRI, Barrackpore Kolkata – 700 120, West Bengal.
13.0	Shri Haridas	Ex-Deputy Advisor (Fy.), Planning Commission, New Delhi- 110 059.

Sub Group-III: Fishery Policies and HRD		
1.0	Dr W S Lakra	Director/ VC, CIFE, (Deemed University), Mumbai-400 061, Maharashtra.
2.0	Dr M V Gupta	World Food Laureate, Hyderabad, Andhra Pradesh.
3.0	Dr K Vijaya Kumaran	Director General, Fishery Survey of India, Mumbai-400 001, Maharashtra.
4.0	Shri B K Mishra	Managing Director, FISCOPFED, New Delhi.
5.0	Dr M Surya Prakash	Sr. Executive Director, NFDB, Blocks: 401-402, Maitri Vihar Ameerpet, Hyderabad - 500 038 *Ph: + 91 40 23737256; Fax: + 91 40 23737208*
6.0	Shri B Vishnu Bhatt	Fisheries Development Commissioner, Ministry of Agriculture,New Delhi.
7.0	Member	Secretary (Fisheries), Government of West Bengal, Writers' Building, Kolkata – 700 001, West Bengal.
8.0	Member	Director, Department of Fisheries, Govt. of Gujarat, Gandhinagar, Gujarat.
9.0	Member	Director, Department of Fisheries, Government of Karnataka, Bangalore, Karnataka. .
10.0	Member	Director, Department of Fisheries, Government of Kerala, Thiruvananthapuram, Kerala.
11.0	Dr Salim Sultan Member Secretary	Executive Director, NFDB, Blocks: 401-402, Maitri Vihar Ameerpet, Hyderabad- 500 038 *Tel:+40 23737256; Fax:+40 23737208*

1.5 Constitution of Drafting Committee

A Drafting Committee was constituted with the following members to draft the Report of the Working Group.

Members of Draft Committee		
1.0	Dr Y S Yadava	Director, BOBP-IGO
2.0	Dr Dilip Kumar	Former Vice-Chancellor & Director, CIFE
3.0	Dr A P Sharma	Director, CIFRI
4.0	Dr G Syda Rao	Director, CMFRI
5.0	Dr Vasudevappa	Sr. Executive Director, NFDB
6.0	Dr R S Biradar	Joint Director, CIFE
7.0	Ms Chandrika Sharma	Executive Secretary, ICSF
8.0	Dr P Paul Pandian	Deputy Commissioner (Fy.), DAHD&F
9.0	Dr P K Katiha	Principal Scientist, CIFRI
10.0	Shri C Haridas	Ex-Deputy Adviser (Fy.), Planning Commission
11.0	Dr Boby Ignatius	Senior Scientist, CMFRI

1.6 Preparation of the report

The Working Group on Development and Management of Fisheries and Aquaculture for the Twelfth Five-Year Plan (2012-17) met on three occasions to discuss the issues and potentialities of fisheries and aquaculture in India and chart a road map for preparation of the report for consideration of the Government. The first meeting of the Working Group was held on 15 April 2011 at the NFDB, Hyderabad; the second on 22 July 2011 at the Central Inland Fisheries Research Institute (CIFRI), Barrackpore (Kolkata); and the third on 18 August 2011 at the Central Institute of Brackish water Aquaculture (CIBA), Chennai. In between, an Interface Meeting was organized by the Planning Commission between the Twelfth Plan Working Groups and the States at NASS Complex, New Delhi on 23 June 2011. This Meeting was attended by Dr Dilip Kumar, Chair, Working Group on Fisheries and Aquaculture and Dr P Paul Pandian, Deputy Commissioner (Fisheries), DAHD&F, Ministry of Agriculture.

In the first meeting, decision was taken to set up three sub-groups namely, (i) Sub-Group-I on Marine Fisheries (including Mariculture, brackish water aquaculture); (ii) Sub-Group-II: Inland Fisheries, freshwater aquaculture and coldwater fisheries and (iii) Sub-Group- III: Fishery policies and HRD. Dr G Syda Rao, Director, Central Marine Fisheries Research Institute (CMFRI), Kochi; Dr A P Sharma, Director, CIFRI, Barrackpore and Dr W S Lakra, Director, Central Institute of Fisheries Education (CIFE), Mumbai were made the chairpersons of the three Sub-Groups.

In the second Meeting of the Working Group held in Barrackpore on 22 July 2011, the three Sub-groups presented their reports. Subsequently, in the Third Meeting of the Working Group held in Chennai on 18 August 2011, a Drafting Committee was constituted to draft the Report of the Working Group. The Drafting Committee met on two occasions at CIFRI, Barrackpore to draft the Report for submitting to the Working Group for a final decision.

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CHAPTER 2.0

2.0 Indian Fisheries: An overview

2.1 Introduction

The fisheries sector is an important player in the overall socio-economic development of India. The sector came into focus soon after independence in 1947, mainly for two reasons: (1) to promote fisheries production in order to ensure food security (subsequently foreign exchange earnings were also added); and (2) socio-economic development of fishers/fish farmers through subsidization of various assets. As a result, starting from a purely traditional activity in the early fifties when India commenced with the First Five-Year Plan (1950-51 – 1955-56), fisheries and aquaculture have now transformed into a significant commercial enterprise. The sector's contribution to employment generation, food and nutritional security and foreign exchange earnings is now well recognized.

The fisheries sector contributed Rs. 67 913 crores to the GDP (at current prices) during 2009-2010, which is 0.96 percent of the total GDP at factor cost[3] (MoSPI, 2011) and 5.41 percent of the GDP at factor cost from agriculture, forestry and fishing. The share of fisheries sector in the total GDP at factor cost in current prices increased from 0.40 percent in 1950-51 to 0.96 percent in 2009-10, recording an increase of 140 percent ***(Figure 1)***. The fisheries sector has also been one of the major contributors of foreign exchange earnings. During 2010-11, export of marine products reached 813 091 tonnes valued at Rs. 12 901.47 crore and US $ 2.857 billion[4].

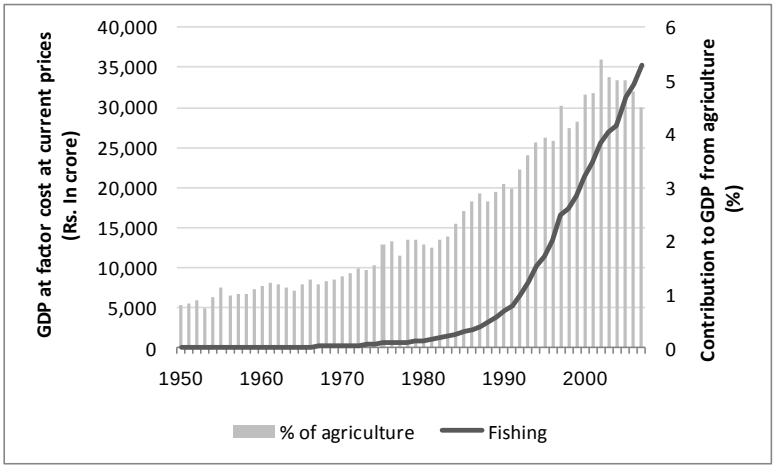


Figure 1: GDP from fisheries and its contribution to agriculture sector (MoSPI, 2011)

[3] Ministry of Statistics and Programme Implementation: Annual and Quarterly Estimate of GDP at Current Prices, Base Year 2004-05 (http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=82)
(http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=82)
[4] MPEDA 2011 (http://www.mpeda.com/inner_home.asp?pg=trends)

2.2 Fisheries resources

Marine and inland fisheries and aquaculture constitute the main components of fisheries sector in India. Aquaculture is practiced in both fresh and brackish waters. In recent years, mariculture or sea farming is gaining popularity and a couple of fin and shellfish species and sea weeds are now being farmed. Ornamental fish farming, although a non-food activity also has a promising future and is likely to contribute to the overall growth of fisheries sector in the coming years in terms of foreign exchange earnings and additional livelihood opportunities for fishers and unemployed young men and women in both urban and rural areas. The following paragraphs describe the resources under different sub-sectors of the fisheries sector.

2.2.1 Marine fisheries

After declaration of the Exclusive Economic Zone (EEZ) in 1977, the oceanic resources available to India are estimated at 2.02 million sq. km, comprising 0.86 million sq. km (42.6 % of the total) on the west coast, 0.56 million sq. km (27.7%) on the east coast and 0.60 million sq. km (29.7%) around the Andaman and Nicobar Islands ***(Figure 2)***. The continental shelf area amounts to 530 000 sq. km of which 71 percent area is available in the Arabian Sea (west coast) and the remaining 29 percent in the Bay of Bengal (east coast). With absolute right on the EEZ, India has also acquired the responsibility to conserve, develop and optimally exploit the marine living resources within this area.

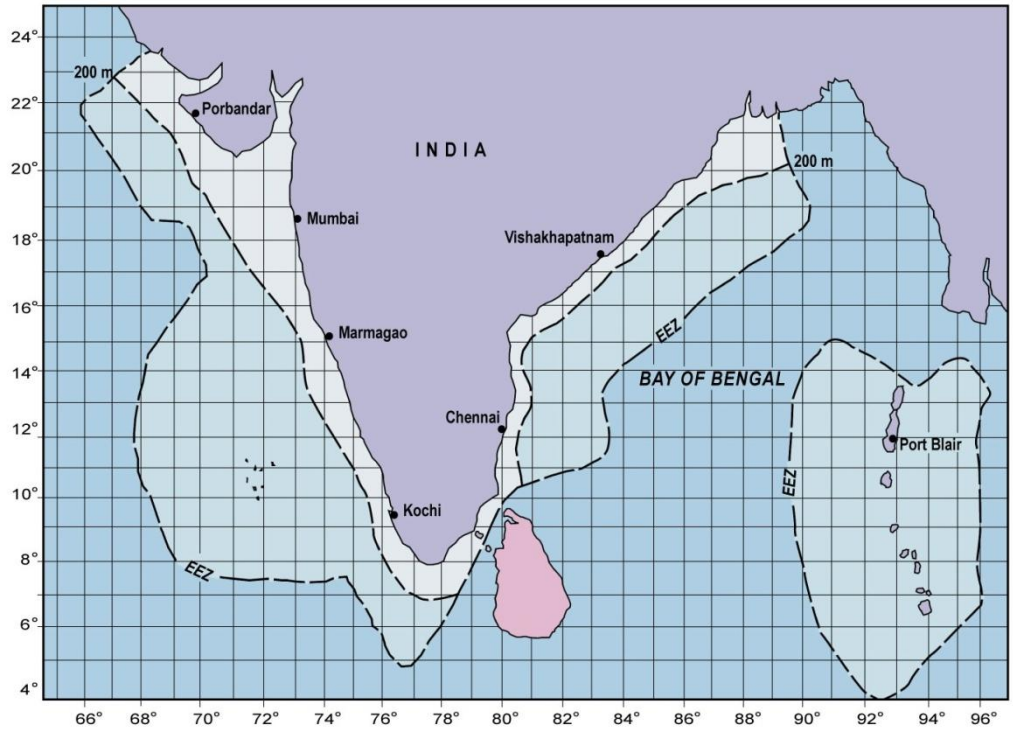


Figure 2: Exclusive Economic Zone of India

The country has a long coastline of 8 118 km and an equally large area under estuaries, backwaters, lagoons, etc, which is highly amenable for developing

capture as well as culture fisheries. As per the National Marine Fisheries Census, 2005 (NMFC, 2005), the marine fisheries activities are spread in approximately 1 376 fish landing centres and 3 322 fishing villages located along the coastline on the mainland and the two Island territories of Lakshadweep and the Andaman & Nicobar Islands.

Marine fisheries constitute a valuable source of food and employment, and a net contributor to the balance of payment. Marine fisheries have progressively increased by nearly six times during the past 50 years. About 0.933 million people are employed in the sector on full-time basis, 1.01 million on part-time basis and 1.39 million are engaged in other ancillary activities. Major fish production comes from the coastal resources. As per the early estimates of NFMC, 2010[5], there are about 8.63 lakh fishers[6] families in the mainland and about 9.26 lakh people are engaged as active fishers.

The estimated marine resource potential of the Indian EEZ is 4.24 million metric tonnes (mmt) at the present exploitation rates. In marine fisheries, while inshore waters have been almost exploited to the sustainable levels (CMFRI, 2011), contributions from the deep sea have been insignificant. The trend based surveys have indicated that in the depth range up to 100 m, which contributes to about 86 percent of the total exploited resources; practically there is little possibility of witnessing quantitative increase in production. However, the depth ranges beyond 100 m have avenues of expansion, albeit more in qualitative terms. In this domain, the possibility revolves around oceanic resources like tuna, bill fishes and allied species whose combined potential is pegged at 0.2 mmt with the lucrative yellow fin tuna contributing to the tune of 40 percent to it.

The Indian marine waters harbour around 1 707 species of fish, of which about 200 species are commercially significant. The estimated landings from the marine capture fisheries stand at 3.220 mmt (CMFRI, 2010), with a growth rate of 4.62 percent. The gross value of the marine fish landings at the landing centre level is estimated at Rs.19 753 crores and at the retail level at Rs.28 511 crores (SEETTD, 2011). Gujarat has emerged as the leading producer of marine fish in the country during 2009-2010, followed by Kerala, Maharashtra and Tamil Nadu.

Time-series trend in landings of marine fisheries shows considerable variation through the period 1950-2010. These changes are: (i) increase in number of species harvested/caught; (ii) changes in catch composition; and (iii) decline in availability of some species and increase in the others, such as the oil sardine along the coast line.

Group-wise (FAOSTAT), demersal fishes constitute about 33 percent of the total landings; pelagic species form about 27 percent and marine species (fin fishes, etc) constitute about 23 percent of the catch. The other marine groups (crustaceans, cephalopods and molluscs) constitute about 17 percent of the

[5] The NFMC, 2010 has been conducted by the Central Marine Fisheries Research Institute and the results are yet to be made official.

[6] The word 'fisher' includes both fishermen and fisherwomen.

landings. Another feature of the decadal trend of landings is that among various groups, the contribution by pelagic and demersal fin fish resources has shown marked increase while the crustaceans (shrimps) and molluscs are fluctuating around a flat trend. This adds relevance to the argument that quantum increase need not necessarily indicate increase in value of the products in the same vein.

2.2.2 Inland fisheries

The inland capture fisheries resources of the country comprise a maze of rivers, canals, estuaries, floodplain lakes, wetlands, lagoons, upland lakes and reservoirs. The river system includes 14 major and 44 medium rivers, innumerable tributaries and anabranches. With a combined length of 45 000 km and 20 000 sq. km of catchment area, the country's riverine resources provide one of the richest fish germplasm of the world. The floodplains are primarily continuum of rivers and exist in the form of oxbow lakes, especially in the States of Bihar, West Bengal, Assam (Brahmaputra and Barak valleys), Manipur and eastern Uttar Pradesh. The country has an estimated 1.2 million hectare (mha) of floodplain lakes and wetlands where fish and fisheries remain a traditional economic activity with tremendous socio-economic impact in the rural sector. The cold-water fisheries resources comprise rivers, streams, lakes, reservoirs with a combined riverine length of 8 253 km and 41 600 ha of sprawling lakes and reservoirs. Besides, there are vast sheets of inland saline water bodies lying unexploited in different States of the country, mainly in northern and central India.

Seven major rivers contribute to the estuarine resource of the country. Besides, there are large numbers of smaller rivers on both the coasts, which end up in estuaries. The Hooghly-Matlah estuarine system, which is the largest and richest estuarine system in the country, encompasses the Sundarbans. The other important resources include the Mahanadi, Narmada**,** Tapti and some smaller peninsular estuaries.

India has more than 3.0 mha of reservoirs distributed under divergent geo-climatic, morphometric and edaphic environments. Based on a 1995 study of the Food and Agriculture Organization (FAO) of the United Nations[7], these water bodies are classified as small (1 000 ha), medium (1 000 to 5 000 ha) and large (5 000 ha). The size-wise distribution of reservoirs in India is as follows:

Distribution of small, medium and large reservoirs in India

	Small	**Medium**	**Large**	**Total**
Number	19 134	180	56	19 370
Area (ha)	14 85 557	5 27 541	11 40 268	31 53 366

The reservoirs are predominantly located in the peninsular States, *viz.*, Tamil Nadu, Karnataka, Andhra Pradesh, Kerala, Orissa, and Maharashtra. These six

[7] ***Sugunan, V.V., 1995. Reservoir Fisheries of India. FAO Fisheries Technical Paper, No. 345. Rome, FAO.1995.pp.423.***

States account for more than 56 percent of the total reservoir area in the country. Of the 19 134 small reservoirs, 17 989 (94%) are located in southern India. Similarly, 34 percent of the medium reservoirs are also distributed in these States. The reservoirs form a large resource size carrying a huge untapped production potential.

2.2.3 Aquaculture

The freshwater culture resources in the country comprise 2.41 mha of ponds and tanks. The other resources where fish farming can be undertaken include the floodplain lakes and other natural lakes, reservoirs, irrigation canals and paddy fields. India is basically a carp country with more than 75 percent of the production being contributed by carps alone. The other significant contributor in recent years is *Pangasius* species. India is now the third largest producer of *Pangasius* in the world after Vietnam and Thailand.

Since the early eighties, development of brackish water fish culture has gained prominence. About 1.2 mha has been estimated as amenable for brackish water aquaculture in the coastal areas of the country. Besides tiger shrimp (*Penaeus monodon*), the exotic white leg shrimp (*Littopenaeus vannamei*) is also becoming a popular species. Farmed shrimps contribute a sizeable percentage to the total exports from the country.

The inland fisheries resources provide full time vocation to 1.24 million inland fishers, and 3.4 mmt of annual fish production. India is the third largest producer of inland fish in the world (after China and Bangladesh) and the sector plays a great role in nutritional security and employment potential. The sector is also an important source of ancillary jobs for the rural population, especially in marketing, retailing, transportation, etc. However, the sector remains largely unorganized even today mainly due to scattered and diffused nature of activities. Though fisheries has been recognized as a thrust area in the successive Five-Year Plans, there has been little attention to the development of inland fisheries resources. A snap shot of country's marine and inland fisheries resources are shown in ***Table 1*** below.

Table 1: Fisheries resources of India – At a glance

Marine Resources & Fisher Statistics	
Coastline (km)	8 118
Exclusive Economic Zone (million km^2)	2.02
Continental shelf ('000 km^2)	530
Fish Landing Centres (Nos.)	1 376
Fishing villages (Nos.)	3 322
Fishermen families (Nos.) (NMFC,2005)	764 868
Fisher folk population (Nos.) (NMFC,2005)	3 574 704
Inland Resources	
Rivers & canals (km)	195 210
Reservoirs (lakh ha.)	31.5
Tanks and ponds (lakh ha)	24.14
Floodplain/derelict water bodies (lakh ha)	8 – 12
Brackishwater (lakh ha)	12.40
Saline/alkaline affected area (lakh ha)	12.00

2.3 Fish production

2.3.1 Fish production and trend

Fish production in India has shown an increasing trend from 0.72 mmt in 1950-51 to reach 8.288 mmt in 2010-11(P). With a vast production potential, particularly in inland fisheries (mainly reservoirs) and aquaculture, the sector has shown an average growth of about 6 percent over the Five-Year Plan periods. In case of marine fisheries, production has increased from 0.53 mmt in 1950-51 to 3.220 mmt in 2010 -11. In the inland sector, the growth has been steady, increasing from 0.218 mmt during 1950-51 to about 5.068 mmt in 2010-11, with an annual growth rate of 4.21 percent ***(Table 2 & Figure 3)***.

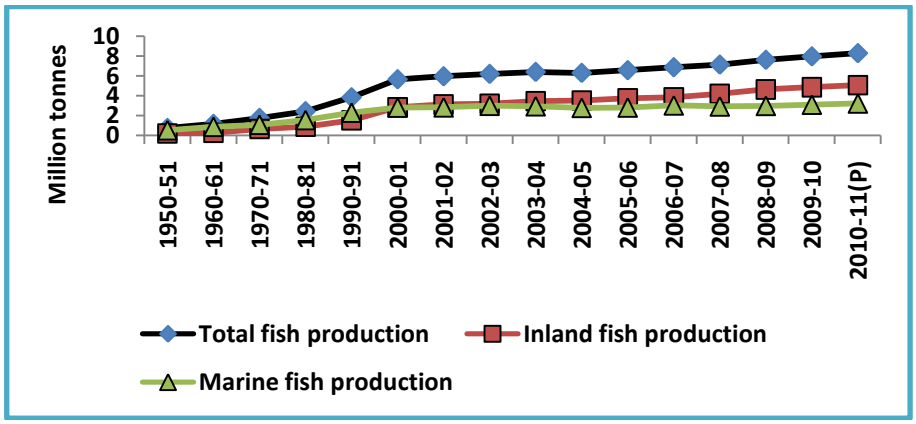


Figure 3: Fish production trends (total, marine & inland) [From 1950-51 to 2010-2011(P)]

2.3.2 Fish production potential

The harvestable potential of marine fishery resources in the EEZ has been revalidated at about 4.419 mmt[8], of which the pelagic resources account for 2.128 mmt; demersal resources for 2.083 mmt and oceanic resources for 0.280 mmt. As compared to the last estimate carried out in 2000, the current estimate is about 0.5 mmt more.

Depth-wise marine fish production potential shows that about 86.84 percent of the resources (3.837 mmt) are available in the 100 meter depth zone; 5.86 percent (0.259 mmt) in 100-200 meter depth; and 2.59 percent (0.115 mmt) in the 200-500 meter depth zone. The resources in oceanic area have been estimated as 0.208 mmt, which is 4.71 percent of the total potential. The oceanic resources largely comprise yellow fin tuna (80 000 metric tonnes- mt), skipjack tuna (99 000 mt), bigeye tuna (500 mt), billfishes (5 900 mt), pelagic sharks (20 800 mt) and other species (1 800 mt).

[8] ***The potential has been revalidated to 4.419 mmt in 2011. The estimate of 3.934 mmt was worked out by a Working Group set up by the Ministry of Agriculture in 2000. The full report of the revalidation carried out in 2011 is awaited.***

Table 2: Fish Production in India
(1950-51 to 2010-2011)

Year	Fish Production ('000 tonnes)		
	Marine	Inland	Total
1950-51	534	218	752
1955-56	596	243	839
1960-61	880	280	1 160
1965-66	824	507	1 331
1970-71	1 086	670	1 756
1973-74	1 210	748	1 958
1978-79	1 490	816	2 306
1979-80	1 492	848	2 340
1980-81	1 555	887	2 442
1981-82	1 445	999	2 444
1982-83	1 427	940	2 367
1983-84	1 519	987	2 506
1984-85	1 698	1 103	2 801
1985-86	1 716	1 160	2 876
1986-87	1 713	1 229	2 942
1987-88	1 658	1 301	2 959
1988-89	1 817	1 335	3 152
1989-90	2 275	1 402	3 677
1990-91	2 300	1 536	3 836
1991-92	2 447	1 710	4 157
1992-93	2 576	1 789	4 365
1993-94	2 649	1 995	4 644
1994-95	2 692	2 097	4 789
1995-96	2 707	2 242	4 949
1996-97	2 967	2 381	5 348
1997-98	2 950	2 438	5 388
1998-99	2 696	2 602	5 298
1999-00	2 852	2 823	5 675
2000-01	2 811	2 845	5 656
2001-02	2 830	3 126	5 956
2002-03	2 990	3 210	6 200
2003-04	2 941	3 458	6 399
2004-05	2 779	3 526	6 305
2005-06	2 816	3 756	6 572
2006-07	3 024	3 845	6 869
2007-08	2 920	4 207	7 127
2008-09	2 978	4 639	7 617
2009-10 (P)	2 689	4 862	7 851
2010-11 (P)	3 220	5 068	8 288

Sources:

(i) Department of Animal Husbandry, Dairying and Fisheries (2009), Handbook of Fisheries Statistics, 2008. Ministry of Agriculture, Government of India.

(ii) Department of Animal Husbandry, Dairying and Fisheries (2011), Annual Report, 2010-11. Ministry of Agriculture, Government of India.

Amongst the different groups of pelagic species, oil sardines top with a share of 0.51 mmt, followed by ribbon fish (0.23 mmt) and Indian mackerel (0.2 mmt). In the demersal group, penaeid prawns top with a share of 0.24 mmt, followed by croakers (0.22 mmt) and non-penaeid prawns (0.21 mmt).

The inland fisheries and aquaculture offer immense potential for enhancement of fish productivity and production. The fish productivity of freshwater aquaculture is far below the potential (2.85 t/ha from the ponds managed under the FFDA programme against a moderate production potential estimate of 5.0 tonnes/ha). The area under culture is also a small part of the existing resources 0.95 mha out of 2.41 mha. Similarly for brackishwater aquaculture nearly 15 percent of the amenable area is under culture and has considerable scope for enhancing the productivity.

In case of inland fisheries, reservoirs and floodplain wetlands offer greater scope for increase in fish production through culture-based fisheries. The average fish production potential was estimated at 250 kg/ha for reservoirs and 1500 kg/ha for floodplains/wetlands. Against this the fish yield is only 30 kg/ha for reservoirs and about 350 kg/ha for floodplains/wetlands. In case of reservoirs adopted under the NFDB Reservoir Fisheries Development Programme, average fish yield of 174 kg/ha for small, 94 kg/ha for medium and 33 kg/ha for large reservoirs was documented, with an average fish yield of 110 kg/ha. For floodplains/wetlands, the fish yield from West Bengal wetlands has been estimated at over 3 tonne/ha. Further, the irrigation canals are rarely exploited for fish production.

2.4 Global fisheries

The State of the World Fisheries and Aquaculture (SOFIA, 2010) of the FAO of the United Nations estimated (Provisional) that in 2009 the total world fish production reached an all time high of 145.1 mmt, comprising 90.0 mmt from capture fisheries (both inland and marine) and 55.1 mmt from aquaculture. Of the total production, 117.8 mmt was used as human food and 27.3 mmt for non-food use. With an estimated world population of 6.8 million[9], the per capita food fish supply was estimated at 17.2 kg during the year.

As per the 2008 statistics contained in SOFIA, 2010, the proportion of fully exploited fish stocks was estimated at 50 percent, depleted or recovering stocks at 32 percent and underexploited or moderately exploited stocks at 15 percent. Further, it is also estimated that 4.3 million vessels contribute to the global fishing fleet of which 59 percent (2.54 million) are powered by engines and the remaining 41 percent (1.76 million) are traditional boats, operated by sails or oars. Problems persist with the high levels of unwanted and often unreported by-catch and discards in many fisheries round the world, including the capture of ecologically important species and juveniles of economically valuable species. The latest estimate of global discards from fishing is about 7.0 mmt per year.

[9] The World population has since touched the 7.0 billion mark.

In terms of global ranking, in 2008, India was second to China in total fish production; sixth in marine and inland capture fisheries (after China, Peru, Indonesia, USA, Japan); third in inland capture fisheries (after China and Bangladesh) and second in aquaculture (after China). ***Table 3*** provides a comparative account of the global and Indian fish production from capture and culture fisheries.

Table 3: Fish production in India and the World and its percent contribution to World fish production (in mmt)

Year	Capture fish production		Aquaculture Production		Total fish Production	
	Global	India	Global	India	Global	India
2005	92.0	3.691	44.3	2.967	136.3	6.658 (4.88%)
2006	89.7	3.845	47.3	3.180	137.0	7.025 (5.13%)
2007	89.9	3.859	49.9	3.112	139.8	6.971 (4.99%)
2008	89.7	4.105	52.5	3.479	142.2	7.584 (5.33%)
2010	90.0	4.02*	55.1	4.27*	145.1	8.290 (5.71%)

**** Provisional figures.***

In 2008, 39.7 percent (56.5 mmt) of total world fish production was marketed as fresh, while 41.2 percent (56.6 mmt) as frozen, cured or otherwise prepared for direct human consumption. Since the mid-1990's, the proportion of fish used for direct human consumption has grown as more fish is used as food and less for producing fish meal and fish oil.

Globally, aquaculture continues to be the fastest-growing animal-food-production sector with per capita supply from aquaculture increasing from 0.7 kg in 1970 to 7.8 kg in 2008, an average annual growth rate of 6.6 percent. The value of the world aquaculture harvest excluding aquatic plants is estimated at US$ 98.4 billion in 2008. The actual total output value from the entire aquaculture sector should be significantly higher than this level, because the value of aquaculture hatchery and nursery production and that of the breeding of ornamental fisheries are yet to be estimated and included.

In 2008, global export of fish and fishery products reached a record value of US$ 102.0 billion, representing a share of about 10 percent of total agricultural exports. Prices of fish and fishery products were also affected by the food price crisis, following the general upward trend in all food prices. China, Norway and Thailand are the top three fish exporters. China's fishery exports have grown considerably since the 1990's and a growing share of these exports consists of reprocessed imported raw material. China, Thailand and Vietnam, accounted for 50 percent (US$ 50.8 billion) of world export of fish and fishery products in value terms.

Like India, the fisheries sector continues to be a source of income and livelihoods for millions of people around the world. In 2008, an estimated 44.9 million people were directly engaged, full time or part-time in fisheries and aquaculture. This number represents a 167 percent increase compared with the 16.7 million people in 1980.Women comprised 12 percent of the total population (5.39 million). It is also estimated that, for each person employed in capture fisheries and aquaculture production, about three jobs are produced

in secondary activities, including post-harvest. Further, on average, each fisher/farmer provides for three dependents or family members. Employment in fisheries sector has grown faster than the world's population and also than employment in traditional agriculture. The majority of fishers and fish farmers are in developing countries, mainly in Asia, which has experienced the largest increase in recent decades, reflecting in particular the rapid expansion of aquaculture activities.

The number of people employed in direct production in the sector cannot be taken as the only indicator of the magnitude of fisheries contribution to the national economy. The contribution of people engaged in other ancillary activities, such as processing, net and gear making, ice production and supply, boat construction and maintenance, packaging, marketing and distribution is also substantial and adds to the overall contribution from the sector. Besides, those engaged in research, development and administration linked with the fisheries sector are also important contributors to the sustainable growth of the sector.

Small-scale fisheries contribute more than half of the world's marine and inland fish catch, almost all of which is destined for direct human consumption. These fisheries employ more than 90 percent of the world's 45 million fishers and they support another 84 million people employed in jobs associated with fish processing, distribution and marketing. More than 95 percent of small-scale fishers and related workers in post-harvest sectors live in developing countries. In spite of their significant contributions to the global fish food supplies, small-scale fishing communities live and work in very difficult conditions.

The SOFIA, 2010 has also estimated the average production per person in fisheries (capture and aquaculture) sector, which is 2.4 tonnes per year for Asia; 23.0 tonnes for Europe; 13.8 tonnes for Latin America and the Caribbean and 2.0 tonnes per year for Africa. The figures on production per person indicate the degree of industrialization of fishing activities, and also the key role played by small-scale fisheries in this regard.

2.5 Exports

During 2010-11(April 2010 – March 2011), export earnings for the first time in the history of marine products exports from India touched US $ 2.857 billion mark. In volume terms the exports aggregated to 813 091 mt, valued at Rs. 12 901.47 crore. As compared to the previous year, the seafood exports recorded a growth of 19.85 percent in quantity, 28.39 percent in rupee and 33.95 percent growth in US $ earnings. These developments in the marine products export happened despite continuing recession in the international markets, debt crisis in European Union (EU) economies, continuing anti-dumping duty in US and the sluggish growth in US economy and political instability in the Arab world. The increased production and productivity of shrimps, *L. vannamei* (whiteleg shrimp) and *P. monodon* (black tiger shrimp) and better price realization of major items like cuttlefish, shrimp and squid

helped realizing a higher export turnover. ***Figure 4*** provides a glimpse of the trend in exports from 1961-62 to 2010-11.

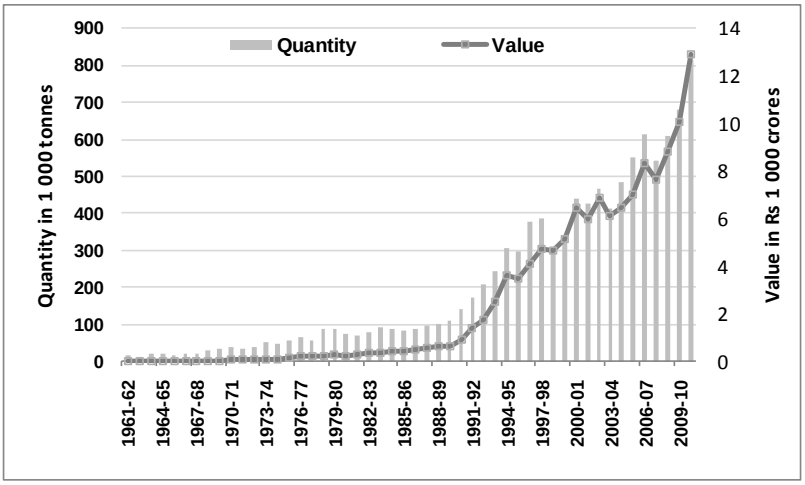


Figure 4: Trends in export of marine products [1961-62 to 2010-11] (Source: Handbook of Fisheries Statistics, 2008 and the Marine Products Export Development Authority)

Frozen shrimp retained its position as the major export item, accounting for 44.17 percent of the total US $ earnings. Shrimp exports during 2010-11 period increased by 16.02 percent, 36.72 percent and 42.90 percent in quantity, rupee and US $ terms respectively. Fish continued to remain as the principal export item in quantity terms and the second largest export item in value terms, with a share of 38.42 percent in quantity and 20.42 percent in US $ earnings.

The EU remained as the largest market with a share of 26.78 percent in US $ realization, followed by South East Asia (16.43%), China (15.41%), USA (15.35%), Japan (13.06%), Middle East (5.19%) and other countries (7.79%). The export to the US market increased by 8.75 percent compared to the previous year. The significant development in the expansion of export is the strengthening of India's presence in Southeast Asia and Middle East markets, where the quantitative increase has been to the tune of 57 percent and 26 percent respectively. Similarly, exports to African countries have also registered a significant increase in comparison to the previous year.

In a recent study conducted by ASSOCHAM (Associated Chambers of Commerce and Industry of India) on the seafood market in India by 2014, it is said that the seafood exports that totaled US $ 1.9 billion in 2008-09 and moved up to US $ 2.857 billion in 2010-11 are likely to touch US $ 4.7 billion by 2013 -14, provided the key thrust areas like value-addition, expansion of aquaculture, technological upgrade and tapping unexplored resources get a boost. Further, the growing demand from EU, USA, China, Southeast Asia and Japan (after the 11 March 2011 tsunami) is likely to give a boost to the seafood exports from the country.

2.6 Employment

One of the most significant characteristic of the Indian fisheries sector is its small-scale nature. Fishing is a traditional economic activity in India practiced for generations by the fisher communities. The fishers can be broadly classified as (1) inland fishers, (2) marine fishers and (3) fish farmers. As per the Indian Livestock Census, 2003, 14.49 million people were engaged in various fisheries related activities. About 75 percent of the fishers are engaged in inland fisheries activities and about 25 percent in marine fisheries activities.

A National Marine Fisheries Census (NMFC) was conducted in 2005 by the CMFRI, Kochi (for mainland coastal States/UTs) and the Fishery Survey of India (FSI), Mumbai (for the two Island groups). As per the NMFC, 2005 the marine fisheries sector provides employment to about 0.9 million fishers in active fishing and about 0.7 million fishers in various other fishing operations. The number of people involved in marine fisheries related activities include nearly 0.2 million in fish marketing, 0.1 million in repairs of fisheries requisites, around 0.2 million in fish processing and 0.1 million in other ancillary activities. In all, an estimated 3.51 million people depend on marine fisheries for their livelihoods in India.

Compared with the previous NMFC undertaken in 1980, it is seen that marine fisher population has nearly doubled from 1.87 million in 1980 to 3.51 million in 2005. Among the maritime states, West Bengal has the highest concentration of fishers per kilometer of coastline (1 706), followed by Kerala (1 012) and Odisha (938). More details can be seen in ***Table 4*** below:

Table 4: State and activity-wise marine fisher population in India

State/UTs	Active Fishermen	Fishing allied	Non fishing/ working	Total Population
West Bengal	70 750	57 741	141 074	269 565
Odisha	121 282	152 534	176 575	450 391
Andhra Pradesh	138 614	152 892	218 485	509 991
Tamil Nadu	206 908	104 509	478 991	790 408
Puducherry	10 341	10 095	22 592	43 028
Kerala	140 222	71 074	390 938	602 234
Karnataka	37 632	45 699	87 583	170 914
Goa	2 515	3 382	4 771	10 668
Maharashtra	72 074	81 780	165 543	319 397
Gujarat	83 322	75 082	164 811	323 215
Daman & Diu	5 868	1 603	21 834	29 305
A & N Islands	4 247	6 580	4 439	15 266
Lakshadweep	8 040	3 561	28 721	40 322
India	**901 815**	**766 532**	**1 906 357**	**3 574 704**

Among those engaged in active marine fishing, majority (81%) are full-time, 13 percent on part-time basis and the rest in occasional fishing. Fishing as a full time profession is relatively popular in the west coast States/UTs (Gujarat, Goa, Daman & Diu, Maharashtra, Karnataka, Lakshadweep and Kerala) where

84 percent of active fishers are engaged in full-time fishing as compared to the east coast States/UTs (West Bengal, Orissa, Andhra Pradesh, Puducherry, Andaman & Nicobar Islands and Tamil Nadu), where 79 percent fishers engage in full-time fishing. This is also supported by the fact that fishing operations are more capital-intensive in the west coast States/UTs than in the east coast States/UTs. The engagement profile of fishers in the country is presented in ***Figure 5*** below.

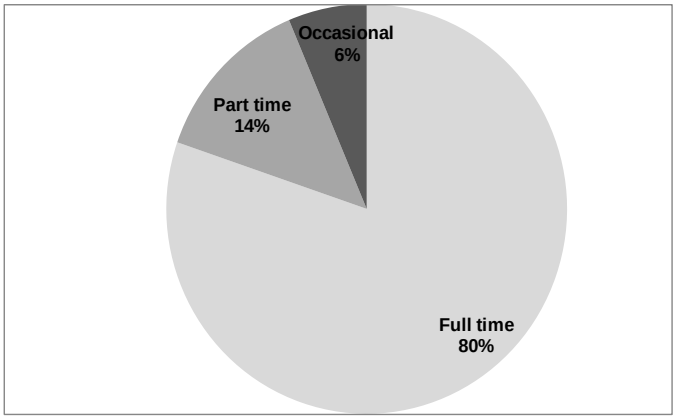


Figure 5: Engagement pattern of active marine fishers in India

Source: National Marine Fisheries Census, 2005

The 2005 NMFC also provides information on work of women in marine fisheries. It notes that among women, the major fishing-related activities are marketing (41.8 percent), labour (18.4 percent) and curing/processing (18 percent). Further, as many as 73.6 percent of those engaged in marketing are women, while 75.7 percent of those in curing and processing are also women. It is apparent that women dominate marketing and processing activities in marine fisheries. State-wise data indicates that the largest numbers of women engaged in marketing are in Maharashtra (39 288), Tamil Nadu (31 019) and Andhra Pradesh (27 160). Significant numbers of women engage in processing/curing activities in Andhra Pradesh (24 524), Orissa (16 447) and Maharashtra (8 584).

2.7 Fishing fleet

The marine fishing fleet[10] comprises about 2 43 939 fishing crafts of which 107 448 (44.05%) are traditional and 76 748 (31.46%) motorized traditional crafts. The mechanized fishing vessels (MFVs) comprise 59 743 vessels – 24.49 percent of the total ***(Table 5)***. As seen by the number of traditional crafts and small-mechanized vessels, the major fishing activities are still concentrated in the areas within 100 meter depth zone. As compared to the west coast, concentration of traditional crafts (including motorized) is more on the east coast (about 67 % of the total). In the case of MFVs, the trend is

[10] ***Source: National Marine Fisheries Census, 2005, Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India.***

reverse (about 64 % of the total). The scale of mechanization is also reflected in the total fish landings of the two coasts.

Table 5: State-wise detail of fishing vessels in India

Sl. No	State/Union Territory	Mechanized vessels	Motorized vessels	Non-motorized vessels	Total
1	West Bengal	6 829	1 776	10 041	18 646
2	Odisha	3 577	4 719	15 444	23 740
3	Andhra Pradesh	2 541	14 112	24 386	41 039
4	Tamil Nadu	7 711	22 478	24 231	54 420
5	Pondicherry	627	2 306	1 524	4 457
6	Kerala	5 504	14 151	9 522	29 177
7	Karnataka	4 373	3 705	7 577	15 655
8	Goa	1 087	932	532	2 551
9	Maharashtra	13 053	3 382	7 073	23 508
10	Gujarat	13 047	7 376	3 729	24 152
11	Daman & Diu	562	654	211	1 427
12	Andaman & Nicobar Islands	165	781	1 837	2 783
13	Lakshadweep	667	376	1 341	2 384
14	**India**	**59 743**	**76 748**	**107 448**	**243 939**

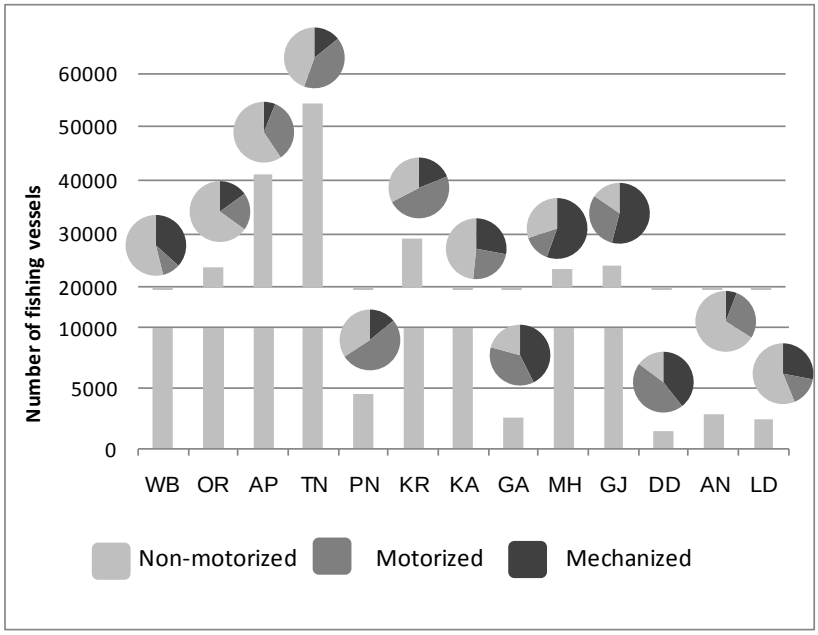
Source: National Marine Fisheries Census, 2005

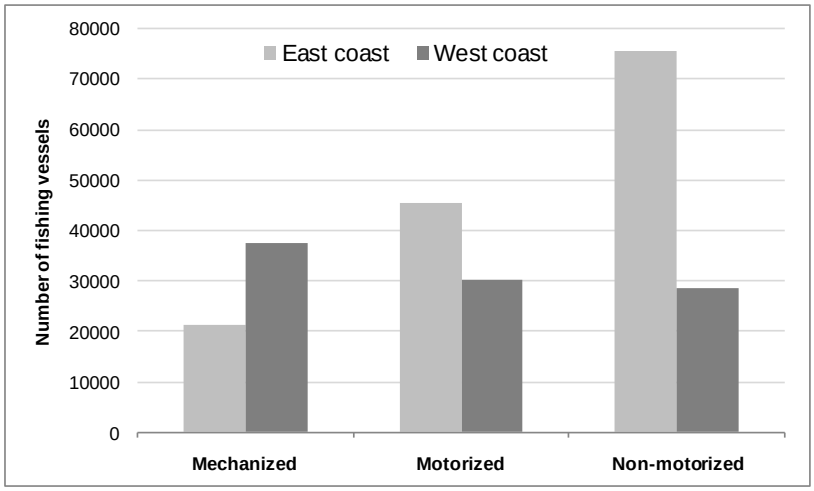
At the end of the First Five-Year Plan (1951-1956), there were 863 MFVs operating along the Indian coast. Presently, the number is 59 743. At the national level, the mechanized sector contributes about 67 percent of the landing. In 1969 it was a mere 20 percent. Motorized sector contributes about 25 percent and the balance 8 to 10 percent is contributed by the traditional crafts. With the advent of mechanization, use of traditional harvesting gear like bag net, cast net, small meshed gill net has declined and more efficient gear like purse seines have became popular. ***Figure 6*** depicts category-wise and coast-wise distribution of fishing vessels in the country.

2.8 Post-harvest infrastructure and marketing

As per available data, approximately 67 percent of the total fish produced in the country is consumed in fresh form and nearly 6 percent is used for reduction into fishmeal. Altogether 23 percent is consumed in processed and preserved form that includes 16 percent used for drying, 7 percent for freezing and less than one-half percent for canning- almost all of these under medium and small- scale sectors.

In the marine fisheries sector, the Central Government has been implementing a Central Sector Scheme and a Centrally Sponsored Scheme since 1964 to provide infrastructure facilities for landing and berthing of MFVs, traditional and motorized fishing craft and deep sea fishing vessels.





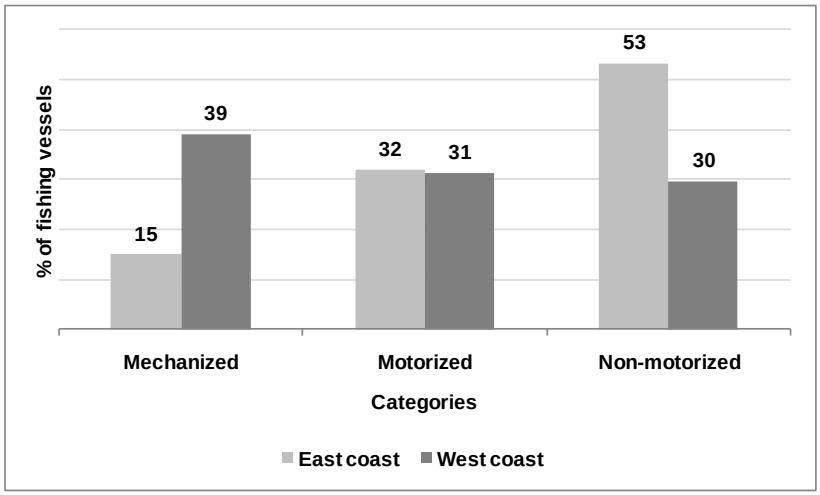


Figure 6: Category-wise (top) and coast-wise Distribution (middle and bottom) of fishing vessels in India

So far out of the 1 376 fishery centers situated in 3 322 coastal fishing villages along the Indian coast, only 256 fishing centres have been developed, which form only 18.6 percent of the existing fishing centres. The facilities created so far are adequate to accommodate only about 25-30 percent of the country's MFVs, resulting in over-crowding and a host of other accompanying problems. Therefore, there is an imperative need to develop more fishing harbours and landing centres to meet the requirements of the existing fishing fleet.

2.9 Policies and legislative support

2.9.1 Institutional setting

Entry 57 of List 1 of Seventh Schedule of the Constitution of India specifies *Fishing and Fisheries beyond Territorial Waters* as Union Subject, whereas Entry 21 of List II speaks of Fisheries as a State Subject. Reading both the Entries together, it follows that control and regulation of fishing and fisheries within territorial waters is the exclusive province of the State, whereas beyond the territorial waters, it is the exclusive domain of the Union. The Central Government acts as a facilitator and coordinator responsible for policy formulation, carrying out fishery research and channeling funding support to the States/UTs in line with the national priorities and the commitments made to the State/UT Governments. The Ministry of Agriculture (Department of Animal Husbandry, Dairying and Fisheries- DAHD&F), within the purview of its allocated business, helps the coastal States/UTs in development of fisheries within the territorial waters, besides attending to the requirements of the sector in the EEZ. Therefore, management of fishery exploitation in the EEZ requires close coordination between the Union and the States.

As explained above, both the Union and the State Government agencies manage fisheries activities. At the Centre, the DAHD&F is the focal point, and in the State/UTs, it is the Department of Fisheries (DoF). Other Central Ministries/Departments like the Ministry of Commerce and Industry (MoCI), Ministry of Earth Sciences (MoES), Ministry of Food Processing Industries (MoFPI), Ministry of Environment and Forests (MoEF) play important role in various aspect of fisheries resources management. At the national level, the Ministry of Defence (MoD) through the Indian Coast Guard (ICG) is also associated with the management of fisheries in the EEZ.

Role of Central Government: The DAHD&F, which is responsible for fisheries development and management in the country, formulates developmental strategies for the sector and issues policy guidelines for fisheries development and management. It also provides technical and financial assistance for the purpose to various States/UTs. The financial assistance is over and above the budgetary support provided to the States by the Planning Commission.

To promote export of fish and fish products, the Government of India established the Marine Products Export Development Authority (MPEDA) under the MoCI in 1972. While the processing aspect fall under the MoFPI, the control of marine biodiversity and marine pollution falls under the jurisdiction of MoEF and the MoES. ***Table 6*** gives a brief overview of institutional structure for marine fisheries management in India.

Table 6: Institutional setting for marine fisheries development in India

Item	Agency/Ministry/Department
· Deep sea fishing (List I) · Survey & assessment of fisheries resources · Research · Training & extension . Fisheries development	Ministry of Agriculture /DAHDF, Indian Council of Agricultural Research Fisheries Survey of India, National Fisheries Development Board Ministry of Earth Sciences (MoES)
· Monitoring of fishing by foreign vessels (List I) · Prevention of marine pollution by ships	Ministry of Defence/Coast Guard
· Protection of endangered species (Wildlife Protection Act, 1972)	MoEF
· Fish processing · Processing units .Exports	Ministry of Food Processing Industries/ Ministry of Commerce & Industry (MoCI) - MPEDA and NFDB
· Seafood exports (List I) · Quality control	MoCI - MPEDA Export Inspection Council
· Law of the Sea negotiations (List I)	Ministry of External Affairs
· Potential fishing zones · Monitoring ocean pollution	MoES
· Fishing vessel industry (List I) · Major fishing ports (List I) · Minor fishing ports (List II)	Ministry of Shipping, Road Transport and Highways/, Ministry of Agriculture, State Governments
· Fisheries in Territorial Waters (List II)	State Governments
· Protection of marine biodiversity (List III)[11] · Protection of coastal habitats (List III) · Focal point for Ramsar, CITES, CMS & CBD Conventions (List III)	Ministry of Environment and Forests (MoEF) MoES
Infrastructure	Ministry of Agriculture/MoCI, MPEDA

Role of the State Governments: The State/UT Governments are the principle custodians of fisheries and aquaculture activities in their respective jurisdictions (land as well as the territorial waters). In the marine sector, they are responsible for fisheries development and management with the main objectives of planning and development of infrastructure facilities for landing and berthing of fishing craft, creating suitable marketing facilities, implementation of various fisheries development programmes *viz*., channelising financial assistance for purchase of fishing implements, implementation of socio-economic programmes and interactions with the Government of India and other agencies for technical and financial assistance. Each State/UT has a Department of Fisheries, which functions as its main implementation agency for fisheries and aquaculture development programmes.

[11] ***Concurrent List***

2.9.2 Fisheries legislation

For sustainable development of the marine resources, India amended its constitution in 1976. The Indian Parliament enacted the Territorial Sea, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Acts in 1976, pursuant to which a 200 nautical mile EEZ was established. Since then, India has also enacted a number of other laws and regulations, including the Marine Products Export Development Authority Act, 1972; the Indian Coast Guard Act, 1978, the Maritime Zones of India (Regulation of Fishing by Foreign Vessels), Act, 1981 and the related Rules of August, 1982, the Environment Protection Act, 1986, etc. The other Central legislation, which has important bearing on the fisheries sector include the Merchant Shipping Act, 1956 and the Wildlife Protection Act, 1972. However, there is still no law to regulate the wholly Indian-owned fishing vessels operating in the EEZ. A Bill prepared by the DAHD&F to regulate fishing in the Indian EEZ is under process.

The Marine Fishing Regulation Act (MFRA) of the maritime States/UT Governments and the Maritime Zones of India (Regulation of Foreign Fishing Vessels) Act, 1981 of the Government of India provide for prohibition of fishing by mechanized fishing vessels in the areas earmarked for traditional and small-motorized crafts. For monitoring the fishing activities to be carried out in different assigned fishing zones by respective fleets, patrol boats have been provided under a Central Scheme to the Department of Fisheries of the maritime States. The resources monitoring surveys conducted by the FSI, Mumbai are being linked with the management measures to be evolved and applied for sustainable development of fisheries in the country.

The inland fisheries sector is regulated through the provisions of the Indian Fisheries Act, 1897, which has been repealed by most of the inland States as their own Act. Many States have also formulated stand-alone acts for regulating specific activities such as seed production, etc. Regulation of coastal aquaculture is being carried out through the Coastal Aquaculture Authority Act, 2005. Further, a model bill for regulation of inland fisheries and aquaculture has been prepared by the DAHD&F and is under circulation to the States for their consideration. Similarly, Guidelines for Fish Seed Certification have also been prepared and circulated to the States.

2.10 R & D support to the sector

2.10.1 Fisheries development

Central Institute of Fisheries, Nautical and Engineering Training, Kochi: The Central Institute of Fisheries, Nautical & Engineering Training (CIFNET) was established in 1963 by the Ministry of Agriculture, Government of India at Cochin. Subsequently, two units of the Institute were set up at Chennai and at Visakhapatnam. The primary objective of CIFNET is to make available sufficient number of trained operatives for fishing vessels and technicians for shore establishments. The Institute conducts various courses including (i) four year degree course 'Bachelor of Fishery Science (Nautical Science)' approved and affiliated by Cochin University of Science & Technology and recognized by the University Grants Commission; (ii) Two Trade courses-

Vessel Navigator & Marine Fitter of two years duration, approved by the Ministry of Labour and affiliated to the National Council for Vocational Training (NCVT); and (iii) short-term training programmes for the benefit of students from professional colleges, sister organizations, Department of Fisheries of the State/UT Governments, etc.

National Institute of F**isheries Post Harvest, Technology & Training, Cochin:** The National Institute of Fisheries Post-Harvest Technology and Training (NIFPHATT), formerly known as the Integrated Fisheries Project (IFP) was set up in October 1952 when a tripartite agreement between the Government of Norway, India and the United Nations was signed to set up an Indo-Norwegian Project (INP) for fisheries and fishermen community development at Neendakara in the then Travancore- Cochin State (present Kerala State). In 1961 the Project moved to Kochi and in 1972 the administration of the Project was completely taken over by the Government of India and the INP was renamed as IFP. In 2008, the IFP was further renamed as the National Institute of Fisheries Post-Harvest Technology and Training. The Institute is now mainly mandated to develop value added products by way of process and product diversification; technology development and transfer to beneficiaries consisting of rural fishermen community; capacity building and popularisation and test marketing of value added products of fish varieties including low value, unconventional species and seasonally abundant fishes. The Project also has a unit in Visakhapatnam.

Fishery Survey of India, Mumbai: The FSI is responsible for survey and assessment of marine fishery resources of the Indian EEZ. The FSI has six operational bases at Mumbai, Mormugao and Kochi along the west coast, Chennai and Visakhapatnam along the east coast and Port Blair in the Andaman & Nicobar Islands. A total of 13 ocean ongoing survey vessels are deployed for fisheries resources survey and monitoring for various commercially important fin and shell fish species and other biological investigations. Besides resource survey, the FSI monitors fishery resources for the purpose of regulation and management, makes an assessment of suitability of different types of craft and gear for deep-sea and oceanic fishing, imparts in-vessel training to CIFNET/Polytechnic trainees, disseminates information on fishery resources through various media to the fishing community, industry, other end users, etc.

Central Institute of Coastal Engineering for Fishery, Bangalore: The Central Institute of Coastal Engineering for Fishery (CICEF) formerly known as the office of the Pre-Investment Survey of Fishing Harbours (PISFH), under the Ministry of Agriculture was established in January 1968, under technical and manpower assistance from the FAO of the United Nations. The main objectives were to identify potential fishery harbour sites existing along the coastline of the country; to undertake engineering and economic investigations for selected fishery harbour sites; and to prepare techno-economic feasibility reports. The office of PISFH was renamed as CICEF in August 1983 and additional mandates were entrusted to undertake reconnaissance surveys for selection of suitable sites in the maritime states for development of brackish water shrimp culture farms.

National Fisheries Development Board, Hyderabad: The National Fisheries Development Board (NFDB) was set up in July, 2006 to realize the untapped potential of fisheries sector in inland and marine fish capture, culture, processing & marketing of fish, and overall growth of the sector with the application of modern tools of research & development including biotechnology for optimizing production and productivity. The activities of the Board are focused towards increasing fish production of the country to a level of 10.3 mmt, to double the exports and provide employment to 3.5 million people by extending assistance to various agencies for implementation of activities under inland, brackish water and marine sectors. It is also mandated to be a platform for public-private partnership in fisheries sector.

Coastal Aquaculture Authority, Chennai: The Coastal Aquaculture Authority (CAA) was established under the Coastal Aquaculture Authority Act, 2005. The main objective of the Authority is to regulate coastal aquaculture activities in coastal areas of the country in order to ensure sustainable development without causing damage to the coastal environment. The Authority is empowered to make regulations for the construction and operation of aquaculture farms in coastal areas, inspection of farms to ascertain their environmental impact, registration of aquaculture farms, fixing standards for inputs and effluents, removal or demolition of coastal aquaculture farms, which cause pollution, etc. For the purpose of registration of shrimp farms, the Authority has constituted State and District Level Committees in all the coastal States/UTs.

2.10.2 Scientific research[12]

The current components of fisheries research can be broadly grouped under the following organizations: (a) Indian Council of Agriculture Research (ICAR) system; (b) Ministry of Agriculture; (c) Ministry of Commerce and Industries; (d) Ministry of Food Processing Industries; (e) Ministry of Earth Sciences and (f) Other Bodies such as the Council of Scientific and Industrial Research and the State Agricultural Universities. However, the ICAR is the main organization for conducting fisheries research in the country and the following institutes form part of the ICAR system:

1. ***Central Marine Fisheries Research Institute (CMFRI), Kochi, Kerala:*** The Institute carries out work on marine fisheries resources and their exploitation besides training and extension programmes.
2. ***Central Inland Fisheries Research Institute (CIFRI), Barrackpore, West Bengal:*** The Institute conducts research activities on open inland water systems and fishery resources in rivers, reservoirs, wetlands, lakes and estuaries besides, extension and training related to these systems.
3. ***Central Institute of Fisheries Technology (CIFT), Kochi, Kerala***: The Institute conducts R & D programmes on design of fishing crafts and gear, fishing technology, fish processing, preservation and also helps in quality control certification for export of fishery products.

[12] ***Fisheries and Aquaculture Research Capabilities and Needs in India – World Bank Technical paper 147 (Fisheries Series)***

4. ***Central Institute of Fisheries Education (CIFE), Mumbai, Maharashtra:*** The Institute is a 'Deemed University' responsible for fisheries education at post graduate and doctoral level. It also takes a lead role in developing and updating syllabus for fisheries education at post graduate and doctoral levels, which provide model for State Agricultural Universities to follow. The Institute also conducts various training programmes catering to State Fisheries Officials and private participants through its regional centres. In view of research being integral part of higher education, CIFE also conducts upstream, basic, applied and action research on various aspects of fisheries and aquaculture, including policy and socio-economics.

5. ***Central Institute of Brackish water Aquaculture (CIBA), Chennai, Tamil Nadu:*** The Institute concentrates on brackish water aquaculture for developing technologies for shrimp and brackish water fish culture systems and also connected extension and training programmes.

6. ***Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar, Orissa:*** The Institute deals with research programme and studies evolving technologies related to production and productivity in freshwater aquaculture as well as extension and training.

7. ***National Bureau of Fish Genetic Resources (NBFGR), Lucknow, Uttar Pradesh:*** The Bureau conducts work on genetic characterization, gene-banking, bio-diversity database and conservation of various fish species. The Bureau coordinates with the resources specific fisheries institute and other national agencies in so far as fish conservation programmes are concerned.

8. ***Directorate of Cold Water Fisheries Research (DCFR), Bhimtal, Uttar Pradesh:*** This Directorate carries out research and studies on coldwater fishery resources and biology, ecology, breeding etc. of cold water fishes. It is also developing hatchery and aquaculture technologies for indigenous and exotic coldwater fishes.

2.10.3 International cooperation

India recognizes and honors that it is a part of the international community and participates fully in global fisheries initiatives. It also acknowledges that many fisheries issues and protection of marine environment, need international and regional cooperation as spelled out in the 1982 United Nations Convention on Law of the Sea (UNCLOS). Fisheries arrangements are the natural outcomes of UNCLOS and the 1995 UN Fish Stocks Agreement. India signed the UNCLOS in 1995 and ratified the Convention in 1996. India has also ratified the UN Fish Stocks Agreement in 2003. Apart from these global initiatives in fisheries, India also actively participates in organizations such as World Trade Organization, Convention on Biological Diversity (CBD), etc, where issues concerning fisheries are articulated and decisions taken on sustainable use of the fisheries resources. The following paragraphs describe India's participation in key UN Fisheries organizations such as the FAO; Regional Fisheries Management Organizations and Regional Fisheries Bodies.

Food and Agriculture Organization of the United Nations

Being a member of the United Nations, India is also a member of the FAO. Since the establishment of FAO in October 1945, India has actively cooperated with FAO

in development and implementation of both binding and non-binding (voluntary) fisheries instruments, the most notable being the Code of Conduct for Responsible Fisheries. To promote sustainable utilization of the fisheries resources and also contribute to national and global food security, India has implemented several technical cooperation projects with assistance from FAO.

Other UN Organizations

Besides FAO, India is also actively participating in fisheries and related matters promoted by other UN Bodies such as the United Nations Development Programme, International Labour Organization, World Maritime Organization, United Nations Environment Programme, etc.

Regional Fisheries Management Organizations

Apart from UN organizations, India is member to several organizations with management and regulatory mandates. These organizations are more focused on conservation of resources and designing of resource allocation rules. A brief description of these Organizations is given below:

The Indian Ocean Tuna Commission (IOTC): The IOTC was established during 1996-97 as an Article XIV body of FAO. Its objective is to promote cooperation among its Members with a view to ensuring, through appropriate management, the conservation and optimum utilization of tuna and tuna-like fishes and encouraging sustainable development of fisheries based on such stocks. The main operational area of the IOTC is the high seas (beyond the EEZ of coastal states in the Indian Ocean) although some of its measures have bearings on EEZ of the countries also. India is a founder member of IOTC.

Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR): The CCAMLR came into force in 1982, as part of the Antarctic Treaty System, in pursuance of the provisions of Article IX of the Treaty. It was established mainly in response to concerns arising from increase in krill catches in the Southern Ocean. CCAMLR is different from many other international fisheries management organisations as it considers both commercial harvesting and conservation of marine living resources from an ecosystem perspective.

Regional Fisheries Advisory Bodies

The regional bodies with advisory mandate on the other hand, assist their member- countries in promoting regional cooperation for sustainable uses of their resources and help in in-country capacity building to move towards this objectives.

The Asia-Pacific Fishery Commission[13] (APFIC): APFIC was established under the APFIC agreement as the Indo-Pacific Fisheries Council in 1948 by the FAO. It is a Regional Consultative Forum and functions as an Article XIV body of the FAO. It works in partnership with other regional organizations and arrangements and members. It provides advice and acts as an information broker to increase knowledge of fisheries and aquaculture in the Asia-Pacific region to underpin decision making.

Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation[14] (BIMSTEC): Bangladesh, India, Sri Lanka, and Thailand formed

[13] ***http://www.apfic.org***

[14] ***http://www.bimstec.org***

an Economic Cooperation in June 1997 and named it BIST-EC. Consequent upon the joining of Myanmar, Nepal and Bhutan, the name was changed to BIMST-EC. In the first Summit on 31 July 2004, the member-countries agreed to change the name to BIMSTEC or the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation. The prime objective of BIMSTEC is to create an enabling environment for rapid economic development, accelerate social progress in the sub-region and promote active collaboration and mutual assistance on matters of common interest. The Fisheries Secretariat of the BIMSTEC is entrusted to Thailand.

Bay of Bengal Programme Inter-Governmental Organisation[15] (BOBP-IGO): The BOBP-IGO evolved from the erstwhile Bay of Bengal Programme of the FAO in 2003. India is the host country of the BOBP-IGO. Other members are Bangladesh, Maldives and Sri Lanka. The objective of the Organisation is to promote and establish responsible fisheries in a time bound manner to ensure socio-economic well-being of the marine fishers and ecological security of fisheries resources in the Bay of Bengal while catalyzing the growth of the sector to substantiate economic development of the member-countries. Major work of the Organisation in recent times include critical policy support to the Government on European Union regulation on catch certification, training programmes on sustainable management of fisheries, capacity building on fisheries data strengthening, technical support for improvement of fisheries harbour, etc.

INFOFISH[16]: INFOFISH was originally launched in 1981 as a project of the FAO. Since 1987, it is an inter-governmental organization providing marketing information and technical advisory services to the fishery industry of the Asia-Pacific region and beyond from its headquarters in Kuala Lumpur, Malaysia.

Indian Ocean Rim Association for Regional Cooperation (IOR-ARC): The Indian Ocean Rim-Association for Regional Cooperation (IOR-ARC) was established in 1997. The Association disseminates information on trade and investment regimes, with a view to helping the region's business community better understand the impediments to trade and investment within the region.

Network for Aquaculture Centres in Asia-Pacific[17] (NACA): NACA is an inter-governmental organization that promotes rural development through sustainable aquaculture. NACA seeks to improve rural income, increase food production and foreign exchange earnings and to diversify farm production.

South Asian Association for Regional Cooperation (SAARC)[18]: SAARC was founded in December 1985 and is dedicated to economic, technological, social and cultural development emphasizing collective self-reliance. Its seven founding members are Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka. Afghanistan joined the organization in 2005. The 16 stated areas of cooperation are agriculture and rural, biotechnology, culture, energy, environment, economy and trade, finance, funding mechanism, human resource

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[15] ***http://www.bobpigo.org***

[16] ***http://www.infofish.org/infofish/about.html***

[17] ***http://www.enaca.org***

[18] ***http://www.saarc-sec.org***

development, poverty alleviation, people to people contact, security aspects, social development, science and technology; communications, tourism.

The South Asia Cooperative Environment Programme[19] (SACEP): SACEP was established in 1982 by the governments of South Asia to promote and support protection, management and enhancement of the environment in the region. SACEP member countries are Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.

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[19] *http://www.sacep.org*

CHAPTER 3.0

3.0 Review of Programmes for Fisheries and Aquaculture Development during the Eleventh Five-Year Plan

3.1 Introduction

The Fisheries Division of the Department of Animal Husbandry, Dairying and Fisheries (DAHD&F), Ministry of Agriculture implemented 17 Central Sector/Centrally Sponsored Schemes during the Ninth Five-Year Plan period (1997–2002). During the Tenth Plan (2002–2007), based on the discussions of the Working Group on Fisheries set up for the Tenth Plan with the Planning Commission and the DAHD&F, the 17 ongoing schemes were converged into seven major schemes. The objective of merging these schemes was to have a comprehensive and focused approach for fisheries development in the country. Subsequently, during the Eleventh Plan period (2007–2012), the scheme on 'Training and Extension', which was operated as a separate scheme up to the end of Tenth Plan, was included as a component under the 'National Scheme on Welfare of Fishermen'. Thus during the Eleventh Plan, six schemes, including the scheme on National Fisheries Development Board (NFDB) were implemented. The names of the six schemes and their allocations are given in ***Table 7*** below.

Table 7: Schemes implemented during the Eleventh Five-Year Plan and their allocation

Sl. No.	Name of the Scheme	Allocation *(Rs. in crore)*
1	Central Assistance to Fisheries Institutes	371.00
2	Strengthening of Database & Geographical Information System for Fisheries Sector	25.00
3	National Fisheries Development Board	1 550.00
4	Development of Inland Fisheries & Aquaculture	350.00
5	Development of Marine Fisheries, Infrastructure & Post-Harvest Operations	300.00
6	National Scheme on Welfare of Fishermen	180.00
	Total	**2 776.00**

Source: Hand Book on Fisheries Statistics, DAHD&F, 2008.

3.2 Financial achievements

The financial achievements under each of the above-mentioned six schemes during the Eleventh Five-Year Plan Period are given in ***Table 8***. The anticipated expenditure (in % against the Revised Estimates or RE) for the schemes during the Plan period is expected to be between 95 to 105 percent with an overall expenditure of around 99 percent. For most of the schemes, the utilization has been 100 percent, barring the scheme on 'Strengthening of Database and GIS for the Fisheries Sector' and 'Assistance to Fisheries Institutes', where the utilization has been low.

Table 8: Financial achievements under different Schemes during the Eleventh Five-Year Plan Period (up to 2010-11)

(Rs. in crore)

Schemes	X I Plan outlay	Total RE till 2010-11	Utilization	BE for 2011-12	Total Expected expenditure	% Utilization of RE
Development of Inland Fisheries & Aquaculture	300	65.28	70.13	24.00	94.13	105.43
Development of Marine Fisheries, Infrastructure & Post-Harvest Operations	350	222.23	230.77	71.00	301.77	102.91
National Scheme on Welfare of Fishermen	180	124.13	124.71	39.00	163.71	100.36
Strengthening of Database and GIS for the Fisheries Sector	25	26.25	24.48	10.00	34.48	95.12
Assistance to Fishery Institutions	371	186.99	165.95	46.00	211.95	90.97
National Fisheries Development Board	1 550	289.2	289.2	108.00	397.2	100.00
Total	**2 776**	**914.18**	**905.24**	**298.00**	**1203.24**	**99.26**

3.3 Physical achievements

The following paragraphs describe the progress under each of the above mentioned six schemes.

3.3.1 Development of marine fisheries, infrastructure and post-harvest operations

During the Tenth Five-Year Plan period, all the schemes concerning marine fisheries were brought under a comprehensive scheme titled 'Centrally Sponsored Scheme on Development of Marine Fisheries, Infrastructure and Post-Harvest Operations' with necessary modifications. In the Eleventh Five-Year Plan, this scheme was implemented with three major components *viz.* (i) Development of Marine Fisheries; (ii) Development of Infrastructure and Post-Harvest Operations; and (iii) Provisions for taking up innovative activities.

The scheme is largely intended to improve the socio-economic conditions of marine fisher folk and the broader objectives are (i) to supplement the efforts of the coastal State/UT Governments for development of marine fisheries sector; (ii) creation of infrastructure facilities for safe landing and berthing of fishing vessels along the country's coastline; (iii) creation of infrastructure facilities for processing and preservation of fish quality thereby reducing post-harvest losses; (iv) to reduce the burden of the fishermen by subsidizing the input cost on High Speed Diesel (HSD); and (v) to improve the safety of

fishermen at sea. The scheme has the following components and sub-components:

A. Development of Marine Fisheries

(i) Motorization of traditional craft,

(ii) Safety of fishermen at sea,

(iii) Fishermen development rebate on HSD Oil,

(iv) Introduction of intermediate craft of improved design including proto-type study of new intermediate vessel design,

(v) Establishment and operation of Vessel Monitoring System,

(vi) Promotion of fuel efficient and environment-friendly fishing practices,

(vii) Management of marine fisheries.

B. Development of Infrastructure and Post Harvest Operations

(i) Establishment of fishing harbours and fish landing centres,

(ii) Strengthening of post-harvest infrastructure,

(iii) Assistance for maintenance dredging of fishing harbours and fish landing centres.

C. Taking up innovative activities

The unit costs and funding pattern of the components and sub-components under marine fisheries and mariculture schemes is detailed in ***Annexure 1***.

The above-mentioned schemes are being implemented in all the coastal States/UTs and the component on 'Strengthening of Post-harvest Infrastructure' is also extended to inland States. The funding pattern varies with components and sub-components. For taking up of innovative projects, 100 percent expenditure is borne by the Centre. The target groups/ beneficiaries of the scheme are fishers, their families and fishery entrepreneurs. The Eleventh Plan outlay for the scheme was Rs. 350 crores and the revised Budget Estimate (BE) for the first four years of the Plan was Rs. 222.23 crores. The financial achievement of the scheme till 2010-11 is given in the ***Table 9*** below and brief progress under each of the schemes is provided in the following paragraphs.

Table 9: Financial achievements under the scheme on 'Development of Marine Fisheries, Infrastructure and Post-Harvest Operations during the Eleventh Plan (up to 2010-11)

(Rs. in crore)

Item/Year	2007-08	2008-09	2009-10	2010-11	2011-12 (BE)	Total
Revised budget estimate	40.50	44.99	61.00	75.74	71.00	293.23
Actual expenditure	41.49	49.56	61.61	78.11	47.42	278.19*

**** Total expenditure up 31 December 2011.***

Development of marine fisheries: This scheme includes seven components and the level of assistance under each component and the physical progress achieved during the Plan period is detailed in ***Table 10***.

Table 10: Physical achievements under the component on 'Development of Marine Fisheries' during the Eleventh Plan

Quantifiable deliverables	Achievements during the first four years of the Plan Period	Physical targets for the entire Plan
Motorization of traditional crafts (nos)	4 908 (98.16 %)	5 000
Safety of fishermen at sea (nos)	1154 (256 %)	450
Fishermen development rebate on HSD oil (KL)	40 993 (12.27 %)	3 34 000
Introduction of intermediate crafts of improved design (nos)	88 (106 %)	83
Promoting resource specific deep sea fishing vessels (nos)	3 (6 %)	50
Promoting fuel efficient and environment-friendly fishing practices	--	5 000
Management of marine fisheries	--	

Motorization of traditional craft: This production-oriented scheme was introduced during the Seventh Five-Year Plan (1985-1990) with the main objectives of (i) technological up gradation of traditional fishing sector; (ii) to help fishermen reduce their physical strain; and (iii) to extend the range of their fishing operation, primarily to increase the quantum of fish catch, income and thereby to uplift their socio- economic status.

During the Eleventh Plan, 50 percent of the unit cost is provided as subsidy subject to a maximum of Rs.30 000 per outboard motor/inboard motor (OBM/IBM) of 8-10 HP. The cost of subsidy is shared equally between the Centre and the States. In case of UTs, full cost is borne by the Centre. As per the data available from the DAHD&F, out of a total of 107 448 traditional crafts in the country, 76 748 have been motorized so far. As against a target of 5 000 crafts to be motorized during the Eleventh Plan, until the end of the fourth year of the Plan, 4 908 crafts were motorized.

Fishermen development rebate on HSD Oil: In order to reduce the pressure on the input costs on account of mounting operational expenses of small mechanized fishing vessels (MFVs) of less than 20m overall length (LoA), the Centrally Sponsored Scheme provides financial assistance to the State Government/UTs for subsidizing the cost of HSD oil used by small MFVs. During the Tenth Plan, the fishermen development rebate was fixed at Rs. 1.50 per liter of HSD oil used by the boats. Keeping in view the increased fuel prices and the demand expressed by various fisher organizations and the State Governments, the Central rebate on HSD oil for MFVs was enhanced. Presently, the rebate is limited to 50 percent of the sales tax exempted by the States with a ceiling of Rs. 3.00 per liter. While approving the scheme in the Eleventh Plan, it was made conditional that the MFVs of <20 meter LoA, registered before the Tenth Plan and owned by fishermen belonging to the

Below Poverty Line (BPL) category would only be eligible to receive the assistance. Further, a ceiling of 500 liters per boat per month during active fishing months was also added to the conditions. Owing to this, many fisher organizations and some of the coastal State Governments have represented for removal of the new conditions. Restoration of the diesel subsidy to all categories of fishermen as demanded by the fisher organizations and States has not been agreed to by the Ministry of Finance.

Due to the above reasons, the physical progress of the scheme was poor and until the end of the fourth year of the Plan, only 12.27 percent of the target could be achieved. Similarly, physical progress under the schemes on 'Promoting resource specific deep sea fishing vessels' and 'Promoting fuel efficient and environment-friendly fishing practices' was also poor and very few beneficiaries opted for assistance under these two components.

Safety of fishermen at sea: This component was introduced to improve the sea safety of fishers to reduce loss of human life and property at sea mainly due to ill-equipped vessels, lack of communication equipment and non-availability of an early warning system on board. Subsidy to the tune of 75 percent of the unit cost of Rs.1.50 lakh per kit consisting of GPS, communication equipment, echo-sounder and search and rescue beacon is provided under the scheme. This component is implemented through State Fisheries Federations/Corporations and Panchayati Raj Institutions. Progress under this component has been very good and as against a target of 450 units, already 1154 units (256 %) have been sanctioned.

Development of infrastructure and post-harvest operations: The Central Government (Ministry of Agriculture) has been implementing a scheme since 1964 to provide infrastructure facilities for landing and berthing of MFVs, traditional and motorized fishing crafts and deep sea fishing vessels. The central financial assistance is provided to various implementing agencies comprising (i) 75 percent to coastal States, Port Trusts, Fishermen Cooperative Societies/ Organizations and 100 percent to UTs for (a) construction of minor fishing harbours (FHs) and fish landing centres (FLCs); and (b) up-gradation/ expansion/repair/renovation of existing minor fishing harbours and FLCs; (ii) 100 percent assistance to coastal States, Port Trusts, Fishermen Cooperative Societies/Organizations for construction of major fishing harbours, including expansion/modernization of existing major fishing harbours; and (iii) 50 percent assistance to private entrepreneurs for construction of major/minor fishing harbours and FLCs on Build, Operate & Transfer (BOT) basis.

Besides, a Central Sector Scheme on 'Post-harvest marketing infrastructure' implemented till the end of Eighth Five-Year Plan (1992-1987) was reintroduced as a component under the present scheme during the Tenth Five-Year Plan with a view to creating necessary facilities to provide remunerative prices to the fishers for their produce and making available fresh fish at reasonable prices to the consumers. Under this scheme, State Fisheries Cooperatives, Cooperative Federations and Primary Cooperatives are assisted in strengthening their post-harvest infrastructure like preservation and cold

storage, fish transport, developing retail fish marketing, setting up of central fish markets in metros and big cities.

The components implemented during the Tenth Plan were continued in the Eleventh Plan and these include (i) establishment of fishing harbours and FLCs; (ii) strengthening of post-harvest infrastructure; and (iii) assistance for maintenance dredging of fishing harbours and FLCs. As mentioned earlier, this scheme also covers assistance to State Fisheries Cooperatives, Cooperative Federations and primary cooperatives for strengthening their marketing infrastructure. Details of the components of this scheme are given in ***Annexures 2 - 4*** and the component-wise physical achievements during the first four years of the Plan period are detailed in ***Table 11*** below.

Table 11: Physical achievements under the component 'Infrastructure Development and Post-harvest Operations' during the Eleventh Plan

Quantifiable deliverables	Achievements during the first four years of the Plan period	Physical Target for the Eleventh Plan
Establishment of Fishing Harbours (FHs) & Fish Landing Centres (FLCs) (nos)	18(11 FHs+4 new FLCs+ repairs to existing 4 FHs)	55 (10 FHs+30 new FLCs+ repairs to existing 10 FHs and 5 FLC)
Strengthening of post-harvest infrastructure (nos)	29 (18 Ice plants + 3 retail outlets + 8 transportation facilities	115 (4 central fish markets+ 36 fish preservation & processing facilities+45 fish retail outlets+ 30 transportation facilities)
Assistance for Dredging of fishing harbours /FLCs	--	--

The scheme has so far received mixed response. While the progress in respect of fishing harbours has been good, it has not been so for the FLCs. Similarly, the component on strengthening of marketing infrastructure has shown tardy progress during the Plan period.

3.3.2 Development of inland fisheries and aquaculture

The objectives of the Centrally Sponsored Scheme on 'Development of inland fisheries and aquaculture' during the Eleventh Plan were to (i) enhance inland fish production and fish productivity; (ii) popularize modern fish farming; (iii) create employment opportunities through fisheries and aquaculture; (iv) diversify aquaculture practices; (v) provide assistance to fish farmers engaged in aquaculture; and (vi) provide training to farmers through the Fish Farmers' Development Agencies (FFDAs) and the Brackish water Fish Farmers' Development Agency (BFDA).

The salient features of the scheme include provision of subsidy for fish farmers for construction of new ponds and renovation of existing ponds and tanks; first

year inputs like fish seed, feed, fertilizers and other inputs; setting up of fish seed hatcheries and fish feed mills and creation of a cadre of trained and well organized fish farmers fully engaged in aquaculture. The structure and components of the scheme are as follows:

i) Development of freshwater aquaculture,
ii) Development of brackish water aquaculture,
iii) Coldwater fisheries and aquaculture,
iv) Development of waterlogged areas,
v) Productive utilization of inland saline/alkaline soils for aquaculture,
vi) Integrated development of inland capture resources (reservoirs/rivers, *etc*),
vii) Innovative projects.

A total of 429 FFDAs has been sanctioned over successive Plan periods in the country. Besides, 39 BFDAs have also been sanctioned so far to promote coastal aquaculture practices. Thus all potential coastal and inland districts have been covered for undertaking aquaculture in the country. During the last one decade, the FFDAs have covered an additional 2.20 lakh ha water area for freshwater aquaculture, imparted training to an additional 2.70 lakh fish farmers and benefiting about 3.70 lakh people. Since inception of the scheme, these FFDAs have covered a water area of about 7.50 lakh ha under improved aquaculture practices with an average productivity of about 2 850 kg/ha/year and imparted training in scientific aquaculture to about 9.00 lakh fish farmers in the country. The number of beneficiaries under FFDA is reported to be 13.00 lakh. It is further reported that a water area of over 36 000 ha has been covered under brackish water aquaculture, imparting training to over 32 000 fish farmers and benefiting more than 25 000 fish farmers.

Besides FFDAs and BFDAs, the National Federation of Fishermen Co-operatives Limited (FISHCOPFED), an apex body of fisher cooperatives in the country and the Fisheries Institutes under the Indian Council of Agriculture Research (ICAR), Department of Agriculture Research and Education, Ministry of Agriculture are also assisting in the implementation of the scheme by providing research inputs form time to time.

The funding assistance under the scheme is shared between the Centre and States on 75:25 basis for all the components of the scheme except towards Aquatic Quarantine & Inspection Unit and Network of Diagnostic Laboratories for Aquatic Animal Health for which 100 percent expenditure is met by the Centre. All fish farmers and fisheries co-operative societies engaged in aquaculture activities are eligible for assistance under the scheme. The unit cost and funding pattern is given in ***Annexures 5-11***.

A Central assistance of Rs. 300.00 crore was proposed under the scheme and the revised budget estimate for the first four years of the Plan was kept at Rs. 65.28 crores. ***Table 12*** provides financial achievement under the scheme during the first four years of the Eleventh Plan.

Table 12: Financial achievements under inland fisheries and aquaculture scheme during the Eleventh Plan till 2010-11

(Rs. in crore)

Item/Year	2007-08	2008-09	2009-10	2010-11	Total	BE-2011-12
Revised budget estimate	12.03	12.90	19.00	21.35	65.28	24.00
Actual expenditure	12.84	13.60	20.75	22.94	70.13	--
% utilization	106.73	105.43	109.21	107.45	107.43	--

Under the scheme, the target for bringing the area under improved practices of aquaculture was 1.85 lakh ha against which 1.1882 lakh ha area was brought under improved practices in the first four years of the current Plan period ***(Table 13)***. Further, as against a target of 1.25 lakh farmers, 1.74 lakh farmers were trained in scientific aquaculture practices.

Table 13: Physical achievements under inland fisheries and aquaculture scheme during the Eleventh Plan till 2010-11

Quantifiable deliverables	Target	Achievement	% achievement
Area to be brought under fish cultivation (lakh ha)	1.85	1.1882 (Both FW& BW)	64.22
Training of fish farmers (lakh no.)	1.25	1.74	139.2

3.3.3 National scheme for welfare of fishermen

The main objectives of this scheme are to provide basic amenities like housing, drinking water, community hall, etc. for fisher communities; facilitate better living conditions for fishers and their families; improve the social and economic security of active fishers and their dependents; and update their knowledge and skills to practice sustainable fishing. The scheme has four components: (i) Development of Model Fishermen Villages; (ii) Group Accident Insurance for Active Fishermen; (iii) Saving-cum-Relief; and (iv) Training & Extension.

In the first three components of the scheme, assistance is shared on 50:50 basis by the Centre and the State Governments, with 100 percent assistance to the UTs. In case of North-Eastern (NE) States, assistance is shared on 75:25 basis between the Centre and the NE State Governments. Assistance for the scheme on 'Training & Extension' is shared on 80:20 basis between the Centre and the States, with 100 percent assistance to UTs and FISHCOPFED. Details of the unit cost are given in ***Annexures12-13***. Fishers and fishing villages throughout the country are eligible under this scheme. The States/UTs and FISHCOPFED are the main implementing agencies of this scheme.

The budget allocation for the scheme during the Eleventh Plan was Rs. 180.00 crore and the anticipated expenditure is over Rs. 124.00 crore till 2010-11, accounting for 69 percent of the target outlay ***(Table* 14*).***

Table 14: Financial achievements under National Scheme of Welfare of Fishers during the Eleventh Plan (till 2010-11)

(Rs in crore)

Item/Year	Outlay	2007-08	2008-09	2009-10	2010-11	Total	2011-12 (BE)
Revised budget estimate	180.00	20.88	25.00	36.00	42.25	124.13	39.00
Actual expenditure	123.13	21.38	25.15	36.23	41.94	124.70	
% utilization	68.96	102.39	100.60	100.64	99.27	100.46	

Group insurance for active fishers: This component provides insurance cover to fishermen against accidental death or permanent total disability and permanent partial disability. The scheme is implemented through FISHCOPFED. The physical targets of the component are already met as 37 lakh fishers have been covered under insurance during the first four years of the Plan period.

Development of model fishermen villages: Basic amenities such as housing, drinking water and construction of community hall for fishermen are provided under this component. A fishermen village may consist of not less than 10 houses. The villages would be provided with tube wells at the rate of one tube well for every 20 houses. For recreation and common working place, a fishermen village with at least 75 houses is eligible to avail financial assistance for construction of a community hall. Unit costs under the scheme are Rs.50 000 for a house, Rs.30 000 for the tube-well (Rs.35 000 for NE Region) and Rs.1 75 000 for community hall. The Government has increased the unit cost for a fisherman's house from Rs.40 000 to Rs.50 000 during the Eleventh Five-Year Plan. About 7 000 houses are constructed on an average per annum under this scheme.

Saving-cum–Relief scheme (SCR): This component provides financial support to fishers during lean fishing season. To avail the benefits, the beneficiary contributes a part of his earnings during the non-lean months. The Central and State Governments make equal contributions and the accumulated amount is distributed back to fishers in four/three equal installments. About 3.5 lakh fishers have benefited under the SCR scheme.

Fisheries training and extension: This scheme was merged with the 'Welfare Programme for Fishermen' from 2005-06 onwards. The main objective of this component is to provide training to fishery personnel to enhance their extension skills. Assistance is provided to fisher folk in upgrading their skills, for setting up/up-gradation of training/awareness centres in States/UTs. This scheme is being operated with 80 percent Central assistance in case of States and 100 percent for UTs. The other components include publishing of manuals, providing adequate extension material, production of video films on technologies, conducting meeting/workshops/seminars, etc. of national importance. The component has resulted in training of more than 7 000

fishermen per annum. ***Table 15*** below provides a snapshot of the physical progress under the scheme.

Table 15: Physical achievements under National Scheme of Welfare of Fishers during Eleventh Plan (till 2010-11)

Item/activity	Target	Achievement
Fishers covered under insurance scheme (lakh nos.)	25	37
Construction of houses for fishers (Unit nos.)	65 000	29 543
Fishers covered under Saving-cum-Relief scheme (lakh nos.)	5	7.58
Establishment of Training Centres (nos.)	30	18
Training of fishers (unit nos.)	20 000	27 048

3.3.4 Centrally Sector Scheme on strengthening of database and Geographical Information System for fisheries sector

The scheme commenced during 2007-08 by modifying the earlier scheme on 'Strengthening of Database and Information on Networking for the Fisheries Sector' and by including some new components. The main objectives of this scheme are to (i) improve the database on inland and marine fisheries resources and fish production using sound statistical and scientific methodology; (ii) improve the use of Geographical Information System (GIS) in the States/UTs and by other concerned implementing agencies; and (iii) register all fishing vessels in the country and carry out census on marine fisheries.

The salient features of the scheme are to improve the efficiency and quality of data as well as reduction in time lag in preparation and submission of survey reports; estimate fish production from both inland and marine resources of the country; and provide comprehensive data base on the fishery sector so as to facilitate planning process at the State/UT and Central levels. The scheme is being implemented with the following components:

- Sample survey for estimation of inland fishery resources and their potential and fish production,
- Census of marine fisheries,
- Catch assessment surveys for inland and marine fisheries,
- Development of Geographical Information System of the fisheries sector,
- Assessment of fish production potential in coastal areas,
- Evaluation studies/professional services,
- Registration of fishing vessels,
- Development of database of fisheries cooperative in India,
- Mapping of smaller water bodies and development of GIS-based fishery management system,
- Strengthening of Statistical Unit at Headquarters.

The scheme is applicable to the entire country and provides 100 percent Central grant-in-aid to the State Governments/UT Administrations and other implementing agencies. Besides the State Government/UT Administrations, the CMFRI, FSI, CIFRI and FISCOPFED are the other implementing agencies.

The budget allocation for the scheme was Rs. 25.00 crore and till 2010-11 the expenditure is Rs. 24.48 crore, accounting for 98 percent of the targeted outlay ***(Table 16)***. The budget allocation has now been increased to Rs. 48.00 crore. With one year of the current Plan period left, the revised allocation may be difficult to achieve.

Table 16: Financial achievements under the scheme on 'Strengthening of Database and Geographical Information System for Fisheries Sector' during the Eleventh Plan (until 2010-11)

(Rs. in crore)

Item /Year	Outlay	2007-08	2008-09	2009-10	2010-11	Total	2011-12 BE
Revised budget estimate	25.00/ 48.00	2.80	3.00	10.00	10.55	26.35	10.00
Actual expenditure	24.48	2.53	2.40	10.08	9.47	24.48	
% utilization	97.92	90.36	80.00	100.80	89.76	92.90	

The physical progress under various components of the scheme on 'Strengthening of Database and Information on Networking for Fisheries Sector' is given in ***Table 17*** below.

Table 17: Physical achievements under the scheme on 'Strengthening of Database and Geographical Information System for Fisheries Sector' during the Eleventh Plan (till 2010-11)

Item/activity	Target	Achievement
Catch assessment survey of inland and marine fisheries	All States/UTs	Under progress
Development of GIS of inland water bodies	All States/UTs	***
Information technology networking in States	All States/UTs	Under progress
Marine fisheries census	All coastal States/UTs	Data collection completed
Registration of fishing vessels	All coastal States/UTs	Data digitalization is under progress
Development of data base of fisheries cooperatives.	All States/UTs	Under progress

******Linear Image Self Scanning (LISS-III) completed for all States; LISS-IV/Panchromatic Image completed for selected States; Mapping of water bodies completed in selected States; E–Atlas published in 9 States.***

3.3.5 Assistance to fisheries institutes

The DAHD&F, Ministry of Agriculture has four institutions under its fold and provides direct assistance to them under a Central Sector Scheme. These institutions include the Central Institute for Fisheries Nautical and Engineering Training, Kochi; Central Institute for Coastal Engineering for Fisheries, Bengaluru; National Institute for Fisheries Post-Harvest Technology & Training, Kochi and Fishery Survey of India, Mumbai. Besides these four Institutes, the DAHD&F also has two institutions, namely the National Fisheries Development Board, Hyderabad and the Coastal Aquaculture Authority, Chennai that have autonomous status with respect to their working.

Central Institute of Fisheries, Nautical and Engineering Training (CIFNET), Kochi: The primary objective of CIFNET is to make available sufficient number of trained operatives for fishing vessels and technicians for shore establishments. The Institute conducts various courses including (i) four year degree course 'Bachelor of Fishery Science (Nautical Science)' approved by and affiliated to the Cochin University of Science & Technology, Kochi and recognized by the University Grants Commission; (ii) Two Trade courses- Vessel Navigator course (VNC) & Marine Fitter Course (MFC) of two years duration and approved by the Ministry of Labour and affiliated to the National Council for Vocational Training (NCVT); and (iii) short-term training programmes for the benefit of students from various professional colleges, sister organizations, Department of Fisheries of the State/UT Governments, Indian Coast Guard, etc. About 100 persons were trained in the two main courses B.F.Sc (Nautical Science) and VNC/MFC in addition to short-term training programmes conducted on a regular basis.

National Institute of Fisheries Post-Harvest, Technology & Training (NIFPHATT), Cochin: The NIFPHATT, as its name suggests, undertakes various activities in post-harvest fisheries, including value addition of fin and shell fish species for the benefit of small-scale operators. During the Plan period, the Institute has processed more than 150 tonnes of raw fish and marketed about 105 tonnes of fish and fish products on an average per annum besides, imparting training in various disciplines on a regular basis. The Institute is also engaged in taking value addition of fin and shell fishes to the rural areas for the benefit of women processors.

Fishery Survey of India (FSI), Mumbai: The FSI has 13 ocean ongoing vessels, which are deployed for fisheries resource survey and monitoring various commercially important fin and shell fish species and conducts other biological investigations. Besides resource surveys, the FSI monitors fishery resources for the purpose of regulation and management, makes an assessment of suitability of different types of craft and gear for deep-sea and oceanic fishing, imparts in-vessel training to CIFNET/Polytechnic trainees, disseminates information on fishery resources to the fishing community, industry, other end users, etc. The FSI operates more than 1 000 fishing days from its six bases located on the west and east coasts and the UT of Andaman and Nicobar Islands, expending a fishing effort of 2 500 fishing hours for

bottom and mid- water trawl surveys and about 1.80 lakh hooks operated for oceanic and other long lining surveys on an average per annum.

Central Institute of Coastal Engineering for Fishery (CICEF), Bangaluru: The CICEF monitors the progress of construction of ongoing fishing harbours sanctioned under the Centrally Sponsored Scheme by the DAHD&F and renders technical guidance to the maritime States/UTs in the implementation of infrastructure projects. The Institute till the end of December 2010 has carried out engineering and economic investigations for development of fishery harbours and fish landing centres at 81 sites and prepared Techno- Economic Feasibility Reports for 82 sites.

The total outlay under this scheme during the current Plan was Rs. 371 crore. The total utilization till 2010-11 was about Rs.166 crore, which is 44.73 percent of the outlay ***(Table 18)***.

Table 18: Financial achievements under the scheme on 'Assistance to Fisheries Institutes' during the Eleventh Plan (till 2010-11)

(Rs. in crore)

Item /Year	Outlay	2007-08	2008-09	2009-10	2010-11	Total	2011-12 BE
Central Institute for Fisheries Nautical & Engineering Training							
Revised budget estimate	--	10.30	7.00	5.85	7.96	31.11	9.00
Actual expenditure	--	4.39	7.18	4.95	6.44	22.96	--
% utilization	--	42.62	102.57	84.62	80.90	73.80	--
Central Institute for Coastal Engineering for Fisheries							
Revised budget estimate	--	0.00	0.10	0.10	0.10	0.30	0.00
Actual expenditure	--	0.00	0.13	0.10	0.09	0.32	--
% utilization	--		130.00	100.00	90.00	106.67	--
National Institute for Fisheries Post-Harvest Technology & Training							
Revised budget estimate	--	1.59	2.00	1.95	2.00	7.54	2.00
Actual expenditure	--	1.40	1.74	1.96	1.83	6.93	--
% utilization		88.05	87.00	100.51	91.50	91.91	--
Fishery Survey of India							
Revised budget estimate	--	30.04	38.50	37.50	42.00	148.04	35.00
Actual expenditure	--	28.13	31.87	38.75	36.99	135.74	--
% utilization	--	93.64	82.78	103.33	88.07	91.69	--
Assistance to all Fisheries Institutes							
Revised budget estimate	371.00	41.93	47.60	47.60	52.06	189.19	46.00
Actual expenditure	165.95	33.92	40.92	45.76	45.35	165.95	--
% utilization	44.73	80.90	85.97	96.13	87.11	87.72	--

Coastal Aquaculture Authority (CAA), Chennai: The Coastal Aquaculture Authority (CAA) was established under the Coastal Aquaculture Authority Act, 2005. The Authority is a quasi-judicial body and its main objective is to regulate aquaculture activities in the coastal areas of the country in order to ensure sustainable development without causing damage to the environment. The CAA is headed by a retired judge of the Madras High Court. The Authority is empowered to make regulations for construction and operation of aquaculture farms, inspection of farms to ascertain their environmental impact, registration of aquaculture farms, fixing standards for inputs and effluents, removal or demolition of aquaculture farms, which cause pollution, etc. For the purpose of registration of shrimp farms, the Authority has constituted State and District Level Committees. The Authority is now also monitoring introduction of exotic shrimp species for farming in the country.

National Fisheries Development Board (NFDB), Hyderabad: The NFDB, a registered body under the administrative control of the DAHD&F, was registered on 10th July, 2006. The aim of the Board is to realize the untapped potential of fisheries sector in inland and marine fish capture, culture, processing and marketing of fish and overall growth of the sector with the application of modern tools of research and development including biotechnology for optimizing production and productivity. The activities of the Board are focused towards increasing fish production of the country to a level of 10.3 mmt during the Eleventh Plan period, to double the exports and provide employment to people by extending assistance to various agencies for implementation of activities under inland, brackish water and marine sectors. It is also mandated to be a platform for public-private partnership in fisheries sector. During the Plan period, the Board has implemented a wide range of activities to support fisheries and aquaculture development in the country.

The NFDB has been allocated Rs. 1 550.00 crore for the Eleventh Plan period (2007-08 to 2011-12). The overall allocation of funds and utilization for the years 2006-07 to 2011-12 is given below in ***Table 19*** and the scheme-wise physical and financial performance is detailed in ***Annexure 14***.

Table 19: Financial performance of the NFDB

(Rs. in crore)

Year	Opening Balance	BE	RE	Funds released by GoI	Total funds available with NFDB	Funds utilized	Closing Balance
2006-07	--	150.00	30.00	30.00	30.00	3.66	26.34
2007-08	26.34	101.0	50.00	50.00	76.34	27.09	49.25
2008-09	49.25	75.0	46.90	46.90	96.15	71.28	24.87
2009-10	24.87	135.0	100.00	100.00	124.87	85.52	39.35
2010-11	39.35	92.30	92.30	92.30	131.65	131.35	0.30
2011-12	0.30	108.00	--	36.00	36.30	36.00	--
(as on 15.9.2011)			--	355.20	--	354.90	--

(*refund of unspent balances not included)

Most of the schemes undertaken by NFDB performed satisfactorily. Considering the necessity of the schemes for fisheries development in the country, these are recommended to be continued with suggested modifications in most of the

components. It is felt that the Board can play a much bigger role in the fisheries development of the country and it needs to be strengthened with adequate workforce support, field-level agencies to support the activities at the grassroots level and also availability of funds during the Twelfth Plan period.

3.4 Plan budget utilization

It is seen from the above that the achievements as well as fund utilization by the DAHD&F for fisheries development programmes has been satisfactory as against the revised budget estimates. However, the utilization of the funds against the total outlay of the Plan is comparatively low. While ***Table 20*** below provides a gross picture of the budget utilization at the end of the fourth year of the Eleventh Plan, ***Annexure 15*** provides a detailed breakup of the year-wise budget estimate (BE), revised estimate (RE) and actual expenditure in respect of all the Centrally Sponsored and Central Sector Schemes implemented by the DAHD&F. The annexure also provides information on the expenses incurred under the schemes until 31 December 2011.

Table 20: Budget utilization during the Eleventh Five-Year Plan

Items	Amount (Rs. in crore)
Outlay	2 776.00
Revised budget estimate (RE) till 2010-11	914.18
Expenditure till 2010-11	905.25
% utilization of (RE) till 2010-11	110.47
Anticipated expenditure 2011-12	298.00
Total expenditure	**1 203.25**

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CHAPTER 4.0

4.0 Indian Fisheries: Issues and opportunities

4.1 Introduction

In the last sixty years of planned development, the Indian fisheries sector has gone through various phases of development. While the earlier phases were marked by introduction of technologies, mechanization and motorization of the fishing vessels, popularization of fish farming in fresh and brackish waters and creation of infrastructure, the latter decades have felt the need for sustainability and optimizing fish yield from both capture fisheries and aquaculture. In recent years, the shift from traditional emphasis on revenue generation to sustainable development is also visible. The sector's overall contributions to the economy and creation of livelihoods for resource-poor rural communities have been phenomenal and with increasing population, the demand for fish food is also on the rise. However, the sector today stands at cross-roads, where good governance and management is the key to achieving sustainability.

This chapter highlights the issues and opportunities before the fisheries sector in India and discusses ways and means to achieve production hikes without losing focus on sustainable development of the resources.

4.2 Marine fisheries

4.2.1 Achieving sustainability

The marine fisheries sector in India occupies an important place in the socio-economic development of the country. Marine fish production has increased through the Five-Year Plans, reaching 3.22 mmt in 2010-11. Many factors have contributed to this increase. To illustrate a few - (i) introduction of mechanized fishing vessels and synthetic gear material and development of infrastructure for preservation, processing and storage in 1950s; (ii) expansion of trawl fleet and indigenous boat construction in 1960s; (iii) introduction of purse seining, diversification of fishing, development of fishing harbours and expansion of seafood exports in 1970s; and (iv) motorization of traditional fishing craft and increase in number and efficiency of craft and gear in 1980s and 1990s. Thus marine fishery, a subsistence vocation at the time of independence, is today a capital intensive activity with significant contributions to the country's fish food supply, creation of livelihoods and foreign exchange earnings through seafood exports.

The annual harvestable potential yield in the Indian EEZ has recently been re-validated by a Working Group set up by the DAHD&F, Ministry of Agriculture, Government of India. This re-validated yield of 4.419 mmt yield comprises 2.128 mmt of pelagic resources; 2.083 mmt of demersal resources; and 0.280 mmt of oceanic resources. As compared to the last estimate carried out in 2000, the current estimate is about 0.5 mmt more. An estimation of the

depth-wise catch shows that about 86.84 percent (3.837 mmt) of the resources are available in 0-100 m depth zone; 5.86 percent (0.259 mmt) in the 100-200m depth zone and 2.59 percent (0.115 mmt) in the 200-500 meter depth zone. The resources in oceanic area have been estimated as 0.208 mmt, which is 4.71 percent of the total potential.

India is blessed with a long coastline and abundant shelf area located in a tropical regime, providing vast potential for marine fish production. The nutrient inflows from the large number of rivers and their tributaries on both the coasts have made conditions favourable for propagation and growth of a huge diversity of fin and shellfish species. However, the country has not fully capitalized on this large resource size and unique position in terms of production and productivity. This is mainly due to unfettered growth of the fishing fleet, lack of awareness and poor compliance of the prevailing rules and regulations by the marine fishers and weak enforcement measures on part of the management authorities. Resultantly, marine fish production has been fluctuating between 2.5- 3.0 mmt since the mid-nineties.

Historically, India has been a coastal fishing nation and this is adequately reflected in the concentration of fishing vessels in the 0-100 meter depth zone. Consequently, the production potential of this zone has been fully exploited. The sizes (length and weight) of many commercially important fish species landed in the catch provide ample proof of the trend of exploitation of stocks from the coastal waters. Various scientific studies conducted by the CMFRI point towards 'fishing down the food chain', which does not auger well for long-term sustainability of the resources.

The growth of the fishing fleet in the country has been phenomenal with the artisanal fleet (including motorized boats) increasing by about 110 percent from the 1960s to 1990s and the mechanized fleet by about 570 percent during the same period. This increase in number of fishing vessels has been duly complemented by improved and more efficient gear and enhanced capacities of the engines, both for propulsion and hauling of gear.

This increase in the fishing fleet (both in number and power) has resulted in over capacity of boats operating in many inshore waters. Such a critical situation warrants effective management of the boats as well as stocks in the coastal waters for sustaining the current production. If the critical issues in marine fisheries sector are properly addressed and the opportunities are effectively tapped, production from the marine sector can be harvested on sustainable basis.

Motorization of traditional crafts: This scheme was introduced during the Seventh Plan period, with the objective of (i) technological up-gradation of traditional fishing sector, (ii) removing the drudgery of traditional fishers and (iii) to help them extend the range of their fishing operations to increase income and thereby to uplift their socio-economic status. Since inception, the scheme has been modified on a couple of occasions, increasing the quantum of assistance as also allowing for a second dose of subsidy.

As per the 2005 National Marine Fisheries Census (NMFC, 2005), 76 748 traditional crafts have been motorized since inception of the scheme. The motorization has not been evenly distributed in the coastal states. While some States like Tamil Nadu and Kerala have used the assistance under the scheme to the full extent, other states like Odisha, West Bengal and Andhra Pradesh have lagged behind. Allowing a second dose of subsidy has also led to poor maintenance and upkeep of the engines in some States. While on the east coast, diesel engines (Greaves Lombardini) are popular, on the west coast, especially in Kerala, the imported Yamaha and Suzuki engines, which run on kerosene oil, are dominantly used.

In recent years there is an increasing demand for imported 4-stroke engines, which are more efficient than their 2-stroke version, but would still be running on kerosene/petrol. On the other hand, the diesel engines are indigenously made and are much cheaper. In the diesel section, Chinese engines have also been introduced, which have higher horse power and are comparatively cheaper, but have a shorter life span than the Indian make. In the wake of these developments, any suggestion for revision in the assistance for motorization of traditional crafts appears difficult. However, keeping in view the fact that motorization of traditional crafts has been useful for the artisanal fishers, the continuation of this scheme in the Twelfth Plan has to be guided by certain parameters, which may include the following:

(i) The scheme may be continued with focus on those States/UTs where intensity of motorization of traditional crafts is still low.

(ii) Since the cost of diesel motors/engines have gone up, a new unit cost may be fixed, with the subsidy component remaining the same.

(iii) The provision of a second dose of subsidy may be discontinued.

Subsidy on HSD oil: Introduced in the year 1990-91, the scheme on 'Reimbursement of Central Excise Duty on HSD Oil used by Fishing Vessels below 20m Length' has the objective of helping small mechanized fishing owners/operators to bring down their operational costs and thereby encouraging them to increase the fishing duration, fish catch and income. During the Eleventh Five-Year Plan certain conditions were introduced in this scheme, restricting the subsidy on HSD oil to Below Poverty Line (BPL) fishermen and for boats, allowing only those which were constructed before the beginning of the Tenth Five-Year Plan *i.e.* prior to April 2002. These two conditions imposed during the current Plan period resulted in poor response and only 12.3 percent of the physical target set for the scheme could be achieved until the end of 2010-11.

Despite representations by fisher groups and many coastal States, the Ministry of Finance, Government of India has not agreed to reconsider the matter and has suggested revising the scheme in the Twelfth Plan in consultation with the Planning Commission. It is well recognized that expenditure towards fuel constitutes the largest chunk of input costs in fishing operations. With the spiralling fuel prices and also the sharp fluctuations in prices, it is necessary to support small-scale fishers to sustain their fishing operations.

To support the majority of the small-scale fishers, who in most cases are also owner-cum-operator, it is suggested that the subsidy on HSD oil be restricted to vessels below 10 meters overall length (LoA), and the conditions of BPL and period of construction of the boats be removed. This support to the small-vessel category will assist in reducing the pressure on near-shore areas as their fishing in off-shore waters will not put too much of economic strain on their operations. Further, to ensure that such boats start fishing in deeper waters, the area reserved for traditional non-motorized category could be further increased by suitable amendments to the Marine Fishing Regulation Act by the respective coastal States/UTs.

Promoting deep-sea fishing: Due to various reasons, the deep sea fisheries resources available in the country's EEZ have not been adequately harnessed. Lack of motivation, little opportunities in accessing public finance, absence of sound fishing technologies to meet local requirements and the underlying inhibitions of fishing in offshore waters are some of the reasons for this situation. During the Eleventh Five-Year Plan period, schemes were implemented for conversion of fishing vessels below 20 meter LoA and above 20 meter LoA by DAHD&F and the MPEDA respectively. While only a few vessels above 20 meter LoA availed the assistance, about 1 500 vessels below 20 meter LoA participated in the conversion programme. Majority of these vessels were from the southern Districts of Tamil Nadu. So far there are no reports on the operation of the converted vessels below 20 meter LoA, but unconfirmed reports indicate that such vessels are mostly engaged in shark fishing and or still using trawl nets. If this be the case, the purpose of vessel conversion stands defeated.

However, the intentions of the conversion programme still remain noble and with proper monitoring, the excess trawling capacity can be reduced and other selective fishing practices can be promoted in the country. The conversion and up-gradation can also contribute to reduction of fishing pressure in the coastal waters, which is one of the priority goals of the sector. With the latest estimates available on the harvestable potential at different depth zones as mentioned in the foregoing paragraphs, it is all the more important to reduce pressure from the coastal waters and take a sizeable percentage of the fishing fleet offshore, where potential still exists.

Any scheme to upgrade/modify the existing trawlers as multipurpose/ combination vessels to harvest the under tapped resources like tunas, bill fishes, pelagic sharks and oceanic squids, etc will need proper planning and also lessons learned from the past conversion programme(s). Besides, funding for conversion, the scheme should also have in-built provisions for training and capacity building, which will empower the fishing communities to exploit the offshore resources. Simultaneously, the post-harvest infrastructure and market linkages will be required to support the efforts. It is also suggested that the scheme may have different funding pattern for actual fishermen and non-fishermen candidates. To ensure sustainability of the deep sea resources, regular monitoring of the catch will also be necessary.

While considering the vessel conversion programmes during the Eleventh Plan, the larger focus has been on tapping tuna resources from the Indian EEZ. However, other than providing funds for conversion of vessels, the concomitant requirements of training and skill developments for harvesting of tuna resources, post-harvest requirements for marketing of tuna in the best value-added form, etc has received scant attention. In the event of the conversion programme being carried forward during the Twelfth Plan, these requirements need to be carefully addressed.

Another area which may need due recognition is the placement of Fish Aggregating Devices (FADs) in properly identified places in the EEZ to attract tuna and facilitate their capture by the tuna fishing fleet. In many tuna fishing nations, the use of FADs has proved to be highly successful and the government undertakes the construction and deployment of FADs with due involvement of the fishers. The present-day FADs are capital intensive and their deployment and proper upkeep involves full cooperation from the fishers so that the FADs are not damaged and also the tuna resources aggregating on the FADs are shared by a larger group of fishers. Formulation of proper guidelines and also ensuring a mechanism of monitoring the FADs would be a pre-requisite before they are deployed.

Improving design and construction of fishing vessels: in the past two decades or so, there has been no significant intervention in improving the design and construction of fishing vessels in India. Boats are constructed based on traditional knowledge passed on from one generation to the other or learning as an apprentice in a boat building yard. As such there are neither agreed standards for fishing vessel construction nor guidelines for boat yards in the country. The traditional fishing crafts have not undergone any major modification with respect to their design, efficiency or safety since the introduction of the Fibre-reinforced Plastic (FRP) material for boat building in the mid-eighties by the then Bay of Bengal Programme of the FAO and fabrication of a model FRP boat (IND-20 model). Over the years the same design has been stretched both length-wise and breadth-wise to suit the requirements by foregoing all norms of safety and stability of the boats.

In the last two and half decades, with large-scale motorization and depletion of stocks in the coastal waters, the range of operation of the traditional fishing crafts has increased. These developments are happening with no concomitant improvements in their design and safety needs. After the December 2004 Asian Tsunami, the large number of sub-standard FRP boats built by the local boatyards in Tamil Nadu and Puducherry have further aggravated the situation. While introduction of FRP material for boat building has been a boon for the sector, its use by untrained boat builders can also prove to be a major problem. Therefore, it is essential that standards for both boats and boat building yards be prescribed in the country. In view of this a scheme has been proposed in the Twelfth Plan for improving the design and other requirements of the traditional fishing crafts to enable them to fish in the deeper waters. If required the assistance of experienced boat-builders from abroad may also be sought for the purpose.

Reducing by-catch and promoting habitat conservation: Due to increased fishing pressure, indiscriminate and destructive fishing, and inadequate regulatory and management norms, India's fishery resources have been impacted. Intensive trawling and other harmful practices have adversely affected the benthic ecology and biodiversity. In India an estimated 3.5 lakh tonnes of low value catch is landed by trawl fisheries annually. From resource conservation and sustainability point of view, the resource damage happening by non-selective trawl catch is increasing in alarming proportions. Therefore, it is essential to have the provisions introduced in the Marine Fishing Regulation Act (MFRA) of the coastal States/UTs or further strengthened by making them more stringent and implementable to reduce the by-catch and promote resource conservation.

It is needless to state that resource conservation and management measures shall prevent spatial and temporal over fishing while achieving on a continuing basis optimum yield from each fishery. One of the greatest long-term threats to the viability of fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Destruction of natural habitats through deforestation of mangroves and reclamation of land has substantially reduced fish breeding and nursing grounds. As stated earlier, conservation and management of marine fisheries will include programmes towards strengthening of MFRA, optimization of fishing capacity for each coastal state, reduction in by-catch and other post-harvest losses, habitat conservation for facilitating breeding and growth of juveniles, rehabilitation/alternate livelihoods of displaced fishers, stock enhancement through Artificial Reefs (ARs) and FADs, etc.

Climate change and coastal fisheries: Coastal fisheries sector is one of the most vulnerable sectors as far as impacts of climate change are concerned. Marine fishing communities mostly reside within 2-3 hundred meters of the coastline and are the most vulnerable group of people with respect to storms and cyclones, rogue waves and of course rare events such as the tsunami. Climate change related adaptation measures and disaster management for extreme weather events such as cyclones, sea level rise, coastal erosion, etc need to be put in place by taking into consideration the uniqueness of the different coastal regions. Efforts are needed to build adaptive capacity of fishing communities to threats from climate change and climate variability by assisting them to relocate houses, schools, hospitals and dispensaries, and community halls in low-lying areas vulnerable to sea surge and flooding, to safer locations. On the flip side, although the fisheries sector is relatively a minor contributor to carbon dioxide emissions, nevertheless the fishing boats have to reduce the emissions by using fuel efficient engines, adhering to fuel emission norms and adopting suitable methods, such as use of sails for harnessing wind power and thereby reducing fossil fuel consumption.

Island fisheries: India has two major Island territories, one located in the Arabian Sea (the Lakshadweep group of Islands) and the other in the Bay of Bengal (Andaman & Nicobar Group of Islands). In the past Five-Year Plans, sporadic attempts were made to promote fisheries in the two Island groups, which did not meet with much success. Considering the fisheries wealth of the seas surrounding these two Island groups, it is essential to lay focus on their

resources, devise suitable harvest and post-harvest guidelines with forward and backward linkages so that during the ensuing Plan period the fisheries resources are optimally harvested and utilized for the benefit of the nation.

The major fishery of the Lakshadweep Islands include species such as tuna, bill fishes, pelagic sharks, marlins, sailfish and other groups of food fishes such as flying fish, barracuda, seerfish, rainbow runner, garfishes, halfbeaks, snappers, perches, clupeids, carangids, breams, trigger fishes, rays, octopus, etc. The commercial tuna fishery of Lakshadweep Islands presently depends mainly on skipjack tuna. The potential annual yield of tunas is estimated to be about 50 000 tonnes and all other fishes another 50 000 tonnes against the current harvest of about 10 000 tonnes, which is only 10 percent of the harvestable potential. The traditional processed product *masmin* is the favourite item made out of more than 50 percent of the tuna catch while the rest is consumed fresh and small quantities canned into white tuna meat in brine/oil.

Fish production in Lakshadweep could be increased by i) scaling up of modified fishing craft (traditional boats, pole & line boats, gillnetter-cum-troll lines); ii) introduction of new craft (tuna longline-cum-gillnetter for *Sashimi* grade tuna, Maldivian type pole and line vessels, mother/collector vessels; iii) modernization of fishing gear; iv) improving communication network and v) adopting sea farming practices, wherever feasible. Introduction of modern vessels is expected to increase the quantity of fish catch as well as facilitate production of value-added items for export. Training and demonstration programmes in craft and gear technology, fish processing and mariculture are also suggested for the benefit of Lakshadweep fishers.

In Andaman & Nicobar Islands too, the future development of marine fisheries will largely depend on the level of exploitation of the potential tuna resources of about 100 000 tonnes and other varieties such as reef fishes, lobsters, etc. In order to harvest the potential resources, improvements in the existing craft and gear are required as also introduction of larger-sized boats from the mainland. Presently, the crafts used are mainly traditional boats and can only undertake fishing in the near-shore waters. Phased introduction of motorized and mechanized boats with improved gear will enhance fish production from the Islands. Simultaneously, better post-harvest facilities (including landing and berthing infrastructure, processing and storage), conforming to international standards need to be developed.

Both the island groups are strategically located. The location of the Andaman and Nicobar Islands is strategic with respect to the world tuna markets and good connectivity (by both air and sea) between the Islands and the markets could be ideally used for export of high grade tuna products to the Far East countries such as Japan. The Lakshadweep Islands abound in tuna resources, especially skipjack. Like Maldives, the skipjack can be harvested in sizeable quantities for exports as well as production of '*masmin*', which has a good market in Sri Lanka. Further, a sound presence of the Indian fishing fleet in the waters surrounding the two Island groups would reduce poaching of resources as also contribute to the overall security of the country.

Improving MCS in support of sustainability: An effective and implementable Monitoring, Control and Surveillance (MCS) system is pre-requisite for management and conservation of fisheries resources in the Indian EEZ. A successful MCS will have components like fisheries data collection and timely flow of information, critical for taking policy and management decisions; estimation of fishing effort and adjustment of fishing capacity; registration and licensing of fishing vessels, boat building yards, etc; and effective surveillance mechanism including maritime safety and security needs of the country. An effective MCS system will also help in providing business intelligence necessary for promotion of fisheries trade and commerce. In addition, there is an increasing international awareness on the efficacy of fisheries management and linking fisheries trade with quality of fisheries management. In this regard, an established MCS system can act as an assurance to the international community on India's commitment to promote sustainable marine fisheries and can strengthen country's position in international and regional negotiations on fisheries and related matters.

To promote fisheries management in the coming Five-Year Plan, a comprehensive scheme on MCS should be considered for implementation by the DAHD&F with active participation of all coastal States/UTs. The major components of the scheme may *inter alia* include the following:

- Regulation for access to waters and resources;
- Maintenance of records of all vessels and boat building yards;
- Implementation of log book system, as appropriate;
- Monitoring of fishing vessels through appropriate means;
- On shore and at sea surveillance; and
- Setting up of MCS Division at the Central level and in each coastal State and Union Territory for effective implementation of the scheme.

Since it would be for the first time that a MCS scheme would be implemented in the country, the DAHD&F may shoulder larger responsibility in making adequate funds available to the States and also provide adequate training and capacity building for the staff of the Department of Fisheries to implement the scheme.

Establishment of Marine Protected Areas vis-à-vis loss of livelihoods of fishers: Biodiversity conservation efforts in the country have led to establishment of 33 coastal and Marine Protected Areas (MPAs) and 03 Marine Biosphere Reserves, with a total area of approximately 5 319 sq. km covering about 1.3 percent of the continental shelf (415 000 sq. km including the Islands) and less than 0.3 percent of the EEZ (2.02 million sq. km). While MPAs are an important tool for conservation of coastal and marine biodiversity and in the long run are expected to contribute to the sustainability of the marine resources, in many instances the MPAs have resulted in loss of livelihoods of traditional and small-scale fisher folk. Bitharkanika Wildlife Sanctuary and Bitharkanika National Park in Orissa and the Gulf of Mannar Marine National Park are two examples where fishers have lost their livelihoods on account of the conservation efforts by the Government.

Ideally, setting up of such parks should not threaten the livelihood support of artisanal and small-scale fishers, as fishing can co-exist with conservation of other animals and birds with certain dos and don'ts. Further, fishing is also banned for conservation of endangered species such as turtles, etc. In Odisha, for most parts of the year fishing is banned along a sizeable area of the coast for conservation of *Olive ridley* turtles. However, if it is so essential to move the fishers out of the MPAs or close the coastline for fishing for conservation purposes, it is necessary for the Government to chalk out alternative livelihood programmes and also provide adequate compensation to the fishers. There are several such examples in the inland sector too, which need intervention to protect the livelihoods of fishers. The DAHD&F may articulate this issue with the concerned Ministries/Departments in the Union Government to formulate a policy, which may suggest solutions to safeguard the livelihoods of traditional and small-scale fishing communities.

4.2.2 Promoting coastal aquaculture and mariculture

Coastal aquaculture and mariculture offer enormous scope of development along the coastline in the mainland as well as in the Island territories. It is popular in all the coastal States as also in the UTs of Puducherry and Daman & Diu. On one hand these activities can wean away extra pressure from the coastal waters, on the other hand they can add to fish production to meet the growing requirements of the country. Recent estimates indicate that per capita fish consumption in India is around 8-10 kg per year, which is likely to grow with the increasing preference for sea food.

The potential brackish water area available in the coastal regions of the country for shrimp culture is estimated between 1.2 and 1.4 mha. Presently, an area of about 184 115 ha is under farming with an average production of about 110 000 metric tonnes of shrimp per year. The average productivity has been estimated at about 1 000 kg per hectare per year. Since the development of this sector, about 0.3 million persons have gained direct employment in shrimp farming and about 0.6 – 0.7 million people are employed in ancillary units and support activities. The area under culture has also increased from 135 582 ha in 1996-97 to 184 115 ha in 2005-06.

Cultured shrimps (mainly *Penaeus monodon* or popularly known as black tiger) contribute about 50 percent of the total shrimp exports. About 91 percent of the shrimp growers in the country have a holding between 0 - 2 ha, 6 percent between 2- 5 ha and the remaining 3 percent have an area of 5 ha and above. The infrastructure facilities established over the years include hatcheries both in private and public sector, laboratories for testing of pathogens/diseases and processing units. With the introduction of white leg shrimp (*Littopenaeus vannamei*), the farmers now have the choice of farming white leg or tiger shrimp (*P. monodon*). Farming of *L. vannamei* has been successful so far in the country and both production and productivity have increased making farming operations remunerative. However, the availability of specific pathogen free (SPF) seed is still a major constraint in expanding the culture of this species and this requirement needs serious attention.

The long coastline of 8 118 km of the country along with large number of calm bays and lagoons offer good scope to develop mariculture/sea farming. Presently, sea farming is confined to green mussels practiced along the Malabar coast in Kerala producing about 20 000 tonnes annually. Being in the lower strata of the food chain, bivalves are energy efficient and cause least pollution to the environment. The other success story is of seaweed farming carried out along the Ramanathapuram and Tuticorin coasts of Tamil Nadu producing about 5 000 tonnes of sea weed annually. The CMFRI has also been successfully experimenting with sea farming of cobia species in cages in different locations and initial trails offer promising prospects of sea farming developing into a major enterprise.

Keeping in view the available potential that exists for coastal aquaculture and mariculture, developmental plans with both forward and backward linkages are urgently needed to allow these activities to become significant contributors to production of seafood in the country.

Emerging issues and opportunities: Capture fishery in the coastal waters has almost reached its maximum and the future scope of enhancing production lies either in taking the fleet offshore or promoting both mariculture and coastal aquaculture. Coastal aquaculture has a long history of development in India and the farming sector has gone through several phases of ups and downs. Having resolved many issues ranging from environmental to socio-cultural, shrimp farming now seems to be coming of age. On the other hand, mariculture is relatively a new activity and still under pilot-scale implementation, except mussel farming in certain pockets in Kerala. As mentioned in the foregoing paragraph, CMFRI's indigenous sea cage culture technology also has good prospects of large-scale adoption. On the whole, making both coastal aquaculture and sea farming a sustainable activity would need several issues to be addressed in the coming years. Some such issues are briefly discussed in the following paragraphs.

In coastal aquaculture, quality seed of *P. monodon* has emerged as a major bottleneck. While introduction of *L. vannamei* has reduced the pressure on tiger shrimp, yet the latter being an indigenous species need to be promoted, as it still commands a niche market in the global trade. Further, *L. vannamei* farming is totally dependent on import of SPF seed and this could be a serious bottleneck in the future. While initiation of a brood stock development programme for tiger shrimp is the need of the hour and should be taken up through the concerned research institution(s), there is also a need for establishment of brood stock banks, at least one each in the coastal State to meet the needs of the shrimp farmers.

Similarly, the availability of required quantities of quality seed is a major issue in promotion of finfish cage farming in the country. Commercial level seed production can be achieved if quality brood stock can be maintained. In this regard, a national-level facility for raising brood stock can be developed initially by the CMFRI. The juveniles produced by the facility can be used for distribution among farmers for carrying out sea farming in cages.

In aquaculture feed constitutes a major input cost, ranging in between 40-60 percent. Reduction in feed cost is the key to reduced production costs. The other major bottleneck in the feed sector is the lack of indigenously formulated feed for cage farming of marine species such as sea bass, etc. The imported feeds are raising the cost of farmed product, which is not economically viable for the farmers. Therefore, commercial production facilities have to be developed indigenously for production of cost-effective and good quality feed for the species that are selected for commercial-level farming.

Mariculture development in the country needs further refinement in both farming practices as also cage fabrication technology. The farming practices conducted by the research institutions should now be taken up for front line demonstration so that the fish farmers are convinced of their economic viability. For capture-based aquaculture, better knowledge of the seed resources and the impact of their harvest on the natural populations are required. Better management practices should also be an integral part of the commercial-scale technologies developed.

Increased focus on coastal aquaculture and mariculture also takes us to the issue of Integrated Coastal Zone Management (ICZM) planning, which would necessitate allocation of suitable land and water space for carrying out the activities in co-existence with other users of the coastal areas. In this regard, reassessment of suitable area of brackish water aquaculture development through micro-survey at district level is necessary and should be carried out. This will bring in more confidence in the prospective entrepreneurs to make investments in land-based aquaculture or sea farming. Cluster farming or group farming through farmers' association should be encouraged for the benefit of small farmers. Lastly, it may be necessary to also catalyse/facilitate availability of public finance for aquaculture/sea farming, building skills and capacities at all levels and developing markets, especially for the benefit of small-scale operators.

4.3 Inland fisheries and aquaculture

Inland fisheries resources of India include rivers and canals (1.95 lakh km), reservoirs (>3.0 mha), floodplain wetlands (1.2 mha), estuaries (0.26 mha), etc. These water resources have great potential for enhancing fish production and productivity and providing livelihoods to millions of people. The smaller water bodies in the form of ponds and tanks with a water spread area of 2.41 mha are the major aquatic ecosystem for fresh water aquaculture. These water bodies are both in private and public domain. Resources for coldwater fisheries and aquaculture include rivers (8 253 km), natural lakes (21 900 ha) and reservoirs (29 700 ha). Although, they form smaller component of the inland sector, they too have greater scope for development. The fisheries practices followed in these waters are capture fisheries, culture-based fisheries, extensive to intensive aquaculture and other forms of fisheries enhancement. Multiple use nature of majority of these waters with multiple stakeholders is the major constraint to harness their production potential.

The historical scenario of Indian inland fisheries and freshwater aquaculture reveals a paradigm shift from capture fisheries to aquaculture during the last two and half decades. Freshwater aquaculture with a share of 34 percent in inland fisheries in mid-1980s has increased to about 80 percent in recent years. It is recognized as one of the fastest growing enterprises in agriculture and allied activities and this growth is likely to continue in the coming Plan period too.

4.3.1 Conservation of inland fisheries resources

India is endowed with network of 14 major and 44 minor rivers with innumerable tributaries and streams, harbouring a rich aquatic biodiversity. Besides, a vast network of irrigation canals originating from the river valley projects also exist. Estuaries with a large water expanse abound in the lower reaches of most of the rivers and are important breeding grounds for a variety of commercially important fin and shellfishes. Despite this wealth, inland fish production in the country has gone down drastically in recent decades.

All the major rivers in the country are inter-state in nature. Fish being ambulatory in nature, the benefits of any measure taken for fisheries development (even for the purpose of conservation) in the rivers would naturally not accrue to any single State. As such, State Governments are not inclined to provide funds for riverine fisheries development and resource conservation. This has left the riverine fishery development uncared for and neglected.

The deteriorating environmental status of inland water bodies directly affects the country's fish production system. A multi-pronged strategy would be required to reverse the situation. This would include declaration of identified riverine stretches having considerable fish stock and diverse species as sanctuaries for conservation of fish stocks; replenishment of native stocks through ranching and community mobilization; conservation of breeding grounds; pollution control; training to fishers and stakeholders and mass awareness on the importance of rivers in general and for fisheries in particular. The success of all such efforts will depend on the level of participation of fishing communities and other local stakeholders. In the same vein, the estuaries would require special attention in terms of regulated discharge of freshwater; reduced fishing efforts, particularly with regard to mechanized fishing; controlled collection of natural fin/shellfish seed and mangrove conservation.

With increasing emphasis on irrigation, the canal network is becoming a source for fish cultivation, even to serve as a supplementary resource to riverine fisheries. The canals can be used by the communities by adopting technologies of running water fish culture. Fish culture in enclosures within the canals as also in the submerged areas along the canals is a possibility that deserves attention and investment. Issues to be addressed are ownership and harvesting rights, leasing, duration of water retention and suitable farming practices. However, if communities manage and regulate farming operations in the canals with approval from the irrigation authorities, some of the above-mentioned hurdles can be overcome.

The floodplain wetlands or lakes of the Ganges and Brahmaputra River systems have a water spread of about 1.3 mha and are located in the States of Assam, northern Bihar, West Bengal and eastern Uttar Pradesh. These water bodies are continuum of the parent river/tributary; they harbour a rich biodiversity of fishes and are crucial for the fisheries and ecosystem health of the rivers and their tributaries. The floodplain lakes also play an important role in groundwater recharge, nutrient cycling and most of all sustaining livelihoods and nutritional security of a large population residing on the lake/floodplain margins.

In India the coldwater/hill fishery resources are spread from north-western to north-eastern Himalayan region and some parts of Western Ghats, encompassing about ten States. They include rivers (8 253 km), natural lakes (21 900 ha) and reservoirs (29 700 ha). Considering the diverse natural resource-base and wide climatic diversity, they are ideal for developing food, sport and ornamental fisheries of high value. They can be an important source of livelihoods for the hill people, where other income earning opportunities are less and difficult to practice. In the past Five-Year Plans, the developmental needs of these resources have not been adequately addressed. It is suggested that in the coming Plan period a comprehensive plan may be drawn for fisheries and aquaculture development and wherever required for the conservation of the coldwater resources.

The reservoirs are common landscape of most of the Indian States. The reservoirs are classified as small (<1 000 ha), medium (1 000 to 5 000 ha) and large (>5 000 ha). Most of the Indian reservoirs are located in tropical to sub-tropical regime and hence have immense potential for fish yield enhancement. The endemic fish fauna of the reservoirs is rich and with supplementary stocking and appropriate harvesting norms, fish production and productivity can be optimized. However, the present yield from the reservoirs is low- on an average 30 kg/ha. The yield for different categories of reservoirs adopted under the NFDB assistance during the Eleventh Five-Year Plan has been documented at 174 kg/ha for small, 94 kg/ha for medium and 33 kg/ha for large reservoirs (CIFRI, 2011)[20]. Poor management is one of the main reasons for this low yield. It is seen that the reservoir fishing communities are rarely involved in the management, planning or decision making and play a passive role. Similarly, the interventions of the DoF are also minimal leading to poor management of these water bodies and resultant low yields.

Reservoirs can significantly contribute to inland fish production basket of the country and provide livelihoods to a large number of fishers dependent on this resource. This production potential can be harnessed by providing enabling policy, sound management and technology support and mobilizing active participation of resource user communities in the management of the resource. In this regard, some of the major interventions would include bringing more and more reservoirs under scientific fisheries management practices;

[20] ***CIFRI,2011. Summary and Recommendations: NFDB sponsored project "Mid-term Evaluation of NFDB Programme on Stocking of Fingerlings in Reservoirs and its Impact". Central Inland fisheries Research Institute, Barrackpore, 19 p.***

ownership and leasing of reservoirs on long-term basis; stocking with appropriate number and size of fingerlings of carps and other relevant species; developing adequate rearing space (on/off site) for *ex-situ* fingerling production, *in-situ* seed production in cages and pens; introduction of efficient fish harvesting gear & crafts; support for efficient fish marketing; and HRD for reservoir fisheries managers and fishers.

During the Eleventh Five-Year Plan period, the NFDB implemented schemes for augmentation of fish production in the reservoirs through supplementary stocking and HRD activities. The evaluations conducted by CIFRI, Barrackpore on supplementary stocking of reservoirs in the country have come with positive indications of yield enhancement. In view of CIFRI's findings, NFDB's involvement in development of reservoir fisheries could be increased with focus on supplementary stocking of fingerlings and enhancement of skills and capacities of reservoir fishers to handle stocking and harvesting programmes in a cost-effective manner.

It is widely accepted that the problems in marine fisheries are due to over investment – excess fishing capacity while the problems of inland fisheries are due to gross neglect and poor investment. Riverine and estuarine ecosystems are victims of multiple uses and pollutants entering the rivers and their tributaries from point and non-point sources are on the increase leading to eutrophication of the water bodies and consequent loss of fauna and flora. Among multiple uses, water abstraction for irrigation and power generation is perhaps the biggest reason, causing reduced or no flow in the main channel to support fisheries and other riverine fauna and flora.

Thus, fish production from inland fisheries resources is not commensurate with the size and biological productivity of the resources. Barring reservoirs, where production hikes have been achieved in recent years, production from the other resources such as the rivers and their tributaries, floodplain lakes, upland lakes and rivers and the estuaries is on the decline. In recent years, the increasing presence of exotic fish species in the riverine catches is also a serious issue and some of these species in the long run would threaten the existence of endemic species in the inland open waters.

The water spread area of the floodplains is fast shrinking and their fisheries depleting due to heavy encroachment, siltation, eutrophication, weed infestation, broken connections with the main rivers, *etc*. Considering the importance of floodplains in fisheries and other eco-services, it is necessary to conserve these resources both towards ecosystem benefits for the society at large and for fisheries enhancement. Some of the important steps in this direction would be towards restoration of connecting channels (between the lake and the parent river), desiltation, weed clearance, identification of breeding grounds in wetlands, etc. The floodplain lakes are also ideal for production enhancements through activities such as culture-based fisheries and integration of activities such as eco-tourism, horticulture and aforestation in the catchment areas through community-based management approaches.

4.3.2 Freshwater aquaculture

Freshwater aquaculture contributes maximum to India's fish production and this contribution is likely to increase in the years to come. Freshwater aquaculture is a rural enterprise benefitting small and marginal farmers spread across the length and breadth of the country. With coverage of 2.41 mha of ponds and tanks, number of fast growing endemic and exotic fish species and low input technologies, prospects of doubling of fish production exists through freshwater aquaculture. With a production of 0.37 mmt in 1980, freshwater aquaculture has touched 3.5 mmt mark, with major contributions coming from the carps. The three Indian Major Carp (IMC) species – catla, rohu and mrigal together contribute a lion's share with exotic silver carp, grass carp and common carp forming the next important group. The other important categories of fish, that are picking up in production are *Pangasius* species, native catfishes (*magur* and *singhi*) and freshwater prawn, the last two also fetching high market prices. *Pangasius* is mainly farmed in Andhra Pradesh and its production is growing fast, although in recent years the farm-gate prices are reducing, which is acting as a disincentive to the farmers.

The following paragraphs discuss some of the critical interventions required during the Twelfth Plan to augment production from freshwater aquaculture and make it a vibrant enterprise that can support rural livelihoods, increase income and well-being of the small-scale fish farmers in the country and contribute significantly to the country's protein food basket.

4.3.3 Fish Farmer's Development Agency (FFDA)

As compared to the developments in agriculture and livestock/poultry, fish farming still continues to be practiced on low levels of technology, resulting in poor productivity and production. Where freshwater aquaculture using IMC or combination of IMC and exotic carps can achieve between 6-7 tonnes of fish/ha/yr using moderate levels of input based technology, the present average production from the ponds and tanks under the FFDAs is about 2 850 kg/ha/yr. The ponds and tanks which are yet to receive inputs from FFDAs or adopt scientific practices are yielding much lesser- on an average 1 000 tonnes per/ha/yr. Lack of capital, redundant extension services, lack of improved technologies, shortage of vital inputs such as quality seed and cost-effective and efficient feed, and poor post-harvest infrastructure are the main reasons for the low levels of production from these water bodies in the country.

The FFDAs were set up in the year 1974-75 to popularize freshwater aquaculture in the country by assisting fish farmers in securing bank loans and channelizing the subsidy component; organizing trainings for dissemination of improved fish farming methodologies; facilitating inputs such as feed and seed; and hand-holding until the farmers were confident to adopt the modern scientific methods of fish farming. The FFDAs were responsible for creating a cadre of fish farmers well conversant with the scientific methods of fish farming and in the process helped in ushering the first 'Blue Revolution' in the country. With the initial success, the FFDA programme expanded to cover more States and presently 429 FFDAs are in operation. However, one of the weakest flaws in the FFDA programme was that the agencies were not

institutionalized to mature into self-reliant bodies, and with change in Plan support most of them are now unable to function properly.

Organization of FFDAs and issues before them: The FFDAs were originally set up as district-level agencies (registered as Societies) with the District Collector/Deputy Commissioner as chairperson and the District Fisheries Officer as its Chief Executive Officer. Besides subsidy for assisting the farmers, the FFDA scheme until the Ninth Five Year Plan also assisted each active FFDA in meeting the salary component of one Fishery Extension Officer, One Accountant and one typist. This assistance was limited to Rs. 2 lakh per year per FFDA. The salary component has since been withdrawn.

Out of the 429 sanctioned FFDAs, presently 325 FFDAs are active and 104 do not avail any assistance under any of the components of the Centrally Sponsored Scheme of Development of Inland Fisheries and Aquaculture. Financial constraint is one of the major reasons for the present state of affairs. Most FFDAs have expressed their inability to bear the recurring expenditure on salary and other administrative expenses after the changes effected in the Scheme during the Tenth Five-Year Plan.

Presently, most of the FFDAs are active only at the District level, with a meagre support of Extension Officers, who are responsible for ground-level implementation of both the FFDA programme and other Central/State run schemes. With the absence of support at the Block level, there is lack of effective implementation of the scheme, which is also evident in the lower average productivity of the FFDAs. It is worth mentioning that out of the 29 States, 19 States have less than the national average productivity of 2 850 kg/ha/year.

Besides financial and administrative constraints faced by the FFDAs, the existing subsidy structure under the Scheme is not found lucrative by many States. In fact States like Punjab, Haryana and Andhra Pradesh with a high average productivity of 6 094 kg/ha/yr, 4 370 kg/ha/yr and 3 740 kg/ha/yr respectively avail very little assistance under the Scheme. Many States have felt that the existing subsidy structure does not meet the realistic costs and therefore needs revision. For instance, Jharkhand and Chhattisgarh have suggested that the unit cost for construction of ponds should be enhanced to Rs. 7.00 lakhs from the existing 3.00 lakhs and the rate of subsidy be enhanced to 40 percent of this unit cost from the present rate of 20 percent. Hill States like Himachal Pradesh have suggested that the unit cost for construction of ponds in the hilly areas should be Rs. 15 lakhs.

In recent times many suggestions have emerged to enhance the scope and coverage of the scheme. Jammu and Kashmir has suggested inclusion of trout culture, sport fisheries and masheer fisheries and Nagaland has suggested provision of link roads to facilitate transportation of fish catch on the lines of 'Agri-Link Roads'. The NE States have suggested that the subsidy should be shared by the Centre and the NE States in the ratio of 90:10 instead of 75:25 as of now. Bihar has suggested that the scheme should be transformed into a Central Sector Scheme instead of Centrally Sponsored Scheme.

In the Eleventh Five-Year Plan, the Centrally Sponsored Scheme on Development of Inland Fisheries and Aquaculture was implemented by the DAHD&F. With the establishment of the NFDB in July 2006, the Board was also assigned with the task for promoting aquaculture through a set of incentives to fish farmers. However, the complexion of the two schemes was not common in many respects, resulting in confusion in the States/UTs and also in the minds of end users. The DAHD&F's scheme failed to pick up because of the non-functioning of most of the FFDAs and also the fact that the amount of assistance available under different components did not match the field-level requirements. Similarly, the NFDB also did not meet with success in implementation of its programme on freshwater aquaculture, first on account of lack of support at the field-level and second the mismatch between the level of assistance proposed under the scheme and the actual requirements.

Therefore, the lesson learned from the two schemes bring us to the conclusion that any programme to promote freshwater aquaculture in the country would need a strong field-level agency to provide necessary support and hand-holding of the millions of small and marginal farmers and the level of assistance should match the ground-level realities. While there are a large number of measures that would be needed for revival of the FFDA programme in the Twelfth Plan, the following paragraphs highlight the most important changes proposed for consideration of the Government.

All schemes on promotion of aquaculture and related activities implemented by the DAHD&F and the NFDB should be handled by a single agency *i.e.* the NFDB and in doing so the FFDAs would be the field-level outfit supporting the NFDB in implementation of the scheme. To make these agencies more productive and also ensuring a better return on investment, it is suggested that these agencies would be assigned all production-oriented programmes at the district level, such as aquaculture (both fresh and brackish), facilitating seed production, stocking in reservoirs, mariculture, ornamental fisheries, development of ox-bow lakes and floodplain fisheries, etc as the case may be. It is envisaged that the FFDAs will re-establish the critically missing link between the primary producers of the sector and the development agencies by functioning as extension services system to facilitate aquaculture and fisheries development. The system will also promote knowledge-based and technology-mediated aquaculture and sustainable fisheries.

While extension of technologies to the farmers and fishers would be the prime task of these agencies, depending on the resources available, they would be performing multiple tasks and provide the much needed field-level support to NFDB, as its trusted arm in the field. Acting as a single window system, these agencies would also be the interface between fisheries sector and other programmes such as MNREGA (Mahatama Gandhi National Rural Employment Guarantee Act) implemented by the Ministry of Rural Development and the Rashtriya Krishi Vikas Yojana (RKVY) promoted by the Ministry of Agriculture (Department of Agriculture & Cooperation). This would allow adequate allocation of funds under the MNREGA and RKVY programme for the fisheries sector and also their implementation at the field-level. In the absence of these field outfits, it would be difficult for either the NFDB or the DAHD&F to ensure

inclusion of fisheries related activities in the other schemes and programmes being implemented by the sister Ministries/Departments in the States/UTs.

As the mandate of the FFDAs would no longer be restricted to aquaculture in freshwater ponds and tanks, the agencies could be re-christened as Fisheries and Aquaculture Development Agencies or FADA. The existing BFDAs operating in the coastal Districts of the country would also be merged with these agencies to create the FADA. The DAHD&F and NFDB could finalize the structure and functioning of FADA in consultation with the States/UTs. In all likelihoods, the FADAs would hold the key to India's aquaculture and culture-based capture fisheries development in the years to come.

Fish seed production: Production of quality fish seed is a prime requirement for developing aquaculture and culture-based fisheries in reservoirs, etc. The present estimates for fish seed production (mainly carps) from major fish seed producing States are 11 736 million fingerlings and 26 276 million fry (NFDB, 2011) with West Bengal contributing to 84 and 50 percent of fingerling and fry production of the country respectively. This unbalanced seed production scenario does not auger well for the sector. Decentralized seed production and year round availability of quality seed of desired size and species at local level is the critical need for development of fisheries and aquaculture. Ideally seed production centers should be located close to the farming areas to reduce transportation cost, seed mortality and other logistic problems.

Considering the awareness created during last three decades in general and during the Eleventh Five-Year Plan in particular on the importance of good quality seed and impact of appropriate stocking density in final production, it is necessary that quality seed is produced in adequate quantity throughout the country. Keeping in view that both vertical and horizontal hikes in production from aquaculture and also from other resources such as reservoirs and floodplain lakes will require quality seed in adequate numbers, it is essential to lay focus on seed production in the country during the coming Plan period.

The projected demand for fish seed during the Twelfth Five-Year Plan is shown in ***Table 21*** below. Based on the present estimates of 26 276 million fry produced in the country and the annual requirement of 35 100 million fry during the ensuing Plan, the deficit in terms of fry is 8 824 million fry. To meet this huge deficit a multi-pronged strategy would be necessary, otherwise seed would become a major limiting factor in the growth of farmed fish.

Table 21: Annual fish seed (Fingerlings) requirement during the Twelfth Five-Year Plan

Water resource/fish	Area (mha)	Stocking rate (Fingerlings/ha)	Requirement (million fingerlings)
Ponds & tanks (Carps)	2.00	8000	16 000
Reservoirs (Carps)	3.00	1500	4500
Wetlands (Carps)	0.35	3 000	1050
Scampi farming	2.00	2000	4 000

The activities proposed for implementation in the Twelfth Plan period include: promotion of seed production activities in seed deficit States such as Punjab, Haryana, Rajasthan, Madhya Pradesh, Tamil Nadu, etc; establishment of brood banks at the District level/State level and up-gradation of hatcheries for maintaining and holding the brood stock as well as seed; *in situ* production of seed for stocking of reservoirs and other large water bodies; mandatory accreditation and certification of hatchery and seed; import of technology for breeding of commercially important fishes, especially for species holding potential for mariculture; breeding and seed production of indigenous ornamental fishes and rearing of ornamental fishes; public-private partnerships for fish seed production and marketing, *etc*. It would be appropriate to once again reiterate the importance of FADAs in ensuring promotion of seed production activities in the country.

Quality and cost-effective feed: Lack of quality feed for aquaculture and the fast growing cage and pen culture in reservoirs has been a constraint, especially where farmers have intended to take up intensive aquaculture. Good wholesome and cost-effective feed to meet the nutritional requirements at various stages of growth of different fish species and with efficient feed conversion ratio (FCR) is the prime need in aquaculture. Presently, freshwater fish farmers are relying on a crude mixture of rice bran and oil cakes. While these traditional feeds have been useful in extensive and semi-intensive practices, their role in sustainable intensification of aquaculture is limited.

In recent years, the availability of key ingredients such as rice bran and oil cake, especially in the NE States and other hilly regions of the country has become difficult, putting fish farmers in a disadvantageous position. In these circumstances, production of formulated feed is necessary to meet the country-wide requirements of the aquaculture sector. It is estimated that the feed requirements for freshwater aquaculture (including feed required for cage and pen culture) by the end of the Twelfth Plan would be around 10 mmt. However, this demand would depend upon the economic viability of cage fish culture where feed would be the major cost factor. Therefore, development of fish feed mills and scaling up of production from the existing feed mills is necessary and this activity merits support under the Plan. Further, popularization of extruded feed based aquaculture among the farmers through training and result demonstration would also be necessary as this would help in bringing good management practices in freshwater aquaculture operations.

***Disease surveillance and quarantine facilities*:** With the intensification of aquaculture practices and introduction of new species, disease outbreaks are becoming common. The disease outbreaks result in considerable economic loss to farmers and reduction in fish supplies. In general, the awareness levels of farmers on the aquatic animal diseases, health management and their control and treatment is poor and once the disease sets in, farmers are clueless on the treatment procedures or its containment. Further, the infrastructure towards disease surveillance, early warnings, diagnostics and field-level control and treatment is also inadequate. Therefore, the requirement is for an effective programme to improve the health and hygiene in aquaculture through setting up of quarantine facilities; regular surveillance, epidemiological investigations

and networks for early warning; disease diagnostic laboratories and training of field-level workers to assist the farmers in early diagnosis of the problem. Further, networking amongst national-level fisheries institutions and laboratories on scientific investigations, setting up of standard protocols for diagnosis, bio-security, risk assessments and contingency planning in the event of disease outbreaks would also be essential.

Diversification of species in aquaculture: Freshwater aquaculture in India is carp-centric. Estimates indicate that carps (both IMC and exotic) contribute to about 75 percent of the total production from aquaculture, the remaining coming from other species such as *Pangasius*, air-breathing fishes, etc. Amongst carps also there is a single species dominance of *Labeo rohita* or rohu. As per FAO, India utilizes only three bio-categories and 15 species in contrast to 29 species by China, highlighting the needs to diversify aquaculture and ensure sustainability in aquaculture operations.

Introduction of new species into the aquaculture fold will need sound technologies from research Institutions in the country. Presently, experimental trials are on for several species such as murrels, air breathing species, mahseer in the freshwater sector and sea bass, groupers, etc for mariculture. However, a total technology package is yet to be made available. While this work is totally within the competence of ICAR Fisheries Institutions, the DAHD&F or the NFDB can only assist in promotion of the technologies, if made available by the research institutions.

Notwithstanding the availability of technologies on endemic species for broadening the aquaculture species spectrum, the DAHD&F may consider need-based introduction of exotic species that can contribute to increase in fish production, without any adverse impact on the native species and the ecosystem. The Government of India has set up a National Committee on Introduction of Exotic species in the country and this Committee can recommend such species for introduction.

Optimizing water use efficiency in aquaculture: Water is becoming a scarce commodity and there is also an increasing competition for water among various sectors and users. This situation thus calls for harvesting and holding rain water and optimizing its use efficiency in aquaculture. Emergence of re-circulatory aquaculture and recycling of water in intensive aquaculture and hatchery operations are because of this compulsion. There is also a marked intensification trend in aquaculture. All these indicate the critical need for aquaculture engineering inputs to gear the future course of aquaculture. Technologies are required for enhancing water use efficiency that may include systems for removal of metabolites and microbial load, maintenance of higher oxygen regime, minimizing water loss through seepage and percolation, optimizing energy use and application of clean energy, etc. Currently there is only one centre for higher education and research for aquaculture engineering located at the Indian Institute of Technology, Kharagpur, which was established at the recommendation of the National Agriculture Commission in 1976. The unit is required to be strengthened substantially to meet the current

and future needs of qualified aquaculture engineers and researchers and also for developing technologies and tools and machinery.

Use of waterlogged, saline and other degraded land for aquaculture: In India about 2.54 mha of salt affected soils exist, which are unfit or marginally fit for agriculture. There are large tracts of salt affected land (as detailed below) in the semi-arid and arid eco-regions of northern plains and Central High lands in the States of Haryana, Rajasthan, Uttar Pradesh and Gujarat with surface and sub-soil brackish water. These areas can be used for promoting brackish water aquaculture.

Experimental work on use of saline soil was initiated by the Central Institute of Fisheries Education, Mumbai at its Sultanpur and subsequently Rohtak Centres in Haryana. Based on the studies, growth and production of some of the candidate species such as *Chanos chanos* (milk fish), mullet (*Mugil cephalus*), *Etroplus suratensis* (pearl spot) and tiger shrimp (*P. monodon*) was found to be encouraging for taking up culture under monoculture/polyculture and integrated farming in the salt affected areas of the above-mentioned States. It is proposed that suitable schemes to promote utilization of the salt-affected areas may be taken up during the Twelfth Plan period.

4.3.4 Inter-dependence of aquaculture and capture fisheries

Indian aquaculture has strong dependence on capture fisheries. In freshwater farming, the rivers (Ganga and Brahmaputra River systems) are the original home of the Indian Major Carp (IMC) species. Despite perfection in induced breeding of IMC species and also in larval rearing, the original germplasm is still to be sourced from the rivers and their tributaries. For maintaining genetic vigour in the progenies, from time to time, the hatcheries have to use the wild caught brood stock. In case of tiger shrimp farming, the brood stock is sourced exclusively from the wild. Research efforts are yet to completely close the life cycle in case of tiger shrimp and this total reliance on wild caught brood stock will continue until research succeeds in raising quality brood stock in captivity. Despite a ban on collection of juveniles (post larvae) of tiger shrimp from the wild, in some places the juveniles are still caught for stocking the ponds.

Similarly, farming of sea bass, groupers and crabs is largely carried out with juveniles caught from the wild and fattened in sea-based cages or in land-based ponds. So is the case of giant freshwater prawn, where there is still considerable reliance on wild seed for farming of this species. Thus aquaculture impacts the wild stock when large-scale larvae/juveniles/adults are caught from the wild. Further, a significant contribution of capture fisheries is towards fish meal required for farming of carnivorous species. In the absence of quality fish meal such farming operations can become unsustainable. Therefore, the dependence of aquaculture on capture fisheries is significant and aquaculture planning should keep this dependence in mind. It also leads to the point that sustainability of freshwater aquaculture and farming of tiger shrimp will require conservation of wild populations of IMC species, freshwater prawn and tiger shrimp in their natural habitats.

4.3.5 Ornamental fish farming

Promotion of ornamental fish farming is primarily aimed at the export market and also to cater to the growing domestic demand. Presently, many ornamental fish species of high export importance are sourced from the wild, which has adverse impact on the natural resources. For sustainable trade and also for meeting the domestic demand, development of breeding and culture technologies is essential. Around 350 species of attractive freshwater ornamental fishes are available in India, especially in the biodiversity rich Western Ghats and the North Eastern Hills (*e.g.* loaches, barbs, etc). Similarly, a large number of marine ornamentals are also sourced from the wild for exports. Considering the increased popularity of ornamental fishes, captive seed production and rearing technology of many domesticated exotic species and indigenous species having export potential has been standardized. However, to avoid indiscriminate exploitation from the nature, captive breeding and domestication of more native species need to be developed on a priority basis.

To promote development of technologies for breeding new species of ornamental value and also increasing their production, it is necessary to provide appropriate support for capital and other inputs, up-gradation and validation of technology, development of skills of entrepreneurs and dissemination of technologies through efficient extension services. Ornamental fish farming is also an avocation that can provide livelihoods to women in both rural and urban settings. Therefore, the Twelfth Five-Year Plan schemes on ornamental fisheries should contain components which support employment of women and un-employed youth.

In concluding the discussions on proposed support to aquaculture in the Twelfth Plan, it could summed up that developmental strategies for freshwater aquaculture will include both horizontal and vertical increase in production; utilization of new resources such as water logged, saline lands and irrigation canals; diversification of species and intensification of culture practices including integration of aquaculture with agriculture/livestock/poultry. In addition, focus will be on region-specific aquaculture, public- private partnership for scientific aquaculture; fish health management and disease diagnostics and promotion of ornamental fisheries. Finally, the support of field-level agencies is inevitable if the targets are to be achieved.

4.4 Infrastructure

The infrastructural requirements of the fisheries sector are manifold. Ranging from construction of Fishing Harbours (FH) and Fish Landing Centres (FLCs) to establishment of hygienic domestic markets and setting up of cold chains, the prime objective is to ensure that spoilage is reduced and fish reaches to the consumers in the best possible condition. There are various other infrastructural requirements of the fisheries sector, but the following paragraphs will be mainly dealing with the construction and modernization of the FHs and FLCs and setting up of domestic markets and cold chain in the country during the Twelfth Five-Year Plan period.

4.4.1 Setting up of fishing harbours and fish landing centers

Development of infrastructure for providing safe landing and berthing facilities to fishing boats started way back in 1964 (during the Third Five-Year Plan: 1961-66). Over the years, the programme took shape in the form of two major schemes *viz*. (i) a Centrally Sponsored Schemes (CSS) for Development of Minor FHs and FLCs and (ii) a Central Sector Scheme (CS) for development of Major FHs in Major Ports of the country. While the CSS provided 50 percent contributions from the Central Government (Ministry of Agriculture) and the balance 50 percent coming from the State Governments (100 % provided by the Central Government in case of UTs), the CS scheme provided 100 percent funding by the Ministry of Agriculture. In the latter case all the major harbours were constructed and maintained by the Major Port Trusts.

Since inception of the programme in 1964, a total of 06 Major FHs; 44 Minor FHs; and 176 FLCs have been constructed in the country and 18 Minor FHs and 18 FLCs are under various stage of construction[21]. Until the early part of this century, the Central Institutes of Coastal Engineering for Fishery (CICEF) was solely responsible for undertaking techno-economic feasibility studies and surveys for establishment of infrastructure facilities in the country. However, later a number of other agencies, both under public and private sector, have been permitted to carry out the techno-economic feasibility studies and assist the State/UT Governments in development of the infrastructure.

The larger purport of the two schemes until the Ninth Five-Year Plan was to provide capital cost for construction of the facility (depending upon the approved requirements of the project) and towards initial (capital) dredging, wherever required to allow for safe movement of vessels within the FH/FLC basin. The schemes, however, did not cover the subsequent maintenance of the facility. It was envisaged that maintenance cost should come from the revenue accrued from the user charges and other income-generating activities of the harbour. However, this has not happened in most of the facilities constructed under the two schemes, leading to their disrepair and neglect.

Further, the two schemes did not incorporate or strongly enforce setting up of management committees, with larger participation of the user groups and or community mobilization for maintenance or upkeep of the facilities. The initial investments in setting up of the facilities also overlooked the need for skills and capacity development of the user groups in maintaining hygiene and sanitation, overall operation and hand-holding until the users were fully capable of running the facility in a business-mode. Both the States/UTs under whose jurisdiction the Minor FHs/FLCs come and the Port Trusts who are responsible for the Major FHs paid little attention to the issues referred to above resulting in poor condition of the facilities. Starting from the Tenth Plan onwards, some efforts have been made towards renovation and repair of the FHs/FLCs by the Ministry of Agriculture (and also through NFDB) and the Ministry of Commerce and Industries (through MPEDA).

[21] Handbook of Fisheries Statistics,2008.

Presently, the infrastructure facilities set up in the country for safe landing and berthing of the fishing vessels cater to about 25 percent of the fleet, leading to congestion in most of the FHs/FLCs. The congestion in the FHs/FLCs also brings in delay in discharge of the cargo by the fleet and or loading of the provisions for proceeding on a fishing trip. Usually the turn-around time of a fishing boat at the landing wharf/jetty should be minimum so that other boats do not have to wait beyond a certain period.

Due to the limited number of FHs/FLCs available along the coastline, large numbers of boats land their catch on sandy beaches, where no back-up facilities are available to allow for auction, packing or storing, etc. In many places poor road connectivity is responsible for spoilage of the fish landings, which otherwise would have gone for human consumption. In the given circumstances, it is essential to augment the infrastructural facilities in considerable numbers during the Twelfth Five-Year Plan. Further, the existing facilities that are in utter need of repair/renovation/extension should also be taken up in a planned manner during the ensuing Plan.

Further, it would be appropriate to highlight here that the past oversight of not looking at the managerial aspects of the facilities and the skills and capacities of user groups to operate the FHs/FLCs in a 'business mode' should not be repeated. These aspects are vital for the success of the facility and repair/renovation/extension plans should have these components built into the sanctions. At this juncture it may also be important to state that the marine waters are reaching their maximum sustainable yield and thus our efforts should aim at reducing post-harvest losses and taking the maximum landed catch for human consumption and not for other purposes.

Until a decade back, CICEF was the only specialized institution in the country conducting techno-economic feasibility studies for setting up of FHs/FLCs. In the last one decade or so many additional agencies have been authorized to carry out such studies, reducing the burden on CICEF. A couple of maritime universities have also been established, which can take up work of this nature. While CICEF did some pioneering work in establishing guidelines for techno-economic appraisals and also monitoring/quality control in respect of FH/FLC infrastructure, it did not involve itself much in standard setting for such facilities in the Indian fisheries and coastal environment context.

Except a one-time exercise on preparing master-plan for setting up of FHs/FLCs in the country, regular updating of the master-plan and or other policy advisories have not come from CICEF. It is also reported that CICEF is facing severe human resource crunch and unable to shoulder larger responsibilities. In view of the above, it would be appropriate for the States/UTs also to facilitate development of such expertise in the technical institutions such as the Engineering Colleges located within their jurisdictions. Each State/UT, with the assistance of such technical institutions should develop their own master plans, which can further be consolidated to make a national-level master plan by CICEF or NFDB. Further, CICEF should engage itself more in standard setting and appraisal of larger facilities that would need critical review by the experts.

Until the establishment of the NFDB, the entire range of activities (new construction, renovations/up-gradation, etc) was handled by the Harbour Section of the Fisheries Division of the DAHD&F. However, post 2006 activities such as repair/renovation are also being handled by the Board. At a time when the Harbour Section is thinly staffed, handling of activities such as repair/renovation/modernization by the NFDB is a welcome step. While continuing to handle this work, NFDB may also have to relook at its own technical capacity to handle this work. The Board has little in house expertise in harbor engineering and presently relies on staff having general engineering background. Since harbour engineering has its own peculiar requirements, engineers trained in this area would alone be in a position to evaluate the proposals and oversee/monitor subsequent developments properly.

Looking at this issue in more details, it is seen that presently the fishing harbour matters are being dealt at three places – (i) Harbour section of the DAHD&F responsible for approval of new facilities and also up-gradation of the existing facilities; (ii) NFDB attending to renovation/repair/modernization of existing facilities and (iii) CICEF responsible for conducting techno-economic appraisal of proposals received by the Ministry of Agriculture and also monitoring of the facilities under construction. Such distribution of work, especially bearing in mind the lack of adequate complement of staff competent to handle the harbour engineering matters at all the three places (Harbour Section, NFDB, CICEF), may not auger well for the development of FHs/FLCs in the country. Therefore, a clear-cut decision is needed for consolidation of the available manpower and expertise.

To begin with, first there is a need to re-define the role and function of CICEF to make its output focused and productive. The present restrictions in recruitment of staff may prohibit CICEF to augment its workforce. Therefore, CICEF may restrict its techno-economic feasibility appraisals to larger proposals and leave the smaller FHs/FLCs to engineering institutions and other agencies already enlisted with the DAHD&F or the coastal State/UT Governments.

Second, CICEF may also engage in standard-setting for FH/FLC design; material to be used in various facilities of a modern FH/FLC; maintenance of hygiene and sanitation and equipment required for the purpose; training and skills and capacity development of the user-groups, etc. CICEF from time to time may also impart trainings to State/UT-level agencies for up-gradation of their expertise in conducting techno-economic feasibility investigations, FH/FLC designs, etc. On the whole, CICEF should upgrade itself into a centre of excellence in harbor engineering works in the country and leave the other minor works to State/UT level agencies/institutions. In the longer run this would reduce the State's reliance on CICEF for works of routine nature and enhance their in-house capabilities in harbor engineering works.

The third issue that needs a decision pertains to the consolidation of the activities presently being carried out by the Harbour section of the DAHD&F and the NFDB. For all reasons, activities of similar nature may not be justified to be handled at two different places. Therefore, it is necessary that all matters

related to new proposals and modernization, renovation/repairs be handled at one place. In this regard, the NFDB stands out as the likely choice for various reasons. The Board has a larger flexibility to recruit or hire additional staff it requires on consultancy or on regular basis and experts that may be required for examining the proposals received from the States/UTs.

4.4.2 Improving marketing of fish

It is generally felt that post-harvest infrastructure is grossly inadequate in fisheries sector. As spoilage of fish starts right from the time it is caught, proper storage, preservation and prompt disposal or transport services are essential. Various studies have pointed to the high levels of wastage in the Indian fishery due to spoilage. This is particularly acute during the monsoon, when up to 30 percent of the catch could be lost. This is a vital area to be addressed, and may result in increased economic returns to those dependent on the fishery without any increase in fishing effort. Therefore, strengthening of post- harvest infrastructure such as chilled storage facilities, ice plants, cold chains and freezing/processing units, roads and transportation, modern and hygienic wholesale and retail market outlets etc., as well as effective marketing system in identified areas are the key requirements for the development of this sector. This would ensure higher profit margins to the producers enabling faster fisheries development. This will also promote quality assurance and better food safety standards for fish food for domestic consumers and also for the export market.

Presently, fish markets, both wholesale and retail in the country are in a pathetic condition. Besides, a larger volume of fish is sold through street markets, often on footpaths close to open drains. This unhygienic environment and the fact that fish is seldom kept in ice, results in fast deterioration of the quality of the fish. Mostly whole fish is sold in the market and there is negligible processing/value addition. Further, while marketing, transportation or storage of fish, the standard norms of hygiene and sanitation are least considered, leading to a product that is contaminated and unsafe from food safety point of view.

This core activity has witnessed a slow growth in the country, lagging far behind the production trends. In the Eleventh Five-Year Plan, the NFDB has made efforts to reverse the situation and many States/UTs have availed assistance from NFDB to set up new fish markets, both wholesale and retail or modernize the existing markets. This programme, which has just picked up, needs to be vigorously pursued during the Twelfth Plan also since development of modern hygienic fish markets will improve the acceptability of fish food and also increase its consumption in the country.

Further, the cold chain concept, which again is in rudimentary stages in the country, calls for provisions of integrated facilities to retain the quality of refrigerated or frozen fish from the time of harvesting till it reaches the consumers in distant parts of the country. Development of cold chain system in the country requires the following facilities:

- Adequate supply of ice at landing centres for holding fresh fish before processing;
- Containers for holding fresh fish in ice, cold storage at landing centers;
- Intermediate points on the transit route;
- Insulated/refrigerated vans for transport of fish and fish products
- Processing, marketing and distribution centers; and
- Facilities at retail markets.

In the case of inland fisheries, there are no authentic studies available on the requirement of ice for storage and marketing of fish. Ice has to be mostly transported, often over long distances to the landings centers/villages and ponds at considerable cost. The availability of ice to the producer, especially during non-summer months becomes a serious concern. Some of the constraints in non-availability of ice in the inland sector are constant increase in power tariff; differential charges on ice plants/factories *vis-à-vis* cold storages; hefty security deposits on quarterly basis charged by the Electricity Department; refusal of Banks to advance loan to ice factories on viability grounds; high surcharge rate on ice plants; etc. These issues need to be looked into if availability of ice is to be improved for meeting the requirements of the inland States in the coming years.

The inland sector, although characterized by highly displaced landings, has an advantage in having production sites close to the consumption centers. However, the reservoir fisheries are an exception to this and necessitate strengthening of infrastructure. There is a growing realization that closer ties between primary producers and those engaged in marketing would be mutually rewarding, the former being assured of a ready market for his/her produce at a reasonable price and the later being assured of an uninterrupted supply of raw material for his/her production line.

The Central Sector Scheme implemented till the end of the Eighth Five-Year Plan was re-introduced as a component under the CSS on 'Development of Marine Fisheries, Infrastructure and Post-Harvest Operations' during the Tenth Five-Year Plan with a view to creating necessary facilities to provide remunerative prices to the fish farmers for their produce and making available fresh fish at reasonable prices to the consumers. Under this scheme, State Fisheries Cooperatives, Cooperative Federations and primary cooperatives were assisted in strengthening marketing infrastructure to minimize the post-harvest losses through ideal marketing system. Since re-introduction of the scheme during the Tenth Five-Year Plan, 13 ice plants/cold storages, 29 fish retail outlets/kiosks and 29 insulated/refrigerated vehicles were setup in the country. During the Eleventh Five-Year Plan, 13 fish preservation and processing facilities, 18 fish retail outlets and 98 fish transport facilities were set up in the country.

This scheme needs to be continued during the Twelfth Five-Year plan too, with greater emphasis on improving hygiene and sanitation in the fish markets and establishment of a cold chain for fish marketing in the country. Again NFDB would be in an ideal position to handle this activity along with the setting up of

FH/FLCs in the country. As an added advantage, NFDB would also be able to establish linkages between the harvest and post-harvest activities and promote the 'boat to plate concept'.

4.4.3 Public - Private Partnerships

In the preamble to the National Public-Private Partnerships Policy 2011 (draft), the Government of India (Ministry of Finance) states that the Government of India is committed to improving the level and the quality of economic and social infrastructure services across the country. In pursuance of this goal, the Government envisages a substantive role for Public Private Partnership (PPPs) as a means for harnessing private sector investment and operational efficiencies in the provision of public assets and services.

The preamble further states that India has already witnessed considerable growth in PPPs in the last one and half decade. It has emerged as one of the leading PPP markets in the world, due to several policy and institutional initiatives taken by the Central as well as many State Governments. To provide a broader cross-sectoral fillip to PPPs, extensive support has been extended through project development funds, viability gap funding, user charge reforms, provision of long tenor financing and refinancing as well as institutional and individual capacity building. PPPs are now seen as the preferred execution mode in many sectors such as highways, ports and airports. Increasingly, PPPs are being adopted in the urban sector and in social sectors. Over the years an elaborate eco-system for PPPs has developed, including institutions, developers, financiers, equity providers, policies and procedures. The Draft Policy also states that the government is committed to continue to create an enabling environment for PPPs across the country, through initiatives including enabling funds and schemes, guidelines, institutional structures as well as processes.

While the PPP concept has picked up in many other infrastructure development sectors as mentioned above, it is yet to take roots in the fisheries sector. Establishment of fishing harbours/FLCs and cold chains are some of the areas where PPP mode can work well and the NFDB could facilitate the process. Some of the commonly adopted forms of PPPs include management contracts, 'build-operate-transfer (BOT)' and its variants, 'build-lease-transfer (BLT)', 'design-build-operate-transfer (DBFOT)', 'operate-maintain-transfer (OMT)', etc and these could be used for development of the required infrastructure. In the long run, this would ease the vexing issue of maintenance/repair of the facilities, such as the fishing harbours/FLCs. Further, as many coastal States are facing financial crunch, they would welcome the entry of private sector, through the PPP mode. However, while promoting the PPP route, the NFBD would have to maintain focus on a strong element of service delivery and adequate checks and balances. To ensure accountability and transparency, NFDB may introduce stringent Monitoring and Evaluation (M&E) System and the project specific framework for M&E be made mandatory for each project/ scheme. Secondly, there should be periodical third party led comprehensive assessment of all the projects and schemes and the cost expected to be incurred be incorporated in each project/scheme.

The modalities for private sector involvement in FH/FLC construction/ operation could be worked out by the Government. Besides FHs and FLCs, the PPP mode could also include fish markets and establishment of cold chains. This is likely to improve the marketing infrastructure and help reducing fish spoilage to a considerable extent. It may be relevant to highlight here that in metros like Chennai, a good number of fish markets are owned and operated by private individuals/trusts and their performance *vis-à-vis* the markets operated by the State-run agencies is much better.

Another concept of PPPs with the inclusion of community has its potential in management of reservoirs and other public property resources. In such cases, the Department of Fisheries can provide technical assistance and facilitate overall management; the local fishing communities can undertake management functions such as stocking, harvesting, compliance of rules and regulations, etc; and the private sector entity can contribute by way of investment including procurement of stocking material and marketing. Similar mechanism may have its application in the fisheries management of lakes and floodplain fisheries. The DAHD&F or the NFDB could work out a policy paper on sharing of benefits between public, private and fishing communities.

4.5 Welfare of fisher community and human resource development (HRD)

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- 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.

Although there is dearth of comprehensive studies on the socio-economic aspects of small-scale fishers in the country, the available information does point towards a very low base in respect of most of the vital human development indices, such as education, health, economic well-being, etc. Moreover, their profession, which is akin to hunting in fraught with uncertainties that have been aggravated in recent times due to pollution, intra and inter-sectoral conflicts on resource usage and the impacts of climate change, etc.

A major scheme for welfare of fishermen was launched in 1991-92 by amalgamating two schemes *viz.* 'Janta Personal Accident Policy' (initiated in 1983) and the 'National Welfare Fund for Fishermen' (initiated in 1986-87). A new component on 'Saving-cum-relief (SCR)' was also added to this. Subsequently, the component of 'Training and Extension' (started in 1994-95 after modification of the earlier scheme namely 'Training/Seminar/Workshop)' was also been merged with the Welfare Scheme in 2007-08. The scheme on 'Training and Extension' was a separate scheme till 2006-07. Accordingly, in

the Eleventh Five-Year Plan, the Scheme was operated with the following four components:

(i) Development of Model Fishermen Villages,

(ii) Group Accident Insurance for Active Fishermen,

(iii) Saving-cum-Relief, and

(iv) Training and Extension.

The component on 'Development of Model Fishermen Villages' is aimed at providing basic civic amenities such as housing, drinking water and construction of community halls for fishermen villages. The cost of a house constructed under the scheme was Rs. 30 000 when it was launched in the Seventh Plan, and subsequently revised to Rs. 40 000 during the Ninth Plan period. In the Eleventh Plan, the unit cost has been increased to Rs. 50 000 for house, Rs. 30 000 for tube-well (Rs. 35 000 for NE Region) and Rs. 175 000 for the community hall. About 7 000 houses are constructed on an average per annum under this scheme.

Increasing risk coverage: Keeping in view the low levels of income, which do not create much wealth, the fisher family faces severe hardships in the event of death of the earning member. A similar situation prevails when the fisher meets with an accident and ends up in disability impeding his active life. The Group Accident Insurance for Active Fishermen (GAIS) provides for insurance cover to fishermen actively engaged in fishing. Introduced in the Sixth Plan, the scheme has gone through several modifications and presently the compensation available for death or permanent total disability of the fisher is Rs. 100 000 and Rs.50 000 for permanent partial disability. Accordingly, the upper limit for insurance premium has been increased to Rs. 30 per head, which is subsidized by the Centre and the State on 50:50 basis. In case of UT, 100 percent premium is borne by the Centre. A single policy is taken in respect of all those States/UTs that are participating through FISHCOPFED. More than 30 lakh fishers are covered annually under the GAIS.

Based on the popularity of the scheme and the fact that it provides risk coverage to poor fishers, it may be advisable to continue GAIS in its present form during the Twelfth Plan, except with an increase in the compensation from Rs. 100 000 to Rs. 200 000 on death and from Rs. 50 000 to Rs. 100 000 on disability. In the coming years, it may also be useful to increase the benefits from the existing death/disability to health coverage. There are several examples of low premium, health coverage schemes in the market (Janta Health Plan) and their models could be copied. However, before the GAIS portfolio is enlarged, it may be appropriate to have a clear-cut definition of those who would be eligible under the scheme and also a data base on the fishers and other likely beneficiaries.

The component on Saving-cum-Relief (SCR) is under implementation from the Ninth Plan onwards with the larger objective of conserving the resources and also reducing risk exposure of marine fishers to the perils of the sea in rough weather, mainly during the monsoon months when the sea is rough. The beneficiary has to contribute part of the earnings during non-lean months,

which is matched with equal contributions by the Centre and the State and the accumulated amount is distributed back to the fisher in three/four equal installments. Presently, a contribution of Rs. 600 in 9 months of fishing period is being made by the fishermen and Rs. 1 200 is contributed by the Centre and the States on 50:50 basis. The total sum of Rs. 1 800 is distributed to the fishermen @ Rs. 600 per month for three months of lean period. About 3.5 lakh fishers are benefited under the SCR scheme annually.

The scheme has received mixed reviews in the past. However, on the whole the scheme is meeting its objectives to a certain extent and fishers are largely satisfied with its implementation. They have also desired that the monthly contributions could be increased 2-3 times, since the amount paid to them during the closed season is meager and they are unable to cope with the increasing costs. In fact some States/UTs are topping up the money paid during the closed season with either additional money or in kind (food grain).

It is, therefore, proposed that the SCR may continue during the Twelfth Plan and the monthly contributions be increased to Rs. 450 (Rs.150 each contributed by the fisher, Centre and State), bringing it to a total contribution of Rs. 3 600/4 050 for a saving period of 8/9 month. With this increase in monthly contributions, a total of Rs. 900/1 350 per month would be reimbursed to the fisher for four/three months when fishing would be banned.

Safety at sea of small-scale fishers has been a grey area in the marine fisheries sector, with minor interventions during the Eleventh Five-Year Plan period. Every year hundred of fishers perish while fishing at sea. Most of the accidents can be avoided with proper training, better communication and navigation equipment, sound weather warning and by inculcating a sense of safety among the fishers. Safety at sea is also a function of fisheries management and, therefore, the development programmes need to consider the elements of safety while formulating/implementing a scheme.

Further, occupational safety and health aspects of small-scale fishers are extremely poor and there are very few efforts to address the problems on a county-wide basis. The hygiene and sanitation conditions on board fishing vessels and at shore are pathetic and need considerable improvements. All these issues warrant specific attention and appropriate interventions during the ensuing Plan period.

In the Eleventh Five-Year Plan a scheme on 'Safety at Sea' provides subsidy to the tune of 75 percent of the unit cost of Rs.1.50 lakh per kit consisting of GPS, communication equipment, echo-sounder and search and rescue beacon. This component is implemented through State Fisheries Federations/ Corporations and Panchayati Raj Institutions. The scheme did become popular and it has been suggested by fisher groups that the scheme should be continued during the Twelfth Plan period. However, the choice of items should be made flexible and left to the fishers, depending on their need. It is also felt that the scheme components should include floatation devices, which are missing in the kit promoted during the Eleventh Plan.

4.5.1 Human resource development

The scheme on 'Training and Extension' implemented during the Eleventh Five-Year Plan is mandated to provide training to fishery personnel so as to assist them in undertaking fisheries extension programmes effectively. Assistance is provided to fisher folk in upgrading their skills, for setting up/up-gradation of training/awareness centres in the States/UTs. This scheme is being operated with 80 percent Central assistance in the case of States and 100 percent for UTs. The other components include publication of extension material, production of video films on technologies and other significant developments in fisheries and aquaculture, conducting meeting/workshops/ seminars, etc. of national importance. Besides this scheme, training and extension activities have also been undertaken by the NFDB through the States/UTs, Central institutions and other agencies during the Eleventh Plan.

Training and Capacity Building: The development of any sector largely depends on the human resource and programmes that are implemented by trained and skilled personnel are often successful. Therefore, human resource development (HRD) is integral part of development and cannot be overlooked. So far, HRD activities in the fisheries sector in India have been inadequate and do not meet the requirements of the sector, especially in the wake of growing challenges such as social mobilization of the community and their empowerment, getting access to information and services, developing technical and managerial skills, etc, which lead to adoption of good management practices, hygiene and safety, sustainable farming practices, adapting to climate change, etc. The fisheries managers in the DoF are poorly motivated and mostly stagnating in their jobs. Lack of training opportunities and skill refreshments result in their inability to cope with the technical needs of the sector. Their low status compared to counterparts in the agriculture or other allied sectors is also a de-motivating factor, which needs to be addressed, while looking at the overall requirements of the sector.

With the setting up of the NFDB in 2006, the HRD activities conducted at different levels of the stakeholders did receive a boost. However, the NFDB sponsored programmes in imparting training and capacity development appear to have reached a plateau and do not seem to be gaining further momentum. To provide a result-oriented thrust to the HRD needs of the sector in the ensuing Plan period, the training and capacity development programmes need to be re-oriented keeping in mind that that training and skill development are continuous needs and not ad-hoc interventions. The skills and capacity building activities, especially of the fisheries managers, should aim at bringing attitudinal changes to accept the role of a primary producer as a partner in development. Therefore, besides improving the technical skills, social skills also need to be improved. Further, training programmes for fisheries managers should be linked with their career advancement as this would catalyze their interest in availing training as and when opportunities arise.

To ensure that HRD programmes are taken up to meet the needs of the entire range of stakeholders, a comprehensive policy on 'Training and Capacity Building Needs' is required that can effectively address the sectoral needs and

also look into the specific requirements of each state. The larger onus of meeting the training and capacity building needs of the primary stakeholder lies with the State/UT Governments and they need to strengthen their paraphernalia to meet the requirements of the stakeholders. The State should develop precise training need assessment for each group and subject area of training to enable the training agencies to prepare modules and delivery designs. Further, pre- and post-training evaluation should be an integral part of each training programme. Adequate focus is also required on organizational strengthening, including strengthening of extension service system to support the primary producers in developing their capacity for pursuing sustainable fisheries and aquaculture. The Central Institutions and other national–level agencies can cater to more specialized needs and also training of the trainers.

In the Twelfth Five-Year Plan, this programme should be handled by the NFDB in cooperation with the institutions under the Ministry of Agriculture, State Agriculture Universities (College of Fisheries) and the Krishi Vigyan Kendras (KVKs). To ensure conduct of relevant and quality training it is also important that the State should develop precise training need assessment for each group and subject area of training and the same be submitted to the training agencies for preparation of modules and delivery design. Pre- and post-training evaluation should also be introduced for each training programme with post-training follow-up system.

Strengthening fisheries cooperatives: While a large number of fisheries cooperatives exist in the country, their role in sustainable development of the resources is insignificant. Barring a handful of cooperatives, most of the other fisheries cooperatives are either defunct or existing to avail government subsidies and other benefits. In many countries around the world, fisheries cooperative are playing useful role. The Fisheries Cooperatives of Japan are an excellent example in this regard. In the Twelfth Plan period, it would be useful to strengthen the fisheries cooperatives in India and the FISHCOPFED could play a pivotal role in this important task. The Federation should concentrate on building capacity of fisheries cooperatives to ensure that they operate on sound democratic principles and transparency and adopt business models with diversified portfolios, rather than concentrating on just one or two activities. Training in both technical matters and business management would also be one of the most critical needs for revival of cooperatives, but this aspect could be left to the technical/management Institutions. Incidentally, the United Nations has declared 2012 as the 'International Year of the Cooperatives' and it would be a good coincidence to begin the revival of the fisheries cooperatives in India in 2012.

4.6 Fisheries information system

A Central Sector Scheme on 'Strengthening of Database and Geographical Information System for Fisheries Sector' was launched during 2007-08 by modifying the earlier scheme on 'Strengthening of Database and Information Networking for Fisheries'. The Scheme has the following components:

- Sample survey for estimation of inland fishery resources and their potential for fish production.
- Census on marine fisheries.
- Catch assessment survey for inland and marine fisheries.
- Development of GIS based fishery management system.
- Assessment of fish production potential in coastal areas.
- Evaluation Studies/professional services.
- Registration of Fishing Vessels.
- Development of database of fisheries cooperative of India.
- Mapping of smaller water bodies.
- Strengthening of Unit at Headquarters.

4.6.1 Database on inland fisheries and aquaculture

The database on inland fisheries and aquaculture resources and their fish production is weak and despite efforts made during the last three and a half decades, the picture on resource size, resource use as well as production is still hazy. Presently, the available figures on inland fisheries and aquaculture in the country are mere estimates with low reliability. During the Tenth Five-Year Plan, inland water bodies of 0.5 ha and above were mapped using satellite images of LISS III in all the States and LISS IV in five States for development of GIS. In the Eleventh Five-Year Plan, CIFRI, Barrackpore used LISS IV/LISS III/PAN images to develop aquatic resource map for twenty States, covering water bodies greater than 0.5 ha. The ground truthing for five states has also been completed.

The resources under inland fisheries and aquaculture are highly dispersed and mostly located in inaccessible and difficult terrain. In case of freshwater aquaculture, the resource size is small and often difficult to capture. Therefore, a multi-pronged strategy would be necessary to fulfill this important requirement and *inter alia* would include resource mapping through GIS; regular building and updating of the data-base; manual survey of water resources, etc. Like marine fisheries, census may also be undertaken for inland fisheries during the Twelfth Plan. In case FADAs are set up, these agencies could be useful coordinators in undertaking the task at the district-level.

4.6.2 Database on marine fisheries

Presently, the statistics on marine fish landings are being collected by the DoF of the respective coastal State Governments as well as the CMFRI, Kochi and its centres located in different coastal states of the country. The DoF over the years have diluted their attention on data gathering, resulting in poor data quality as also time lag in providing the information. On the other hand, CMFRI has been continuing with its data collection programme, which unlike the DoF information is more robust and is carried out systematically following standard methodology. Further, CMFRI being a national institute with international repute, has the wherewithal to improvise, tweak, streamline and regularize the information flow on scientifically established norms as and when required.

Additionally CMFRI's advanced facilities and the detailed biological studies on species of commercial importance and correlating them with fluctuations in the marine ecosystem, including global warming can further lead to improving of methodologies and survey designs for data collection and processing, which in turn can be passed on towards capacity building of the DoF staff.

The DAHD&F is actively considering entrusting CMFRI the task of providing database on marine fisheries and this may be agreed to by the Government. Presently, percolation of the core of CMFRI's methodology onto the method followed by DoF is not complete and there is an issue of lack of homogeneity of the output thus generated. Roping CMFRI in for a couple of years to work in tandem with the DoFs would help CMFRI to use its specialization in the field and provide data that is expected to be statistically robust. As CMFRI is already spending considerable amount of funds towards collecting this data across the country, inclusion of the State's resources would further bolster its groundswell thereby reducing sampling errors of the estimates.

The CMFRI, as a specialized research agency focusing on R&D needs of the country, which no other agency in the country can perform, has always been basing its assessment investigations on the precise data assiduously collected by it. CMFRI needs precise information flowing to feed its research endeavors without halt and so getting it involved in the data collection mechanism would only do a world of good in its research pursuits. The short run problems faced by CMFRI are mostly lack of hands to collect the data, which when properly paired with the DoFs would greatly get reduced. Towards attaining the final goal of strengthening the State level setups, DAHD&F may provide necessary assistance during the ensuing Plan period to strengthen the States' technical capabilities to collect quality data in association with CMFRI.

The CMFRI with funding assistance from the DAHD&F has completed two censuses on marine fisheries, the first one in the year 2005 and the second in 2010 for the mainland. The censuses for the two Island territories were conducted by the Fishery Survey of India. This has been a useful exercise and need to be continued with inclusion of more parameters, especially on the socio-economic attributes of marine fishing communities to make the census comprehensive.

The use of GIS for mapping existing coastal aquaculture sites including potential areas for aquaculture as well as mariculture would be another useful activity to be taken up during the ensuing Plan period. Further, a National Fisheries Information Grid could also be established involving all the concerned institutions in the country.

The issue of registration of fishing vessels along with other coastal security issues has been greatly emphasized after the terrorist attack in Mumbai on 26.11.2008. It is desirable to have a uniform system for registration of all types of fishing vessels irrespective of their size and tonnage, in lieu of different registration regimes adopted by coastal States/UTs. This component is implemented in nine coastal States and four UTs besides establishing requisite infrastructure facilities for creation of a centralized database in the DAHD&F. Under this component, 100 percent Central assistance is provided to

all coastal States/UTs and National Informatics Centre (NIC) for development of required software and creation of necessary infrastructural facilities. Besides, the entire cost for development of centralized database in New Delhi and its management, maintenance and operation will be met under the scheme. This activity will continue in the ensuing Plan period and could form a part of the proposed scheme on MCS.

4.6.3 Introduction of log book system

While standard sampling programmes for collection of data from the marine fisheries sector would continue, it is also suggested to introduce the log book system for marine fishers. Use of log books for obtaining data is being increasingly practiced and recently the European Union (EU) has also introduced log books as a part of its certification scheme for fish catches destined for the EU member-states. With its pre-dominant small-scale fisheries, use of log books in India would be a daunting task, but a beginning could be made in the Twelfth Five-Year Plan, initially starting with the mechanized fishing vessels. The introduction of log books could also be a part of the scheme on MCS.

4.6.4 Improving networking

Two national information grids, one for marine fisheries and the other for inland fisheries and aquaculture are proposed to be set up during the ensuing Plan period. The modalities for setting up of this grid could be worked out in consultation with the NIC. Modern technologies such as 'cloud computing' could be used for the grids, which would be cost-effective in the long run. The grids will be the repository of all information on marine and inland fisheries sectors; will be a single-window source for all information relating to the sector; and will facilitate networking with all key stakeholders, especially the States/UTs and the Institutions. These grids could also collate information of concern to the sector from the other Ministries/Departments dealing with fisheries-related matters. The grid masters could either be located in the DAHD&F or at the assigned institutions for marine and inland fisheries. These grids will also facilitate computerized reporting system for fisheries data base available on the grids for user groups. This is also likely to bring in more transparency in the fisheries sector.

4.7 Development-enabling fisheries policy, legislative support and institutional strengthening

The Working Group constituted by the Planning Commission for the Fisheries Sector has been mandated with the task of preparing its report on development and management of fisheries and aquaculture in the Twelfth Five-Year Plan period. Since management has been identified as one of the requisites for the fisheries sector during the Twelfth Plan, the following paragraphs deal with the interventions proposed for enabling policy development, legislative support and institutional strengthening and, or/ restructuring to make fisheries management and governance in the country more effective and meaningful.

4.7.1 Development- of enabling policy and/policy reforms

Appropriate policies provide the required framework for development of any sector. This is all the more important for food production sectors, which involve large number of stakeholders as also institutions. Fisheries developmental programmes in the country have been largely guided by the Five-Year Plans, which define the broad policies for the sector. Other than this, attempts have been made from time to time to formulate policies for individual activities/programme such as deep sea fishing, shrimp farming, etc. The meetings of the Central Board of Fisheries held during the eighties and nineties also spelt out broad policies for the sector. Fisheries being a State subject, many States have also formulated their policies for sustainable development of the sector.

However, at the national level, the 2004 Comprehensive Marine Fisheries Policy (CMFP, 2004) could perhaps be cited as the first policy document in the country. The CMFP, 2004 is now seven years old and keeping in view the contemporary changes in the sector, this policy is outdated in many respects. It is suggested that like the National Agriculture Policy, a National Fisheries Policy (NFP), encompassing both marine and inland fisheries and aquaculture, may be formulated with full involvement of the developmental agencies, Fisheries Institutions and stakeholders, especially the fisher community during the Twelfth Plan period. This policy should take into account the developmental requirements of the sector, inter and intra-sectoral coordination and linkages, institutional strengthening, trade matters, availability of public finances, etc. The NFP should adequately address the challenges before the sector so as to enhance its contributions to the overall economy of the country. Such a policy will also provide important framework and guiding principles to States for developing their own policies based on developmental priorities, nature of available resources and issues confronting the sector. Regarding the need for enabling policy, Central Institute of Fisheries Education (CIFE) organized 5 zonal workshops in different parts of the country involving all stake holders during 2006-07. In these workshops, the issues which require policy support have been identified for different sub-sectors of fisheries and aquaculture. The output of these workshops may be considered while preparing policy frame work for fisheries and aquaculture at State and national level.

4.7.2 Legal support

The existing legal support to develop sustainable fisheries in the country is inadequate. The division of responsibilities between the Centre and the States and also the ramification of fisheries related activities within the jurisdiction of several Ministries/Departments at the Centre have posed problems in providing a strong and implementable legal support to the sector. Several examples can be cited in this regard. The present-day Marine Fishing Regulation Act (MFRA) enacted by all the coastal States/UTS is a product of the model Bill circulated by the Central Government in 1979, largely to address the intra-sectoral conflicts in marine fisheries. In the last three decades, since the model Bill was circulated, the marine sector has undergone a sea change, placing much larger responsibilities on the State to manage its marine fisheries resources.

However, none of the coastal States have reviewed their MFRA to incorporate the topical needs of the fisheries sector.

Similarly, most of the inland States have repealed the Indian Fisheries Act of 1897, to enact their own law to regulate inland fisheries. Based on an archaic law, the present law regulating inland fisheries in the inland States also remains ineffective and fails to meet the requirements of the sector. In this regard, the Central Government had circulated a Model Bill, which is yet to receive due attention by the concerned States. Further, a conspicuous gap remains in not regulating fishing by wholly Indian owned fishing vessels in the area fully under the competence of the Central Government (*i.e.* beyond Territorial Waters). In this regard, a Bill was circulated to the States seeking their comments, before it was placed before the Parliament for its consideration. However, some States opposed the Bill and the matter still remains inconclusive.

Other than the above-mentioned examples, there are many areas in the fisheries sector where legislation is necessary in the interest of the long-term development of fisheries and aquaculture in the country. In the last two to three decades India has also participated in development of many international instruments of binding and non-binding nature catalyzed by expert UN Organizations like the FAO, International Maritime Organization, etc. To allow India's full participation in these international instruments, it is necessary for the country to accord ratification/accession to such instruments. It is proposed that the DAHD&F may consider the legislative requirements of the sector both in terms of domestic legislation as also international instruments and fulfill the gaps during the ensuing Plan period.

4.7.3 Institutional strengthening

Institutions form the back bone of primary sectors such as fisheries. The institutional structure in support of fisheries sector is comprehensive and covers both development as well as research needs of the sector. At the Central Government-level, the Ministry of Agriculture alone has 08 Research and five developmental Institutions, including the NFDB and one regulatory body. Similarly, the Ministry of Commerce and Industry, the Ministry of Earth Sciences, Department of Science and Technology also have Institutions, whose mandates include support to the fisheries sector. Despite the large number of public-funded institutions, the fisheries sector's requirements are not adequately addressed. The following paragraphs highlight the issues as well as propose interventions for restructuring and strengthening the institutions under the DAHD&F, Ministry of Agriculture, including the Board.

The DAHD&F under the Ministry of Agriculture, in terms of its Allocation of Business, has the mandate to attend to Fishing and Fisheries (inland, marine and beyond territorial waters) and the Fishery Survey of India, Mumbai. It is seen that over the years the mandate and functions of the institutions under the ambit of DAHD&F have remained almost static, without making significant changes to meet the growing needs of the sector. As a result the contributions of these institutions are not meeting the aspirations of the beneficiaries or the

primary producers. Further, these institutions have considerably weakened in terms of manpower and wherewithal, leading to inadequate support to the sector. Over the years, the staff strength of the Fisheries Division in the DAHD&F has also dwindled while the work load has increased manifold. This situation too has not augured well for the sector.

However, with the establishment of the NFDB in July 2006, the workload of DAHD&F was reduced to some extent. During the Eleventh Five-Year, some of the developmental programmes handled by the DAHD&F were either fully transferred to the Board or shared by both.

Strengthening the National Fisheries Development Board

The NFDB, set up as an autonomous body (under the Societies Act of Andhra Pradesh), is mandated to undertake development of the fisheries sector. Its autonomous status provides flexibility in terms of operation, man power development, etc. Conceived largely on the patterns of the National Dairy Development Board, the NFDB has completed five years, but its development seems to be stymied and losing the vigor with which it was set up.

The Twelfth Plan provides an ideal opportunity to the Government to boost the Board's performance. While adequate funding would be a pre-requisite, the Board also needs to be appropriately staffed with quality manpower, capable of delivering the goods. The Board has so far failed to attract talent, as it has opened its doors only for serving Government staff (from the State as well as Central Government) with rigid recruitment rules in terms of age, qualification, etc. The NFDB should have the flexibility to attract talent by changing the recruitment rules to include direct recruitment of at least 75 percent of the staff at appropriate levels and if need be invite qualified staff to come on its payroll, even if they are from the private sector.

With a mandate to develop marine and inland fisheries, promote aquaculture, strengthen infrastructure and undertake HRD activities, the NFDB also need to have adequate institutional support and field- level machinery. To accomplish this, it is suggested that the work programme of the four institutions under the DAHD&F be completely dovetailed with the NFDB so that these institutions provide the necessary technical support for fisheries harvest and post-harvest activities to the Board.

With regard to the field-level machinery, it has been proposed in the earlier chapter(s) that the FFDAs and the BFDAs be merged into a single entity, the Fisheries and Aquaculture Development Agency (FADA) and linked to NFDB as it its field-level arm. The modalities of FADA's structure including manpower requirement, funding, areas of operation and lines of control can be worked out in consultation with the State Governments. These agencies will also perform the important task of extension, which has so far eluded the fisheries sector. Going by the experience of the NFDB during the last 5 years, it is felt that in the absence of any field-level support, it may be difficult for the Board to penetrate effectively at the grassroots.

In view of a major shift in policy and outlook of the States from revenue generation and custodian of fisheries resources to a service providing agency for promoting aquaculture and fisheries for development would require adequate institutional strengthening and organizational restructuring, bringing enabling policies/policy reforms and supporting legislations. Initial support is proposed to the States for bringing desired institutional and organizational restructuring in conformity with their development priority and goals.

Coming back to the DAHD&F, it may be prudent for the Department to transfer all production-oriented schemes relating to marine and inland sectors, infrastructure development programmes and HRD activities to the Board. The DAHD&F may focus on policy and legal issues; MCS activities in respect of marine fisheries; trade matters; international cooperation; strengthening of data base and information networking; implementation of welfare programmes for fisher communities; and administrative and personal matters of the institutions. Besides, the Department may also perform the important task of coordination with sister Ministries/Departments at the Centre and on critical policy and legal issues with the States/UTs. This allocation of work between the DAHD&F and the NFDB could be a win-win situation for both the organizations as also for the fisheries sector.

Re-organizing fisheries institutions

As mentioned earlier, the DAHD&F has four specialized institutes under its fold, namely:

(i) Fishery Survey of India (FSI)

(ii) Central Institute of Fisheries Nautical Engineering & Training (CIFNET)

(iii) Central Institute of Coastal Engineering for Fishery (CICEF)

(iv) National Institute for Fisheries Post-Harvest Technology and Training (NIFPHATT)

Details on their mandate have been described elsewhere in the document and, therefore, not repeated here. Over the years, these four institutions have also weakened considerably in terms of their manpower and wherewithal. Some of them have also lost their relevance to a considerable extent and are undertaking work that has little impact on the sector *per se*. Presently, a sound review of their performance might conclude that their continuation or otherwise may not have much impact on the fisheries sector.

However, by redefining their mandates and bringing all the four institutes under one umbrella might change the situation. Therefore, it is proposed that all the four institutes be merged into a single institute and be responsible for undertaking (i) fisheries survey in both marine and inland waters (including stock assessment); (ii) coastal engineering for harbours, fish landing centres coastal aquaculture, etc.; (iii) fisheries nautical engineering and training (restricted to actual operators) and safety at sea; and (iv) improvements in post-harvest fisheries, including value addition of species aimed at domestic markets and small-scale processors. The above mentioned four areas of work

could also be defined as the four pillars of the new institute, which may be named as the Indian Fisheries Development Institute (IFDI).

This convergence of the four institutions as a single entity will bring the entire manpower under a common pool, which will overcome the present manpower shortage in the institutions to a considerable extent and also allow lateral movement of staff from one area to the other. The pooling of wherewithal will optimize their use and reduce wastage of the facilities created so far. In the process some of redundant activities carried out by these Institutes could be stopped and only need-based activities would be allowed. The new institute will also be a hub of human resource development, especially for training the trainers and providing an important support to the NFDB. The work programme of the new institute for the twelfth Five-Year Plan could be decided in tune with the requirements of the Board.

The modalities of merging the four institutions and charting the mandate of the new institute could be finalized after detailed discussions at the DAHD&F level. In all probability this convergence of manpower and resources would also be a win-win situation for the Government as well as for the fisheries sector.

Finally, the States as the custodians of fisheries resources shall also be required to undertake their institutional strengthening and re-organization wherever considered necessary.

4.8 Coordination and linkages

4.8.1 Inter-Ministerial/Departmental coordination

Amongst all the primary production sectors, fisheries is perhaps one such sector that has maximum cross-sectoral linkages, necessitating effective coordination to safeguard the interests of the sector. In the case of inland fisheries and aquaculture, competing requirements for resources have often relegated fisheries needs to the background. Similarly, in the marine sector lack of coordination has led to adverse impacts on fisher communities. In this regard, the exclusion of fishers from the MPAs stands out as an example.

With the increasing demand on finite resources such as fisheries, it is likely that inter-sectoral competition for resources would aggravate. In such a situation, the fisheries sector cannot work in isolation. Rather effective coordination and consultation with other concerned Ministries/Departments at the Centre and a similar exercise at the State level would be necessary to ensure that the fisheries sector's needs are not compromised. With the shifting of production–oriented and infrastructure development schemes to the NFDB, it would be easier for the DAHD&F to concentrate on works of normative nature and undertake effective coordination/consultation and wherever necessary negotiations to ensure that the requirements of the fisheries sector are adequately considered along with the requirements of the other competing sectors in the country.

4.9 Programme monitoring and evaluation

During the Five-Year Plans the Government of India implements several schemes for fisheries development. Many schemes have also been carried forward from one Plan to the other. From time to time some of the schemes are subject to review and changes are made on the basis of the recommendations contained in the review. Further, the physical and financial progress of these schemes is also regularly ascertained, based on which funds are released to the States/UTs or other implementing agencies. However, there is no mechanism to conduct regular Monitoring and Evaluation (M&E) of these schemes either by the Government itself or through third parties.

It is needless to state that regular M&E of the schemes can result in ascertaining the progress of the scheme comprehensively rather than just looking at the physical and financial progress. Further, regular M&E can bring in greater accountability and transparency in operation of the scheme. Finally, it can also facilitate mid-term corrections, if things are going wrong.

In view of the above, it would be essential if all the schemes implemented during the Twelfth Five-Year Plan have in-built mechanisms for M&E and also periodical assessment to be carried out by third parties. To make the M&E objective and free from bias, the administrative approvals issued for each scheme may also list the term of reference for M&E. Appropriate budget may be earmarked in each scheme for this important function. To bring efficiency with ease, suitable software should be developed and introduced in all the States and other concerned agencies and linked to the websites of DAHD&F and NFDB. Option for availing cloud computing mode for such operations can also be considered.

4.10 Research development interface

Sustainable development of any sector, whether it is industrial or food production, requires constant inputs from the research arena. In the case of capture fisheries and aquaculture, regular inflow of sound technology and up-gradation of data base can ensure steady growth of the sector and help in contribution to the food basket as well as economy of the country.

To ensure the above development to take place, it is also essential that the research institutions and development agencies move in unison like the two wheels of a cycle. A sound interface and seamless channels of communication between the two can bring in the best results that can feed into the system and finally reach the primary producers, who are also the ultimate beneficiaries of technology or information. Presently, there is poor flow of technology from research institutes to the development departments and also poor promotion of technology. This deadlock needs to be broken.

In the early seventies, close cooperation between research and development in the fisheries sector did result in the sector becoming vibrant and dynamic, especially in aquaculture. The All India Coordinated Research Projects (AICRPs) implemented by the Indian Council of Agricultural Research (ICAR) allowed the composite fish culture or poly culture of carps to reach the small farmers

across the length the breadth of the country. Similarly, the AICRP on Air breathing Fish Culture, Brackish water Fish Farming and Reservoir Fisheries provided boost in their respective areas. During the same time the establishment of FFDAs by the Ministry of Agriculture at district level in the country allowed the technologies generated by the research institutions and promoted under the AICRP to reach the farmers all over the country. Later a similar story was repeated in the brackish water farming areas along the coastline of the country. All this culminated in the first 'blue revolution' that the country witnessed in the late seventies and is still continuing, albeit with reduced speed.

The above developments do stand out as 'success stories' in the annals of Indian fisheries sector and such success stories need to be replicated to provide the sector a second dose of 'blue revolution'. The lessons learnt from the excellent connections and rapport between research and development in the past need to be replicated in future also. The big challenge before us in the coming years is to bridge the above gap and once again create a seamless path where technology generated in the research institutions flows to those who need them. The eight ICAR Fisheries Research Institutes, with 'state-of-the-art' facilities, are mandated to undertake research and provide necessary guidance to the development agencies on one hand and directly to the farmers on the other hand. The technologies generated in these institutes should be put to rigorous piloting or demonstration as done earlier in the seventies and eighties.

Moving to capture fisheries, there is lot of scope for development of technologies, which can be adopted by the primary producers, but mainly constrained owing to multiuse nature of the water bodies. In capture fisheries, where fishers constantly grapple with the uncertainties of nature, it is all the more essential that good data, which is based on well researched material, flows to the fishers as well as to the Governments to enable them to take considered decisions.

One of the main reasons for this weak linkage between research and development is weak feedback loop. There is increased need of taking research decisions in tune with the requirements of the primary producers. The fisheries research needs to be made more demand driven. Fisheries being a specialized area, it is necessary to allocate resources efficiently as people trained by the system attract low employment scope outside the sector.

In the Twelfth Five-Year Plan, it would be appropriate if steps are taken to improve this situation, by formalizing the research-development interface and also by bringing in more accountability in the process. Since it is proposed to transfer all the production-oriented schemes to the NFDB, the Board may consider setting up of a National-level Committee involving all the concerned players, including the user groups to develop a feedback loop. A committee of this nature is likely to benefit both the researchers as well as the fisheries managers in the country.

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CHAPTER 5.0

5.0 Twelfth Five-Year Plan: Programmes and strategies

5.1 Objectives

The proposed programmes and strategies for fisheries and aquaculture development in the Twelfth Five-Year Plan aim at holistic development of the sector. It is now widely acknowledged that fisheries have a major role in supply of nutritious protein for the growing population and in accelerating the overall economy of the country. To achieve this, it is essential that both increase in production and resource sustainability would go hand-in-hand. In this regard, the objectives for development and management of fisheries and aquaculture in the Twelfth Five-Year Plan are proposed as follows:

- Enhancing production of fish on an environmentally sustainable and socially equitable basis;
- Ensuring optimum exploitation of fisheries resources in the Indian Exclusive Economic Zone in a manner consistent with the principles of ecologically sustainable development;
- Conserving aquatic resources and genetic diversity and preservation of health of ecosystems while ensuring bio-security;
- Maximizing net economic returns to the fishers and fish farmers through technological support and implementing efficient and cost -effective aquaculture and fisheries management practices;
- Strengthening infrastructure in harvest, post-harvest, value-addition and marketing;
- Increasing the per capita availability and consumption of fish to about 11 kg/capita/annum;
- Augmenting export of fish and fish products;
- Securing and increasing employment opportunities in the sector;
- Improving safety and labour conditions in fisheries and aquaculture;
- Uplifting the social and economic conditions of fishers and fish farmers and ensuring their welfare; and
- Improving overall governance and management of fisheries sector in the country through institutional strengthening and human resource development.

5.2 Programmes and strategies

The programmes and strategies for fisheries and aquaculture development in the country during the Twelfth Five-Year Plan have been developed keeping in view the objectives identified for the sector. While most of the programmes implemented during the Eleventh Five-Year Plan are proposed to be continued, greater emphasis will be on quality execution of the programmes in the ensuing Plan with an equally strong focus on management and conservation of

the resources. The following paragraphs highlight the programmes and strategies for fisheries development and management in the Twelfth Five-Year Plan.

5.2.1 Development of marine fisheries, infrastructure and post-harvest operations

Development of marine fisheries, infrastructure and post-harvest operations would be taken up during the Twelfth Plan through a set of programmes aimed at both increasing production and optimum utilization of the resources. While most of the activities are carried forward from the Eleventh Plan with some changes in the unit cost and subsidy components, some new components/programmes have also been added to meet the growing requirements of the sector and removing institutional weaknesses. ***Table 22*** below provides a snap-shot of the activities to be implemented during the Twelfth Five-Year Plan. Details on the unit costs and funding pattern are provided in ***Annexures 16 - 18***. All the activities under this scheme would be implemented by the NFDB.

Table 22: Components under development of marine fisheries, infrastructure and domestic fish marketing

Development of marine fisheries	Development of infrastructure	Development of domestic fish marketing
Motorization of traditional craft	Construction and expansion of Minor Fishing Harbours (FHs) and Fish Landing Centres (FLCs)	Modernization of wholesale fish markets
Fishermen development rebate on HSD oil	Modernization of FHs and FLCs	Modernization of retail markets
Use of sail in motorized boats	Strengthening of post-harvest infrastructure	Construction of new retail market with 10-20 stall capacity
Conversion of trawlers to resource specific fishing vessels	Developing fish preservation and storage infrastructure	Setting up of retail fish outlets /kiosks
Safety of fishermen at sea	Assistance for maintenance dredging of FHs and FLCs.	Cold chain development and preparation of value added products. Establishment of ice plant.
Development of Monitoring Control and Surveillance system for marine fisheries	--	Campaign for promotion of fish products and increased consumption of fish and fish products
Management of marine fisheries	--	Organization of fish festival/fish mela
Production enhancement through mariculture	--	Setting up of model fish dressing units
--	--	Hygienic drying of fish
--	--	Fish transportation from FH/FLC to markets by women SHGs

In the marine sector a new scheme on Monitoring, Control and Surveillance (MCS) will be introduced to largely regulate the fishing fleet and bring in orderliness in their operations. Since this scheme would be of regulatory nature and being implemented for the first time, it is proposed that this scheme be handled by the DAHD&F directly in association with the Department of Fisheries (DoF) of the coastal States/UTs and other concerned agencies. The proposed scheme will deal with the following activities:

- Regulation for access to waters and resources, including authorization schemes for vessels;
- Maintenance of records of all vessels (through appropriate registration and licensing) and their current owners and operators authorized to undertake fishing subject to their jurisdiction;
- Maintenance of records of all boat building yards and their operation and construction of boats as per specified norms and guidelines;
- Implementation of log book system, as appropriate for particular category of fishing vessels;
- Implementation of Vessel Monitoring System (VMS), where appropriate, in accordance with the relevant national, regional or international standards, including the requirement for vessels under their jurisdiction to carry VMS on board;
- Implementation of observer programmes, where appropriate, in accordance with relevant national, regional or international standards, including the requirement for vessels under their jurisdiction to carry observers on board;
- Provision of training and education to all persons involved in MCS operations;
- Planning, funding and undertaking MCS operations in a manner that will maximize their ability to prevent, deter and eliminate IUU fishing from the Indian EEZ;
- Promotion of industry knowledge and understanding of the need for, and their cooperative participation in MCS activities to prevent, deter and eliminate IUU fishing;
- Promotion of knowledge and understanding of MCS issues within national judicial systems;
- Setting up of MCS Division at the Central level (Ministry of Agriculture-MoA) and in each coastal State and Union Territory for effective implementation of the scheme;
- Establishment and maintenance of systems for acquisition, storage and dissemination of MCS data, taking into account applicable confidentiality requirements;
- Ensuring effective implementation of national and, where appropriate, internationally agreed boarding and inspection regimes consistent with international law, recognizing the rights and obligations of masters and of inspection officers, and noting that such regimes are provided for in certain international agreements, such as the 1995 UN Fish Stocks Agreement, and only apply to the parties to those agreements.

5.2.2 Development of inland fisheries and aquaculture

Developmental programmes and strategies for inland fisheries and aquaculture during the Twelfth Five-Year Plan aim at inclusion of all available resources for augmentation of fish production. The schemes include a judicious mix of production enhancement and resource conservation programmes for ensuring sustainability. In inland capture fisheries, the rivers and their tributaries (including cold water resources), the floodplain wetlands and the estuarine resources have been overlooked in the past Plans leading to resource deterioration and fall in production and productivity. As the future of these resources largely lies in conservation and habitat restoration (wherever permissible), the focus will be on the following activities:

- Identification of riverine stretches for conservation as sanctuaries, primarily for maintaining brood stock populations and genetic biodiversity;
- Replenishment of depleted stocks through river ranching in selected stretches;
- Conservation/protection of breeding grounds of commercially important fish species;
- Habitat improvements in floodplain lakes and wetlands and supplementary stocking in identified water bodies for stock enhancement; and
- Community mobilization for increased participation of local communities in implementation of conservation and habitat improvement programmes.

While implementing the above-mentioned programmes, it would be ensured that the ecological functions of these resources are not altered. Besides, several policy and inter-Ministerial/Departmental initiatives would also be made to reduce pollution load into the inland capture fisheries resources, promote aforestation programmes in the catchment areas to reduce siltation, conduct vulnerability assessment of these water bodies for climate change, enhance involvement of community participation in developmental processes and strengthen the legal base to meet the growing requirements of the inland fisheries sector.

The reservoirs, with their large water-spread area and the fact that most of them are located in tropical to sub-tropical climate zones, are likely to be main fish production centers in the years to come. The input-output ratio in reservoir fisheries *vis-a-vis* other production sectors such as marine fisheries or aquaculture is the best. In reservoirs, with minimum capital inputs and with appropriate management norms, production levels can be highly remunerative. The proposed interventions for the reservoirs during the ensuing Plan period are aimed at supplementary stocking with quality seed of Indian Major Carps; creation of adequate rearing space for *ex-situ/in-situ* seed production; efficient fish harvesting gear and craft; support for creation of improved fish marketing paraphernalia; bringing more and more reservoirs under scientific fisheries management practices; ownership and leasing of reservoirs on long-term; and continuous programmes for HRD of reservoir fisheries managers and fishers.

Aquaculture, both in fresh and brackish waters would be another important area of increasing fish production during the Twelfth Five-Year Plan. The schemes proposed for aquaculture aim at horizontal and vertical expansion of the farming area; optimizing productivity of existing waters including cold waters, water logged, saline and waste waters; canals; diversification of species and intensification of culture practices including integration of aquaculture with agriculture/livestock; fish health management and disease diagnostics and strengthening of field-level extension machinery.

Fish production and productivity from aquaculture would largely depend on availability of quality seed in sufficient quantities. Therefore, aquaculture programmes will also focus on achieving local-level fish seed self sufficiency to cater to the needs of the sector in different parts of the country. Presently, seed production in the country is West Bengal centric and seed supplies are made to many parts of the country. This results in considerable mortality of seed on account of long-distance transportation. Popularization of seed production in other States with potential for aquaculture will ease the situation, both in terms of quality as well as quantity.

Similarly, adequate thrust would also be given to quality feed production so that aquaculture practices are not hampered on account of non-availability of good feed. Presently carp culture is largely dependent on crude mix of oil cakes and rice bran, and this raw material is also in short supply in many parts of the country, especially in the North-Eastern States. Promotion of feed manufacturing units can ease this problem to a large extent. Poor health management and disease outbreaks take a sizeable toll of farmed fishes. This puts enormous burden on the farmers, who at times resort to quick remediation to save the stock. To reduce the incidence of disease outbreaks and also provide advance warnings to fish farmers, efforts will be made towards fish health management and a sound surveillance mechanism on disease outbreaks and their containment.

The Twelfth Plan Programmes aim at revival of the FFDAs and the BFDAs. These agencies are proposed to be merged into one district-level agency (Fisheries and Aquaculture Development Agency or FADA) to attend to the developmental needs of the sector and provide a single-window source for assistance to the fishers and fish farmers. The FADA will also meet the extension needs of the fish farmers and fishers (especially the reservoir fishers), which is so far very weak. Adequate funding would be required for setting up of FADAs and their operation during the Twelfth Plan.

In the non-food sector, it is proposed to promote ornamental fisheries in both rural and urban areas. The focus in this area would be on development of entrepreneurial skills among women and unemployed youth to take up ornamental fish farming and other activities associated with it, such as manufacturing of aquaria, marketing of other aquaria accessories, etc. On the technical front, assistance is proposed to be provided for breeding of native varieties of ornamental species that have export market and can also reduce pressure on wild ornamental species.

Table 23 below provides a list of activities proposed to be implemented during the Twelfth Plan. Details on the unit costs and funding pattern are provided in ***Annexures 19 - 25***. All these schemes would be implemented by the NFDB.

Table 23: Components under inland fisheries and aquaculture development

Development of freshwater aquaculture	**Development of brackish water aquaculture**
Construction of new ponds in Plains	Construction of brackish water fish and shrimp farms
Construction of new ponds in Hill States/North-East Region	Renovation of brackish water fish and shrimp farms
Reclamation/ renovation of ponds/tanks in Plains	First year inputs for culture of *Penaeus monodon* and *Littopenaeus vannamei* and fin fish
Reclamation/ renovation of ponds/tanks in hilly areas	Aquatic Quarantine and Inspection Unit (AQIU)
Input cost for composite fish culture	Assistance to Specific Pathogen Free shrimp culture farms for additional infrastructure to cater to bio-security and waste management.
Input cost for integrated fish farming (with agriculture, horticulture)	Disease surveillance
Inputs for integrated fish farming– Livestock (poultry, ducks, pigs)	--
Freshwater fish seed hatchery	--
Small-scale seed unit (spawn)	--
Fish seed rearing units (ponds with water supply)	--
Renovation/re-modeling of rearing space/nursery pond with brood stock maintenance and rearing in hatcheries of government/ private sector	--
Input cost for fish seed rearing (up to fingerling)	--
Fish feed units	--
Establishment of freshwater prawn seed hatchery	--
Development of Brood stock Bank for raising quality brood stock of freshwater fish and prawn species including development of ponds/farm and transport arrangements	--
Disease surveillance	--

Development of coldwater fisheries/aquaculture	Development of saline waterlogged/saline land areas for aquaculture
Preparation of resource survey report/feasibility report	Development of water logged areas
Construction of raceway	Inputs – seed, feed, etc.
Input cost	--
Running water fish culture in hilly areas including cost of inputs	--
Hatcheries	--
Capacity: 5.0 million eyed ova/year	--
Capacity: 0.4-0.5 million fry/year	--

Development of reservoir fisheries	Development of inland capture fisheries in rivers, floodplain lakes, etc.	Development of ornamental fisheries
Stocking of fingerlings in small, medium and large reservoirs.	Riverine fisheries conservation and awareness programme	Backyard hatchery
Pen/cages/rearing ponds for fish seed raising	Stocking of floodplain wetlands (mauns/beels/chaurs)	Small hatchery
Craft and gear for reservoir fishers.	Restoration of floodplain wetlands (mauns/beels)	Commercial unit
Construction of landing centre.	Restoration of river connecting channels and water regulatory structures (Mauns/beels)	Aquarium fabrication, accessories and service Unit
Assistance for fish marketing	Development of seed rearing units	--

5.2.3 National scheme for welfare of fishermen and fisherwomen

Being poorest of the poor, the welfare of fisher community in India is of utmost importance. Thus the welfare schemes implemented for the fisher community during the Eleventh Five-Year Plan are also proposed to be continued during the ensuing Plan. However, changes have been proposed in some schemes to make them more useful and comprehensive. The components that are proposed to be continued are as follows:

- Development of Model Fishermen Villages
- Group Accident Insurance for Active Fishers
- Saving-cum-Relief

Since fisher women have been playing a pivotal role in the sector, it is proposed to extend the Group Accident Insurance and Saving-cum-Relief components to women also. Similarly, the contribution of migrant fish workers is increasing and their welfare too needs attention. A large number of mechanized fishing vessels, especially in States such as Gujarat are engaging migrant fish workers from other States (*e.g.* Orissa, Andhra Pradesh).

However, guidelines for including this category of workers in the ambit of welfare programmes would have to be worked out before a final decision is taken. It is proposed that DAHD&F may implement the welfare schemes with the active involvement of National Federation of fishermen's Cooperatives Limited (FISHCOPFED). The components proposed to be assisted during the Twelfth Five-Year Plan are given in ***Annexure 26***.

The HRD programme for the Twelfth Five-Year Plan will include a wide range of activities aimed at capturing the HRD needs of the entire gamut of stakeholders, from fishers to managers. The HRD activities would broadly include a range of training programmes, exposure visits and trainer's training. It is proposed that a 'Need Analysis' be undertaken by the NFDB, which is also the implementing agency for the scheme during the ensuing Plan period. This study will bring out the training needs for the sector, the training institutions/agencies and other modalities for conducting the training programmes. The study will also focus on strengthening the capacities of the State/UT Governments to undertake HRD programmes at their level on a continuing basis. The unit costs and other details will be worked out by the Board based on the 'Need Analysis'.

5.2.4 Central Sector Scheme on strengthening of database and Geographical Information System for fisheries sector

Reliable and robust database is a pre-requisite for undertaking any developmental programme or for formulating policies and plans. This is all the more important for countries like India, which is not only of continental proportions but also has a huge diversity in terms of fisheries resources and their production and productivity levels. The situation is further compounded with pre-dominant small-scale fisheries, which is widely dispersed in both marine and inland sectors. To enable this diversity to be captured in both time and scale, the on-going Central Sector Scheme (Strengthening of Database and Geographical Information System for Fisheries Sector), which covers inland and marine sectors is proposed to be continued with the following components:

- Strengthening of data-base and resource mapping of water bodies using GIS platform;
- Documentation of all water bodies through satellite imagery data and revalidation through manual survey;
- Socio-economic status of fishers covering parameters such as assessment of literacy, income and health status, etc.;
- Quinquennial census of marine and inland fisheries sectors. Special drive to be undertaken to map the cold water fisheries resources; and
- Vulnerability assessment of marine and inland fisheries and aquaculture resources for climate change.

It is proposed that this scheme be handled by the DAHD&F since some of the activities under the scheme may require coordination with other Ministries/ Departments at the Centre and with the DoF in the States/UTs. It is also

suggested the DAHD&F may take a decision on the agency that would be responsible for marine fisheries data collection. The issue has been discussed in Chapter 4.0 of this Report.

5.3 Fisheries institutions

In Chapter 4.0 it was proposed that the four institutions under the DAHD&F be merged into one institute (Indian Fisheries Development Institute – IFDI) and be placed under the NFDB to provide technical support to the Board in implementation of its activities. The activities to be undertaken by the new Institute may be worked out by the Board in consultation with the Institute and the allocation of budget be done accordingly.

5.4 Institutional strengthening including capacity building, policy and legislative support

Sound policies and comprehensive legislative framework form the back bone of good governance. In the fisheries sector, policies have been largely restricted to the Five-Year Plan documents or occasional stand-alone policies (*e.g.* the 2004 Comprehensive Policy on Marine Fisheries). The entire fisheries sector has so far not been covered with a sound policy framework, as was done for the agriculture sector in the past. In fact a comprehensive policy on fisheries sector can be a guiding factor for all the States/UTs and help them in shaping their policies and programmes from time to time.

The Twelfth Five-Year Plan provides an ideal opportunity to the DAHD&F to plug this vital gap and prepare a comprehensive policy at the central level and also guiding principles for states to develop their own comprehensive fisheries policies for the sector. During the discussions of the Sub-Groups and also in the two meetings of the main Working Group, several areas that needed policy initiatives were discussed. The following list details some of the important areas that would need policy-level interventions during the ensuing Plan:

- Treating fisheries and aquaculture at par with agriculture;
- Leasing of inland natural and manmade waters such as rivers, reservoirs, floodplain lakes, etc for fisheries and aquaculture purposes;
- Conservation and habitat restoration of inland water bodies, maintaining minimum flow levels in rivers and allocation of water for aquaculture purposes through cross-sectoral policy interventions;
- Introduction of exotic aquatic species;
- Insurance for aquaculture and capture fisheries' assets such as boats, nets, etc;
- Reducing pollution load in inland water bodies;
- Deep sea fishing;
- Leasing of coastal waters for mariculture purpose;
- Occupational safety and health aspects of fishers;

- Cross- sectoral issues in coastal and marine fisheries such as displacement of fishers due to setting up of national parks and marine sanctuaries, manmade disasters such as oil spills and due to other economic activities (oil exploration, commercial ports, etc.) and national security purposes;
- Habitat restoration by Installation of Artificial Reefs and FADs, bio-inventorying and biodiversity preservation in marine ecosystem;
- Vulnerability reduction of coastal fishers from natural disasters, including climate change and developing their adaptive capacities;
- Strengthening of fisheries cooperative societies;
- Human resource development in fisheries sector;
- Promotion of co-management regime for management of common pool public property fisheries resources;
- India's accession to international binding instruments and implementation of their provisions;
- Safe and hygienic fish and fish products thorough zero use of banned drugs and chemicals in aquaculture, improved sanitation and hygienic conditions in all post-harvest operations, etc; and
- Encouraging public, private and community participation in fisheries sector for attracting investment and better use of available resources.

Similarly, on the legislative front the sector may need several inputs to plug the legal void for strengthening of the sector. Some of the important requirements in this area are listed below:

- Revision of the Marine Fishing Regulation Acts (MFRAs) through a Model Bill that takes care of the topical requirements of the sector from both national and international perspectives;
- Renewed emphasis on the Model Bill prepared for Inland fisheries and aquaculture; and
- New legislation to regulate fishing by wholly Indian owned fishing vessels in the Exclusive Economic Zone.

Fisheries and aquaculture is a State subject and the activities are primarily multi-stakeholder. Therefore, it would be essential that both policy formulation and legislative framework is carried out through extensive stakeholder consultations at each and every stage. This would ensure a stakeholder-based approach and the policies and legislations would be well-accepted by the stakeholders resulting in higher level of compliance.

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CHAPTER 6.0

6.0 Proposed targets and outlays for the Twelfth Five-Year Plan

6.1 Summary of targets set for the Twelfth Five-Year Plan

Marine capture fisheries production reached new heights by the end of Eighth Five-year Plan and then declined during the Ninth Five-Year Plan. In the Tenth and Eleventh Plan periods, marine production registered a steady growth and it is expected that this growth would continue in the Twelfth Plan period also, albeit with appropriate incentives and a set of checks and balances.

While motorization of traditional fishing crafts and development rebate on HSD oil programme for fishing vessels are expected to continue, new incentives would be towards harnessing of the deep sea resources, use of Fish Aggregating Devices and Artificial Reefs for stock enhancement, mariculture, etc. The implementation of Monitoring, Control and Surveillance as a new programme in the ensuing Plan is expected to bring more discipline and orderliness in the sector and regulate the activities so as to maintain the growth in a sustainable manner.

In addition, infrastructural development undertaken during the Eleventh Five-Year Plan and further development of infrastructure during the Twelfth Five-year Plan will reduce post-harvest losses and improve operational efficiency. Further, with improved marketing support this will also add to the availability of more fish for human consumption.

Keeping the above in view, it is expected that during the Twelfth Five-Year Plan, marine fisheries will grow at 2.0 percent annually.

With the growth rate of 2.0 percent annually, it is estimated that 3.669 mmt of fish would be harvested at the end of Twelfth Five-Year Plan (2016-17). With this production, the country will be exploiting about 83 percent of its potential harvest of 4.419 mmt. This rate of exploitation of the resources is within the range of precautionary limits because a part of this harvest would also be contributed by mariculture.

While inland fisheries have grown in absolute terms, the rate of growth in terms of potential is not yet achieved. This can be attributed to less focus on sustainable development of inland capture fisheries in the past Plans; increasing pressure on inland resources, including habitat degradation; and multiple-use of inland water-bodies with least priority to the needs of fisheries sector. In aquaculture, the gradual decline of FFDAs and BFDAs and also their resultant poor performance, limited availability of quality seed and feed in many parts of the country and extremely weak extension services has impacted the overall growth of aquaculture in the country.

However, with the establishment of the NFDB in July 2006 and major initiatives on inland capture fisheries (mainly reservoirs) and aquaculture during the

Eleventh Five-Year Plan, some positive developments are visible. Many inland States are now keen to harness the reservoir productivity through a judicious mix of supplementary stocking and good management practices. Therefore, there is a general realization that future hikes in fish production in India are likely to come from inland fisheries and aquaculture.

Keeping in mind the recent developments and trends in production during the past Plan periods, it is expected that a growth rate of 8.0 percent can be achieved by the inland sector. With this growth rate, it is estimated to reach a fish production target of 7.910 mmt by the end of the Twelfth Plan Period (2016-17).

While reservoirs and freshwater aquaculture would be the two main pillars of fish production from inland sector, other resources such as upland water bodies, floodplain lakes and wetlands, irrigation canals, saline and waterlogged areas would be gradually mainstreamed to start contributing to the production.

Rejuvenation and consolidation of the two field-level agencies (FFDAs and BFDAs) into one single agency – Fisheries and Aquaculture Development Agency or FADA is expected to catalyze the process to a large extent. It is proposed to link this new agency with the NFDB so that it can provide all field-level functions such as extension, developing linkages and coordination and monitoring of the activities for the benefit of the States as also the Board. A State-level coordination and monitoring unit will facilitate linkages between FADAs in the State and the NFDB.

Programmes aimed at decentralized production and distribution of quality seed and feed for aquaculture and also culture-based-capture fisheries would complement the overall efforts aimed at optimizing production and productivity from inland fisheries and aquaculture in the country.

On the institutional front, strengthening of NFDB; bringing all development-related schemes under one agency; and restructuring of the fisheries institutions will be a major step in consolidating the wherewithal available with the Government. Further, need-based Human Resource Development programmes at all levels (fishers to managers) are also likely to contribute to improved management of the resources. HRD proposals, both content and mode of delivery with in-built system for pre- and post-evaluation be made flexible as per the need assessment conducted by the States/UTs.

On the policy and legal front, the DAHD&F with its new charter of work will be able to concentrate more on normative activities, formulation of policies and legislation to meet the growing needs of fisheries and aquaculture and intra- and inter-Ministerial/Departmental coordination to make the sector's foundation more robust and sustainable. The DAHD&F will also develop guiding principles for the States and encourage and support them to bring necessary development enabling policy reforms. In the revised distribution of work between NFDB and DAHD&F, the Department will also be able to focus more on welfare of the fisher community, strengthen fisheries database, improve MCS, and build stronger linkages between research and development.

With the scenarios for inland and marine fisheries described in the foregoing paragraphs, the total fish production during the Twelfth Five-Year Plan is likely to grow around 6.0 percent on an average per year. Given the growth rate of population, such a growth rate in fisheries will ensure the scope of increasing nation's footprints in the international market while meeting the domestic demand.

Table 24 and Table 25 below provide snap shots of the past performance and projections for the Twelfth five-Year Plan period.

Table 24: Past Performance of the fisheries sector

Plan Period	Production at the end of the period (000 tonnes)			Average Annual Growth Rate during the Plan (%)		
	Marine	Inland	Total	Marine	Inland	Total
VII (1985-90)	2 275	1 402	3 677	6.49	4.92	5.75
VIII (1992-97)	2 967	2 381	5 348	3.98	6.87	5.18
IX (1997-2002)	2 380	3 126	5 506	-0.83	5.65	2.23
X (2002-07)	3 024	3 845	6 869	1.44	4.25	2.92
XI (2007-12)						
2007-08	2 920	4 207	7 127	-3.44	9.41	3.76
2008-09	2 972	4 636	7 608	1.78	10.20	6.75
2009-10	2 689	4 862	7 551	-9.52	4.87	-0.75
2010-11 (Provisional)	3 220	5 068	8 288	19.75	4.24	9.76
2011-12 (Projected)	3 323	5 383	8 706	3.19	6.22	5.04

Table 25: Projections for Twelfth Five-Year Plan

Year	Targeted Production (000 tonnes)			Expected Annual Growth Rate (%)		
	Marine	Inland	Total	Marine	Inland	Total
2012-13	3 389	5 814	9 203	2	8	5.71
2013-14	3 457	6 279	9 736	2	8	5.79
2014-15	3 526	6 781	10 307	2	8	5.87
2015-16	3 597	7 324	10 920	2	8	5.95
2016-17	3 669	7 910	11 579	2	8	6.02

6.2 Summary of budget outlay (Scheme-wise)

During the Eleventh Five-Year Plan six schemes were implemented, which also included the NFDB. During the Twelfth Five-Year Plan, it is proposed to implement eight schemes. The two additional schemes include (i) Human Resources Development (HRD) in fisheries sector and (ii) Monitoring, Control, Surveillance (MCS), strengthening of policy and legal frameworks and other need-based interventions. In the Eleventh Plan the schemes on HRD were part of the National Scheme on Welfare of Fishermen. Besides, the NFDB also implemented various HRD programmes through its schemes. Keeping in view

the focus on HRD in the Twelfth Plan, it is proposed to have a separate scheme on HRD in fisheries sector, to be implemented by the Board.

The second scheme on MCS, strengthening of policy and legal frameworks and other need-based interventions is a new addition for ensuring sustainable growth of the fisheries sector. The DAHD&F proposes to implement a comprehensive programme on MCS during the Twelfth Plan with the active involvement of all coastal States/UTs. This would be a good move to bring discipline and orderliness in the sector. As mentioned in the earlier chapters it is proposed that all developmental schemes may be implemented by the NFDB and the schemes on welfare, strengthening of data base and MCS by the DAHD&F. For all work related purposes, the Fisheries Institutions shall be attached to NFDB. However, the personal and policy related matters of the institutions shall be handled by the DAHD&F.

A total outlay of the Rs.6 000.00 crore has been proposed for the Twelfth Plan and the ***Table 26*** provides a break-up of the proposed outlays for each of the eight schemes to be implemented during the ensuing Plan period:

Table 26: Projections for the Twelfth Five-Year Plan

Sl. No.	Proposed Schemes	Implementing Agency	Estimated Outlay (Rs. crore)
1.0	Development of Marine Fisheries, Infrastructure and Post-Harvest Operations	National Fisheries Development Board (NFDB)	1 000.00
2.0	Development of Inland Fisheries and Aquaculture	-do-	1 200.00
3.0	Human Resource Development in Fisheries Sector	-do-	300.00
4.0	National Scheme on Welfare of Fishermen and Women	Department of Animal Husbandry, Dairying & Fisheries (DAHD&F)	800.00
5.0	Strengthening of Data base in Fisheries Sector	-do-	300.00
6.0	Monitoring, Control & Surveillance; Strengthening of Policy and Legal Frameworks and other Need-based Interventions.	-do-	800.00
7.0	Assistance to Fisheries Institutions	NFDB & DAHD&F	600.00
8.0	National Fisheries Development Board	NFDB	1 000.00
9.0	**Total**		**6 000.00**

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Annexure 1: Marine fisheries and mariculture schemes

Scheme component	Existing funding pattern
Motorization of traditional craft	50% of the unit cost with ceiling of Rs.30 000/ OBM/IBM.
Safety of fishermen at sea	75% of the unit cost (Rs.1.5 lakh) of the safety kit.
Fishermen development rebate on HSD Oil	50% of sales tax relief granted by State/UT with ceiling of Rs. 3.00/litre with a ceiling of 500 litre/boat/month during fishing.
Conversion of trawlers to resource specific fishing vessels	New
Management of marine fisheries	To bear expenses for conducting awareness programmes. 100% consultancy for implementing CCRF. 100% for capacity evaluation. 100% cost for community outreach programmes on sustainable fisheries. 100% cost for production of audio visuals on overfishing/over capacity.
Enhancement of production through mariculture	New

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Annexure 2: Components assisted under the scheme on 'Development of Infrastructure and Post-Harvest Operations'

Scheme component	Existing funding pattern
Construction and expansion of Minor Fishing Harbours (FHs) and Fish Landing Centres (FLCs)	75% to coastal States, Port Trusts and others for new minor FHs and FLCs including expansion and modernization of the existing ones. 100% for major FH to States, UTs, Port Trusts and others. 50% to private entrepreneurs for new FHs on BOOT basis.
Modernization of FH and FLCs	New
Strengthening of Post-Harvest Infrastructure (i) Developing fish preservation and storage infrastructure	(a)100% for Government undertakings, Corporations, etc. (b) 75% to NGOs, Cooperatives in NE Region, Fisher SHGs, SHGs of SC/STs, Fisher Cooperatives, SHGs of women. (c) 50% for NGOs, Cooperatives, SHGs other than (b) above, private companies of SC/STs and fishermen. (d) 25% to Private companies/organizations other than (c) above. (e) 50% to Municipal Corporations and Marketing Boards for development of central fish markets.
Assistance for maintenance dredging of fishing harbours and FLCs	(a) 50% to coastal States, Port Trusts and 100% to UTs for maintenance dredging of existing FHs and FLCs. (b) 100% for maintenance of dredger covering insurance, dry docking, repair and up-gradation of the Dredger TSD Sindhuraj (owned by DAHD&F).

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Annexure 3: Infrastructure development for harbours and landing centres

Scheme component	Existing unit cost & funding pattern
Renovation/up-gradation of existing fishing harbours	As per the recommendation of CICEF, Bangalore; 100% grant to State Governments/Port Trusts.
Renovation/up-gradation of existing FLCs	As per the recommendation of CICEF, Bangalore; 100% grant to State Governments/Port Trusts.

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Annexure 4: Development of domestic fish marketing

Scheme component	Existing unit cost & funding pattern
Modernization of wholesale fish markets	Rs.250.00 lakhs/50 stalls. 90% of capital cost as grant to Fisheries Departments, quasi Government organizations, Local Civic Bodies, and Research Institutes.
Modernization of retail markets	New
Construction of new retail markets with 10-20 stall capacity	Rs.50.00 lakhs to 100.00 lakhs for establishment of major retail markets (20 outlets) and up to Rs. 50.00 lakhs for minor retail markets (10 outlets). 90% of capital cost as grant to Fisheries Departments, quasi Government organizations, Local Civil Bodies, Research Institutes, 25% of capital cost as subsidy to entrepreneurs and 30% to SC/ST, Women and NE beneficiaries.
Setting up of retail fish outlets/kiosks	Up to Rs.10.00 lakh subsidy @ 25 % of approved project cost to entrepreneurs (30% subsidy for SCs/STs/NE region).
Cold chain development and processing of value added and products Insulated vehicle for fish transport Establishment of Ice plants	Unit cost to be decided/appraised on case to case basis. 90% of capital cost as grant to Department of Fisheries, Fisheries Corporations/Federations; 40% of capital cost as subsidy to Entrepreneurs.
Campaign for promotion of fish products and consumption	Each proposal will be examined and appraised on case to case basis. 100% grant to Government Departments, Research Institutions and quasi Government organizations.
Organization of fish festival/fish mela	Up to Rs. 50.00 lakh; 50% of the expenditure to Government Departments/quasi Government organizations.
Model Fish Dressing Unit	Up to Rs. 150.00 lakh; 90% grant to the Government Departments/quasi Government organizations.

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Annexure 5: Development of freshwater aquaculture

Scheme component	Existing unit cost & funding pattern
Construction of new ponds	Rs. 3 lakh per ha in the plain areas. Subsidy @ 20% with a ceiling of Rs. 60 000/ha for all farmers except SCs/STs for whom it will be Rs. 75 000/ha (25%).
	Rs. 4 lakh/ha in the hill States/Districts and NE region. Subsidy @ 20% with a ceiling of Rs. 80 000/ha for all farmers except SCs/STs for whom it will be Rs1 00 000/ha (25%).
Reclamation/Renovation of ponds/ tanks Plain areas	Rs. 75 000/ha. Subsidy @ 20% with a ceiling of Rs. 15 000/ ha for all farmers except SCs/STs for whom it will be Rs.18 750/ha (25%).
Cost of inputs	Rs. 50 000/ha. Subsidy @ 20% with a ceiling of Rs. 10 000/ ha for all farmers except SCs/STs for whom it will be Rs. 12 500/ha (25%).
Input cost for integrated fish farming: Inputs for integrated fish farming – Livestock	New
Freshwater fish seed hatchery	Rs.12 lakh for a fish seed hatchery with 10 million (fry) capacity for plain areas and Rs.16 lakh for same capacity in the hill States/Districts and NE Region. Subsidy @ 10% with a ceiling of Rs. 1.2 lakh and Rs.1.6 lakh in the plain and hilly areas respectively to entrepreneurs only.
Small-scale seed unit (spawn)	Revised
Fish seed rearing units	Unit cost Rs. 3 lakh/ha.
Renovation/re-modeling rearing space/nursery pond with brood stock maintenance and rearing in hatchery government/ private sector (aged about 3 years and above)	Rs. 4.00 lakh/hatchery of 7-8 million fry production/year State Fisheries Departments will receive 90% one-time grant only.
Input cost for fish seed rearing (Up to fingerling)	Rs. 0.5 lakh/ha
Fish feed units	Small Units- Unit cost is Rs. 7.5 lakh with a capacity of 1.2 quintals/day. The subsidy would be @ 20% with a ceiling of Rs. 1.5 lakh per unit to entrepreneurs.
Establishment of freshwater prawn seed hatchery	(i) Unit cost is Rs. 30.0 lakh for a large freshwater prawn hatchery with a minimum capacity of 25 million PL/year. This would be one time grant for States to establish hatchery at State level.
	(ii) Unit cost is Rs. 12.0 lakh for a small hatchery of 5-10 million PL/year capacity. Subsidy @ 20% with a ceiling of Rs. 2.40 lakh to entrepreneurs as one time grant.
Brood stock bank development for cultivable freshwater fish and prawn	Rs. 25.00 lakh including a farm, transport arrangements for dissemination. Full grant to Government Agencies/Government

species including development of pond, farm and transport arrangements	institutions only.
Establishment of laboratories at State level for monitoring soil and water quality and environment and fish health investigations	Unit cost of Rs. 35 lakh (Rs. 25 lakh for construction of building and Rs. 10 lakh for equipment, glassware & chemicals, etc.)
Transportation of fish/prawn seed.	This will be applicable only for the hill States/districts and NE region.
	Subsidy @ Rs. 30 for 1 000 fry transported to all FFDAs. Not applicable to individual fish farms.
Purchase of vehicle Transportation of fish/prawn seed.	50% cost of vehicle for each new FFDA and 50% cost for the replaced vehicle (Second vehicle).
	This will be applicable only for the hill States/districts and NE region.

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Annexure 6: Development of brackish water aquaculture

Scheme component	Existing unit cost & funding pattern
Construction of Brackish water fish and shrimp farms	Beneficiaries will be small shrimp farmers having land holding of 2 ha or less. The assistance would be 25% cost subject to a maximum of Rs. 60 000/ha as subsidy.
Renovation of Brackish water fish and shrimp farms	Beneficiaries will be small shrimp farmers having land holding of 2 ha or less. The assistance would be 25% cost subject to a maximum of Rs. 60 000/ha as subsidy.
First year inputs for culture of *P. monodon* and fin fish	New
Aquatic quarantine and inspection unit (AQIU)	Unit head quarter at Delhi and supporting staff at NBFGR (ICAR Institute) and nodal units one each on east and west Coasts. 100% expenditure will be incurred by the Centre.
Assistance to Specific Pathogen Free shrimp culture farms for additional infrastructure to cater to bio-security & waste management	Rs.15.00 lakh for 5 ha. Water spread area and above: 1. Back ended subsidy of 25% on the capital cost. 2. Back ended subsidy of 30% on the capital cost to SCs/STs.

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Annexure 7: Coldwater fisheries and aquaculture

Scheme component	Existing unit cost & funding pattern
Preparation of resource survey/feasibility reports	Rs. 5 lakh as one time grant to the State Governments.
Construction of raceway	Trout culture-Unit cost Rs. 1 lakh/raceway (45 m^3). Subsidy @ 20% with a ceiling of Rs. 20,000/per ha. For SC/ST it will be Rs. 25 000/ha @25%.
Input cost	Trout culture- Unit cost Rs. 1.8 lakh/ha. Subsidy @ 20% with a ceiling of Rs. 36 000/ per ha except for SC/ST for whom it will be Rs. 45 000/ha @ 25%.
Running water fish culture in hilly areas including cost of inputs	Rs.40 000/unit of 100 m^3. The above cost is inclusive of Rs. 8 000 towards inputs.
Short term investigation, breeding or rearing, etc	Rs. 5 lakh as one time grant to the State Government.
Construction, renovation, extension or remodeling of fish farms	One time grant. Amount to be decided on the merit of the proposal.
Farming units for cold water fish species and first year inputs	Unit cost of Rs. 50,000/- for a unit size – 15m x 2m x 1m. Subsidy to beneficiaries @ 20% with a maximum ceiling of Rs.10 000/- per unit.
Units for running water fish culture	Unit cost including input Rs. 60 000.
i) Capacity:5.0 million fry/year	Rs. 30.00 lakhs/unit. One time grant to the States/ ICAR Institutions/Quasi Government Organizations.
ii) Capacity:0.4-0.5 million fry/year	Rs. 12 lakhs/unit;20% subsidy for farmers/entrepreneurs
Feed mill (Extruded floating pelletted feed of 1 tons/hour production capacity	Rs.10 crore. 40% equity on machinery and equipment in respect of listed companies; (or) 40% soft loan (with 5% interest) through commercial banks for entrepreneurs/Profit making Fisheries Federations/Corporations.
Feed mill of 2 tons/day.	Rs. 25.00 lakhs/unit 40% Soft loan on the capital cost (excluding land cost) @5% interest rate through nationalized Banks.

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Annexure 8: Development of saline waterlogged/saline land areas

Scheme component	Existing unit cost & funding pattern
Development of water logged areas other than floodplain lakes	Unit cost Rs. 2 lakh/ha with 20% subsidy.
Inputs (fish) seed, feed, manure, fertilizers, preventing measures for diseases, transportation charges, etc.	Unit cost Rs. 75 000/ha.
Inputs (prawn) seed, feed, manure, fertilizers, preventing measures for diseases, transportation charges, etc.	Unit cost Rs. 75 000/ha.
Cost for construction	Unit cost Rs. 3.0 lakh/ha. Subsidy @ 20% with ceiling of Rs. 60 000/ha.

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Annexure 9: Inland capture fisheries (reservoirs, rivers, wetlands, etc.)

Scheme component	Existing unit cost & funding pattern
Fingerling Stocking in reservoirs @ 500/ha for large, 1000/ha for medium sizeand large reservoirs. Fingerling stocking in small reservoirs @ 2000/ha.	Rs. 1/- per fingerling of 80 - 100 mm. IMC and other species indicated in the guidelines. This cost would include rearing of seed *in situ*/*ex situ* and transportation. 100% grant for stocking of fingerlings. Implementing agency shall pay 25% lease/license amount to NFDB.
Pen for fish seed raising	Unit cost Rs. 60 000/0.1 ha.
Craft and gear (net, boat, ice box out board engine, etc) per fishing unit of two fisher	Unit cost of Rs. 1 lakh.
Construction of landing Centre	Unit cost Rs. 5 lakh per landing centre. Assistance to state government.
Marketing	New.
Riverine fisheries conservation and awareness programme	Financial assistance to State Government for conservation/ river ranching, etc with a maximum ceiling of Rs. 2 lakh in a year.
Stocking of floodplain wetlands (mauns/beels/ chaurs) @ 2 000 fingerlings/ha.	Rs.3/fingerling with 100% grant to the State Government.
Restoration of floodplain wetlands (mauns/beels)	Rs. 10 000/ha for three years, with 90% subsidy; the balance to be borne by the State Government.
Restoration of river connecting channels and water regulatory structures (Mauns/ beels / chaurs)	Rs. 5 lakh/km for restoration of channel with maximum of Rs.10 lakhs and maximum of Rs. 20 lakh for providing water regulatory structures. In both cases the subsidy component shall be 90%, the balance to be borne by the State Government.

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Annexure 10: Ornamental fisheries

Scheme component	Existing unit cost & funding pattern
Backyard hatchery	Rs. 1.50 lakh; 50% unit cost as subsidy to entrepreneurs, members of Women SHGs/Fisherwomen Cooperative Societies.
Small hatchery	New
Commercial unit	Rs. 4.00 lakh; 50% unit cost as subsidy to beneficiaries.
Integrated Ornamental Fishery Units	Rs. 15.00 lakh. 90% Subsidy to the Government Agencies/Government institutions and 50 % unit cost as subsidy to entrepreneur.
Aquarium Fabrication, accessories and service Unit	Rs. 1 lakh/person with 50% subsidy for women and 25% for entrepreneur.
Setting up of Aquarium fabrication units	Rs. 1.00 lakh; 50% unit cost as subsidy to members of Women SHGs/ Fisherwomen Cooperative Societies and 25% unit cost as subsidy to individual persons.

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Annexure 11: Need-based financial assistance for development and demonstration of innovative/new technologies

Scheme component	Existing unit cost & funding pattern
Cage culture in reservoirs GI Pipe Modular cages	New
Input cost	New
For increasing fish production/ productivity as broodstock development,	Unit cost to be recommended by the Central Fisheries Institute concerned. Onetime 100% grant to the Central/State Government Organizations/Federation.
New species, Low cost feed with high nutritive value, New farming practices (cage/ pen culture), etc Revised to pilot-scale demonstrations, field trials, up-scaling of programmes and activities developed by R&D institutions and other agencies	Unit cost to be recommended by the Central Fisheries Institute concerned. Subsidy on 40% of the project cost as promotional incentive on capital cost as back-ended subsidy to the entrepreneurs.
Development of fish breeding/nursery grounds through mangrove plantations	Unit cost to be approved by the competent institution 75% grant to meet the cost of mangrove sapling, transplantation and rearing and remaining; 25% cost of labour component to be met through MNREGA Scheme.

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Annexure 12: Scheme for welfare of fishers

Scheme component	Existing unit cost & funding pattern
Development of adaptive capacity of fishing villages Revised from Development of Model Fishermen Villages Group Accident Insurance for Active Fishermen; Saving-cum-Relief; Construction of houses; Training & Extension	In case of 1st three component of Scheme the assistance is shared on **50:50** basis by the Centre and State Government and in case of UT Admn., 100% Assistance is born by the Government of India. In case of North Eastern States, the assistance is shared on 75:25 basis between centre and the State. The assistance for Training & Extension is shared n 80:20 basis by the Centre and the State Government and in case of UT Administrations/ FISHCOPFED 100% assistance is given by the Government of India.

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Annexure 13: Human resource development programmes

Scheme component	Existing unit cost & funding pattern
Training programme on different aquaculture practices, processing and extension activities to farmers/master trainers/government officers at induction level	To be decided on case to case basis: i.20 participants per batch ii. period of training 10 days iii. TA will be provided on request from the organizing institute after submission of travel documents iv. No DA is eligible to the participants since boarding and lodging facilities being provided by the concerned training institutes with the funding support of NFDB v. Funding support will be provided to the training organizing institutes towards course fee, honorarium and TA to the resource personnel, publication, local visit and miscellaneous expenditure, where justified. vi.100% financial assistance to Government as per the guidelines of NFDB.

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Annexure 14: Financial and physical progress under schemes operated by NFDB

Sl No.	Scheme component/sub-component	Physical Progress	Financial Progress
1.0	Intensive Aquaculture in Ponds and Tanks with the following components: • Construction/renovation of fish ponds • Establishment of Fish Seed Hatcheries • Renovation of Government Fish Seed Hatcheries • Renovation of fish seed rearing farms in Government/private sector	• 7 916 ha developed in 11 states. • 39 fish seed hatcheries and 3 freshwater prawn hatcheries in 11 states. • 25 units in Assam, Chhattisgarh, Nagaland, Haryana, Maharashtra, Jammu Kashmir, Goa and Mizoram with a production capacity of 72 million fry/ year. • Renovation of 81 seed farms with 388.75 ha water spread area in Maharashtra, Mizoram, Madhya Pradesh, Nagaland & Odisha.	• Rs. 31.96 crore sanctioned. • Rs. 3.06 crore sanctioned. • Rs. 0.81 crore Sanctioned. • Rs. 4.83 crore sanctioned.
2.0	Training and demonstration programmes for increasing production and productivity through intensive farming of fish in tanks and ponds	Trained 67 971 farmers from various states.	Released Rs. 16.32 crore.
3.0	Implementation of Technology Up-gradation schemes	Assisted ICAR fisheries research institutions and universities for undertaking the following 9 technology up-gradation projects: Genetic conservation and live gene bank of Mahseer; captive brood stock bank of Scampi; establishment of hatchery and seed production facilities of *Pangasinodon hypophthalmus* (Striped Cat fish) by CIFA in Andhra Pradesh; brood stock development of common carp *Cyprinus carpio* (Amur) by KVAFSU, Bida;, fish culture in derelict water bodies such as chaurs & mauns in Bihar and cryo-preservation technology for milt.	Released Rs. 3.68 crore.
4.0	Reservoir Fisheries Development	Fingerlings stocked in 3 411 reservoirs in 20 States covering 15.57 lakh ha of effective water spread area. Trained 46 000 fishermen from	Sanctioned Rs. 95.87 crore.

		these reservoirs.	
5.0	Cold water fisheries	219 new trout raceway units, 300 running water fish culture units, renovation/up-gradation of 3 trout farms, 9 trout seed hatcheries, one trout feed mill sanctioned for establishment in Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir and Sikkim. In addition, 561 farmers were trained on trout farming practices.	Sanctioned Rs 10.47 crore.
6.0	Coastal Aquaculture • Training and Demonstration • Providing additional infrastructure for SPF shrimp culture farms • Establishment of Aquatic Quarantine Facility at Chennai • Demonstration of Seabass Culture • Marketing Study on Asian Seabass • Monitoring culture and disease surveillance of *L. vannamei*	• Training imparted to 6 430 beneficiaries in the coastal states in adoption of GMP's in shrimp farming, mud crab fattening, marine ornamental fish culture, seaweed culture, crab and lobster fattening, seabass culture and alternative livelihood for shrimp and crab collectors. • Two farmers from Andhra Pradesh assisted for establishing additional infrastructure for SPF shrimp farms (SPF *L. vannamei*) in an area of 30.04 hectares. • Aquatic Quarantine Facility established for regulating import of SPF *L. vannamei* brood stock. So far 25 000 SPF *L. vannamei* brood stock quarantined. • Funded demonstration of techno economic viability of culture of Seabass (*Lates calcarifer*) in farmer's ponds in Tamil Nadu, Andhra Pradesh, Karnataka and Maharashtra states. • Prospective study on marketing and value chain improvement strategies for promoting Sea bass. • To monitor disease occurrence of *L. vannamei* species in hatchery and culture systems; to evolve	• Released Rs. 1.57 crore. • Released subsidy of Rs. 17.09 lakh. • Sanctioned Rs. 289.90 lakh for setting up the facility and Rs. 59.44 lakh as revolving funds. • Released Rs. 141.15 lakh. • Released Rs. 13.60 lakh. • Released Rs. 31.00 lakh and Rs. 15.00 lakh.

		effective measures to contain the spread of the disease.	
7.0	Mariculture • Open sea cage culture • Setting up of Demonstration of Marine Ornamental fish Hatchery and Brood stock bank	• To demonstrate the techno-economic viability of open sea cage farming of Asian sea bass, lobsters, etc to fishermen in 14 locations. • Setting up of demonstration hatchery for marine ornamental hatchery at Parangipettai, Tamil Nadu & development of broodstock for breeding of 25 different marine ornamental fishes.	• Released Rs. 115.00 lakh. • Released Rs. 37.00 lakh.
8.0	Infrastructure for post-harvest processing • Establishment of Fish Net Making Factory in Kerala • Modernization of fishing harbours and fish landing centres • IQF Project at the factory of M/s Sasoondock Matsyodhyog Sahakari Sanstha Ltd., Sasoondock, Mumbai • Shrimp Seed Multiplication Centre at Srikakulam District, Andhra Pradesh-Jumpstart Programme.	• Establishment of Fish net factory at Azheekkal, Kannur District, Kerala. The factory has commenced production of fish net material. • Modernization of 23 FHS and FLCs in Andhra Pradesh, Karnataka, Kerala, Orissa, Tamil Nadu and Gujarat States. Modernization of a fishing harbour in Karwar, Karnataka is completed. • The Sanstha was assisted to install the IQF machinery in their processing plant as 20% equity participation. The plant has started producing 7-8 value added products of IQF shrimp and other products for export to EU countries - both in raw and cooked form. • A Memorandum of Agreement signed between NFDB and M/s Moana Technologies India (Private) Ltd. (MTIPL) for establishment of SPF-Shrimp Seed Multiplication Center. A Jump start programme was taken up by the MTIPL by importing 3.00 lakh SPF- Post Larvae (PL) of *P. monodon* from Hawaii, USA for rearing up to brood stock. The MTIPL has supplied around 50 million SPF-seed to the farmers in Andhra Pradesh, Tamil Nadu, Gujarat and Maharashtra.	• Rs. 10.00 crore released as soft loan. • Rs. 36.36 crore released. • Rs. 155.20 lakh released. • Rs. 3.20 crore released to M/s Moana Hong Kong Limited (MHKL). Rs. 2.29 crore released for acquisition of 97.45 acres of land and obtaining the final blue prints of the multiplication centre from MHKL. Rs. 0.45 crore utilized for installing a 5KW power supply at the project site and building an approach road from National Highway to project site.

9.0	Deep Sea Fishing and tuna processing • Tuna processing facility at National Institute for Fisheries Post-harvest Technology and Training, (NIFPHATT), Visakhapatnam. • Training	• Establishment of common facility centre for export processing of sashimi grade tuna. • To train 1881 fishermen in tuna fishing by using long lines, deep sea fishing and maintenance and repair of outboard diesel engines installed in FRP boats and improving livelihoods of fisher folk using satellite based navigation methods.	• Released Rs. 185.00 lakh to NIFPHATT as equity participation. • Released Rs. 43.41 lakh to Fishery Survey of India, Fishery Institute of Technology and Training, Tamil Nadu and M S Swaminathan Research Foundation, Chennai.
10.0	Domestic marketing • Modernization/Construction of whole sale markets, retail fish markets and retail fish outlets • Cold Chain Development and processing of value added fish products & Setting up of solar fish drying units. • Technology up-gradation, training on hygienic handling and value addition of fish products. • Organization of Fish Festivals/Campaign.	• Modernization of 44 wholesale fish markets, 36 retail markets, 23 retail outlets and 20 kiosks in Andhra Pradesh, Chhattisgarh, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Nagaland, Orissa, New Delhi, Pondicherry, Rajasthan, Tamil Nadu and West Bengal. A fish market in Nellore, Andhra Pradesh has been completed. • Establishment of a unit for value added products from fresh water fish in Haryana and construction of a 100 MT capacity ice plant in West Bengal. • Technology up-gradation project to Central Food Technology Research Institute, Mysore for production of value added fish products and the Directorate of Research on Women in Agriculture, Bhubaneswar for training 9 880 fishers on 'hygienic handling of fish'. • Organized Indian Fish Festival – INFISH 2009 and INFISH 2010 at Hyderabad. In addition, provided financial	• Rs. 58.51 crore released. • Rs. 1.47 crore released. • Sanctioned Rs. 132.82 lakh. • Rs. 3.13 crore released.

		assistance to conduct 25 fish festivals in Andhra Pradesh, Assam, Karnataka, Jharkhand, Kerala, Maharashtra, Nagaland, Puducherry, Tamil Nadu, Uttar Pradesh and West Bengal.	
11.0	Fish dressing centers and solar drying of fish	Establishment of 3 model fish dressing centres, 30 solar drying units/platforms and to train 300 fishers on hygienic handling of fish, solar fish drying and value addition in Tamil Nadu, West Bengal and Kerala.	Released Rs. 2.87 crore.
12.0	Ornamental Fisheries	For setting up of 734 integrated ornamental fisheries unit and backyard hatcheries in Andhra Pradesh, Gujarat, Jammu & Kashmir, Kerala and Odisha. Training imparted on ornamental fish keeping, breeding and 12 aquarium fabrication units to 2 720 beneficiaries in Jammu & Kashmir, Kerala, Mizoram, Odisha, Tamil Nadu and West Bengal.	Sanctioned Rs. 5.70 crore.
13.0	Human Resource Development	Capacity building programmes conducted for 1 273 fisheries officials across the country to train farmers, fishers, master trainers, officers of the public sector units concerned with fisheries development in States and UTs.	Expenditure of Rs. 2.02 crore.
14.0	NFDB Office Complex	For establishment of NFDB campus, 5.13 acres of land situated at Rajendranagar, Hyderabad was acquired from Sri Venkateswara Veterinary University, Tirupati on lease basis for 30 years for construction of administrative building and staff quarters. Construction of administrative building is in its final stages of completion. Simultaneously construction of quarters is also nearing completion.	Rs. 13.86 crore released.

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Annexure 15: Eleventh Plan and Annual Plan Allocations for Centrally Sponsored Schemes and Central Sector Schemes on Fisheries Sector of the DAHD&F

Financial Performance:

(Rs in crores)

Fisheries Schemes & 11th Plan outlay	**2007-08**			**2008-09**			**2009-10**			**2010-11**			**2011-12**	
Centrally Sponsored Schemes (Scheme-wise 11th Plan Approved outlay)	**BE**	**RE**	**Actual Exp.**	**BE**	**RE**	**Actual Exp.**	**BE**	**RE**	**Actual Exp.**	**BE**	**RE**	**Actual Exp.**	**BE**	**Exp. as on 31.12.2011**
Development of Inland Fisheries & Aquaculture **(Rs 300 crore)**	9.00	12.03	12.84	12.00	12.90	13.60	17.90	19.00	20.75	18.50	21.35	22.9431	24.00	26.2680
Development of Marine Fisheries, Infrastructure & Post-Harvest Operations **(Rs 350 crore)**	32.00	40.50	41.49	45.00	44.99	49.56	60.00	61.00	61.61	62.80	75.74	78.1143	71.00	47.4209
National Scheme of Welfare of Fisheries **(Rs 180 crore)**	18.38	20.88	21.38	25.00	25.00	25.15	33.00	36.00	36.23	34.20	42.25	41.9448	39.00	28.1772
Total CSS (Fisheries) **(Rs 830 crore)**	59.38	73.41	75.71	82.00	82.89	88.31	110.90	116.00	118.59	115.50	139.34	143.0022	134.00	101.8661
Central Sector Schemes														
Strengthening of Database & GIS of Fisheries Sector **(Rs 25crore/48 crore)**	2.80	2.80	2.53	3.00	3.00	2.40	5.00	10.00	10.08	10.15	10.55	9.4702	10.00	3.4593
Assistance to Fisheries Institutes **(Rs 371 crore)**	43.00	41.93	33.92	55.00	47.60	40.92	47.60	45.40	45.76	44.49	52.06	45.3523	46.00	27.5769
• Central Institute for Fisheries Nautical & Engineering Training	11.50	10.30	4.39	10.00	7.00	7.18	7.00	5.85	4.95	7.30	7.96	6.4376	9.00	3.8841
• Central Institute for Coastal Engineering for Fisheries	0.00	0.00	0.00	0.10	0.10	0.13	0.10	0.10	0.10	0.10	0.10	0.0999	0.00	0.00
• National Institute for Fisheries Post-Harvest Technology & Training	1.50	1.59	1.40	1.90	2.00	1.74	2.00	1.95	1.96	2.00	2.00	1.8277	2.00	1.4993
• Fishery Survey of India (FSI)	30.00	30.04	28.13	43.00	38.50	31.87	38.50	37.50	38.75	35.09	42.00	36.9871	35.00	22.1935
National Fisheries Development Board **(Rs 1 550 crore)**	100.50	50.00	50.00	75.00	46.90	46.90	135.00	100.00	100.00	92.30	92.30	92.3000	108.00	72.00
Total CS (Fisheries) (Rs1946 crore)	146.30	94.73	86.45	133.00	97.50	90.22	187.60	155.40	155.84	146.94	154.91	147.1255	164.00	103.0362
TOTAL FISHERIES (CSS & CS) (Rs 2 776 crore)	205.68	168.14	162.16	215.00	180.39	178.53	298.50	271.40	274.43	262.44	294.25	290.1247	298.00	204.9023

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Annexure 16: Development of marine fisheries and mariculture

Components	Proposed unit cost and funding pattern
Motorization of traditional craft	Cap on motorization restriction to 20 000 units with emphasis on States/UTs where the present motorization of traditional crafts is low. The unit cost is fixed at Rs. 70 000 per OBM/IBM with subsidy component of 50% of the unit cost. The existing provision of providing second dose to beneficiary to be discontinued.
Fishermen development rebate on HSD Oil	Subsidy will be provided to all vessels less than 10meter overall length (LoA). 50% subsidy on the Central Excise Duty subject to a maximum of Rs.6/litre to States with a ceiling of 500L/boat /month.
Use of sail in motorized boats	To promote use of sails in motorized boats, one-time 100 % subsidy will be provided. The unit cost may be fixed at Rs. 2 500/sail.
Conversion of trawlers to resource specific fishing vessels	The unit cost for conversion is proposed up to Rs. 20 lakh with a subsidy component of 30%. To avail this assistance, the existing trawl unit with the boat should be destroyed.
Safety of Fishermen at Sea	Sea safety measures like VHF, Emergency Position Indicating Radio Beacon (EPIRB) and Distress Alert Transmitter (DAT), FRP floats, etc. to be made available to registered mechanized fishing vessels (MFVs). The unit cost for the above items may be limited to Rs. 2.5 lakhs, with a subsidy of 50%. The fishers will have the option to choose the items, if the full package is not required. The unit cost for floatation devices for motorized boats may be Rs.10 000/boat, with 50% subsidy. The assistance towards sea safety may be linked to the Group Insurance for Active Fishermen Scheme for better compliance. This would also ensure the safety of fishers on board MFVs.
Development of Monitoring Control and Surveillance (MCS) system for marine fisheries	The proposed new scheme on Monitoring, Control and Surveillance will *inter alia* have the following components: • Setting up of an MCS Division in the Department of Animal Husbandry, Dairying & Fisheries (DAHD&F), Ministry of Agriculture; • Setting up of an MCS Division in Department of Fisheries of States/UT Administrations; • Issue of biometric cards to marine fishers; • Development of national fishermen database; • Mandatory registration and licensing of all fishing vessels including artisanal vessels; • Implementation of color coding for all fishing boats; • Fitment of distress alert transmitters, GPS and other safety devices; • Fitment of automatic identification system for tracking and

	regulating fishing vessels; • Registration and licensing of boat building yards and development of a centralized data base; • Setting up of harbor based MCS Units; • Setting up of fishermen MCS committees at Fishing Harbours (FHs), Fish Landing Centres (FLCs) and fishing villages; • Awareness campaign , outreach and educational programmes and capacity building at all levels; and • Data compilation processing and dissemination. Unit costs are not suggested at this stage as details have to be worked out.
Management of Marine Fisheries	Programmes for management of marine fisheries will include popularization of the Code of Conduct for Responsible Fisheries and implementation of its provisions; outreach programmes on community mobilization for sustainable management of fisheries, including development of community-based fisheries management approaches; production of audio-visual material to aid fisheries management; and capacity development of community. It is suggested to provide 100 % funding support to the activities under this scheme and the units costs may be fixed after assessing the requirements.
Enhancement of production through mariculture	***Open sea cage culture:*** Rs. 6 lakh/cage including input cost with 30% subsidy; 40% subsidy for SC/ST beneficiaries. ***Establishment of National brood stock bank for marine fin fishes:*** Rs.15.00 crore/centre for development of brood stock bank and egg production centre is proposed. Full grant to Government Agencies/ Institutions, including Research Institutes. ***Seed banks:*** 10 seed banks for marine fin fishes in the maritime States/UTs. Rs. 2.00 crore per seed bank is proposed. Full grant to Government Agencies/ Institutions, including Research Institutes. ***Installation of Fish Aggregating Devices (FADS) and Artificial Reefs (ARs):*** One time grant of Rs. 2.0 crore per State and Rs. 2.0 crore per UT for installing FADs/ARs is proposed. ***Bivalve culture:*** Unit cost to be decided by the NFDB. Subsidy component of 30% for general category farmers and 40% for SC/ST beneficiaries is proposed. ***Seaweed culture:*** Unit cost to be decided by the NFDB. Subsidy component of 30% for general category farmers and 40% for SC/ST beneficiaries.

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Annexure 17: Development of infrastructure and post-harvest operations

Components	Proposed unit cost and funding pattern
Construction and expansion of Minor Fishing Harbours (MFH) and Fish Landing Centres (FLCs)	Unit cost of approximately Rs. 50 crore for MFH and Rs. 4 crore for FLC proposed with provision of 75% subsidy to coastal States and 100% for UTs. In case of private sector opting to construct MFH/FLC on BOOT/BOT basis, the cost sharing is proposed on 50:50 basis.
Modernization of Fishing Harbours and FLCs	100% grant to States/UTs @ 10 crore for a MFH and Rs. 1 crore for FLC is proposed.
Strengthening of Post-Harvest Infrastructure Developing fish preservation and storage infrastructure	i) Ice plants @ Rs. 50 lakh for 20 t capacity and Rs. 30 lakh for 10 t capacity is proposed. Subsidy @ of 90% for Government/ Co-operatives and 30% for private entrepreneurs. In case of SC/ST entrepreneurs, the subsidy will be 40 %. ii) Cold storage and processing units of 200 tonne capacity @ 10 crore/unit is proposed. Subsidy component will be as above.
Assistance for maintenance dredging of fishing harbours and fish landing centres.	It is proposed that maintenance dredging of existing MFHs and FLCs be subsidized @ 75% of the cost to coastal States and 100% to UTs. Terms and conditions for assistance to be finalized by the NFDB.

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Annexure 18: Development of domestic fish marketing

Components	Proposed unit cost and funding pattern
Modernization of wholesale fish markets	Rs.300 lakhs/50 stalls; of which 5 lakhs will be towards capacity building of user associations and management operations. 90% of the capital cost as grant to State Government, quasi Government organizations and Local Civic Bodies.
Modernization of retail markets	Unit cost ranging from Rs. 60 lakhs to Rs.120.00 lakhs, depending on the work involved. Of the sanctioned amount, Rs. 5 lakh will be towards capacity building of user associations and management operations. 90% of capital cost as grant to State Government, quasi Government organizations and local civic bodies.
Construction of new retail market with 10-20 stall capacity	Unit cost ranging from Rs. 75 lakhs to 150.00 lakhs depending on the work involved. Of the sanctioned amount, Rs. 5 lakh will be towards capacity building of user associations and management operations. 90% of capital cost as grant to State Government, quasi Government organizations and local civic bodies.
Setting up of retail fish outlets /kiosks	Up to Rs.10.00 lakhs. Subsidy @ 30 % of approved project cost to entrepreneurs/SHG/Fisheries Professionals. 50% subsidy for traditional fisher women/SCs /STs/North-Eastern (NE) States.
Cold chain development and processing of value added products. Establishment of Ice plant	Transportation of fish from landing centre/arrival point to the wholesale/retail market. Unit cost of Rs. 4 lakh with 40% subsidy component. As per the proposed assistance under ***Annexure 17***.
Campaign for promotion of fish products and increased consumption	Up to Rs. 2.0 lakhs. Each proposal will be examined and appraised on case to case basis. 100% grant to Government Departments, Research institutions, and quasi Government organizations.
Organization of fish festival/fish mela	Up to Rs. 60.00 lakhs. Each proposal will be examined and appraised on case to case basis. 50% of the expenditure to Government Departments, quasi Government organizations.
Model Fish Dressing Unit	Up to Rs.150.00 lakh unit. 90% grant to the Government Departments /quasi Government organizations.
Sun drying of fish on racks (Unit of 20 racks)	Rs. 20 000/unit to be given to fisher women with 50% subsidy.
Fish transportation from FH/FLC to markets by women SHGs	Rs. 400 000/unit to be given to women SHGs with 50% subsidy.

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Annexure 19: Development of freshwater aquaculture

Description of items	Proposed unit cost and funding pattern
Construction of new ponds in Plains	Rs. 4.5 lakh/ha with a subsidy component of 30%. In case of SC/ST, women and beneficiaries from disturbed and disadvantaged areas the subsidy component would be 40%.
Construction of new ponds in Hill States/NE Region	Rs. 6 lakh/ha in the hill States/Districts and NE region with a subsidy component of 30%. For women, SC/ST and beneficiaries from disturbed and disadvantaged areas, the subsidy component will be 40%.
Reclamation/renovation of ponds/tanks in Plains	Rs. 1.5 lakh/ha. Subsidy @ 30% with a ceiling of Rs.45 000/ha for all farmers. For SC/ST and beneficiaries from disturbed and disadvantaged areas, the subsidy will be @ 40% with a ceiling of Rs. 60 000/ha.
Reclamation/renovation of ponds/tanks in hilly areas	Rs.1.5 lakh/ha. Subsidy @ 30% with a ceiling of Rs.45 000/ha for all farmers. For SC/ST and beneficiaries from disturbed and disadvantaged areas and NE region, the subsidy will be @ 40% with a ceiling of Rs. 60 000/ha.
Cost of inputs for composite fish culture	Rs.1.5 lakh/ha with subsidy @ 30% for all farmers except women, SCs/STs and beneficiaries from disturbed and disadvantages areas for whom it would be 40%.
Input cost for integrated fish farming (with agriculture, horticulture) Inputs for integrated fish farming – Livestock (poultry, ducks, pigs)	Rs.0.60 lakh/ha for seed stocking with subsidy @ 30%. For SC/ST, Hill and NE region and beneficiaries from disturbed and disadvantaged areas, the subsidy will be 40%. Rs. 2.5 lakh/ha for livestock juveniles. Subsidy @ 30%, except for SC/ST, Hill and NE region and beneficiaries from disturbed and disadvantages areas for whom it will be 40%,
Freshwater fish seed hatchery	Rs.16 lakh for a fish seed hatchery with 15 million (fry) capacity for plain areas and Rs. 20 lakh for same capacity in the Hill States and NE Region and beneficiaries from disturbed and disadvantaged areas. Subsidy @ 50% to entrepreneurs and 90% for State Government/quasi Government organizations.
Small-scale seed unit (spawn)	Rs. 3 lakh for a small-scale fish seed hatchery with 3 million fry capacity for Plains and Rs. 4 lakh for NE region and hilly States. Subsidy @ 50% to entrepreneurs only.
Fish seed rearing units with water supply	Unit cost Rs. 6 lakh/ha including water supply. Subsidy @ 50 to entrepreneurs and 90% for State Government/quasi Government organizations
Renovation/re-modeling of rearing space/nursery pond with brood stock maintenance and rearing in hatchery of government/private sector (aged about 3 years and above)	Rs. 2.00 lakhs/ha for rearing ponds with 40% subsidy for private entrepreneurs. 90% onetime grant for State Governments.

Input cost for fish seed rearing (up to fingerling)	Rs. 1.5 lakh/ha with subsidy @ 50% for entrepreneurs and 90% for State Government.
Fish feed units	Small Units: Unit cost of Rs. 10 lakh with a capacity of 2 quintals/day. The subsidy would be @ 30% to entrepreneurs and 40% for SC/ST, beneficiaries from disturbed and disadvantaged areas.
	Medium Units: Unit cost of Rs.50 lakh with a capacity of 5 tonne/day. The subsidy would be @ 30% to entrepreneurs and 40% for SC/ST, beneficiaries from disturbed and disadvantaged areas.
Establishment of freshwater prawn seed hatchery	Unit cost is of Rs. 100.0 lakh for a large freshwater prawn hatchery with a minimum capacity of 10 million PL/yr. Subsidy @ 30% to entrepreneurs and 40% for SC/ST, beneficiaries from disturbed and disadvantaged areas.
	(ii) Unit cost is of Rs. 50.0 lakh for a small hatchery of 5 million PL/yr capacity. Subsidy @ 30% to entrepreneurs and 40% for SC/ST, beneficiaries from disturbed and disadvantaged areas as one time grant.
Brood Bank Development for freshwater fish &prawn species including development of ponds/ farm and transport arrangements	Rs. 50.00 lakhs including a farm, transport arrangements for dissemination. Full grant to Government Agencies/Government institutions only.
Establishment of laboratories at State level for monitoring soil and water quality and environment and fish health parameters	Unit cost of Rs. 100 lakh (Rs.40 lakh for construction of building and Rs. 60 lakh for equipment and other infrastructure in coastal states. This would be one time grant to the States/other fisheries organizations/Public-Private Partnership for fisheries professional.

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Annexure 20: Development of brackishwater aquaculture

Description of items	Proposed unit cost and funding pattern
Construction of brackish water fish and shrimp farms	Rs. 6 lakh with 30% subsidy; 40% for SC/ST and beneficiaries from disturbed and disadvantaged areas for small fish and shrimp farmers having land holding of 2 ha or less.
Renovation of brackish water fish and shrimp farms	Rs. 3 lakh/ha with 30% subsidy; 40% for SC/ST and beneficiaries from disturbed and disadvantaged areas for small fish and shrimp farmers having land holding of 2 ha or less.
First year inputs for culture of *Penaeus monodon* and *Littopenaeus vannamei* and fin fish	Rs. 2.5 lakh/ha 30%, 40% for SC/ST and beneficiaries from disturbed and disadvantaged areas for small fish and shrimp farmers having land holding of 2 ha or less.
Aquatic Quarantine and Inspection Unit	Setting up of three additional centres at Mumbai, Kochi and Kolkata. 100% expenditure will be borne by the DAHD&F/NFDB.
Assistance to Specific Pathogen Free shrimp culture farms for additional infrastructure to cater to bio-security and waste management.	Rs.10.00 lakh/ha subject to a maximum of 50 lakh for a cluster of minimum of 5 ha water spread area, with subsidy of 30% on the capital cost for general beneficiaries and 40% for SC/ST beneficiaries.

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Annexure 21: Coldwater fisheries and aquaculture

Description of Items	Proposed unit cost and funding pattern
Preparation of resource survey report/feasibility report	Rs.10 lakh as one time grant to the State Governments to prepare status paper on the resource available in the State.
Construction of raceway	Trout culture- unit cost @ Rs.1.5 lakh/raceway (50 m^3) with a subsidy component of 40%.
Input cost	Inputs for trout culture- @1.5 lakh/raceway (50 m^3) with a subsidy component of 40%
Running water fish culture in hilly areas including cost of inputs	Rs. **6**0 000/unit of 100 m^3. The above cost is inclusive of Rs.10 000 towards inputs with a subsidy of 40%.
Hatchery: i) Capacity: 5.0 million fry/ year (supply of eyed ova) ii) Capacity: 0.4-0.5 million fry/year	Rs. 3 crore/unit; one time grant to State Government organizations. Rs. 30 lakh/unit; 40% subsidy for farmers/ entrepreneurs
Feed mill (Extruded floating pelletted feed of 1 tonne/ hour production capacity	Rs. 2 crore/unit; 40% subsidy on machinery for entrepreneurs and 90% subsidy for State Government.
Feed mill of 2 tonne/day.	Rs. 50.00 lakh/unit; 30% subsidy for entrepreneurs.

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Annexure 22: Development of saline and saline waterlogged areas for aquaculture

Description of Items	Proposed unit cost and funding pattern
Development of saline water logged areas, other than floodplain wetlands	Unit cost Rs.5 lakh/ha with subsidy of 30% for general beneficiaries and 40% for SC/ST.
Inputs (fish) seed, feed, fertilizers, fish health management, transportation charges, etc.	Fin/shell fish Culture – Rs. 2.0 lakh/ha. Subsidy @ 30% for all farmers except. 40 % for SCs/ST beneficiaries.

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Annexure 23: Development of reservoir fisheries

Description of Items	Proposed unit cost and funding pattern
Stocking of fingerlings in reservoirs @ 500/ha for large and 1000 /ha for medium and 2000/ha for small reservoirs, with the following guidelines: • I year: 100% *ex-situ* stocking and development of community plan and capacity building for *in situ* stocking in reservoirs. • II year: 100% *ex-situ* stocking and development of infrastructure for *in-situ* seed production. • III year: 100% *in-situ* seed stocking. • The funding for stocking will be for the first two years only.	Rs. 3 per fingerling of 80 - 100 mm of Indian Major Carps or other species as indicated in the guidelines. The cost includes rearing of seed *in-situ*/*ex-situ* and transportation. 100% grant for stocking of fingerlings. Implementing agency shall pay 25% lease/license amount to NFDB.
Pen for fish seed raising	Rs.10 lakh/ha for construction, input material, boat and support to Co-operative/ SHG/ similar operative group for community plan and capacity building.
Craft & gear (net, boat, ice box, OBM, etc) per fishing unit of two fishers	Unit cost of Rs.1 lakh with 50% subsidy per unit.
Construction of landing centre	Unit cost Rs. 30 lakh per landing centre (Jetty, fish handling and storage, flake ice machine and sanitary facility). Expenditure to be shared on 75:25 basis between Centre and the State.
Assistance for fish marketing	Rs.5 lakh/landing centre for insulated van, small kiosk with subsidy of 50 %.

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Annexure 24: Development of inland capture fisheries

Description of Items	Proposed unit cost and funding pattern
Riverine fisheries conservation and awareness programme	Financial assistance to State Government for conservation with a maximum ceiling of Rs. 2 lakh/ km of identified river stretch as per guidelines of CIFRI, Barrackpore.
Stocking of floodplain wetlands (beels/ chaurs) @ 2000 fingerlings/ha.	Rs.3/fingerling with 100% grant to the State Government.
Restoration of floodplain wetlands (mauns/beels)	Rs. 10 000/ha for three years, with 90% subsidy; the balance to be borne by the State Government.
Restoration of river connecting channels and water regulatory structures (Mauns/beels/chaurs)	Rs. 5 lakh/km for restoration of channel with maximum of Rs.10 lakhs and maximum of Rs. 20 lakh for providing water regulatory structures. In both cases the subsidy component shall be 90%, the balance to be borne by the State Government.

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Annexure 25: Development of ornamental fisheries

Description of Items	Proposed unit cost and funding pattern
Backyard hatchery	Unit cost of Rs. 1.5 lakh with a subsidy component of 50% to entrepreneurs, members of women SHGs/ Fisherwomen Cooperative Societies.
Small hatchery	Rs. 30 lakh for SHGs or Co-operatives of 20 or more members with 50% subsidy and additional Rs. 10 lakh for common infrastructure.
Commercial unit	Rs. 20.00 lakhs with 30% subsidy for individual beneficiaries.
Aquarium fabrication, accessories and service unit	Rs. 5 lakh for women SHG with 50% subsidy.

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Annexure 26: National scheme for welfare of fishermen and fisherwomen

Components	Proposed unit cost and funding pattern
Development of Model Fishermen Villages	The Scheme may continue with the existing unit cost and funding pattern. The scheme may be dovetailed with the Indira Awas Yojana, wherever feasible.
Group Accident Insurance for Active Fishermen	The insured amount may be raised from Rs. 1.0 lakh to Rs. 2.0 lakh for death and total disability and from Rs. 50 000 to Rs. 1 lakh for partial disability. Modalities may also be worked out to include migrant workers and fishers (men and women) engaged in post-harvest sector. The scheme may also be linked with safety of fishers at sea, in rivers and reservoirs.
Saving-cum-Relief	The monthly contributions may be increased to Rs. 150:150:150 (by fisher: Centre: State). The scheme may also extend to inland States exercising conservation measures and to migrant fish workers and women engaged in post-harvest operations.

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REPORT OF
THE WORKING GROUP ON

FISHERIES

FOR
THE TWELFTH - FIVE YEAR PLAN
(2012 – 2017)

GOVERNMENT OF INDIA
PLANNING COMMISSION
DECEMBER 2011

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LIST OF ACRONYMS

APFIC	Asia Pacific Fisheries Commission
ARs	Artificial Reefs
ATMA	Agriculture Technology Management Agencies
BIMSTEC	Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
BoB	Bay of Bengal
BOBP-IGO	Bay of Bengal Programme Inter-Governmental Organisation
BOBLME	Bay of Bengal Large Marine ecosystem
CAGR	Cumulative Annual Growth Rate
CBD	Convention on Biological Diversity
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCRF	Code of Conduct for Responsible Fisheries
CIBA	Central Institute of Brackishwater Aquaculture
CIFE	Central Institute of Fisheries Education
CIFRI	Central Inland Fisheries Research Institute
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMFRI	Central Marine Fisheries Research Institute
CMFP	Comprehensive National Marine Fishing Policy, 2004
EEZ	Exclusive Economic Zone
DAHD&F	Department of Animal Husbandry, Dairying and Fisheries
DARE	Department of Agriculture Research and Education
DoF	Department of Fisheries
EAFM	Ecosystem Approach to Fisheries Management
EEZ	Exclusive Economic Zone
FAD	Fish Aggregating Devices
FADA	Fisheries and Aquaculture Development Agency
FAO	Food and Agriculture Organization of the United Nations
FFDAs	Fish Farmers' Development Agencies
FISHCOPFED	National Federation of Fishermen Co-operatives Limited
FLC	Fish Landing Centre
FRP	Fibre-reinforced Plastic
FSI	Fishery Survey of India
GATT	General Agreement on Trade and Tariff
GEF	Global Environment Facility

GoI	Government of India
HRD	Human Resource Development
IBM	Inboard Motors
IAY	Indira Awas Yojana
ICAR	Indian Council of Agricultural Research
ICG	Indian Coast Guard
IOR-ARC	Indian Ocean Rim Association for Regional Cooperation
IOTC	Indian Ocean Tuna Commission
IPOA	International Plan of Action
IUU	Illegal, Unreported and Unregulated Fishing
KVK	Krishi Vigyan Kendra
LoA	Length Overall
LOP	Letter of Permit
LSA	Life Saving Appliances
MCS	Monitoring, Control and Surveillance
M&E	Monitoring & Evaluation
MFRA	Marine Fishing Regulation Act
MFV	Mechanized Fishing Vessel
MGNERGA	Mahatama Gandhi National Rural Employment Guarantee Scheme
MHA	Million Hectare
MPA	Marine Protected Areas
MPEDA	Marine Products Export Development Authority
MoU	Memorandum of Understanding
MoA	Ministry of Agriculture
MoCI	Ministry of Commerce and Industry
MoD	Ministry of Defence
MoEA	Ministry of External Affairs
MoEF	Ministry of Environment & Forests
MoES	Ministry of Earth Sciences
MoFPI	Ministry of Food Processing Industries
MoS	Ministry of Space
MoSRTH	Ministry of Shipping, Road Transport and Highways
MMD	Mercantile Marine Department
MMT/MT	Million Metric Tonnes/Metric Tonnes
NACA	Network for Aquaculture Centres in Asia-Pacific
NFDB	National Fisheries Development Board
NIC	National Informatics Centre
NM	Nautical Miles

NMFC	National Marine Fisheries Census, 2005
OBM	Out Board Motors
PFZ	Potential Fishing Zone
RFB	Regional Fisheries Body
RKVY	Rajiv Gandhi Krishi Vikas Yojana
SACEP	South Asia Cooperative Environment Programme
SOFIA	State of the World Fisheries and Aquaculture
SPF	Specific Pathogen Free
SPS	Sanitary and Phytosanitary
SSF	Small-scale Fisheries
TAC	Total Allowable Catch
TBT	Technical Barriers to Trade
UT	Union Territory
UNCLOS	United Nations convention on the Law of the Sea
WTO	World Trade Organization
VMS	Vessel Monitoring System

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EXECUTIVE SUMMARY

1.0 Indian Fisheries: An overview

1.1 The fisheries sector is an important player in the overall socio-economic development of India. Starting from a purely traditional activity in early fifties when India commenced with the First Five-Year Plan, fisheries and aquaculture have now transformed into a significant commercial enterprise, contributing to employment generation, food and nutritional security and foreign exchange earnings.

1.2 The fisheries sector contributed Rs 67 913 crores to the GDP (at current prices) during 2009-2010, which is 0.96 percent of the total GDP at factor cost[1] and 5.41 percent of the GDP at factor cost from agriculture, forestry and fishing. During 2010-11 the export of marine products reached 813 091 tonnes valued at Rs. 12 901.47 crore and US $ 2.857 billion[2].

1.3 The marine resources of the country comprise an Exclusive Economic Zone (EEZ) of 2.02 million sq. km, a continental shelf area of 530 000 sq. km and a coastline of 8 118 km. The inland resources include a maze of rivers, canals, estuaries, floodplain lakes and the ponds and tanks. With a combined length of 45 000 kms, the riverine resources provide one of the richest fish germplasm in the world. Further, the reservoir resources cover more than 3.0 million ha (mha) water spread area and are mostly distributed in favourable climatic environment. India is the third largest producer of inland fish in the world (after China and Bangladesh) and the second largest producer of farmed fish, after China.

1.4 Fish production in India has shown an increasing trend from 0.72 million metric tonnes (mmt) in 1950-51 to reach 8.288 mmt in 2010-11(P). This comprises 3.220 mmt from marine sources and 5.068 mmt from inland fisheries (including aquaculture). With a vast production potential, particularly in inland fisheries (mainly reservoirs) and aquaculture, the sector has shown an average growth of about 6 percent over the Five-Year Plan periods.

1.5 As per the Indian Livestock Census, 2003, 14.49 million people were engaged in various fisheries related activities. About 75 percent of the fishers are engaged in inland fisheries and about 25 percent in marine fisheries. One of the most significant characteristics of Indian fisheries sector is its small-scale nature. Besides being a source of protein rich nutritious food, income and livelihood to poor fishers, the fisheries sector is important for engaging the rural population in a number of ancillary activities- *i.e.* marketing, retailing, transportation, etc.

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[1] ***Ministry of Statistics and Programme Implementation: Annual and Quarterly Estimate of GDP at Current Prices, Base Year 2004-05 (http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=82)***
(http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=82)

[2] ***MPEDA, 2011 (http://www.mpeda.com/inner_home.asp?pg=trends)***

2.0 Indian Fisheries: Opportunities for development

2.1 The fisheries sector in India is passing through a watershed period. The crisis before the sector is partly due to the problems created by the sector itself and partly from external factors that are beyond its control. In marine fisheries, uncontrolled fishing capacity has led to over-exploitation of the coastal resources. While the estimated potential of the offshore waters offers opportunities for increase in production, the fishing fleet has limited capacity to harness the deep sea resources. This calls for up- gradation of the fleet as well as skills and capacities of the fishers and incentives to promote diversified fishing in the offshore waters. Use of Fish Aggregating Devices (FADs) and Artificial Reefs (ARs) for stock enhancement and promotion of mariculture could enhance production. Implementation of Monitoring, Control and Surveillance (MCS) as a new programme in the ensuing Plan is expected to bring more discipline and orderliness in the sector and regulate the activities so as to maintain the growth rate in a sustainable manner.

2.2 While inland fisheries have grown in absolute terms, the rate of growth in terms of potential is not yet achieved. This can be attributed to less focus on sustainable development of inland capture fisheries in the past Plans; increasing pressure on the resources, including habitat degradation; and multiple-use of inland water-bodies with least priority to fisheries requirements. In the inland sector, while reservoirs and freshwater aquaculture would be the two main pillars of growth, other resources such as upland water bodies, floodplain lakes and wetlands, irrigation canals, saline and waterlogged areas also need to be gradually mainstreamed to start contributing to the production.

2.3 Freshwater aquaculture, which contributed to the 'Blue Revolution' in the country in late seventies, is now almost stagnating in terms of species diversification and yield rates. The average yield rates for the country as a whole (excluding the ponds under the Freshwater Fish Farmer's Development Agencies or FFDAs) are around 1 000 kg/ha/yr, whereas production can be increased to 4-5 thousand kg/ha/yr. Indian aquaculture, especially freshwater farming, in the past two decades has grown with little scientific inputs and is also lacking good inputs in terms of seed, feed, health management and marketing support. Programmes aimed at production and distribution of quality seed and feed for aquaculture and also culture-based-capture fisheries, husbandry of farmed species and availability of quality water would be essential to optimize production and productivity from inland fisheries and aquaculture in the country.

2.4 The gradual decline of FFDAs and Brackish water Farmer's Development Agencies (BFDAs) and their resultant poor performance coupled with weak extension services has impacted the overall growth of aquaculture in the country. Therefore, rejuvenation and consolidation of the two field-level agencies (FFDA and BFDA) into a single agency – Fisheries and Aquaculture Development Agency or FADA is expected to catalyze the process and strengthening of extension services system to a large extent. These agencies can undertake extension of technologies, promote networking of farmers and

fishers (mainly from reservoirs) and provide effective liaison between the farmers and developmental and other extension agencies such as the Krishi Vigyan Kendras (KVKs) and the Agriculture Technology Management Agencies or the ATMAs. They can also assist these primary producers in sourcing public finance, which is otherwise is becoming difficult for them. Further, the mandate of these agencies can be extended to cover fisheries development in reservoirs and floodplain lakes and promotion of ornamental fisheries, etc and thus provide a single-window support to fisheries and aquaculture in the inland fisheries sector.

2.5 Reservoir fisheries, as the second major source of fish production in the Twelfth Plan, would need support for supplementary stocking of quality seed in appropriate numbers. Many medium and large-sized reservoirs where auto-stocking is feasible would need sound management norms to allow the fishes to breed in the reservoirs and contribute to fish production. Besides, such reservoirs would also need appropriate post-harvest support and capacity building of the fishermen to maximize their income and ensure optimum utilization of the resources.

2.6 In the ensuing Plan it is also necessary to develop fisheries and aquaculture in upland lakes and streams, saline and water logged areas and irrigation canals. In the non-food sector, due attention is required on ornamental fisheries to generate employment in both rural and urban areas.

2.7 The inadequacies in infrastructure for landing and berthing facilities of marine fishing fleet and for domestic marketing have been the main reasons for post-harvest losses, which are estimated around 15-20 percent. Creation of additional infrastructure for landing and berthing of fishing vessels and also up-gradation of the existing facilities and development of infrastructure for domestic marketing can reverse the situation. The reduced post-harvest losses can augment the supplies available for human consumption and fish marketed in good condition can also fetch better remuneration for the fishers, who are otherwise finding it difficult to make both ends meet.

2.8 The fisher community in India can be termed as the poorest of the poor. Living in inaccessible and remote coastal areas or along the riparian tracts and reservoir catchment area, the fisher communities are largely bereft of the schemes/programmes of the Government aimed at uplifting the socio-economic conditions of the poor rural communities. The welfare programmes implemented by the Department of Animal Husbandry, Dairying and Fisheries (DAHD&F), Ministry of Agriculture for fisher communities have been extremely useful and their continuation in the Twelfth Plan can further improve the socio-economic conditions of the poor fisher folk.

2.9 The fisheries sector needs to avail the benefits under the welfare and developmental programmes of other Ministries/Departments such as Indira Awas Yojana (IAY), Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), etc. Wherever possible, a convergence could be brought in between the existing schemes of the fisheries sector with these larger programmes to maximize the benefits to poor fishers and their families.

2.10 Besides laying adequate attention to the socio-economic upliftment of the fisher community and providing long-lasting benefits to build-up their resilience and improve their safety nets, the sector as a whole also needs sound and need-based programmes for Human Resources Development (HRD). It is expected that the HRD programmes will cover a wide range of stakeholders (fishers to extension personnel and sector managers) to ensure that the skills and capacities are built at all levels to ensure sustainable development of the resources.

2.11 The weak information base in the fisheries sector is a matter of great concern. The inadequacies in the database and lack of knowledge on important attributes of the sector can lead to faulty planning. It is also seen that in many areas data has been generated but has remained in unprocessed form and inaccessible to the user groups. This critical area needs to be carefully reviewed and efforts made to plug the gaps, strengthen the data collection and processing mechanism and to ensure that the information flow is timely and seamless.

2.12 On the institutional front, it is essential to strengthen the National Fisheries Development Board (NFDB) and bring all development-related schemes under the Board, the purpose for which it was created. The DAHD&F may handle welfare programmes, strengthening of fisheries data base, implementation of the proposed scheme on MCS, fisheries policy, regulatory and legal matters, coordination with the sister Ministries/Departments at the Centre and the States to make the sector's foundation more robust and sustainable and build stronger linkages between research and development. The NFDB can also offer a platform for pooling of technologies and good management practices from research institutes and channeling these to the end users through piloting demonstration projects. This clear demarcation of work between the DAHD&F and the NFDB will remove duplication of work, if any. Further, the four institutions under the DAHD&F also need restructuring and if required consolidation to meet the requirements of the sector. For all practical purposes, these institutions should also be placed under the NFDB so that they provide the much-needed technical support to the Board.

2.13 On the policy and legal front, the DAHD&F may focus more on normative activities, formulation of policies and legislation to meet the growing needs of fisheries and aquaculture in the country. To make the fisheries sector competitive and emerge as a viable economic enterprise, good governance and management of the sector is essential. In this regard a sound MCS system should be in place at the earliest. The fisheries sector is also in the need of development enabling policies and effective governance through institutional strengthening and bringing reforms in the existing fisheries legislation or enactment of new laws to plug the gaps. Besides, DAHD&F may also provide guidance and support to States for developing and reforming their own policies and improving overall governance including strengthening of their institutional and organizational setup.

2.14 Policies that would contribute to development of aquaculture would include treating aquaculture at par with agriculture to avail the benefits of taxation, water and power tariff, allocation of resources; conservation of riverine

stretches for protection of germplasm; leasing of water bodies for aquaculture and mariculture purposes, etc. The policies should also aim at protection of livelihoods of fishers from various other economic and conservational activities. In the area of legislation, the existing Marine Fishing Regulation Act (MFRA) of the coastal States/Union Territories (UTs) needs revision to incorporate the requirements of MCS, Code of conduct for Responsible Fisheries (CCRF), etc. Similarly, a model bill is needed for inland fisheries and aquaculture and a Central Act is required to regulate fishing by wholly Indian-owned fishing vessels in the EEZ.

3.0 Growth projections and proposed outlay for the Twelfth Five- Year Plan

3.1 In the Tenth and Eleventh Plan periods, fish production registered a steady growth and it is expected that this growth would continue in the Twelfth Plan also, albeit with appropriate incentives and checks and balances. With the scenarios for inland and marine fisheries described in the foregoing paragraphs, the fisheries sector is likely to grow around 6.0 percent on an average per year during the Twelfth Five-Year Plan. With this growth rate, the total fish production is targeted at 11.58 mmt by the end of the Twelfth Plan Period (2016-17). To achieve this growth, it is estimated that the sector would require Rs. 6 000 crores for the Twelfth Plan period. The proposed programmes for HRD, institutional strengthening, policy reforms and overall improvement in the management and governance aspects during the Twelfth Plan period will also have spill over positive impacts on the output and performance of the fisheries sector during the subsequent Plans.

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CHAPTER 1.0

1.0 Working Group and Terms of Reference

1.1 Working Group

In pursuance of the Planning Commission's Letter No Q.12043/2/2010-Agri dated March 03, 2011; the Working Group on Development and Management of Fisheries and Aquaculture for the Twelfth Five-Year Plan was constituted. Subsequently additional members were co-opted in the group based on their expertise for specialized inputs. The Working Group comprised the following:

1.1.1 Members of the Working Group

Sl. No.	Name	Address / Tel / Fax / Mobile
1.0	**Dr Dilip Kumar** **Chairman**	Former Vice Chancellor & Director, Central Institute of Fisheries Education, C-9/9698, Vasant Kunj, New Delhi- 110 070. *Tel:+11 26899185; Mobile:+9560455702* *Email: dk.dilipkumar@gmail.com*
2.0	**Dr P Krishnaiah** **Member**	Chief Executive, National Fisheries Development Board, Blocks 401-402, Maitri Vihar, HUDA Commercial Complex, Ameerpet, Hyderabad-530 038, Andhra Pradesh. *Tel:+40 23737266; Fax:+40 23737208* *Mob:+9849909155*
3.0	**Chairman** **Member**	Marine Products Export Development Authority, MPEDA House, Panampilly Nagar, Kochi, Kerala. *Tel:+484 2311979, 2311803; Fax:+484-2313361*
4.0	**Joint Secretary** **Member**	Ministry of Food Processing Industries, Panchsheel Bhavan, August Kranti Marg, New Delhi-110049. *Ph:+11 26491808*
5.0	**Deputy Director General (Fisheries)** **Member**	ICAR, Krishi Anusandhan Bhavan II, Room No 309, PUSA, New Delhi-110 012. *Tel: +11 2584678; Mob:+9650934444*
6.0	**Fisheries Development Commissioner** **Member**	Department of Animal Husbandry, Dairying & Fisheries, Room No: 242-C, Krishi Bhavan, New Delhi-110 001. *Tel/Fax:+11 23386379; Mob:+9868203214*
7.0	**Member Secretary** **Member**	Coastal Aquaculture Authority, Shastri Bhawan Annex-26, Haddows Road Chennai-600 006, Tamil Nadu. *Tel:+44 24617523;Fax:+44 24610311* *Mob:+9445006775*
8.0	**Director** **Member**	Central Inland Fisheries Research Institute, Barrackpore – 700 120, West Bengal.

		Tel:+33 25920177; Fax:+33 25920388 *Mob:+9051787111* *E-mail:apsharma1@gmail.com*
9.0	**Managing Director** **Member**	National Federation of Fishermen's Cooperative Ltd., 7, Sarita Vihar Institutional Area, New Delhi – 110 076. *Tel:+11 26956692; Mob:+9911301828*
10.0	**Managing Director** **Member**	Matsyafed, Thiruvananthapuram, Kerala.
11.0	**Dr Shivananda Murthy** **Member**	Former Director of Extension, KVAFSU & Prof. of Aquaculture, College of Fisheries, Mangalore - 575 002, Karnataka. *Tel/Fax:+824 2240118; Mob:+9448500384* *Email: hsmurthy05@yahoo.com*
12.0	**Dr Y S Yadava** **Member**	Director, Bay of Bengal Programme Inter Governmental Organisation, 91,St. Mary's Road, Abhiramapuram, Chennai-600 018, Tamil Nadu. *Tel: +44 24936188; Fax:+44 24936102* *Mob:+9841042235*
13.0	**Dr M V Gupta** **Member**	World Food Laureate, C-502 Aditya Elite, B.S. Maktha, Somajiguda, Hyderabad -500 016, Andhra Pradesh. *Mob:+9866508555*
14.0	**Dr M Sinha** **Member**	Technical Adviser, Govt. of Tripura, Directorate of Fisheries P.N. Complex, Gurkhabasti, Agartala-6 *Mob:+9436459502* *Email: sinha_ mr@yahoo.com*
15.0	**Dr M M Goswamy** **Member**	Prof. of Zoology, Guwahati University, Guwahati-781 014, Assam. *Mob:+9435348461* *Email: mrigen_goswami@rediffmail.com*
16.0	**Shri Ajit Sinha Patil** **Member**	103- B Wing, Mittal Tower, Nariman Point Mumbai-400 021, Maharashtra. *Mob:+9323810927* *Email: panchamaqua@vsnl.com*
17.0	**Ms Chandrika Sharma** **Member**	Executive Secretary International Collective in Support of Fishworkers, 27, College Road, Chennai-600 006, Tamil Nadu. *Tel:+44 28275303; Fax:+44 28254453*
18.0	**Director of Fisheries** **Member**	Government of Andhra Pradesh 4th Street, Shanthi Nagar, Masab Tank, Hyderabad- 500028, Andhra Pradesh. *Tel:+40 23376255; Fax:+40 23376256* *Email: manmohansingh_ias@rediffmail.com.*
19.0	**Director of Fisheries** **Member**	Government of Jharkhand, Kanke Road, Ranchi-834 001, Jharkhand. *Tel:+651-2480747; Mob:+9431106932*
20.0	**Secretary (Fisheries)- Member**	Government of West Bengal Writers' Building, Kolkata, West Bengal.

21.0	**Director** **Member**	Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneswar-751 002 Orissa. *Tel:+674 2465421; Fax:+674 2465407*
22.0	**Director** **Member**	Central Institute of Brackishwater, Aquaculture, R A Puram, Chennai-600 028, Tamil Nadu. *Tel:+44 24617253; Fax:+44 24610311* *Email: ciba@tn.nic.in*
23.0	**Director** **Member**	Central Marine Fisheries Research Institute, Post Box: 1603, Ernakulam North Post Kochi- 682 018, Kerala. *Tel: +484-2394867; Fax:+484-2394909* *Mob:+9446344513* *E-mail: gsydarao@gmail.com*
24.0	**Adviser** **(Agriculture)** **Member**	Planning Commission, Yojana Bhavan, New Delhi -110 001 *Tel/Fax:+11 23327703*
25.0	**Shri Tarun Shridhar** **Member Secretary**	Joint Secretary (Fisheries), DAHD&F Krishi Bhawan, New Delhi- 110 001 *Tel:+11 23381994; Fax:+11 23070370* *Email:tshridhar@gmail.com*

1.1.2 Co-opted Members of the Working Group

1.0	**Dr W S Lakra**	Director, Central Institute of Fisheries Education, Versova, Andheri (West), Mumbai-400 061, Maharashtra. *Tel:+22 26363404; Fax:+22 26361573;* *Mob:+9920906001*
2.0	**Dr Madhu Soodana Kurup**	Vice Chancellor, Kerala University of Fisheries & Ocean Studies, Panangad, Kochi-682506, Kerala. *Email:kurup424@gmail.com*
3.0	**Dr Manoj Sharma** **Aquaculturist**	21, Suryadarshan Row House, Beside CNG Station, Jahingirpura, Rander Road Surat- 395 005, Gujarat. *Mob:+9824112856, 9825412857* *Email:mapl.shrimp@gmail.com*
4.0	**Dr N Sarangi**	Former Director, CIFA NA-510, Neela Chakra Apartment, L. B. Shastri Marg, Cuttack Road, Bhubaneswar-751 006, Orissa. *Tel:+674 2312808; Mob:+9437075176* *Email:sarangi012@yahoo.com*
5.0	**Dr S D Tripathi**	Former Director, Central Institute of Fisheries Education, Mumbai-400 061, Maharashtra.
6.0	**Shri Suresh Kumar**	Chairman-12th Plan Working Group on Extension.
7.0	**Dr R S Biradar**	Joint Director, CIFE, Versova, Andheri (West), Mumbai- 400 061, Maharashtra.
8.0	**Dr S C Mukherjee**	Former Joint Director, CIFE, Mumbai, 187 A, Sahid Nagar, P.O. – Bhubaneswar-751 007,

		Orissa. *E mail : subhasmukherjee48@gmail*.com
9.0	**Dr K Vijayakumaran**	Director General Fishery Survey of India, Botawala Chambers Sir. P. M. Road, Mumbai, Maharashtra. *Tel:+22 22617101; Fax:+22 22702270* *Mob:+9448312631*
10.0	**Dr C Vasudevappa**	Sr. Executive Director, NFDB, Blocks 401-402, Maitri Vihar, HUDA Commercial Complex, Ameerpet, Hyderabad-530 038, Andhra Pradesh. *Tel:+40 23737266; Fax:+40 23737208* *Mob:+9704567877*
11.0	**Dr P Paul Pandian**	Dy. Commissioner (Fy), Room No:491 Krishi Bhawan, DAHDF, New Delhi-110 001 *Tel/Fax:+11 23097013* *Email:pl_pndn@yahoo.com*
12.0	**Dr P K Katiha**	Principal Scientist, CIFRI, Monirampore, Barrackpore Kolkata – 700 120 *Tel:+33 25920177; Fax:+33 25920388;* *Mob:+9433060941* *Email: pkatiha@yahoo.com*
13.0	**Shri C Haridas**	Ex-Deputy Adviser (Fy), Planning Commission, Flat No: 102; C-Block, Pocket-3, DDA Flat (Bindapur), Dwaraka, New Delhi-110 059. *Tel:+11 25633581; Mob:+9868892287*
14.0	**Dr Boby Ignatius**	Sr. Scientist, CMFRI, Post Box:1603, Ernakulam North Post Kochi-682018. *Tel:+484 2394867; Fax:+484 2394909*

1.2 Terms of Reference (Specific)

The Terms of Reference (Specific) of the Working Group are given below:

(i) To assess the extent achieved by the programmes/schemes in meeting their objectives during XI Plan both in terms of physical and financial parameters and the extent contributed by the States in furthering the process of development of fisheries in terms of financial allocation and deployment of qualified technical manpower.

(ii) To recommend modifications for improvement in such of those schemes which have a potential of increasing fish production in the country, and also recommend doing away with those schemes which have made no significant impact so far.

(iii) To recommend leasing policy of fisheries and other water bodies suitable for fisheries in the country, including suggestions for implementation mechanisms.

(iv) To address constraints faced by aquaculture in terms of inputs, technology, disease control, basic infrastructure and marketing.

(v) To recommend measures for sustainable exploitation of marine fishery resources, especially of deep sea resources and suggest concrete measures to supplement the fish catch from marine resources through sea farming, mariculture, biotechnology, resource replenishment programmes like setting up of artificial reefs, reduction of by- catch, *etc*.

(vi) To make a critical assessment of the infrastructure facilities for fishing harbours, fish landing centers, processing and marketing network in the country and suggest measures to fill up the gaps for effective utilization of projected fish catch.

(vii) To recommend steps for wide expansion of non-food fisheries for pearl culture, ornamental fisheries, etc. as an alternative source of income and export earnings.

(viii) To assess likely impact on fish production due to climate change and suggest measures to be adopted by the fishermen/fish farmers in order to counter any likely adverse effect due to climate change.

(ix) To review the delivery mechanisms for development of fisheries, especially in aquaculture and suggest convergence of efforts among the existing organizations like ATMA, KVK, ICAR, Universities and other research organizations. Other innovative and non-traditional delivery mechanisms may be suggested.

(x) To enhance and strengthen welfare measures for the fishermen both inland and marine and augment the measures by converging with similar programmes of other Departments like IAY of Rural Development and other schemes of the Ministry of Social justice.

(xi) To facilitate larger private participation in the development of fisheries in the country.

1.3 Terms of Reference (General)

(i) The Chairman of the Working Group may co-opt any other official/non/official expert/representative of any organization as a member(s), if required.

(ii) The Working Group may also examine and address any other issue which is important though not spelt out in the ToRs. The Working Group may also devise its own procedures for conducting its business/meetings/field visits/constitutions of Sub-Groups, etc.

(iii) The expenditure of the members on TA/DA in connection with the meetings of the Working Group or any work incidental to the functions of the Working Group/Sub-Group will be borne by the parent Department/Ministry/Organization for official members and by the Planning Commission for non-official members.

(iv) The Working Group will submit its draft report to the Planning Commission by June 2011 and final one in September 2011.

(v) Shri C Haridas, Consultant (Fisheries), Planning Commission, Room No 421-B, Yojana Bhavan, New Delhi – 110 001, Tel No. 011 23042422,

email: c_haridas@rediffmail.com, Fax No.011 23327703 will be the Nodal officer for this Group in the Planning Commission. Any further query/correspondence in this regard may be made with him, and also with the Member Secretary of the Working group. The National Fisheries Development Board (NFDB), Hyderabad will extend the requisite secretariat assistance in the preparation of the report and bring out copies (100) of the same.

Sd/-
(G Rajeev)
Under Secretary to the Government of India

1.4 Constitution of Sub-Groups

In the first meeting of the Working Group on Development and Management of Fisheries and Aquaculture for the Twelfth Five-Year Plan (2012 – 2017), the following three Sub-Groups were constituted:

Sub Group-I: Marine Fisheries		
1.0	Dr G Syda Rao	Director, Central Marine fisheries Research Institute (CMFRI), Kochi, Kerala.
2.0	Dr Y S Yadava	Director, Bay of Bengal Programme Inter-Governmental Organisation, Chennai – 600 018, Tamil Nadu.
3.0	Dr Sebastian Mathew	Programme Adviser, ICSF, 27, College Road, Chennai-600 006, Tamil Nadu. *Tel:+ 91 44 28275303; Fax:+ 91 44 28254453* *Mob:+ 09444065433* *E-mail: sebastian1957@gmail.com*
4.0	Dr R Paul Raj	Member Secretary, Coastal Aquaculture Authority, Chennai-600 006, Tamil Nadu.
5.0	Dr A G Ponnaiah	Director, Central Institute of Brackishwater Aquaculture Chennai-600 028, Tamil Nadu.
6.0	Shri Thampi Samraj	Joint Director (Training & Aqua), Marine Products Export Development Authority, Kochi, Kerala.
7.0	Member	Managing Director, Matsyafed, Thiruvananthapuram, Kerala.
8.0	Shri K Sellamuthu	Commissioner, Department of Fisheries, Government of Tamil Nadu, Chennai–600 006, Tamil Nadu.
9.0	Dr Manmohan Singh	Commissioner of Fisheries, Government of Andhra Pradesh, Hyderabad– 500 028, Andhra Pradesh.
10.0	Dr Manoj Sharma	Shrimp Farmer, Surat-395005, Gujarat,
11.0	Dr Ajit Sinha Patil	Aqua-farmer, Mumbai-400 021, Maharashtra.
12.0	Dr Sandeep Kumar Mandal	Deputy Director of Fisheries, Government of West Bengal, Kolkata, West Bengal.
13.0	Shri C T Betgeri	Director, Central Institute of Coastal Engineering for Fishery, Bangalore – 560 013, Karnataka.
14.0	Dr Boby Ignatius Member	Sr. Scientist, CMFRI, Kochi-682 018, Kerala.
15.0	Shri Y Prakasha Rao Member Secretary	Executive Director, NFDB, Hyderabad- 500 038, Andhra Pradesh.

Sub Group-II: Inland Fisheries and Freshwater & Coldwater Aquaculture		
1.0	Dr A P Sharma	Director, CIFRI, Barrackpore-700120, West Bengal.
2.0	Dr M Sinha	Advisor (Fisheries), Government of Tripura, Tripura, Agartala.
3.0	Dr C Vasudevappa	Senior Executive Director, NFDB, Hyderabad-500 038, Andhra Pradesh.
4.0	Director	Department of Fisheries, Govt of Jammu and Kashmir, Srinagar, J&K.
5.0	Dr P C Mahanta	Director, Directorate of Cold Water Fisheries Research, Bhimtal, Uttarakhand.
6.0	Dr M M Goswamy	Prof. of Zoology Guwahati University, Guwahati-781 014, Assam.
7.0	Director	Central Institute of Freshwater Aquaculture, Bhubaneswar-751 002, Odisha.
8.0	Shri Rajiv Kumar	Director of Fisheries, Government of Jharkhand, Ranchi – 834 001, Jharkhand.
9.0	Dr (Ms) M Mukherjee	Director, Department of Fisheries, Government of West Bengal, Kolkata, West Bengal.
10.0	Shri Kanwaljit Singh Sidhu	Chairman, Punjab fish Farmers & Fisher men Association, 237 H. Bhai Randhir Singh Nagar, Ludhiana, Punjab. *Mob:+9815538587*
11.0	Dr G Venugopal	Principal Scientist (Fisheries) National Research Centre on Meat, Uppal Hyderabad-500 039, Andhra Pradesh. *Mob:+9490623322* *Email: venugopal.g.cife@gmail.com*
12.0	Managing Director	KAVIL, Ernakulam, Kerala.
13.0	Dr E V Gopinatha Sai Member Secretary	Executive Director, NFDB, Hyderabad- 500 038, Andhra Pradesh.

Co-opted members of Sub-Group II		
1.0	Dr J K Jena Member	Director National Bureau of Fish Genetics Resources Lucknow-226 002, Uttar Pradesh.
2.0	Prof H R Singh Member	Former Vice Chancellor, Allahabad University Allahabad, Uttar Pradesh.
3.0	Dr A K Roy	Secretary (Fisheries), Government of Assam Secretariat, Dispur, Assam.
4.0	Dr S C Mukherjee	Ex-Joint Director, CIFE, Mumbai, Maharashtra.
5.0	Shri Nishat Ahmed	Director, Department of Fisheries Government of Bihar, Patna, Bihar.
6.0	Dr P Nath	Director, Department of Fisheries, Government of Arunachal Pradesh, Itanagar, Arunachal Pradesh.
7.0	Dr Dipayan De	South Asian Forum for Environment, Kolkata, West Bengal.
8.0	Dr B N Pandey	Former Dean and Prof. of Zoology, Magadh University, Bodh Gaya, Bihar.
9.0	Dr P N Pandey	Former Professor, University of Ranchi, Ranchi, Bihar.
10.0	Dr S Purukaystha	Assam Agricultural Competitive Project,

		Guwahati, Assam.
11.0	Shri Sudhir Pandey	Chaur-based Fisheries Development Group, Village-Balua, Dholi, Muzaffarpur, Bihar.
12.0	Dr P K Katiha	Principal Scientist, CIFRI, Barrackpore Kolkata – 700 120, West Bengal.
13.0	Shri Haridas	Ex-Deputy Advisor (Fy.), Planning Commission, New Delhi- 110 059.

Sub Group-III: Fishery Policies and HRD		
1.0	Dr W S Lakra	Director/ VC, CIFE, (Deemed University), Mumbai-400 061, Maharashtra.
2.0	Dr M V Gupta	World Food Laureate, Hyderabad, Andhra Pradesh.
3.0	Dr K Vijaya Kumaran	Director General, Fishery Survey of India, Mumbai-400 001, Maharashtra.
4.0	Shri B K Mishra	Managing Director, FISCOPFED, New Delhi.
5.0	Dr M Surya Prakash	Sr. Executive Director, NFDB, Blocks: 401-402, Maitri Vihar Ameerpet, Hyderabad - 500 038 *Ph: + 91 40 23737256; Fax: + 91 40 23737208*
6.0	Shri B Vishnu Bhatt	Fisheries Development Commissioner, Ministry of Agriculture,New Delhi.
7.0	Member	Secretary (Fisheries), Government of West Bengal, Writers' Building, Kolkata – 700 001, West Bengal.
8.0	Member	Director, Department of Fisheries, Govt. of Gujarat, Gandhinagar, Gujarat.
9.0	Member	Director, Department of Fisheries, Government of Karnataka, Bangalore, Karnataka. .
10.0	Member	Director, Department of Fisheries, Government of Kerala, Thiruvananthapuram, Kerala.
11.0	Dr Salim Sultan Member Secretary	Executive Director, NFDB, Blocks: 401-402, Maitri Vihar Ameerpet, Hyderabad- 500 038 *Tel:+40 23737256; Fax:+40 23737208*

1.5 Constitution of Drafting Committee

A Drafting Committee was constituted with the following members to draft the Report of the Working Group.

Members of Draft Committee		
1.0	Dr Y S Yadava	Director, BOBP-IGO
2.0	Dr Dilip Kumar	Former Vice-Chancellor & Director, CIFE
3.0	Dr A P Sharma	Director, CIFRI
4.0	Dr G Syda Rao	Director, CMFRI
5.0	Dr Vasudevappa	Sr. Executive Director, NFDB
6.0	Dr R S Biradar	Joint Director, CIFE
7.0	Ms Chandrika Sharma	Executive Secretary, ICSF
8.0	Dr P Paul Pandian	Deputy Commissioner (Fy.), DAHD&F
9.0	Dr P K Katiha	Principal Scientist, CIFRI
10.0	Shri C Haridas	Ex-Deputy Adviser (Fy.), Planning Commission
11.0	Dr Boby Ignatius	Senior Scientist, CMFRI

1.6 Preparation of the report

The Working Group on Development and Management of Fisheries and Aquaculture for the Twelfth Five-Year Plan (2012-17) met on three occasions to discuss the issues and potentialities of fisheries and aquaculture in India and chart a road map for preparation of the report for consideration of the Government. The first meeting of the Working Group was held on 15 April 2011 at the NFDB, Hyderabad; the second on 22 July 2011 at the Central Inland Fisheries Research Institute (CIFRI), Barrackpore (Kolkata); and the third on 18 August 2011 at the Central Institute of Brackish water Aquaculture (CIBA), Chennai. In between, an Interface Meeting was organized by the Planning Commission between the Twelfth Plan Working Groups and the States at NASS Complex, New Delhi on 23 June 2011. This Meeting was attended by Dr Dilip Kumar, Chair, Working Group on Fisheries and Aquaculture and Dr P Paul Pandian, Deputy Commissioner (Fisheries), DAHD&F, Ministry of Agriculture.

In the first meeting, decision was taken to set up three sub-groups namely, (i) Sub-Group-I on Marine Fisheries (including Mariculture, brackish water aquaculture); (ii) Sub-Group-II: Inland Fisheries, freshwater aquaculture and coldwater fisheries and (iii) Sub-Group- III: Fishery policies and HRD. Dr G Syda Rao, Director, Central Marine Fisheries Research Institute (CMFRI), Kochi; Dr A P Sharma, Director, CIFRI, Barrackpore and Dr W S Lakra, Director, Central Institute of Fisheries Education (CIFE), Mumbai were made the chairpersons of the three Sub-Groups.

In the second Meeting of the Working Group held in Barrackpore on 22 July 2011, the three Sub-groups presented their reports. Subsequently, in the Third Meeting of the Working Group held in Chennai on 18 August 2011, a Drafting Committee was constituted to draft the Report of the Working Group. The Drafting Committee met on two occasions at CIFRI, Barrackpore to draft the Report for submitting to the Working Group for a final decision.

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CHAPTER 2.0

2.0 Indian Fisheries: An overview

2.1 Introduction

The fisheries sector is an important player in the overall socio-economic development of India. The sector came into focus soon after independence in 1947, mainly for two reasons: (1) to promote fisheries production in order to ensure food security (subsequently foreign exchange earnings were also added); and (2) socio-economic development of fishers/fish farmers through subsidization of various assets. As a result, starting from a purely traditional activity in the early fifties when India commenced with the First Five-Year Plan (1950-51 – 1955-56), fisheries and aquaculture have now transformed into a significant commercial enterprise. The sector's contribution to employment generation, food and nutritional security and foreign exchange earnings is now well recognized.

The fisheries sector contributed Rs. 67 913 crores to the GDP (at current prices) during 2009-2010, which is 0.96 percent of the total GDP at factor cost[3] (MoSPI, 2011) and 5.41 percent of the GDP at factor cost from agriculture, forestry and fishing. The share of fisheries sector in the total GDP at factor cost in current prices increased from 0.40 percent in 1950-51 to 0.96 percent in 2009-10, recording an increase of 140 percent ***(Figure 1)***. The fisheries sector has also been one of the major contributors of foreign exchange earnings. During 2010-11, export of marine products reached 813 091 tonnes valued at Rs. 12 901.47 crore and US $ 2.857 billion[4].

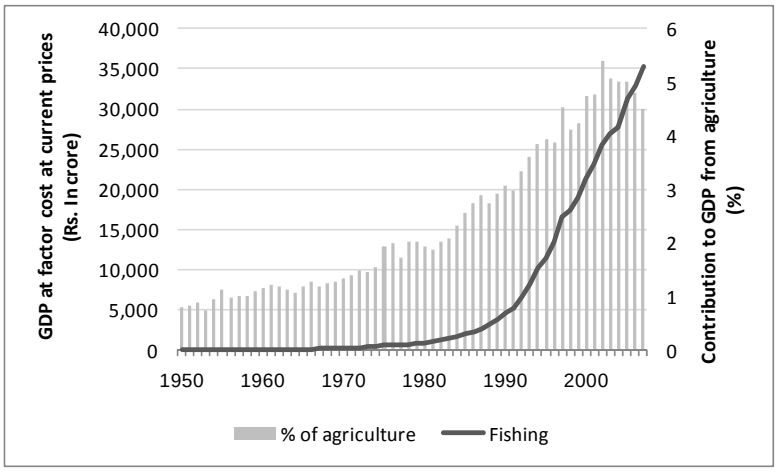

Figure 1: GDP from fisheries and its contribution to agriculture sector (MoSPI, 2011)

[3] *Ministry of Statistics and Programme Implementation: Annual and Quarterly Estimate of GDP at Current Prices, Base Year 2004-05 (http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=82)*
(http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=82)
[4] *MPEDA 2011 (http://www.mpeda.com/inner_home.asp?pg=trends)*

2.2 Fisheries resources

Marine and inland fisheries and aquaculture constitute the main components of fisheries sector in India. Aquaculture is practiced in both fresh and brackish waters. In recent years, mariculture or sea farming is gaining popularity and a couple of fin and shellfish species and sea weeds are now being farmed. Ornamental fish farming, although a non-food activity also has a promising future and is likely to contribute to the overall growth of fisheries sector in the coming years in terms of foreign exchange earnings and additional livelihood opportunities for fishers and unemployed young men and women in both urban and rural areas. The following paragraphs describe the resources under different sub-sectors of the fisheries sector.

2.2.1 Marine fisheries

After declaration of the Exclusive Economic Zone (EEZ) in 1977, the oceanic resources available to India are estimated at 2.02 million sq. km, comprising 0.86 million sq. km (42.6 % of the total) on the west coast, 0.56 million sq. km (27.7%) on the east coast and 0.60 million sq. km (29.7%) around the Andaman and Nicobar Islands ***(Figure 2)***. The continental shelf area amounts to 530 000 sq. km of which 71 percent area is available in the Arabian Sea (west coast) and the remaining 29 percent in the Bay of Bengal (east coast). With absolute right on the EEZ, India has also acquired the responsibility to conserve, develop and optimally exploit the marine living resources within this area.

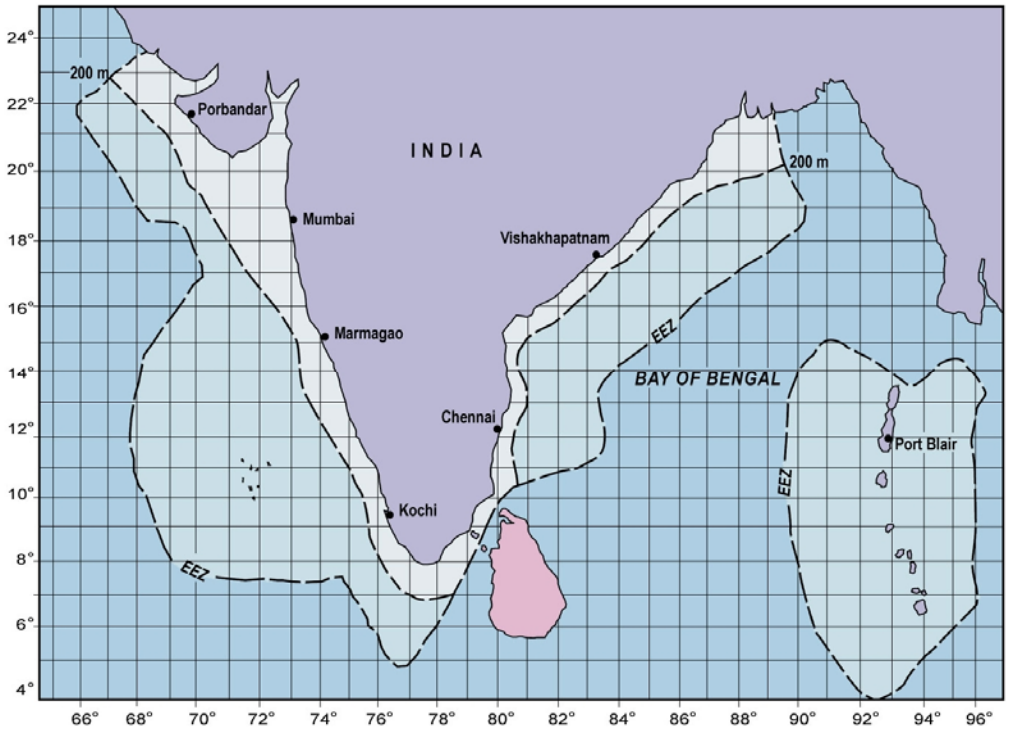

Figure 2: Exclusive Economic Zone of India

The country has a long coastline of 8 118 km and an equally large area under estuaries, backwaters, lagoons, etc, which is highly amenable for developing

capture as well as culture fisheries. As per the National Marine Fisheries Census, 2005 (NMFC, 2005), the marine fisheries activities are spread in approximately 1 376 fish landing centres and 3 322 fishing villages located along the coastline on the mainland and the two Island territories of Lakshadweep and the Andaman & Nicobar Islands.

Marine fisheries constitute a valuable source of food and employment, and a net contributor to the balance of payment. Marine fisheries have progressively increased by nearly six times during the past 50 years. About 0.933 million people are employed in the sector on full-time basis, 1.01 million on part-time basis and 1.39 million are engaged in other ancillary activities. Major fish production comes from the coastal resources. As per the early estimates of NFMC, 2010[5], there are about 8.63 lakh fishers[6] families in the mainland and about 9.26 lakh people are engaged as active fishers.

The estimated marine resource potential of the Indian EEZ is 4.24 million metric tonnes (mmt) at the present exploitation rates. In marine fisheries, while inshore waters have been almost exploited to the sustainable levels (CMFRI, 2011), contributions from the deep sea have been insignificant. The trend based surveys have indicated that in the depth range up to 100 m, which contributes to about 86 percent of the total exploited resources; practically there is little possibility of witnessing quantitative increase in production. However, the depth ranges beyond 100 m have avenues of expansion, albeit more in qualitative terms. In this domain, the possibility revolves around oceanic resources like tuna, bill fishes and allied species whose combined potential is pegged at 0.2 mmt with the lucrative yellow fin tuna contributing to the tune of 40 percent to it.

The Indian marine waters harbour around 1 707 species of fish, of which about 200 species are commercially significant. The estimated landings from the marine capture fisheries stand at 3.220 mmt (CMFRI, 2010), with a growth rate of 4.62 percent. The gross value of the marine fish landings at the landing centre level is estimated at Rs.19 753 crores and at the retail level at Rs.28 511 crores (SEETTD, 2011). Gujarat has emerged as the leading producer of marine fish in the country during 2009-2010, followed by Kerala, Maharashtra and Tamil Nadu.

Time-series trend in landings of marine fisheries shows considerable variation through the period 1950-2010. These changes are: (i) increase in number of species harvested/caught; (ii) changes in catch composition; and (iii) decline in availability of some species and increase in the others, such as the oil sardine along the coast line.

Group-wise (FAOSTAT), demersal fishes constitute about 33 percent of the total landings; pelagic species form about 27 percent and marine species (fin fishes, etc) constitute about 23 percent of the catch. The other marine groups (crustaceans, cephalopods and molluscs) constitute about 17 percent of the

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[5] The NFMC, 2010 has been conducted by the Central Marine Fisheries Research Institute and the results are yet to be made official.

[6] The word 'fisher' includes both fishermen and fisherwomen.

landings. Another feature of the decadal trend of landings is that among various groups, the contribution by pelagic and demersal fin fish resources has shown marked increase while the crustaceans (shrimps) and molluscs are fluctuating around a flat trend. This adds relevance to the argument that quantum increase need not necessarily indicate increase in value of the products in the same vein.

2.2.2 Inland fisheries

The inland capture fisheries resources of the country comprise a maze of rivers, canals, estuaries, floodplain lakes, wetlands, lagoons, upland lakes and reservoirs. The river system includes 14 major and 44 medium rivers, innumerable tributaries and anabranches. With a combined length of 45 000 km and 20 000 sq. km of catchment area, the country's riverine resources provide one of the richest fish germplasm of the world. The floodplains are primarily continuum of rivers and exist in the form of oxbow lakes, especially in the States of Bihar, West Bengal, Assam (Brahmaputra and Barak valleys), Manipur and eastern Uttar Pradesh. The country has an estimated 1.2 million hectare (mha) of floodplain lakes and wetlands where fish and fisheries remain a traditional economic activity with tremendous socio-economic impact in the rural sector. The cold-water fisheries resources comprise rivers, streams, lakes, reservoirs with a combined riverine length of 8 253 km and 41 600 ha of sprawling lakes and reservoirs. Besides, there are vast sheets of inland saline water bodies lying unexploited in different States of the country, mainly in northern and central India.

Seven major rivers contribute to the estuarine resource of the country. Besides, there are large numbers of smaller rivers on both the coasts, which end up in estuaries. The Hooghly-Matlah estuarine system, which is the largest and richest estuarine system in the country, encompasses the Sundarbans. The other important resources include the Mahanadi, Narmada**,** Tapti and some smaller peninsular estuaries.

India has more than 3.0 mha of reservoirs distributed under divergent geo-climatic, morphometric and edaphic environments. Based on a 1995 study of the Food and Agriculture Organization (FAO) of the United Nations[7], these water bodies are classified as small (1 000 ha), medium (1 000 to 5 000 ha) and large (5 000 ha). The size-wise distribution of reservoirs in India is as follows:

Distribution of small, medium and large reservoirs in India

	Small	**Medium**	**Large**	**Total**
Number	19 134	180	56	19 370
Area (ha)	14 85 557	5 27 541	11 40 268	31 53 366

The reservoirs are predominantly located in the peninsular States, *viz.*, Tamil Nadu, Karnataka, Andhra Pradesh, Kerala, Orissa, and Maharashtra. These six

[7] ***Sugunan, V.V., 1995. Reservoir Fisheries of India. FAO Fisheries Technical Paper, No. 345. Rome, FAO.1995.pp.423.***

States account for more than 56 percent of the total reservoir area in the country. Of the 19 134 small reservoirs, 17 989 (94%) are located in southern India. Similarly, 34 percent of the medium reservoirs are also distributed in these States. The reservoirs form a large resource size carrying a huge untapped production potential.

2.2.3 Aquaculture

The freshwater culture resources in the country comprise 2.41 mha of ponds and tanks. The other resources where fish farming can be undertaken include the floodplain lakes and other natural lakes, reservoirs, irrigation canals and paddy fields. India is basically a carp country with more than 75 percent of the production being contributed by carps alone. The other significant contributor in recent years is *Pangasius* species. India is now the third largest producer of *Pangasius* in the world after Vietnam and Thailand.

Since the early eighties, development of brackish water fish culture has gained prominence. About 1.2 mha has been estimated as amenable for brackish water aquaculture in the coastal areas of the country. Besides tiger shrimp (*Penaeus monodon*), the exotic white leg shrimp (*Littopenaeus vannamei*) is also becoming a popular species. Farmed shrimps contribute a sizeable percentage to the total exports from the country.

The inland fisheries resources provide full time vocation to 1.24 million inland fishers, and 3.4 mmt of annual fish production. India is the third largest producer of inland fish in the world (after China and Bangladesh) and the sector plays a great role in nutritional security and employment potential. The sector is also an important source of ancillary jobs for the rural population, especially in marketing, retailing, transportation, etc. However, the sector remains largely unorganized even today mainly due to scattered and diffused nature of activities. Though fisheries has been recognized as a thrust area in the successive Five-Year Plans, there has been little attention to the development of inland fisheries resources. A snap shot of country's marine and inland fisheries resources are shown in ***Table 1*** below.

Table 1: Fisheries resources of India – At a glance

Marine Resources & Fisher Statistics	
Coastline (km)	8 118
Exclusive Economic Zone (million km^2)	2.02
Continental shelf ('000 km^2)	530
Fish Landing Centres (Nos.)	1 376
Fishing villages (Nos.)	3 322
Fishermen families (Nos.) (NMFC,2005)	764 868
Fisher folk population (Nos.) (NMFC,2005)	3 574 704
Inland Resources	
Rivers & canals (km)	195 210
Reservoirs (lakh ha.)	31.5
Tanks and ponds (lakh ha)	24.14
Floodplain/derelict water bodies (lakh ha)	8 – 12
Brackishwater (lakh ha)	12.40
Saline/alkaline affected area (lakh ha)	12.00

2.3 Fish production

2.3.1 Fish production and trend

Fish production in India has shown an increasing trend from 0.72 mmt in 1950-51 to reach 8.288 mmt in 2010-11(P). With a vast production potential, particularly in inland fisheries (mainly reservoirs) and aquaculture, the sector has shown an average growth of about 6 percent over the Five-Year Plan periods. In case of marine fisheries, production has increased from 0.53 mmt in 1950-51 to 3.220 mmt in 2010 -11. In the inland sector, the growth has been steady, increasing from 0.218 mmt during 1950-51 to about 5.068 mmt in 2010-11, with an annual growth rate of 4.21 percent ***(Table 2 & Figure 3)***.

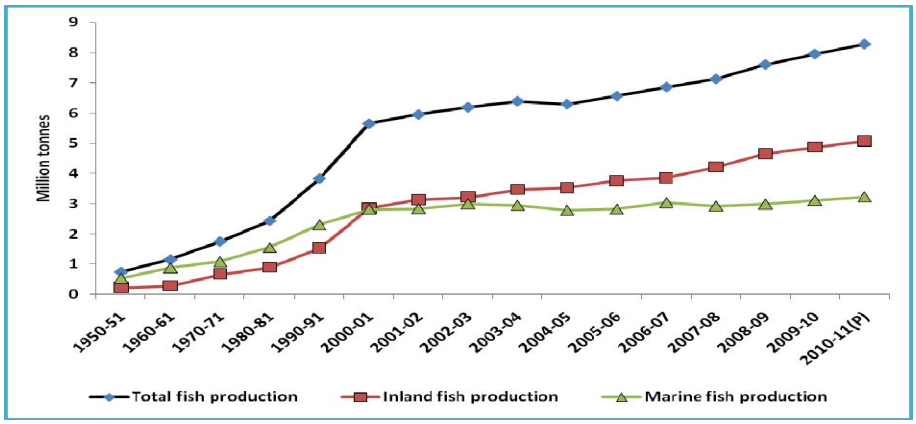


Figure 3: Fish production trends (total, marine & inland) [From 1950-51 to 2010-2011(P)]

2.3.2 Fish production potential

The harvestable potential of marine fishery resources in the EEZ has been revalidated at about 4.419 mmt[8], of which the pelagic resources account for 2.128 mmt; demersal resources for 2.083 mmt and oceanic resources for 0.280 mmt. As compared to the last estimate carried out in 2000, the current estimate is about 0.5 mmt more.

Depth-wise marine fish production potential shows that about 86.84 percent of the resources (3.837 mmt) are available in the 100 meter depth zone; 5.86 percent (0.259 mmt) in 100-200 meter depth; and 2.59 percent (0.115 mmt) in the 200-500 meter depth zone. The resources in oceanic area have been estimated as 0.208 mmt, which is 4.71 percent of the total potential. The oceanic resources largely comprise yellow fin tuna (80 000 metric tonnes- mt), skipjack tuna (99 000 mt), bigeye tuna (500 mt), billfishes (5 900 mt), pelagic sharks (20 800 mt) and other species (1 800 mt).

[8] ***The potential has been revalidated to 4.419 mmt in 2011. The estimate of 3.934 mmt was worked out by a Working Group set up by the Ministry of Agriculture in 2000. The full report of the revalidation carried out in 2011 is awaited.***

Table 2: Fish Production in India
(1950-51 to 2010-2011)

Year	Fish Production ('000 tonnes)		
	Marine	Inland	Total
1950-51	534	218	752
1955-56	596	243	839
1960-61	880	280	1 160
1965-66	824	507	1 331
1970-71	1 086	670	1 756
1973-74	1 210	748	1 958
1978-79	1 490	816	2 306
1979-80	1 492	848	2 340
1980-81	1 555	887	2 442
1981-82	1 445	999	2 444
1982-83	1 427	940	2 367
1983-84	1 519	987	2 506
1984-85	1 698	1 103	2 801
1985-86	1 716	1 160	2 876
1986-87	1 713	1 229	2 942
1987-88	1 658	1 301	2 959
1988-89	1 817	1 335	3 152
1989-90	2 275	1 402	3 677
1990-91	2 300	1 536	3 836
1991-92	2 447	1 710	4 157
1992-93	2 576	1 789	4 365
1993-94	2 649	1 995	4 644
1994-95	2 692	2 097	4 789
1995-96	2 707	2 242	4 949
1996-97	2 967	2 381	5 348
1997-98	2 950	2 438	5 388
1998-99	2 696	2 602	5 298
1999-00	2 852	2 823	5 675
2000-01	2 811	2 845	5 656
2001-02	2 830	3 126	5 956
2002-03	2 990	3 210	6 200
2003-04	2 941	3 458	6 399
2004-05	2 779	3 526	6 305
2005-06	2 816	3 756	6 572
2006-07	3 024	3 845	6 869
2007-08	2 920	4 207	7 127
2008-09	2 978	4 639	7 617
2009-10 (P)	2 689	4 862	7 851
2010-11 (P)	3 220	5 068	8 288

Sources:

(i) Department of Animal Husbandry, Dairying and Fisheries (2009), Handbook of Fisheries Statistics, 2008. Ministry of Agriculture, Government of India.

(ii) Department of Animal Husbandry, Dairying and Fisheries (2011), Annual Report, 2010-11. Ministry of Agriculture, Government of India.

Amongst the different groups of pelagic species, oil sardines top with a share of 0.51 mmt, followed by ribbon fish (0.23 mmt) and Indian mackerel (0.2 mmt). In the demersal group, penaeid prawns top with a share of 0.24 mmt, followed by croakers (0.22 mmt) and non-penaeid prawns (0.21 mmt).

The inland fisheries and aquaculture offer immense potential for enhancement of fish productivity and production. The fish productivity of freshwater aquaculture is far below the potential (2.85 t/ha from the ponds managed under the FFDA programme against a moderate production potential estimate of 5.0 tonnes/ha). The area under culture is also a small part of the existing resources 0.95 mha out of 2.41 mha. Similarly for brackishwater aquaculture nearly 15 percent of the amenable area is under culture and has considerable scope for enhancing the productivity.

In case of inland fisheries, reservoirs and floodplain wetlands offer greater scope for increase in fish production through culture-based fisheries. The average fish production potential was estimated at 250 kg/ha for reservoirs and 1500 kg/ha for floodplains/wetlands. Against this the fish yield is only 30 kg/ha for reservoirs and about 350 kg/ha for floodplains/wetlands. In case of reservoirs adopted under the NFDB Reservoir Fisheries Development Programme, average fish yield of 174 kg/ha for small, 94 kg/ha for medium and 33 kg/ha for large reservoirs was documented, with an average fish yield of 110 kg/ha. For floodplains/wetlands, the fish yield from West Bengal wetlands has been estimated at over 3 tonne/ha. Further, the irrigation canals are rarely exploited for fish production.

2.4 Global fisheries

The State of the World Fisheries and Aquaculture (SOFIA, 2010) of the FAO of the United Nations estimated (Provisional) that in 2009 the total world fish production reached an all time high of 145.1 mmt, comprising 90.0 mmt from capture fisheries (both inland and marine) and 55.1 mmt from aquaculture. Of the total production, 117.8 mmt was used as human food and 27.3 mmt for non-food use. With an estimated world population of 6.8 million[9], the per capita food fish supply was estimated at 17.2 kg during the year.

As per the 2008 statistics contained in SOFIA, 2010, the proportion of fully exploited fish stocks was estimated at 50 percent, depleted or recovering stocks at 32 percent and underexploited or moderately exploited stocks at 15 percent. Further, it is also estimated that 4.3 million vessels contribute to the global fishing fleet of which 59 percent (2.54 million) are powered by engines and the remaining 41 percent (1.76 million) are traditional boats, operated by sails or oars. Problems persist with the high levels of unwanted and often unreported by-catch and discards in many fisheries round the world, including the capture of ecologically important species and juveniles of economically valuable species. The latest estimate of global discards from fishing is about 7.0 mmt per year.

[9] ***The World population has since touched the 7.0 billion mark.***

In terms of global ranking, in 2008, India was second to China in total fish production; sixth in marine and inland capture fisheries (after China, Peru, Indonesia, USA, Japan); third in inland capture fisheries (after China and Bangladesh) and second in aquaculture (after China). ***Table 3*** provides a comparative account of the global and Indian fish production from capture and culture fisheries.

Table 3: Fish production in India and the World and its percent contribution to World fish production (in mmt)

Year	Capture fish production		Aquaculture Production		Total fish Production	
	Global	India	Global	India	Global	India
2005	92.0	3.691	44.3	2.967	136.3	6.658 (4.88%)
2006	89.7	3.845	47.3	3.180	137.0	7.025 (5.13%)
2007	89.9	3.859	49.9	3.112	139.8	6.971 (4.99%)
2008	89.7	4.105	52.5	3.479	142.2	7.584 (5.33%)
2010	90.0	4.02*	55.1	4.27*	145.1	8.290 (5.71%)

**** Provisional figures.***

In 2008, 39.7 percent (56.5 mmt) of total world fish production was marketed as fresh, while 41.2 percent (56.6 mmt) as frozen, cured or otherwise prepared for direct human consumption. Since the mid-1990's, the proportion of fish used for direct human consumption has grown as more fish is used as food and less for producing fish meal and fish oil.

Globally, aquaculture continues to be the fastest-growing animal-food-production sector with per capita supply from aquaculture increasing from 0.7 kg in 1970 to 7.8 kg in 2008, an average annual growth rate of 6.6 percent. The value of the world aquaculture harvest excluding aquatic plants is estimated at US$ 98.4 billion in 2008. The actual total output value from the entire aquaculture sector should be significantly higher than this level, because the value of aquaculture hatchery and nursery production and that of the breeding of ornamental fisheries are yet to be estimated and included.

In 2008, global export of fish and fishery products reached a record value of US$ 102.0 billion, representing a share of about 10 percent of total agricultural exports. Prices of fish and fishery products were also affected by the food price crisis, following the general upward trend in all food prices. China, Norway and Thailand are the top three fish exporters. China's fishery exports have grown considerably since the 1990's and a growing share of these exports consists of reprocessed imported raw material. China, Thailand and Vietnam, accounted for 50 percent (US$ 50.8 billion) of world export of fish and fishery products in value terms.

Like India, the fisheries sector continues to be a source of income and livelihoods for millions of people around the world. In 2008, an estimated 44.9 million people were directly engaged, full time or part-time in fisheries and aquaculture. This number represents a 167 percent increase compared with the 16.7 million people in 1980.Women comprised 12 percent of the total population (5.39 million). It is also estimated that, for each person employed in capture fisheries and aquaculture production, about three jobs are produced

in secondary activities, including post-harvest. Further, on average, each fisher/farmer provides for three dependents or family members. Employment in fisheries sector has grown faster than the world's population and also than employment in traditional agriculture. The majority of fishers and fish farmers are in developing countries, mainly in Asia, which has experienced the largest increase in recent decades, reflecting in particular the rapid expansion of aquaculture activities.

The number of people employed in direct production in the sector cannot be taken as the only indicator of the magnitude of fisheries contribution to the national economy. The contribution of people engaged in other ancillary activities, such as processing, net and gear making, ice production and supply, boat construction and maintenance, packaging, marketing and distribution is also substantial and adds to the overall contribution from the sector. Besides, those engaged in research, development and administration linked with the fisheries sector are also important contributors to the sustainable growth of the sector.

Small-scale fisheries contribute more than half of the world's marine and inland fish catch, almost all of which is destined for direct human consumption. These fisheries employ more than 90 percent of the world's 45 million fishers and they support another 84 million people employed in jobs associated with fish processing, distribution and marketing. More than 95 percent of small-scale fishers and related workers in post-harvest sectors live in developing countries. In spite of their significant contributions to the global fish food supplies, small-scale fishing communities live and work in very difficult conditions.

The SOFIA, 2010 has also estimated the average production per person in fisheries (capture and aquaculture) sector, which is 2.4 tonnes per year for Asia; 23.0 tonnes for Europe; 13.8 tonnes for Latin America and the Caribbean and 2.0 tonnes per year for Africa. The figures on production per person indicate the degree of industrialization of fishing activities, and also the key role played by small-scale fisheries in this regard.

2.5 Exports

During 2010-11(April 2010 – March 2011), export earnings for the first time in the history of marine products exports from India touched US $ 2.857 billion mark. In volume terms the exports aggregated to 813 091 mt, valued at Rs. 12 901.47 crore. As compared to the previous year, the seafood exports recorded a growth of 19.85 percent in quantity, 28.39 percent in rupee and 33.95 percent growth in US $ earnings. These developments in the marine products export happened despite continuing recession in the international markets, debt crisis in European Union (EU) economies, continuing anti-dumping duty in US and the sluggish growth in US economy and political instability in the Arab world. The increased production and productivity of shrimps, *L. vannamei* (whiteleg shrimp) and *P. monodon* (black tiger shrimp) and better price realization of major items like cuttlefish, shrimp and squid

helped realizing a higher export turnover. ***Figure 4*** provides a glimpse of the trend in exports from 1961-62 to 2010-11.

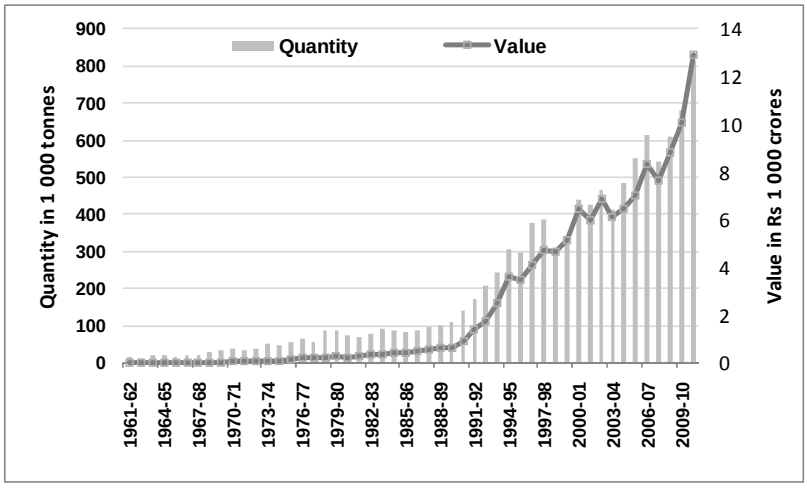


Figure 4: Trends in export of marine products [1961-62 to 2010-11] (Source: Handbook of Fisheries Statistics, 2008 and the Marine Products Export Development Authority)

Frozen shrimp retained its position as the major export item, accounting for 44.17 percent of the total US $ earnings. Shrimp exports during 2010-11 period increased by 16.02 percent, 36.72 percent and 42.90 percent in quantity, rupee and US $ terms respectively. Fish continued to remain as the principal export item in quantity terms and the second largest export item in value terms, with a share of 38.42 percent in quantity and 20.42 percent in US $ earnings.

The EU remained as the largest market with a share of 26.78 percent in US $ realization, followed by South East Asia (16.43%), China (15.41%), USA (15.35%), Japan (13.06%), Middle East (5.19%) and other countries (7.79%). The export to the US market increased by 8.75 percent compared to the previous year. The significant development in the expansion of export is the strengthening of India's presence in Southeast Asia and Middle East markets, where the quantitative increase has been to the tune of 57 percent and 26 percent respectively. Similarly, exports to African countries have also registered a significant increase in comparison to the previous year.

In a recent study conducted by ASSOCHAM (Associated Chambers of Commerce and Industry of India) on the seafood market in India by 2014, it is said that the seafood exports that totaled US $ 1.9 billion in 2008-09 and moved up to US $ 2.857 billion in 2010-11 are likely to touch US $ 4.7 billion by 2013 -14, provided the key thrust areas like value-addition, expansion of aquaculture, technological upgrade and tapping unexplored resources get a boost. Further, the growing demand from EU, USA, China, Southeast Asia and Japan (after the 11 March 2011 tsunami) is likely to give a boost to the seafood exports from the country.

2.6 Employment

One of the most significant characteristic of the Indian fisheries sector is its small-scale nature. Fishing is a traditional economic activity in India practiced for generations by the fisher communities. The fishers can be broadly classified as (1) inland fishers, (2) marine fishers and (3) fish farmers. As per the Indian Livestock Census, 2003, 14.49 million people were engaged in various fisheries related activities. About 75 percent of the fishers are engaged in inland fisheries activities and about 25 percent in marine fisheries activities.

A National Marine Fisheries Census (NMFC) was conducted in 2005 by the CMFRI, Kochi (for mainland coastal States/UTs) and the Fishery Survey of India (FSI), Mumbai (for the two Island groups). As per the NMFC, 2005 the marine fisheries sector provides employment to about 0.9 million fishers in active fishing and about 0.7 million fishers in various other fishing operations. The number of people involved in marine fisheries related activities include nearly 0.2 million in fish marketing, 0.1 million in repairs of fisheries requisites, around 0.2 million in fish processing and 0.1 million in other ancillary activities. In all, an estimated 3.51 million people depend on marine fisheries for their livelihoods in India.

Compared with the previous NMFC undertaken in 1980, it is seen that marine fisher population has nearly doubled from 1.87 million in 1980 to 3.51 million in 2005. Among the maritime states, West Bengal has the highest concentration of fishers per kilometer of coastline (1 706), followed by Kerala (1 012) and Odisha (938). More details can be seen in ***Table 4*** below:

Table 4: State and activity-wise marine fisher population in India

State/UTs	Active Fishermen	Fishing allied	Non fishing/ working	Total Population
West Bengal	70 750	57 741	141 074	269 565
Odisha	121 282	152 534	176 575	450 391
Andhra Pradesh	138 614	152 892	218 485	509 991
Tamil Nadu	206 908	104 509	478 991	790 408
Puducherry	10 341	10 095	22 592	43 028
Kerala	140 222	71 074	390 938	602 234
Karnataka	37 632	45 699	87 583	170 914
Goa	2 515	3 382	4 771	10 668
Maharashtra	72 074	81 780	165 543	319 397
Gujarat	83 322	75 082	164 811	323 215
Daman & Diu	5 868	1 603	21 834	29 305
A & N Islands	4 247	6 580	4 439	15 266
Lakshadweep	8 040	3 561	28 721	40 322
India	**901 815**	**766 532**	**1 906 357**	**3 574 704**

Among those engaged in active marine fishing, majority (81%) are full-time, 13 percent on part-time basis and the rest in occasional fishing. Fishing as a full time profession is relatively popular in the west coast States/UTs (Gujarat, Goa, Daman & Diu, Maharashtra, Karnataka, Lakshadweep and Kerala) where

84 percent of active fishers are engaged in full-time fishing as compared to the east coast States/UTs (West Bengal, Orissa, Andhra Pradesh, Puducherry, Andaman & Nicobar Islands and Tamil Nadu), where 79 percent fishers engage in full-time fishing. This is also supported by the fact that fishing operations are more capital-intensive in the west coast States/UTs than in the east coast States/UTs. The engagement profile of fishers in the country is presented in ***Figure 5*** below.

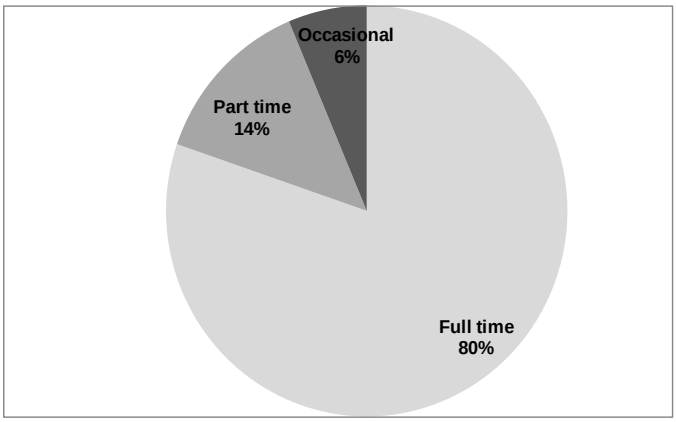


Figure 5: Engagement pattern of active marine fishers in India

Source: National Marine Fisheries Census, 2005

The 2005 NMFC also provides information on work of women in marine fisheries. It notes that among women, the major fishing-related activities are marketing (41.8 percent), labour (18.4 percent) and curing/processing (18 percent). Further, as many as 73.6 percent of those engaged in marketing are women, while 75.7 percent of those in curing and processing are also women. It is apparent that women dominate marketing and processing activities in marine fisheries. State-wise data indicates that the largest numbers of women engaged in marketing are in Maharashtra (39 288), Tamil Nadu (31 019) and Andhra Pradesh (27 160). Significant numbers of women engage in processing/curing activities in Andhra Pradesh (24 524), Orissa (16 447) and Maharashtra (8 584).

2.7 Fishing fleet

The marine fishing fleet[10] comprises about 2 43 939 fishing crafts of which 107 448 (44.05%) are traditional and 76 748 (31.46%) motorized traditional crafts. The mechanized fishing vessels (MFVs) comprise 59 743 vessels – 24.49 percent of the total ***(Table 5)***. As seen by the number of traditional crafts and small-mechanized vessels, the major fishing activities are still concentrated in the areas within 100 meter depth zone. As compared to the west coast, concentration of traditional crafts (including motorized) is more on the east coast (about 67 % of the total). In the case of MFVs, the trend is

[10] ***Source: National Marine Fisheries Census, 2005, Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India.***

reverse (about 64 % of the total). The scale of mechanization is also reflected in the total fish landings of the two coasts.

Table 5: State-wise detail of fishing vessels in India

Sl. No	State/Union Territory	Mechanized vessels	Motorized vessels	Non-motorized vessels	Total
1	West Bengal	6 829	1 776	10 041	18 646
2	Odisha	3 577	4 719	15 444	23 740
3	Andhra Pradesh	2 541	14 112	24 386	41 039
4	Tamil Nadu	7 711	22 478	24 231	54 420
5	Pondicherry	627	2 306	1 524	4 457
6	Kerala	5 504	14 151	9 522	29 177
7	Karnataka	4 373	3 705	7 577	15 655
8	Goa	1 087	932	532	2 551
9	Maharashtra	13 053	3 382	7 073	23 508
10	Gujarat	13 047	7 376	3 729	24 152
11	Daman & Diu	562	654	211	1 427
12	Andaman & Nicobar Islands	165	781	1 837	2 783
13	Lakshadweep	667	376	1 341	2 384
14	**India**	**59 743**	**76 748**	**107 448**	**243 939**

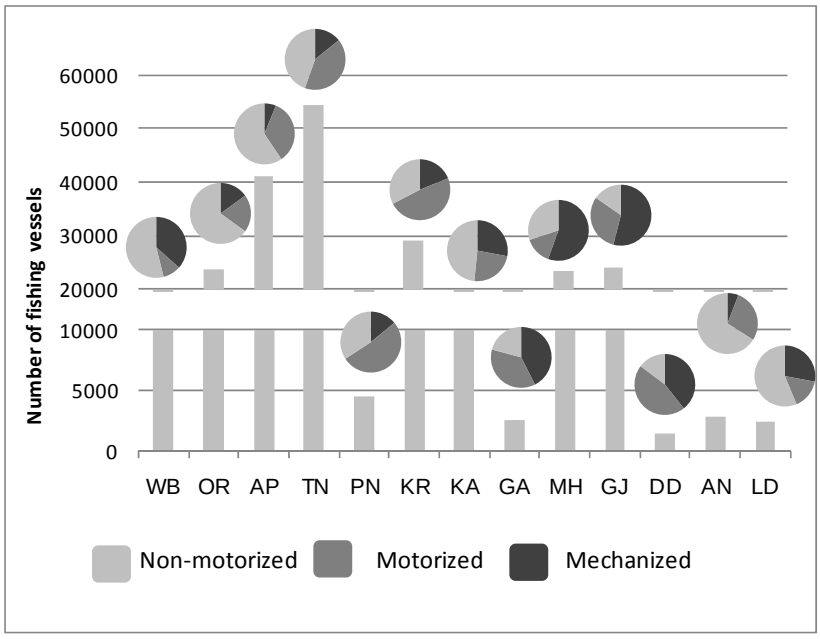
Source: National Marine Fisheries Census, 2005

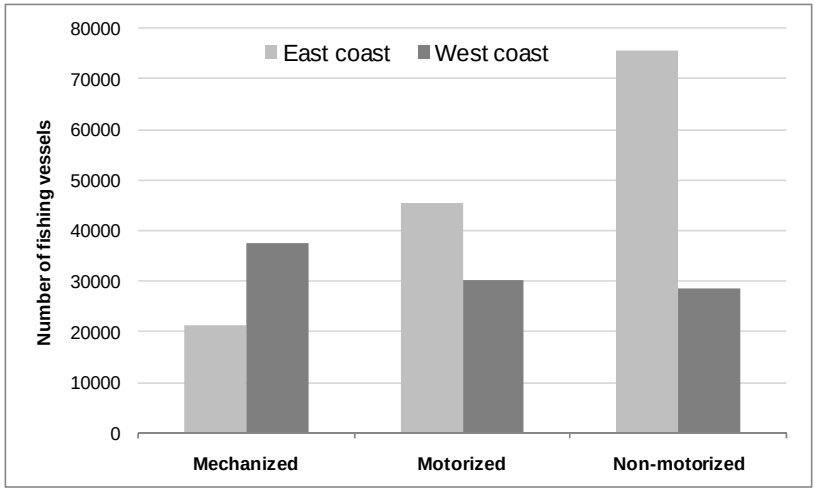
At the end of the First Five-Year Plan (1951-1956), there were 863 MFVs operating along the Indian coast. Presently, the number is 59 743. At the national level, the mechanized sector contributes about 67 percent of the landing. In 1969 it was a mere 20 percent. Motorized sector contributes about 25 percent and the balance 8 to 10 percent is contributed by the traditional crafts. With the advent of mechanization, use of traditional harvesting gear like bag net, cast net, small meshed gill net has declined and more efficient gear like purse seines have became popular. ***Figure 6*** depicts category-wise and coast-wise distribution of fishing vessels in the country.

2.8 Post-harvest infrastructure and marketing

As per available data, approximately 67 percent of the total fish produced in the country is consumed in fresh form and nearly 6 percent is used for reduction into fishmeal. Altogether 23 percent is consumed in processed and preserved form that includes 16 percent used for drying, 7 percent for freezing and less than one-half percent for canning- almost all of these under medium and small- scale sectors.

In the marine fisheries sector, the Central Government has been implementing a Central Sector Scheme and a Centrally Sponsored Scheme since 1964 to provide infrastructure facilities for landing and berthing of MFVs, traditional and motorized fishing craft and deep sea fishing vessels.





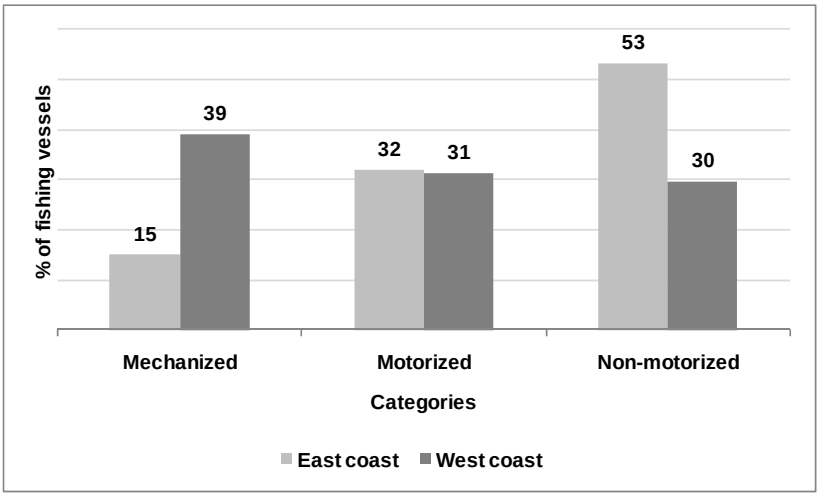


Figure 6: Category-wise (top) and coast-wise Distribution (middle and bottom) of fishing vessels in India

So far out of the 1 376 fishery centers situated in 3 322 coastal fishing villages along the Indian coast, only 256 fishing centres have been developed, which form only 18.6 percent of the existing fishing centres. The facilities created so far are adequate to accommodate only about 25-30 percent of the country's MFVs, resulting in over-crowding and a host of other accompanying problems. Therefore, there is an imperative need to develop more fishing harbours and landing centres to meet the requirements of the existing fishing fleet.

2.9 Policies and legislative support

2.9.1 Institutional setting

Entry 57 of List 1 of Seventh Schedule of the Constitution of India specifies *Fishing and Fisheries beyond Territorial Waters* as Union Subject, whereas Entry 21 of List II speaks of Fisheries as a State Subject. Reading both the Entries together, it follows that control and regulation of fishing and fisheries within territorial waters is the exclusive province of the State, whereas beyond the territorial waters, it is the exclusive domain of the Union. The Central Government acts as a facilitator and coordinator responsible for policy formulation, carrying out fishery research and channeling funding support to the States/UTs in line with the national priorities and the commitments made to the State/UT Governments. The Ministry of Agriculture (Department of Animal Husbandry, Dairying and Fisheries- DAHD&F), within the purview of its allocated business, helps the coastal States/UTs in development of fisheries within the territorial waters, besides attending to the requirements of the sector in the EEZ. Therefore, management of fishery exploitation in the EEZ requires close coordination between the Union and the States.

As explained above, both the Union and the State Government agencies manage fisheries activities. At the Centre, the DAHD&F is the focal point, and in the State/UTs, it is the Department of Fisheries (DoF). Other Central Ministries/Departments like the Ministry of Commerce and Industry (MoCI), Ministry of Earth Sciences (MoES), Ministry of Food Processing Industries (MoFPI), Ministry of Environment and Forests (MoEF) play important role in various aspect of fisheries resources management. At the national level, the Ministry of Defence (MoD) through the Indian Coast Guard (ICG) is also associated with the management of fisheries in the EEZ.

Role of Central Government: The DAHD&F, which is responsible for fisheries development and management in the country, formulates developmental strategies for the sector and issues policy guidelines for fisheries development and management. It also provides technical and financial assistance for the purpose to various States/UTs. The financial assistance is over and above the budgetary support provided to the States by the Planning Commission.

To promote export of fish and fish products, the Government of India established the Marine Products Export Development Authority (MPEDA) under the MoCI in 1972. While the processing aspect fall under the MoFPI, the control of marine biodiversity and marine pollution falls under the jurisdiction of MoEF and the MoES. ***Table 6*** gives a brief overview of institutional structure for marine fisheries management in India.

Table 6: Institutional setting for marine fisheries development in India

Item	Agency / Ministry / Department
· Deep sea fishing (List I) · Survey & assessment of fisheries resources · Research · Training & extension . Fisheries development	Ministry of Agriculture /DAHDF, Indian Council of Agricultural Research Fisheries Survey of India, National Fisheries Development Board Ministry of Earth Sciences (MoES)
· Monitoring of fishing by foreign vessels (List I) · Prevention of marine pollution by ships	Ministry of Defence/Coast Guard
· Protection of endangered species (Wildlife Protection Act, 1972)	MoEF
· Fish processing · Processing units .Exports	Ministry of Food Processing Industries/ Ministry of Commerce & Industry (MoCI) - MPEDA and NFDB
· Seafood exports (List I) · Quality control	MoCI - MPEDA Export Inspection Council
· Law of the Sea negotiations (List I)	Ministry of External Affairs
· Potential fishing zones · Monitoring ocean pollution	MoES
· Fishing vessel industry (List I) · Major fishing ports (List I) · Minor fishing ports (List II)	Ministry of Shipping, Road Transport and Highways/, Ministry of Agriculture, State Governments
· Fisheries in Territorial Waters (List II)	State Governments
· Protection of marine biodiversity (List III)[11] · Protection of coastal habitats (List III) · Focal point for Ramsar, CITES, CMS & CBD Conventions (List III)	Ministry of Environment and Forests (MoEF) MoES
Infrastructure	Ministry of Agriculture/MoCI, MPEDA

Role of the State Governments: The State/UT Governments are the principle custodians of fisheries and aquaculture activities in their respective jurisdictions (land as well as the territorial waters). In the marine sector, they are responsible for fisheries development and management with the main objectives of planning and development of infrastructure facilities for landing and berthing of fishing craft, creating suitable marketing facilities, implementation of various fisheries development programmes *viz*., channelising financial assistance for purchase of fishing implements, implementation of socio-economic programmes and interactions with the Government of India and other agencies for technical and financial assistance. Each State/UT has a Department of Fisheries, which functions as its main implementation agency for fisheries and aquaculture development programmes.

[11] ***Concurrent List***

2.9.2 Fisheries legislation

For sustainable development of the marine resources, India amended its constitution in 1976. The Indian Parliament enacted the Territorial Sea, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Acts in 1976, pursuant to which a 200 nautical mile EEZ was established. Since then, India has also enacted a number of other laws and regulations, including the Marine Products Export Development Authority Act, 1972; the Indian Coast Guard Act, 1978, the Maritime Zones of India (Regulation of Fishing by Foreign Vessels), Act, 1981 and the related Rules of August, 1982, the Environment Protection Act, 1986, etc. The other Central legislation, which has important bearing on the fisheries sector include the Merchant Shipping Act, 1956 and the Wildlife Protection Act, 1972. However, there is still no law to regulate the wholly Indian-owned fishing vessels operating in the EEZ. A Bill prepared by the DAHD&F to regulate fishing in the Indian EEZ is under process.

The Marine Fishing Regulation Act (MFRA) of the maritime States/UT Governments and the Maritime Zones of India (Regulation of Foreign Fishing Vessels) Act, 1981 of the Government of India provide for prohibition of fishing by mechanized fishing vessels in the areas earmarked for traditional and small-motorized crafts. For monitoring the fishing activities to be carried out in different assigned fishing zones by respective fleets, patrol boats have been provided under a Central Scheme to the Department of Fisheries of the maritime States. The resources monitoring surveys conducted by the FSI, Mumbai are being linked with the management measures to be evolved and applied for sustainable development of fisheries in the country.

The inland fisheries sector is regulated through the provisions of the Indian Fisheries Act, 1897, which has been repealed by most of the inland States as their own Act. Many States have also formulated stand-alone acts for regulating specific activities such as seed production, etc. Regulation of coastal aquaculture is being carried out through the Coastal Aquaculture Authority Act, 2005. Further, a model bill for regulation of inland fisheries and aquaculture has been prepared by the DAHD&F and is under circulation to the States for their consideration. Similarly, Guidelines for Fish Seed Certification have also been prepared and circulated to the States.

2.10 R & D support to the sector

2.10.1 Fisheries development

Central Institute of Fisheries, Nautical and Engineering Training, Kochi: The Central Institute of Fisheries, Nautical & Engineering Training (CIFNET) was established in 1963 by the Ministry of Agriculture, Government of India at Cochin. Subsequently, two units of the Institute were set up at Chennai and at Visakhapatnam. The primary objective of CIFNET is to make available sufficient number of trained operatives for fishing vessels and technicians for shore establishments. The Institute conducts various courses including (i) four year degree course ‘Bachelor of Fishery Science (Nautical Science)’ approved and affiliated by Cochin University of Science & Technology and recognized by the University Grants Commission; (ii) Two Trade courses-

Vessel Navigator & Marine Fitter of two years duration, approved by the Ministry of Labour and affiliated to the National Council for Vocational Training (NCVT); and (iii) short-term training programmes for the benefit of students from professional colleges, sister organizations, Department of Fisheries of the State/UT Governments, etc.

National Institute of Fisheries Post Harvest, Technology & Training, Cochin: The National Institute of Fisheries Post-Harvest Technology and Training (NIFPHATT), formerly known as the Integrated Fisheries Project (IFP) was set up in October 1952 when a tripartite agreement between the Government of Norway, India and the United Nations was signed to set up an Indo-Norwegian Project (INP) for fisheries and fishermen community development at Neendakara in the then Travancore- Cochin State (present Kerala State). In 1961 the Project moved to Kochi and in 1972 the administration of the Project was completely taken over by the Government of India and the INP was renamed as IFP. In 2008, the IFP was further renamed as the National Institute of Fisheries Post-Harvest Technology and Training. The Institute is now mainly mandated to develop value added products by way of process and product diversification; technology development and transfer to beneficiaries consisting of rural fishermen community; capacity building and popularisation and test marketing of value added products of fish varieties including low value, unconventional species and seasonally abundant fishes. The Project also has a unit in Visakhapatnam.

Fishery Survey of India, Mumbai: The FSI is responsible for survey and assessment of marine fishery resources of the Indian EEZ. The FSI has six operational bases at Mumbai, Mormugao and Kochi along the west coast, Chennai and Visakhapatnam along the east coast and Port Blair in the Andaman & Nicobar Islands. A total of 13 ocean ongoing survey vessels are deployed for fisheries resources survey and monitoring for various commercially important fin and shell fish species and other biological investigations. Besides resource survey, the FSI monitors fishery resources for the purpose of regulation and management, makes an assessment of suitability of different types of craft and gear for deep-sea and oceanic fishing, imparts in-vessel training to CIFNET/Polytechnic trainees, disseminates information on fishery resources through various media to the fishing community, industry, other end users, etc.

Central Institute of Coastal Engineering for Fishery, Bangalore: The Central Institute of Coastal Engineering for Fishery (CICEF) formerly known as the office of the Pre-Investment Survey of Fishing Harbours (PISFH), under the Ministry of Agriculture was established in January 1968, under technical and manpower assistance from the FAO of the United Nations. The main objectives were to identify potential fishery harbour sites existing along the coastline of the country; to undertake engineering and economic investigations for selected fishery harbour sites; and to prepare techno-economic feasibility reports. The office of PISFH was renamed as CICEF in August 1983 and additional mandates were entrusted to undertake reconnaissance surveys for selection of suitable sites in the maritime states for development of brackish water shrimp culture farms.

National Fisheries Development Board, Hyderabad: The National Fisheries Development Board (NFDB) was set up in July, 2006 to realize the untapped potential of fisheries sector in inland and marine fish capture, culture, processing & marketing of fish, and overall growth of the sector with the application of modern tools of research & development including biotechnology for optimizing production and productivity. The activities of the Board are focused towards increasing fish production of the country to a level of 10.3 mmt, to double the exports and provide employment to 3.5 million people by extending assistance to various agencies for implementation of activities under inland, brackish water and marine sectors. It is also mandated to be a platform for public-private partnership in fisheries sector.

Coastal Aquaculture Authority, Chennai: The Coastal Aquaculture Authority (CAA) was established under the Coastal Aquaculture Authority Act, 2005. The main objective of the Authority is to regulate coastal aquaculture activities in coastal areas of the country in order to ensure sustainable development without causing damage to the coastal environment. The Authority is empowered to make regulations for the construction and operation of aquaculture farms in coastal areas, inspection of farms to ascertain their environmental impact, registration of aquaculture farms, fixing standards for inputs and effluents, removal or demolition of coastal aquaculture farms, which cause pollution, etc. For the purpose of registration of shrimp farms, the Authority has constituted State and District Level Committees in all the coastal States/UTs.

2.10.2 Scientific research[12]

The current components of fisheries research can be broadly grouped under the following organizations: (a) Indian Council of Agriculture Research (ICAR) system; (b) Ministry of Agriculture; (c) Ministry of Commerce and Industries; (d) Ministry of Food Processing Industries; (e) Ministry of Earth Sciences and (f) Other Bodies such as the Council of Scientific and Industrial Research and the State Agricultural Universities. However, the ICAR is the main organization for conducting fisheries research in the country and the following institutes form part of the ICAR system:

1. ***Central Marine Fisheries Research Institute (CMFRI), Kochi, Kerala:*** The Institute carries out work on marine fisheries resources and their exploitation besides training and extension programmes.
2. ***Central Inland Fisheries Research Institute (CIFRI), Barrackpore, West Bengal:*** The Institute conducts research activities on open inland water systems and fishery resources in rivers, reservoirs, wetlands, lakes and estuaries besides, extension and training related to these systems.
3. ***Central Institute of Fisheries Technology (CIFT), Kochi, Kerala***: The Institute conducts R & D programmes on design of fishing crafts and gear, fishing technology, fish processing, preservation and also helps in quality control certification for export of fishery products.

[12] ***Fisheries and Aquaculture Research Capabilities and Needs in India – World Bank Technical paper 147 (Fisheries Series)***

4. ***Central Institute of Fisheries Education (CIFE), Mumbai, Maharashtra:*** The Institute is a 'Deemed University' responsible for fisheries education at post graduate and doctoral level. It also takes a lead role in developing and updating syllabus for fisheries education at post graduate and doctoral levels, which provide model for State Agricultural Universities to follow. The Institute also conducts various training programmes catering to State Fisheries Officials and private participants through its regional centres. In view of research being integral part of higher education, CIFE also conducts upstream, basic, applied and action research on various aspects of fisheries and aquaculture, including policy and socio-economics.

5. ***Central Institute of Brackish water Aquaculture (CIBA), Chennai, Tamil Nadu:*** The Institute concentrates on brackish water aquaculture for developing technologies for shrimp and brackish water fish culture systems and also connected extension and training programmes.

6. ***Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar, Orissa:*** The Institute deals with research programme and studies evolving technologies related to production and productivity in freshwater aquaculture as well as extension and training.

7. ***National Bureau of Fish Genetic Resources (NBFGR), Lucknow, Uttar Pradesh:*** The Bureau conducts work on genetic characterization, gene-banking, bio-diversity database and conservation of various fish species. The Bureau coordinates with the resources specific fisheries institute and other national agencies in so far as fish conservation programmes are concerned.

8. ***Directorate of Cold Water Fisheries Research (DCFR), Bhimtal, Uttar Pradesh:*** This Directorate carries out research and studies on coldwater fishery resources and biology, ecology, breeding etc. of cold water fishes. It is also developing hatchery and aquaculture technologies for indigenous and exotic coldwater fishes.

2.10.3 International cooperation

India recognizes and honors that it is a part of the international community and participates fully in global fisheries initiatives. It also acknowledges that many fisheries issues and protection of marine environment, need international and regional cooperation as spelled out in the 1982 United Nations Convention on Law of the Sea (UNCLOS). Fisheries arrangements are the natural outcomes of UNCLOS and the 1995 UN Fish Stocks Agreement. India signed the UNCLOS in 1995 and ratified the Convention in 1996. India has also ratified the UN Fish Stocks Agreement in 2003. Apart from these global initiatives in fisheries, India also actively participates in organizations such as World Trade Organization, Convention on Biological Diversity (CBD), etc, where issues concerning fisheries are articulated and decisions taken on sustainable use of the fisheries resources. The following paragraphs describe India's participation in key UN Fisheries organizations such as the FAO; Regional Fisheries Management Organizations and Regional Fisheries Bodies.

Food and Agriculture Organization of the United Nations

Being a member of the United Nations, India is also a member of the FAO. Since the establishment of FAO in October 1945, India has actively cooperated with FAO

in development and implementation of both binding and non-binding (voluntary) fisheries instruments, the most notable being the Code of Conduct for Responsible Fisheries. To promote sustainable utilization of the fisheries resources and also contribute to national and global food security, India has implemented several technical cooperation projects with assistance from FAO.

Other UN Organizations

Besides FAO, India is also actively participating in fisheries and related matters promoted by other UN Bodies such as the United Nations Development Programme, International Labour Organization, World Maritime Organization, United Nations Environment Programme, etc.

Regional Fisheries Management Organizations

Apart from UN organizations, India is member to several organizations with management and regulatory mandates. These organizations are more focused on conservation of resources and designing of resource allocation rules. A brief description of these Organizations is given below:

The Indian Ocean Tuna Commission (IOTC): The IOTC was established during 1996-97 as an Article XIV body of FAO. Its objective is to promote cooperation among its Members with a view to ensuring, through appropriate management, the conservation and optimum utilization of tuna and tuna-like fishes and encouraging sustainable development of fisheries based on such stocks. The main operational area of the IOTC is the high seas (beyond the EEZ of coastal states in the Indian Ocean) although some of its measures have bearings on EEZ of the countries also. India is a founder member of IOTC.

Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR): The CCAMLR came into force in 1982, as part of the Antarctic Treaty System, in pursuance of the provisions of Article IX of the Treaty. It was established mainly in response to concerns arising from increase in krill catches in the Southern Ocean. CCAMLR is different from many other international fisheries management organisations as it considers both commercial harvesting and conservation of marine living resources from an ecosystem perspective.

Regional Fisheries Advisory Bodies

The regional bodies with advisory mandate on the other hand, assist their member- countries in promoting regional cooperation for sustainable uses of their resources and help in in-country capacity building to move towards this objectives.

The Asia-Pacific Fishery Commission[13] (APFIC): APFIC was established under the APFIC agreement as the Indo-Pacific Fisheries Council in 1948 by the FAO. It is a Regional Consultative Forum and functions as an Article XIV body of the FAO. It works in partnership with other regional organizations and arrangements and members. It provides advice and acts as an information broker to increase knowledge of fisheries and aquaculture in the Asia-Pacific region to underpin decision making.

Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation[14] (BIMSTEC): Bangladesh, India, Sri Lanka, and Thailand formed

[13] ***http://www.apfic.org***

[14] ***http://www.bimstec.org***

an Economic Cooperation in June 1997 and named it BIST-EC. Consequent upon the joining of Myanmar, Nepal and Bhutan, the name was changed to BIMST-EC. In the first Summit on 31 July 2004, the member-countries agreed to change the name to BIMSTEC or the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation. The prime objective of BIMSTEC is to create an enabling environment for rapid economic development, accelerate social progress in the sub-region and promote active collaboration and mutual assistance on matters of common interest. The Fisheries Secretariat of the BIMSTEC is entrusted to Thailand.

Bay of Bengal Programme Inter-Governmental Organisation[15] (BOBP-IGO): The BOBP-IGO evolved from the erstwhile Bay of Bengal Programme of the FAO in 2003. India is the host country of the BOBP-IGO. Other members are Bangladesh, Maldives and Sri Lanka. The objective of the Organisation is to promote and establish responsible fisheries in a time bound manner to ensure socio-economic well-being of the marine fishers and ecological security of fisheries resources in the Bay of Bengal while catalyzing the growth of the sector to substantiate economic development of the member-countries. Major work of the Organisation in recent times include critical policy support to the Government on European Union regulation on catch certification, training programmes on sustainable management of fisheries, capacity building on fisheries data strengthening, technical support for improvement of fisheries harbour, etc.

INFOFISH[16]: INFOFISH was originally launched in 1981 as a project of the FAO. Since 1987, it is an inter-governmental organization providing marketing information and technical advisory services to the fishery industry of the Asia-Pacific region and beyond from its headquarters in Kuala Lumpur, Malaysia.

Indian Ocean Rim Association for Regional Cooperation (IOR-ARC): The Indian Ocean Rim-Association for Regional Cooperation (IOR-ARC) was established in 1997. The Association disseminates information on trade and investment regimes, with a view to helping the region's business community better understand the impediments to trade and investment within the region.

Network for Aquaculture Centres in Asia-Pacific[17] (NACA): NACA is an inter-governmental organization that promotes rural development through sustainable aquaculture. NACA seeks to improve rural income, increase food production and foreign exchange earnings and to diversify farm production.

South Asian Association for Regional Cooperation (SAARC)[18]: SAARC was founded in December 1985 and is dedicated to economic, technological, social and cultural development emphasizing collective self-reliance. Its seven founding members are Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka. Afghanistan joined the organization in 2005. The 16 stated areas of cooperation are agriculture and rural, biotechnology, culture, energy, environment, economy and trade, finance, funding mechanism, human resource

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[15] ***http://www.bobpigo.org***

[16] ***http://www.infofish.org/infofish/about.html***

[17] ***http://www.enaca.org***

[18] ***http://www.saarc-sec.org***

development, poverty alleviation, people to people contact, security aspects, social development, science and technology; communications, tourism.

The South Asia Cooperative Environment Programme[19] (SACEP): SACEP was established in 1982 by the governments of South Asia to promote and support protection, management and enhancement of the environment in the region. SACEP member countries are Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.

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[19] *http://www.sacep.org*

CHAPTER 3.0

3.0 Review of Programmes for Fisheries and Aquaculture Development during the Eleventh Five-Year Plan

3.1 Introduction

The Fisheries Division of the Department of Animal Husbandry, Dairying and Fisheries (DAHD&F), Ministry of Agriculture implemented 17 Central Sector/Centrally Sponsored Schemes during the Ninth Five-Year Plan period (1997–2002). During the Tenth Plan (2002–2007), based on the discussions of the Working Group on Fisheries set up for the Tenth Plan with the Planning Commission and the DAHD&F, the 17 ongoing schemes were converged into seven major schemes. The objective of merging these schemes was to have a comprehensive and focused approach for fisheries development in the country. Subsequently, during the Eleventh Plan period (2007–2012), the scheme on 'Training and Extension', which was operated as a separate scheme up to the end of Tenth Plan, was included as a component under the 'National Scheme on Welfare of Fishermen'. Thus during the Eleventh Plan, six schemes, including the scheme on National Fisheries Development Board (NFDB) were implemented. The names of the six schemes and their allocations are given in ***Table 7*** below.

Table 7: Schemes implemented during the Eleventh Five-Year Plan and their allocation

Sl. No.	Name of the Scheme	Allocation *(Rs. in crore)*
1	Central Assistance to Fisheries Institutes	371.00
2	Strengthening of Database & Geographical Information System for Fisheries Sector	25.00
3	National Fisheries Development Board	1 550.00
4	Development of Inland Fisheries & Aquaculture	350.00
5	Development of Marine Fisheries, Infrastructure & Post-Harvest Operations	300.00
6	National Scheme on Welfare of Fishermen	180.00
	Total	**2 776.00**

Source: Hand Book on Fisheries Statistics, DAHD&F, 2008.

3.2 Financial achievements

The financial achievements under each of the above-mentioned six schemes during the Eleventh Five-Year Plan Period are given in ***Table 8***. The anticipated expenditure (in % against the Revised Estimates or RE) for the schemes during the Plan period is expected to be between 95 to 105 percent with an overall expenditure of around 99 percent. For most of the schemes, the utilization has been 100 percent, barring the scheme on 'Strengthening of Database and GIS for the Fisheries Sector' and 'Assistance to Fisheries Institutes', where the utilization has been low.

Table 8: Financial achievements under different Schemes during the Eleventh Five-Year Plan Period (up to 2010-11)

(Rs. in crore)

Schemes	X I Plan outlay	Total RE till 2010-11	Utilization	BE for 2011-12	Total Expected expenditure	% Utilization of RE
Development of Inland Fisheries & Aquaculture	300	65.28	70.13	24.00	94.13	105.43
Development of Marine Fisheries, Infrastructure & Post-Harvest Operations	350	222.23	230.77	71.00	301.77	102.91
National Scheme on Welfare of Fishermen	180	124.13	124.71	39.00	163.71	100.36
Strengthening of Database and GIS for the Fisheries Sector	25	26.25	24.48	10.00	34.48	95.12
Assistance to Fishery Institutions	371	186.99	165.95	46.00	211.95	90.97
National Fisheries Development Board	1 550	289.2	289.2	108.00	397.2	100.00
Total	**2 776**	**914.18**	**905.24**	**298.00**	**1203.24**	**99.26**

3.3 Physical achievements

The following paragraphs describe the progress under each of the above mentioned six schemes.

3.3.1 Development of marine fisheries, infrastructure and post-harvest operations

During the Tenth Five-Year Plan period, all the schemes concerning marine fisheries were brought under a comprehensive scheme titled 'Centrally Sponsored Scheme on Development of Marine Fisheries, Infrastructure and Post-Harvest Operations' with necessary modifications. In the Eleventh Five-Year Plan, this scheme was implemented with three major components *viz.* (i) Development of Marine Fisheries; (ii) Development of Infrastructure and Post-Harvest Operations; and (iii) Provisions for taking up innovative activities.

The scheme is largely intended to improve the socio-economic conditions of marine fisher folk and the broader objectives are (i) to supplement the efforts of the coastal State/UT Governments for development of marine fisheries sector; (ii) creation of infrastructure facilities for safe landing and berthing of fishing vessels along the country's coastline; (iii) creation of infrastructure facilities for processing and preservation of fish quality thereby reducing post-harvest losses; (iv) to reduce the burden of the fishermen by subsidizing the input cost on High Speed Diesel (HSD); and (v) to improve the safety of

fishermen at sea. The scheme has the following components and sub-components:

A. Development of Marine Fisheries

(i) Motorization of traditional craft,

(ii) Safety of fishermen at sea,

(iii) Fishermen development rebate on HSD Oil,

(iv) Introduction of intermediate craft of improved design including proto-type study of new intermediate vessel design,

(v) Establishment and operation of Vessel Monitoring System,

(vi) Promotion of fuel efficient and environment-friendly fishing practices,

(vii) Management of marine fisheries.

B. Development of Infrastructure and Post Harvest Operations

(i) Establishment of fishing harbours and fish landing centres,

(ii) Strengthening of post-harvest infrastructure,

(iii) Assistance for maintenance dredging of fishing harbours and fish landing centres.

C. Taking up innovative activities

The unit costs and funding pattern of the components and sub-components under marine fisheries and mariculture schemes is detailed in ***Annexure 1***.

The above-mentioned schemes are being implemented in all the coastal States/UTs and the component on 'Strengthening of Post-harvest Infrastructure' is also extended to inland States. The funding pattern varies with components and sub-components. For taking up of innovative projects, 100 percent expenditure is borne by the Centre. The target groups/ beneficiaries of the scheme are fishers, their families and fishery entrepreneurs. The Eleventh Plan outlay for the scheme was Rs. 350 crores and the revised Budget Estimate (BE) for the first four years of the Plan was Rs. 222.23 crores. The financial achievement of the scheme till 2010-11 is given in the ***Table 9*** below and brief progress under each of the schemes is provided in the following paragraphs.

Table 9: Financial achievements under the scheme on 'Development of Marine Fisheries, Infrastructure and Post-Harvest Operations during the Eleventh Plan (up to 2010-11)

(Rs. in crore)

Item / Year	2007-08	2008-09	2009-10	2010-11	2011-12 (BE)	Total
Revised budget estimate	40.50	44.99	61.00	75.74	71.00	293.23
Actual expenditure	41.49	49.56	61.61	78.11	47.42	278.19*

**** Total expenditure up 31 December 2011.***

Development of marine fisheries: This scheme includes seven components and the level of assistance under each component and the physical progress achieved during the Plan period is detailed in ***Table 10***.

Table 10: Physical achievements under the component on 'Development of Marine Fisheries' during the Eleventh Plan

Quantifiable deliverables	Achievements during the first four years of the Plan Period	Physical targets for the entire Plan
Motorization of traditional crafts (nos)	4 908 (98.16 %)	5 000
Safety of fishermen at sea (nos)	1154 (256 %)	450
Fishermen development rebate on HSD oil (KL)	40 993 (12.27 %)	3 34 000
Introduction of intermediate crafts of improved design (nos)	88 (106 %)	83
Promoting resource specific deep sea fishing vessels (nos)	3 (6 %)	50
Promoting fuel efficient and environment-friendly fishing practices	--	5 000
Management of marine fisheries	--	

Motorization of traditional craft: This production-oriented scheme was introduced during the Seventh Five-Year Plan (1985-1990) with the main objectives of (i) technological up gradation of traditional fishing sector; (ii) to help fishermen reduce their physical strain; and (iii) to extend the range of their fishing operation, primarily to increase the quantum of fish catch, income and thereby to uplift their socio- economic status.

During the Eleventh Plan, 50 percent of the unit cost is provided as subsidy subject to a maximum of Rs.30 000 per outboard motor/inboard motor (OBM/IBM) of 8-10 HP. The cost of subsidy is shared equally between the Centre and the States. In case of UTs, full cost is borne by the Centre. As per the data available from the DAHD&F, out of a total of 107 448 traditional crafts in the country, 76 748 have been motorized so far. As against a target of 5 000 crafts to be motorized during the Eleventh Plan, until the end of the fourth year of the Plan, 4 908 crafts were motorized.

Fishermen development rebate on HSD Oil: In order to reduce the pressure on the input costs on account of mounting operational expenses of small mechanized fishing vessels (MFVs) of less than 20m overall length (LoA), the Centrally Sponsored Scheme provides financial assistance to the State Government/UTs for subsidizing the cost of HSD oil used by small MFVs. During the Tenth Plan, the fishermen development rebate was fixed at Rs. 1.50 per liter of HSD oil used by the boats. Keeping in view the increased fuel prices and the demand expressed by various fisher organizations and the State Governments, the Central rebate on HSD oil for MFVs was enhanced. Presently, the rebate is limited to 50 percent of the sales tax exempted by the States with a ceiling of Rs. 3.00 per liter. While approving the scheme in the Eleventh Plan, it was made conditional that the MFVs of <20 meter LoA, registered before the Tenth Plan and owned by fishermen belonging to the

Below Poverty Line (BPL) category would only be eligible to receive the assistance. Further, a ceiling of 500 liters per boat per month during active fishing months was also added to the conditions. Owing to this, many fisher organizations and some of the coastal State Governments have represented for removal of the new conditions. Restoration of the diesel subsidy to all categories of fishermen as demanded by the fisher organizations and States has not been agreed to by the Ministry of Finance.

Due to the above reasons, the physical progress of the scheme was poor and until the end of the fourth year of the Plan, only 12.27 percent of the target could be achieved. Similarly, physical progress under the schemes on 'Promoting resource specific deep sea fishing vessels' and 'Promoting fuel efficient and environment-friendly fishing practices' was also poor and very few beneficiaries opted for assistance under these two components.

Safety of fishermen at sea: This component was introduced to improve the sea safety of fishers to reduce loss of human life and property at sea mainly due to ill-equipped vessels, lack of communication equipment and non-availability of an early warning system on board. Subsidy to the tune of 75 percent of the unit cost of Rs.1.50 lakh per kit consisting of GPS, communication equipment, echo-sounder and search and rescue beacon is provided under the scheme. This component is implemented through State Fisheries Federations/Corporations and Panchayati Raj Institutions. Progress under this component has been very good and as against a target of 450 units, already 1154 units (256 %) have been sanctioned.

Development of infrastructure and post-harvest operations: The Central Government (Ministry of Agriculture) has been implementing a scheme since 1964 to provide infrastructure facilities for landing and berthing of MFVs, traditional and motorized fishing crafts and deep sea fishing vessels. The central financial assistance is provided to various implementing agencies comprising (i) 75 percent to coastal States, Port Trusts, Fishermen Cooperative Societies/ Organizations and 100 percent to UTs for (a) construction of minor fishing harbours (FHs) and fish landing centres (FLCs); and (b) up-gradation/ expansion/repair/renovation of existing minor fishing harbours and FLCs; (ii) 100 percent assistance to coastal States, Port Trusts, Fishermen Cooperative Societies/Organizations for construction of major fishing harbours, including expansion/modernization of existing major fishing harbours; and (iii) 50 percent assistance to private entrepreneurs for construction of major/minor fishing harbours and FLCs on Build, Operate & Transfer (BOT) basis.

Besides, a Central Sector Scheme on 'Post-harvest marketing infrastructure' implemented till the end of Eighth Five-Year Plan (1992-1987) was reintroduced as a component under the present scheme during the Tenth Five-Year Plan with a view to creating necessary facilities to provide remunerative prices to the fishers for their produce and making available fresh fish at reasonable prices to the consumers. Under this scheme, State Fisheries Cooperatives, Cooperative Federations and Primary Cooperatives are assisted in strengthening their post-harvest infrastructure like preservation and cold

storage, fish transport, developing retail fish marketing, setting up of central fish markets in metros and big cities.

The components implemented during the Tenth Plan were continued in the Eleventh Plan and these include (i) establishment of fishing harbours and FLCs; (ii) strengthening of post-harvest infrastructure; and (iii) assistance for maintenance dredging of fishing harbours and FLCs. As mentioned earlier, this scheme also covers assistance to State Fisheries Cooperatives, Cooperative Federations and primary cooperatives for strengthening their marketing infrastructure. Details of the components of this scheme are given in ***Annexures 2 - 4*** and the component-wise physical achievements during the first four years of the Plan period are detailed in ***Table 11*** below.

Table 11: Physical achievements under the component 'Infrastructure Development and Post-harvest Operations' during the Eleventh Plan

Quantifiable deliverables	Achievements during the first four years of the Plan period	Physical Target for the Eleventh Plan
Establishment of Fishing Harbours (FHs) & Fish Landing Centres (FLCs) (nos)	18(11 FHs+4 new FLCs+ repairs to existing 4 FHs)	55 (10 FHs+30 new FLCs+ repairs to existing 10 FHs and 5 FLC)
Strengthening of post-harvest infrastructure (nos)	29 (18 Ice plants + 3 retail outlets + 8 transportation facilities	115 (4 central fish markets+ 36 fish preservation & processing facilities+45 fish retail outlets+ 30 transportation facilities)
Assistance for Dredging of fishing harbours /FLCs	--	--

The scheme has so far received mixed response. While the progress in respect of fishing harbours has been good, it has not been so for the FLCs. Similarly, the component on strengthening of marketing infrastructure has shown tardy progress during the Plan period.

3.3.2 Development of inland fisheries and aquaculture

The objectives of the Centrally Sponsored Scheme on 'Development of inland fisheries and aquaculture' during the Eleventh Plan were to (i) enhance inland fish production and fish productivity; (ii) popularize modern fish farming; (iii) create employment opportunities through fisheries and aquaculture; (iv) diversify aquaculture practices; (v) provide assistance to fish farmers engaged in aquaculture; and (vi) provide training to farmers through the Fish Farmers' Development Agencies (FFDAs) and the Brackish water Fish Farmers' Development Agency (BFDA).

The salient features of the scheme include provision of subsidy for fish farmers for construction of new ponds and renovation of existing ponds and tanks; first

year inputs like fish seed, feed, fertilizers and other inputs; setting up of fish seed hatcheries and fish feed mills and creation of a cadre of trained and well organized fish farmers fully engaged in aquaculture. The structure and components of the scheme are as follows:

i) Development of freshwater aquaculture,
ii) Development of brackish water aquaculture,
iii) Coldwater fisheries and aquaculture,
iv) Development of waterlogged areas,
v) Productive utilization of inland saline/alkaline soils for aquaculture,
vi) Integrated development of inland capture resources (reservoirs/rivers, *etc*),
vii) Innovative projects.

A total of 429 FFDAs has been sanctioned over successive Plan periods in the country. Besides, 39 BFDAs have also been sanctioned so far to promote coastal aquaculture practices. Thus all potential coastal and inland districts have been covered for undertaking aquaculture in the country. During the last one decade, the FFDAs have covered an additional 2.20 lakh ha water area for freshwater aquaculture, imparted training to an additional 2.70 lakh fish farmers and benefiting about 3.70 lakh people. Since inception of the scheme, these FFDAs have covered a water area of about 7.50 lakh ha under improved aquaculture practices with an average productivity of about 2 850 kg/ha/year and imparted training in scientific aquaculture to about 9.00 lakh fish farmers in the country. The number of beneficiaries under FFDA is reported to be 13.00 lakh. It is further reported that a water area of over 36 000 ha has been covered under brackish water aquaculture, imparting training to over 32 000 fish farmers and benefiting more than 25 000 fish farmers.

Besides FFDAs and BFDAs, the National Federation of Fishermen Co-operatives Limited (FISHCOPFED), an apex body of fisher cooperatives in the country and the Fisheries Institutes under the Indian Council of Agriculture Research (ICAR), Department of Agriculture Research and Education, Ministry of Agriculture are also assisting in the implementation of the scheme by providing research inputs form time to time.

The funding assistance under the scheme is shared between the Centre and States on 75:25 basis for all the components of the scheme except towards Aquatic Quarantine & Inspection Unit and Network of Diagnostic Laboratories for Aquatic Animal Health for which 100 percent expenditure is met by the Centre. All fish farmers and fisheries co-operative societies engaged in aquaculture activities are eligible for assistance under the scheme. The unit cost and funding pattern is given in ***Annexures 5-11***.

A Central assistance of Rs. 300.00 crore was proposed under the scheme and the revised budget estimate for the first four years of the Plan was kept at Rs. 65.28 crores. ***Table 12*** provides financial achievement under the scheme during the first four years of the Eleventh Plan.

Table 12: Financial achievements under inland fisheries and aquaculture scheme during the Eleventh Plan till 2010-11

(Rs. in crore)

Item / Year	2007-08	2008-09	2009-10	2010-11	Total	BE-2011-12
Revised budget estimate	12.03	12.90	19.00	21.35	65.28	24.00
Actual expenditure	12.84	13.60	20.75	22.94	70.13	--
% utilization	106.73	105.43	109.21	107.45	107.43	--

Under the scheme, the target for bringing the area under improved practices of aquaculture was 1.85 lakh ha against which 1.1882 lakh ha area was brought under improved practices in the first four years of the current Plan period ***(Table 13)***. Further, as against a target of 1.25 lakh farmers, 1.74 lakh farmers were trained in scientific aquaculture practices.

Table 13: Physical achievements under inland fisheries and aquaculture scheme during the Eleventh Plan till 2010-11

Quantifiable deliverables	Target	Achievement	% achievement
Area to be brought under fish cultivation (lakh ha)	1.85	1.1882 (Both FW& BW)	64.22
Training of fish farmers (lakh no.)	1.25	1.74	139.2

3.3.3 National scheme for welfare of fishermen

The main objectives of this scheme are to provide basic amenities like housing, drinking water, community hall, etc. for fisher communities; facilitate better living conditions for fishers and their families; improve the social and economic security of active fishers and their dependents; and update their knowledge and skills to practice sustainable fishing. The scheme has four components: (i) Development of Model Fishermen Villages; (ii) Group Accident Insurance for Active Fishermen; (iii) Saving-cum-Relief; and (iv) Training & Extension.

In the first three components of the scheme, assistance is shared on 50:50 basis by the Centre and the State Governments, with 100 percent assistance to the UTs. In case of North-Eastern (NE) States, assistance is shared on 75:25 basis between the Centre and the NE State Governments. Assistance for the scheme on 'Training & Extension' is shared on 80:20 basis between the Centre and the States, with 100 percent assistance to UTs and FISHCOPFED. Details of the unit cost are given in ***Annexures12-13***. Fishers and fishing villages throughout the country are eligible under this scheme. The States/UTs and FISHCOPFED are the main implementing agencies of this scheme.

The budget allocation for the scheme during the Eleventh Plan was Rs. 180.00 crore and the anticipated expenditure is over Rs. 124.00 crore till 2010-11, accounting for 69 percent of the target outlay ***(Table 14).***

Table 14: Financial achievements under National Scheme of Welfare of Fishers during the Eleventh Plan (till 2010-11)

(Rs in crore)

Item / Year	Outlay	2007-08	2008-09	2009-10	2010-11	Total	2011-12 (BE)
Revised budget estimate	180.00	20.88	25.00	36.00	42.25	124.13	39.00
Actual expenditure	123.13	21.38	25.15	36.23	41.94	124.70	
% utilization	68.96	102.39	100.60	100.64	99.27	100.46	

Group insurance for active fishers: This component provides insurance cover to fishermen against accidental death or permanent total disability and permanent partial disability. The scheme is implemented through FISHCOPFED. The physical targets of the component are already met as 37 lakh fishers have been covered under insurance during the first four years of the Plan period.

Development of model fishermen villages: Basic amenities such as housing, drinking water and construction of community hall for fishermen are provided under this component. A fishermen village may consist of not less than 10 houses. The villages would be provided with tube wells at the rate of one tube well for every 20 houses. For recreation and common working place, a fishermen village with at least 75 houses is eligible to avail financial assistance for construction of a community hall. Unit costs under the scheme are Rs.50 000 for a house, Rs.30 000 for the tube-well (Rs.35 000 for NE Region) and Rs.1 75 000 for community hall. The Government has increased the unit cost for a fisherman's house from Rs.40 000 to Rs.50 000 during the Eleventh Five-Year Plan. About 7 000 houses are constructed on an average per annum under this scheme.

Saving-cum–Relief scheme (SCR): This component provides financial support to fishers during lean fishing season. To avail the benefits, the beneficiary contributes a part of his earnings during the non-lean months. The Central and State Governments make equal contributions and the accumulated amount is distributed back to fishers in four/three equal installments. About 3.5 lakh fishers have benefited under the SCR scheme.

Fisheries training and extension: This scheme was merged with the 'Welfare Programme for Fishermen' from 2005-06 onwards. The main objective of this component is to provide training to fishery personnel to enhance their extension skills. Assistance is provided to fisher folk in upgrading their skills, for setting up/up-gradation of training/awareness centres in States/UTs. This scheme is being operated with 80 percent Central assistance in case of States and 100 percent for UTs. The other components include publishing of manuals, providing adequate extension material, production of video films on technologies, conducting meeting/workshops/seminars, etc. of national importance. The component has resulted in training of more than 7 000

fishermen per annum. ***Table 15*** below provides a snapshot of the physical progress under the scheme.

Table 15: Physical achievements under National Scheme of Welfare of Fishers during Eleventh Plan (till 2010-11)

Item / activity	Target	Achievement
Fishers covered under insurance scheme (lakh nos.)	25	37
Construction of houses for fishers (Unit nos.)	65 000	29 543
Fishers covered under Saving-cum-Relief scheme (lakh nos.)	5	7.58
Establishment of Training Centres (nos.)	30	18
Training of fishers (unit nos.)	20 000	27 048

3.3.4 Centrally Sector Scheme on strengthening of database and Geographical Information System for fisheries sector

The scheme commenced during 2007-08 by modifying the earlier scheme on 'Strengthening of Database and Information on Networking for the Fisheries Sector' and by including some new components. The main objectives of this scheme are to (i) improve the database on inland and marine fisheries resources and fish production using sound statistical and scientific methodology; (ii) improve the use of Geographical Information System (GIS) in the States/UTs and by other concerned implementing agencies; and (iii) register all fishing vessels in the country and carry out census on marine fisheries.

The salient features of the scheme are to improve the efficiency and quality of data as well as reduction in time lag in preparation and submission of survey reports; estimate fish production from both inland and marine resources of the country; and provide comprehensive data base on the fishery sector so as to facilitate planning process at the State/UT and Central levels. The scheme is being implemented with the following components:

- Sample survey for estimation of inland fishery resources and their potential and fish production,
- Census of marine fisheries,
- Catch assessment surveys for inland and marine fisheries,
- Development of Geographical Information System of the fisheries sector,
- Assessment of fish production potential in coastal areas,
- Evaluation studies/professional services,
- Registration of fishing vessels,
- Development of database of fisheries cooperative in India,
- Mapping of smaller water bodies and development of GIS-based fishery management system,
- Strengthening of Statistical Unit at Headquarters.

The scheme is applicable to the entire country and provides 100 percent Central grant-in-aid to the State Governments/UT Administrations and other implementing agencies. Besides the State Government/UT Administrations, the CMFRI, FSI, CIFRI and FISCOPFED are the other implementing agencies.

The budget allocation for the scheme was Rs. 25.00 crore and till 2010-11 the expenditure is Rs. 24.48 crore, accounting for 98 percent of the targeted outlay ***(Table 16)***. The budget allocation has now been increased to Rs. 48.00 crore. With one year of the current Plan period left, the revised allocation may be difficult to achieve.

Table 16: Financial achievements under the scheme on 'Strengthening of Database and Geographical Information System for Fisheries Sector' during the Eleventh Plan (until 2010-11)

(Rs. in crore)

Item /Year	Outlay	2007-08	2008-09	2009-10	2010-11	Total	2011-12 BE
Revised budget estimate	25.00/ 48.00	2.80	3.00	10.00	10.55	26.35	10.00
Actual expenditure	24.48	2.53	2.40	10.08	9.47	24.48	
% utilization	97.92	90.36	80.00	100.80	89.76	92.90	

The physical progress under various components of the scheme on 'Strengthening of Database and Information on Networking for Fisheries Sector' is given in ***Table 17*** below.

Table 17: Physical achievements under the scheme on 'Strengthening of Database and Geographical Information System for Fisheries Sector' during the Eleventh Plan (till 2010-11)

Item/activity	Target	Achievement
Catch assessment survey of inland and marine fisheries	All States/UTs	Under progress
Development of GIS of inland water bodies	All States/UTs	***
Information technology networking in States	All States/UTs	Under progress
Marine fisheries census	All coastal States/UTs	Data collection completed
Registration of fishing vessels	All coastal States/UTs	Data digitalization is under progress
Development of data base of fisheries cooperatives.	All States/UTs	Under progress

******Linear Image Self Scanning (LISS-III) completed for all States; LISS-IV/Panchromatic Image completed for selected States; Mapping of water bodies completed in selected States; E–Atlas published in 9 States.***

3.3.5 Assistance to fisheries institutes

The DAHD&F, Ministry of Agriculture has four institutions under its fold and provides direct assistance to them under a Central Sector Scheme. These institutions include the Central Institute for Fisheries Nautical and Engineering Training, Kochi; Central Institute for Coastal Engineering for Fisheries, Bengaluru; National Institute for Fisheries Post-Harvest Technology & Training, Kochi and Fishery Survey of India, Mumbai. Besides these four Institutes, the DAHD&F also has two institutions, namely the National Fisheries Development Board, Hyderabad and the Coastal Aquaculture Authority, Chennai that have autonomous status with respect to their working.

Central Institute of Fisheries, Nautical and Engineering Training (CIFNET), Kochi: The primary objective of CIFNET is to make available sufficient number of trained operatives for fishing vessels and technicians for shore establishments. The Institute conducts various courses including (i) four year degree course 'Bachelor of Fishery Science (Nautical Science)' approved by and affiliated to the Cochin University of Science & Technology, Kochi and recognized by the University Grants Commission; (ii) Two Trade courses- Vessel Navigator course (VNC) & Marine Fitter Course (MFC) of two years duration and approved by the Ministry of Labour and affiliated to the National Council for Vocational Training (NCVT); and (iii) short-term training programmes for the benefit of students from various professional colleges, sister organizations, Department of Fisheries of the State/UT Governments, Indian Coast Guard, etc. About 100 persons were trained in the two main courses B.F.Sc (Nautical Science) and VNC/MFC in addition to short-term training programmes conducted on a regular basis.

National Institute of Fisheries Post-Harvest, Technology & Training (NIFPHATT), Cochin: The NIFPHATT, as its name suggests, undertakes various activities in post-harvest fisheries, including value addition of fin and shell fish species for the benefit of small-scale operators. During the Plan period, the Institute has processed more than 150 tonnes of raw fish and marketed about 105 tonnes of fish and fish products on an average per annum besides, imparting training in various disciplines on a regular basis. The Institute is also engaged in taking value addition of fin and shell fishes to the rural areas for the benefit of women processors.

Fishery Survey of India (FSI), Mumbai: The FSI has 13 ocean ongoing vessels, which are deployed for fisheries resource survey and monitoring various commercially important fin and shell fish species and conducts other biological investigations. Besides resource surveys, the FSI monitors fishery resources for the purpose of regulation and management, makes an assessment of suitability of different types of craft and gear for deep-sea and oceanic fishing, imparts in-vessel training to CIFNET/Polytechnic trainees, disseminates information on fishery resources to the fishing community, industry, other end users, etc. The FSI operates more than 1 000 fishing days from its six bases located on the west and east coasts and the UT of Andaman and Nicobar Islands, expending a fishing effort of 2 500 fishing hours for

bottom and mid- water trawl surveys and about 1.80 lakh hooks operated for oceanic and other long lining surveys on an average per annum.

Central Institute of Coastal Engineering for Fishery (CICEF), Bangaluru: The CICEF monitors the progress of construction of ongoing fishing harbours sanctioned under the Centrally Sponsored Scheme by the DAHD&F and renders technical guidance to the maritime States/UTs in the implementation of infrastructure projects. The Institute till the end of December 2010 has carried out engineering and economic investigations for development of fishery harbours and fish landing centres at 81 sites and prepared Techno- Economic Feasibility Reports for 82 sites.

The total outlay under this scheme during the current Plan was Rs. 371 crore. The total utilization till 2010-11 was about Rs.166 crore, which is 44.73 percent of the outlay ***(Table 18)***.

Table 18: Financial achievements under the scheme on 'Assistance to Fisheries Institutes' during the Eleventh Plan (till 2010-11)

(Rs. in crore)

Item /Year	Outlay	2007-08	2008-09	2009-10	2010-11	Total	2011-12 BE
Central Institute for Fisheries Nautical & Engineering Training							
Revised budget estimate	--	10.30	7.00	5.85	7.96	31.11	9.00
Actual expenditure	--	4.39	7.18	4.95	6.44	22.96	--
% utilization	--	42.62	102.57	84.62	80.90	73.80	--
Central Institute for Coastal Engineering for Fisheries							
Revised budget estimate	--	0.00	0.10	0.10	0.10	0.30	0.00
Actual expenditure	--	0.00	0.13	0.10	0.09	0.32	--
% utilization	--		130.00	100.00	90.00	106.67	--
National Institute for Fisheries Post-Harvest Technology & Training							
Revised budget estimate	--	1.59	2.00	1.95	2.00	7.54	2.00
Actual expenditure	--	1.40	1.74	1.96	1.83	6.93	--
% utilization		88.05	87.00	100.51	91.50	91.91	--
Fishery Survey of India							
Revised budget estimate	--	30.04	38.50	37.50	42.00	148.04	35.00
Actual expenditure	--	28.13	31.87	38.75	36.99	135.74	--
% utilization	--	93.64	82.78	103.33	88.07	91.69	--
Assistance to all Fisheries Institutes							
Revised budget estimate	371.00	41.93	47.60	47.60	52.06	189.19	46.00
Actual expenditure	165.95	33.92	40.92	45.76	45.35	165.95	--
% utilization	44.73	80.90	85.97	96.13	87.11	87.72	--

Coastal Aquaculture Authority (CAA), Chennai: The Coastal Aquaculture Authority (CAA) was established under the Coastal Aquaculture Authority Act, 2005. The Authority is a quasi-judicial body and its main objective is to regulate aquaculture activities in the coastal areas of the country in order to ensure sustainable development without causing damage to the environment. The CAA is headed by a retired judge of the Madras High Court. The Authority is empowered to make regulations for construction and operation of aquaculture farms, inspection of farms to ascertain their environmental impact, registration of aquaculture farms, fixing standards for inputs and effluents, removal or demolition of aquaculture farms, which cause pollution, etc. For the purpose of registration of shrimp farms, the Authority has constituted State and District Level Committees. The Authority is now also monitoring introduction of exotic shrimp species for farming in the country.

National Fisheries Development Board (NFDB), Hyderabad: The NFDB, a registered body under the administrative control of the DAHD&F, was registered on 10th July, 2006. The aim of the Board is to realize the untapped potential of fisheries sector in inland and marine fish capture, culture, processing and marketing of fish and overall growth of the sector with the application of modern tools of research and development including biotechnology for optimizing production and productivity. The activities of the Board are focused towards increasing fish production of the country to a level of 10.3 mmt during the Eleventh Plan period, to double the exports and provide employment to people by extending assistance to various agencies for implementation of activities under inland, brackish water and marine sectors. It is also mandated to be a platform for public-private partnership in fisheries sector. During the Plan period, the Board has implemented a wide range of activities to support fisheries and aquaculture development in the country.

The NFDB has been allocated Rs. 1 550.00 crore for the Eleventh Plan period (2007-08 to 2011-12). The overall allocation of funds and utilization for the years 2006-07 to 2011-12 is given below in ***Table 19*** and the scheme-wise physical and financial performance is detailed in ***Annexure 14***.

Table 19: Financial performance of the NFDB

(Rs. in crore)

Year	Opening Balance	BE	RE	Funds released by GoI	Total funds available with NFDB	Funds utilized	Closing Balance
2006-07	--	150.00	30.00	30.00	30.00	3.66	26.34
2007-08	26.34	101.0	50.00	50.00	76.34	27.09	49.25
2008-09	49.25	75.0	46.90	46.90	96.15	71.28	24.87
2009-10	24.87	135.0	100.00	100.00	124.87	85.52	39.35
2010-11	39.35	92.30	92.30	92.30	131.65	131.35	0.30
2011-12	0.30	108.00	--	36.00	36.30	36.00	--
(as on 15.9.2011)			--	355.20	--	354.90	--

(*refund of unspent balances not included)

Most of the schemes undertaken by NFDB performed satisfactorily. Considering the necessity of the schemes for fisheries development in the country, these are recommended to be continued with suggested modifications in most of the

components. It is felt that the Board can play a much bigger role in the fisheries development of the country and it needs to be strengthened with adequate workforce support, field-level agencies to support the activities at the grassroots level and also availability of funds during the Twelfth Plan period.

3.4 Plan budget utilization

It is seen from the above that the achievements as well as fund utilization by the DAHD&F for fisheries development programmes has been satisfactory as against the revised budget estimates. However, the utilization of the funds against the total outlay of the Plan is comparatively low. While ***Table 20*** below provides a gross picture of the budget utilization at the end of the fourth year of the Eleventh Plan, ***Annexure 15*** provides a detailed breakup of the year-wise budget estimate (BE), revised estimate (RE) and actual expenditure in respect of all the Centrally Sponsored and Central Sector Schemes implemented by the DAHD&F. The annexure also provides information on the expenses incurred under the schemes until 31 December 2011.

Table 20: Budget utilization during the Eleventh Five-Year Plan

Items	Amount (Rs. in crore)
Outlay	2 776.00
Revised budget estimate (RE) till 2010-11	914.18
Expenditure till 2010-11	905.25
% utilization of (RE) till 2010-11	110.47
Anticipated expenditure 2011-12	298.00
Total expenditure	**1 203.25**

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CHAPTER 4.0

4.0 Indian Fisheries: Issues and opportunities

4.1 Introduction

In the last sixty years of planned development, the Indian fisheries sector has gone through various phases of development. While the earlier phases were marked by introduction of technologies, mechanization and motorization of the fishing vessels, popularization of fish farming in fresh and brackish waters and creation of infrastructure, the latter decades have felt the need for sustainability and optimizing fish yield from both capture fisheries and aquaculture. In recent years, the shift from traditional emphasis on revenue generation to sustainable development is also visible. The sector's overall contributions to the economy and creation of livelihoods for resource-poor rural communities have been phenomenal and with increasing population, the demand for fish food is also on the rise. However, the sector today stands at cross-roads, where good governance and management is the key to achieving sustainability.

This chapter highlights the issues and opportunities before the fisheries sector in India and discusses ways and means to achieve production hikes without losing focus on sustainable development of the resources.

4.2 Marine fisheries

4.2.1 Achieving sustainability

The marine fisheries sector in India occupies an important place in the socio-economic development of the country. Marine fish production has increased through the Five-Year Plans, reaching 3.22 mmt in 2010-11. Many factors have contributed to this increase. To illustrate a few - (i) introduction of mechanized fishing vessels and synthetic gear material and development of infrastructure for preservation, processing and storage in 1950s; (ii) expansion of trawl fleet and indigenous boat construction in 1960s; (iii) introduction of purse seining, diversification of fishing, development of fishing harbours and expansion of seafood exports in 1970s; and (iv) motorization of traditional fishing craft and increase in number and efficiency of craft and gear in 1980s and 1990s. Thus marine fishery, a subsistence vocation at the time of independence, is today a capital intensive activity with significant contributions to the country's fish food supply, creation of livelihoods and foreign exchange earnings through seafood exports.

The annual harvestable potential yield in the Indian EEZ has recently been re-validated by a Working Group set up by the DAHD&F, Ministry of Agriculture, Government of India. This re-validated yield of 4.419 mmt yield comprises 2.128 mmt of pelagic resources; 2.083 mmt of demersal resources; and 0.280 mmt of oceanic resources. As compared to the last estimate carried out in 2000, the current estimate is about 0.5 mmt more. An estimation of the

depth-wise catch shows that about 86.84 percent (3.837 mmt) of the resources are available in 0-100 m depth zone; 5.86 percent (0.259 mmt) in the 100-200m depth zone and 2.59 percent (0.115 mmt) in the 200-500 meter depth zone. The resources in oceanic area have been estimated as 0.208 mmt, which is 4.71 percent of the total potential.

India is blessed with a long coastline and abundant shelf area located in a tropical regime, providing vast potential for marine fish production. The nutrient inflows from the large number of rivers and their tributaries on both the coasts have made conditions favourable for propagation and growth of a huge diversity of fin and shellfish species. However, the country has not fully capitalized on this large resource size and unique position in terms of production and productivity. This is mainly due to unfettered growth of the fishing fleet, lack of awareness and poor compliance of the prevailing rules and regulations by the marine fishers and weak enforcement measures on part of the management authorities. Resultantly, marine fish production has been fluctuating between 2.5- 3.0 mmt since the mid-nineties.

Historically, India has been a coastal fishing nation and this is adequately reflected in the concentration of fishing vessels in the 0-100 meter depth zone. Consequently, the production potential of this zone has been fully exploited. The sizes (length and weight) of many commercially important fish species landed in the catch provide ample proof of the trend of exploitation of stocks from the coastal waters. Various scientific studies conducted by the CMFRI point towards 'fishing down the food chain', which does not auger well for long-term sustainability of the resources.

The growth of the fishing fleet in the country has been phenomenal with the artisanal fleet (including motorized boats) increasing by about 110 percent from the 1960s to 1990s and the mechanized fleet by about 570 percent during the same period. This increase in number of fishing vessels has been duly complemented by improved and more efficient gear and enhanced capacities of the engines, both for propulsion and hauling of gear.

This increase in the fishing fleet (both in number and power) has resulted in over capacity of boats operating in many inshore waters. Such a critical situation warrants effective management of the boats as well as stocks in the coastal waters for sustaining the current production. If the critical issues in marine fisheries sector are properly addressed and the opportunities are effectively tapped, production from the marine sector can be harvested on sustainable basis.

Motorization of traditional crafts: This scheme was introduced during the Seventh Plan period, with the objective of (i) technological up-gradation of traditional fishing sector, (ii) removing the drudgery of traditional fishers and (iii) to help them extend the range of their fishing operations to increase income and thereby to uplift their socio-economic status. Since inception, the scheme has been modified on a couple of occasions, increasing the quantum of assistance as also allowing for a second dose of subsidy.

As per the 2005 National Marine Fisheries Census (NMFC, 2005), 76 748 traditional crafts have been motorized since inception of the scheme. The motorization has not been evenly distributed in the coastal states. While some States like Tamil Nadu and Kerala have used the assistance under the scheme to the full extent, other states like Odisha, West Bengal and Andhra Pradesh have lagged behind. Allowing a second dose of subsidy has also led to poor maintenance and upkeep of the engines in some States. While on the east coast, diesel engines (Greaves Lombardini) are popular, on the west coast, especially in Kerala, the imported Yamaha and Suzuki engines, which run on kerosene oil, are dominantly used.

In recent years there is an increasing demand for imported 4-stroke engines, which are more efficient than their 2-stroke version, but would still be running on kerosene/petrol. On the other hand, the diesel engines are indigenously made and are much cheaper. In the diesel section, Chinese engines have also been introduced, which have higher horse power and are comparatively cheaper, but have a shorter life span than the Indian make. In the wake of these developments, any suggestion for revision in the assistance for motorization of traditional crafts appears difficult. However, keeping in view the fact that motorization of traditional crafts has been useful for the artisanal fishers, the continuation of this scheme in the Twelfth Plan has to be guided by certain parameters, which may include the following:

(i) The scheme may be continued with focus on those States/UTs where intensity of motorization of traditional crafts is still low.

(ii) Since the cost of diesel motors/engines have gone up, a new unit cost may be fixed, with the subsidy component remaining the same.

(iii) The provision of a second dose of subsidy may be discontinued.

Subsidy on HSD oil: Introduced in the year 1990-91, the scheme on 'Reimbursement of Central Excise Duty on HSD Oil used by Fishing Vessels below 20m Length' has the objective of helping small mechanized fishing owners/operators to bring down their operational costs and thereby encouraging them to increase the fishing duration, fish catch and income. During the Eleventh Five-Year Plan certain conditions were introduced in this scheme, restricting the subsidy on HSD oil to Below Poverty Line (BPL) fishermen and for boats, allowing only those which were constructed before the beginning of the Tenth Five-Year Plan *i.e.* prior to April 2002. These two conditions imposed during the current Plan period resulted in poor response and only 12.3 percent of the physical target set for the scheme could be achieved until the end of 2010-11.

Despite representations by fisher groups and many coastal States, the Ministry of Finance, Government of India has not agreed to reconsider the matter and has suggested revising the scheme in the Twelfth Plan in consultation with the Planning Commission. It is well recognized that expenditure towards fuel constitutes the largest chunk of input costs in fishing operations. With the spiralling fuel prices and also the sharp fluctuations in prices, it is necessary to support small-scale fishers to sustain their fishing operations.

To support the majority of the small-scale fishers, who in most cases are also owner-cum-operator, it is suggested that the subsidy on HSD oil be restricted to vessels below 10 meters overall length (LoA), and the conditions of BPL and period of construction of the boats be removed. This support to the small-vessel category will assist in reducing the pressure on near-shore areas as their fishing in off-shore waters will not put too much of economic strain on their operations. Further, to ensure that such boats start fishing in deeper waters, the area reserved for traditional non-motorized category could be further increased by suitable amendments to the Marine Fishing Regulation Act by the respective coastal States/UTs.

Promoting deep-sea fishing: Due to various reasons, the deep sea fisheries resources available in the country's EEZ have not been adequately harnessed. Lack of motivation, little opportunities in accessing public finance, absence of sound fishing technologies to meet local requirements and the underlying inhibitions of fishing in offshore waters are some of the reasons for this situation. During the Eleventh Five-Year Plan period, schemes were implemented for conversion of fishing vessels below 20 meter LoA and above 20 meter LoA by DAHD&F and the MPEDA respectively. While only a few vessels above 20 meter LoA availed the assistance, about 1 500 vessels below 20 meter LoA participated in the conversion programme. Majority of these vessels were from the southern Districts of Tamil Nadu. So far there are no reports on the operation of the converted vessels below 20 meter LoA, but unconfirmed reports indicate that such vessels are mostly engaged in shark fishing and or still using trawl nets. If this be the case, the purpose of vessel conversion stands defeated.

However, the intentions of the conversion programme still remain noble and with proper monitoring, the excess trawling capacity can be reduced and other selective fishing practices can be promoted in the country. The conversion and up-gradation can also contribute to reduction of fishing pressure in the coastal waters, which is one of the priority goals of the sector. With the latest estimates available on the harvestable potential at different depth zones as mentioned in the foregoing paragraphs, it is all the more important to reduce pressure from the coastal waters and take a sizeable percentage of the fishing fleet offshore, where potential still exists.

Any scheme to upgrade/modify the existing trawlers as multipurpose/ combination vessels to harvest the under tapped resources like tunas, bill fishes, pelagic sharks and oceanic squids, etc will need proper planning and also lessons learned from the past conversion programme(s). Besides, funding for conversion, the scheme should also have in-built provisions for training and capacity building, which will empower the fishing communities to exploit the offshore resources. Simultaneously, the post-harvest infrastructure and market linkages will be required to support the efforts. It is also suggested that the scheme may have different funding pattern for actual fishermen and non-fishermen candidates. To ensure sustainability of the deep sea resources, regular monitoring of the catch will also be necessary.

While considering the vessel conversion programmes during the Eleventh Plan, the larger focus has been on tapping tuna resources from the Indian EEZ. However, other than providing funds for conversion of vessels, the concomitant requirements of training and skill developments for harvesting of tuna resources, post-harvest requirements for marketing of tuna in the best value-added form, etc has received scant attention. In the event of the conversion programme being carried forward during the Twelfth Plan, these requirements need to be carefully addressed.

Another area which may need due recognition is the placement of Fish Aggregating Devices (FADs) in properly identified places in the EEZ to attract tuna and facilitate their capture by the tuna fishing fleet. In many tuna fishing nations, the use of FADs has proved to be highly successful and the government undertakes the construction and deployment of FADs with due involvement of the fishers. The present-day FADs are capital intensive and their deployment and proper upkeep involves full cooperation from the fishers so that the FADs are not damaged and also the tuna resources aggregating on the FADs are shared by a larger group of fishers. Formulation of proper guidelines and also ensuring a mechanism of monitoring the FADs would be a pre-requisite before they are deployed.

Improving design and construction of fishing vessels: in the past two decades or so, there has been no significant intervention in improving the design and construction of fishing vessels in India. Boats are constructed based on traditional knowledge passed on from one generation to the other or learning as an apprentice in a boat building yard. As such there are neither agreed standards for fishing vessel construction nor guidelines for boat yards in the country. The traditional fishing crafts have not undergone any major modification with respect to their design, efficiency or safety since the introduction of the Fibre-reinforced Plastic (FRP) material for boat building in the mid-eighties by the then Bay of Bengal Programme of the FAO and fabrication of a model FRP boat (IND-20 model). Over the years the same design has been stretched both length-wise and breadth-wise to suit the requirements by foregoing all norms of safety and stability of the boats.

In the last two and half decades, with large-scale motorization and depletion of stocks in the coastal waters, the range of operation of the traditional fishing crafts has increased. These developments are happening with no concomitant improvements in their design and safety needs. After the December 2004 Asian Tsunami, the large number of sub-standard FRP boats built by the local boatyards in Tamil Nadu and Puducherry have further aggravated the situation. While introduction of FRP material for boat building has been a boon for the sector, its use by untrained boat builders can also prove to be a major problem. Therefore, it is essential that standards for both boats and boat building yards be prescribed in the country. In view of this a scheme has been proposed in the Twelfth Plan for improving the design and other requirements of the traditional fishing crafts to enable them to fish in the deeper waters. If required the assistance of experienced boat-builders from abroad may also be sought for the purpose.

Reducing by-catch and promoting habitat conservation: Due to increased fishing pressure, indiscriminate and destructive fishing, and inadequate regulatory and management norms, India's fishery resources have been impacted. Intensive trawling and other harmful practices have adversely affected the benthic ecology and biodiversity. In India an estimated 3.5 lakh tonnes of low value catch is landed by trawl fisheries annually. From resource conservation and sustainability point of view, the resource damage happening by non-selective trawl catch is increasing in alarming proportions. Therefore, it is essential to have the provisions introduced in the Marine Fishing Regulation Act (MFRA) of the coastal States/UTs or further strengthened by making them more stringent and implementable to reduce the by-catch and promote resource conservation.

It is needless to state that resource conservation and management measures shall prevent spatial and temporal over fishing while achieving on a continuing basis optimum yield from each fishery. One of the greatest long-term threats to the viability of fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Destruction of natural habitats through deforestation of mangroves and reclamation of land has substantially reduced fish breeding and nursing grounds. As stated earlier, conservation and management of marine fisheries will include programmes towards strengthening of MFRA, optimization of fishing capacity for each coastal state, reduction in by-catch and other post-harvest losses, habitat conservation for facilitating breeding and growth of juveniles, rehabilitation/alternate livelihoods of displaced fishers, stock enhancement through Artificial Reefs (ARs) and FADs, etc.

Climate change and coastal fisheries: Coastal fisheries sector is one of the most vulnerable sectors as far as impacts of climate change are concerned. Marine fishing communities mostly reside within 2-3 hundred meters of the coastline and are the most vulnerable group of people with respect to storms and cyclones, rogue waves and of course rare events such as the tsunami. Climate change related adaptation measures and disaster management for extreme weather events such as cyclones, sea level rise, coastal erosion, etc need to be put in place by taking into consideration the uniqueness of the different coastal regions. Efforts are needed to build adaptive capacity of fishing communities to threats from climate change and climate variability by assisting them to relocate houses, schools, hospitals and dispensaries, and community halls in low-lying areas vulnerable to sea surge and flooding, to safer locations. On the flip side, although the fisheries sector is relatively a minor contributor to carbon dioxide emissions, nevertheless the fishing boats have to reduce the emissions by using fuel efficient engines, adhering to fuel emission norms and adopting suitable methods, such as use of sails for harnessing wind power and thereby reducing fossil fuel consumption.

Island fisheries: India has two major Island territories, one located in the Arabian Sea (the Lakshadweep group of Islands) and the other in the Bay of Bengal (Andaman & Nicobar Group of Islands). In the past Five-Year Plans, sporadic attempts were made to promote fisheries in the two Island groups, which did not meet with much success. Considering the fisheries wealth of the seas surrounding these two Island groups, it is essential to lay focus on their

resources, devise suitable harvest and post-harvest guidelines with forward and backward linkages so that during the ensuing Plan period the fisheries resources are optimally harvested and utilized for the benefit of the nation.

The major fishery of the Lakshadweep Islands include species such as tuna, bill fishes, pelagic sharks, marlins, sailfish and other groups of food fishes such as flying fish, barracuda, seerfish, rainbow runner, garfishes, halfbeaks, snappers, perches, clupeids, carangids, breams, trigger fishes, rays, octopus, etc. The commercial tuna fishery of Lakshadweep Islands presently depends mainly on skipjack tuna. The potential annual yield of tunas is estimated to be about 50 000 tonnes and all other fishes another 50 000 tonnes against the current harvest of about 10 000 tonnes, which is only 10 percent of the harvestable potential. The traditional processed product *masmin* is the favourite item made out of more than 50 percent of the tuna catch while the rest is consumed fresh and small quantities canned into white tuna meat in brine/oil.

Fish production in Lakshadweep could be increased by i) scaling up of modified fishing craft (traditional boats, pole & line boats, gillnetter-cum-troll lines); ii) introduction of new craft (tuna longline-cum-gillnetter for *Sashimi* grade tuna, Maldivian type pole and line vessels, mother/collector vessels; iii) modernization of fishing gear; iv) improving communication network and v) adopting sea farming practices, wherever feasible. Introduction of modern vessels is expected to increase the quantity of fish catch as well as facilitate production of value-added items for export. Training and demonstration programmes in craft and gear technology, fish processing and mariculture are also suggested for the benefit of Lakshadweep fishers.

In Andaman & Nicobar Islands too, the future development of marine fisheries will largely depend on the level of exploitation of the potential tuna resources of about 100 000 tonnes and other varieties such as reef fishes, lobsters, etc. In order to harvest the potential resources, improvements in the existing craft and gear are required as also introduction of larger-sized boats from the mainland. Presently, the crafts used are mainly traditional boats and can only undertake fishing in the near-shore waters. Phased introduction of motorized and mechanized boats with improved gear will enhance fish production from the Islands. Simultaneously, better post-harvest facilities (including landing and berthing infrastructure, processing and storage), conforming to international standards need to be developed.

Both the island groups are strategically located. The location of the Andaman and Nicobar Islands is strategic with respect to the world tuna markets and good connectivity (by both air and sea) between the Islands and the markets could be ideally used for export of high grade tuna products to the Far East countries such as Japan. The Lakshadweep Islands abound in tuna resources, especially skipjack. Like Maldives, the skipjack can be harvested in sizeable quantities for exports as well as production of '*masmin*', which has a good market in Sri Lanka. Further, a sound presence of the Indian fishing fleet in the waters surrounding the two Island groups would reduce poaching of resources as also contribute to the overall security of the country.

Improving MCS in support of sustainability: An effective and implementable Monitoring, Control and Surveillance (MCS) system is pre-requisite for management and conservation of fisheries resources in the Indian EEZ. A successful MCS will have components like fisheries data collection and timely flow of information, critical for taking policy and management decisions; estimation of fishing effort and adjustment of fishing capacity; registration and licensing of fishing vessels, boat building yards, etc; and effective surveillance mechanism including maritime safety and security needs of the country. An effective MCS system will also help in providing business intelligence necessary for promotion of fisheries trade and commerce. In addition, there is an increasing international awareness on the efficacy of fisheries management and linking fisheries trade with quality of fisheries management. In this regard, an established MCS system can act as an assurance to the international community on India's commitment to promote sustainable marine fisheries and can strengthen country's position in international and regional negotiations on fisheries and related matters.

To promote fisheries management in the coming Five-Year Plan, a comprehensive scheme on MCS should be considered for implementation by the DAHD&F with active participation of all coastal States/UTs. The major components of the scheme may *inter alia* include the following:

- Regulation for access to waters and resources;
- Maintenance of records of all vessels and boat building yards;
- Implementation of log book system, as appropriate;
- Monitoring of fishing vessels through appropriate means;
- On shore and at sea surveillance; and
- Setting up of MCS Division at the Central level and in each coastal State and Union Territory for effective implementation of the scheme.

Since it would be for the first time that a MCS scheme would be implemented in the country, the DAHD&F may shoulder larger responsibility in making adequate funds available to the States and also provide adequate training and capacity building for the staff of the Department of Fisheries to implement the scheme.

Establishment of Marine Protected Areas vis-à-vis loss of livelihoods of fishers: Biodiversity conservation efforts in the country have led to establishment of 33 coastal and Marine Protected Areas (MPAs) and 03 Marine Biosphere Reserves, with a total area of approximately 5 319 sq. km covering about 1.3 percent of the continental shelf (415 000 sq. km including the Islands) and less than 0.3 percent of the EEZ (2.02 million sq. km). While MPAs are an important tool for conservation of coastal and marine biodiversity and in the long run are expected to contribute to the sustainability of the marine resources, in many instances the MPAs have resulted in loss of livelihoods of traditional and small-scale fisher folk. Bitharkanika Wildlife Sanctuary and Bitharkanika National Park in Orissa and the Gulf of Mannar Marine National Park are two examples where fishers have lost their livelihoods on account of the conservation efforts by the Government.

Ideally, setting up of such parks should not threaten the livelihood support of artisanal and small-scale fishers, as fishing can co-exist with conservation of other animals and birds with certain dos and don'ts. Further, fishing is also banned for conservation of endangered species such as turtles, etc. In Odisha, for most parts of the year fishing is banned along a sizeable area of the coast for conservation of *Olive ridley* turtles. However, if it is so essential to move the fishers out of the MPAs or close the coastline for fishing for conservation purposes, it is necessary for the Government to chalk out alternative livelihood programmes and also provide adequate compensation to the fishers. There are several such examples in the inland sector too, which need intervention to protect the livelihoods of fishers. The DAHD&F may articulate this issue with the concerned Ministries/Departments in the Union Government to formulate a policy, which may suggest solutions to safeguard the livelihoods of traditional and small-scale fishing communities.

4.2.2 Promoting coastal aquaculture and mariculture

Coastal aquaculture and mariculture offer enormous scope of development along the coastline in the mainland as well as in the Island territories. It is popular in all the coastal States as also in the UTs of Puducherry and Daman & Diu. On one hand these activities can wean away extra pressure from the coastal waters, on the other hand they can add to fish production to meet the growing requirements of the country. Recent estimates indicate that per capita fish consumption in India is around 8-10 kg per year, which is likely to grow with the increasing preference for sea food.

The potential brackish water area available in the coastal regions of the country for shrimp culture is estimated between 1.2 and 1.4 mha. Presently, an area of about 184 115 ha is under farming with an average production of about 110 000 metric tonnes of shrimp per year. The average productivity has been estimated at about 1 000 kg per hectare per year. Since the development of this sector, about 0.3 million persons have gained direct employment in shrimp farming and about 0.6 – 0.7 million people are employed in ancillary units and support activities. The area under culture has also increased from 135 582 ha in 1996-97 to 184 115 ha in 2005-06.

Cultured shrimps (mainly *Penaeus monodon* or popularly known as black tiger) contribute about 50 percent of the total shrimp exports. About 91 percent of the shrimp growers in the country have a holding between 0 - 2 ha, 6 percent between 2- 5 ha and the remaining 3 percent have an area of 5 ha and above. The infrastructure facilities established over the years include hatcheries both in private and public sector, laboratories for testing of pathogens/diseases and processing units. With the introduction of white leg shrimp (*Littopenaeus vannamei*), the farmers now have the choice of farming white leg or tiger shrimp (*P. monodon*). Farming of *L. vannamei* has been successful so far in the country and both production and productivity have increased making farming operations remunerative. However, the availability of specific pathogen free (SPF) seed is still a major constraint in expanding the culture of this species and this requirement needs serious attention.

The long coastline of 8 118 km of the country along with large number of calm bays and lagoons offer good scope to develop mariculture/sea farming. Presently, sea farming is confined to green mussels practiced along the Malabar coast in Kerala producing about 20 000 tonnes annually. Being in the lower strata of the food chain, bivalves are energy efficient and cause least pollution to the environment. The other success story is of seaweed farming carried out along the Ramanathapuram and Tuticorin coasts of Tamil Nadu producing about 5 000 tonnes of sea weed annually. The CMFRI has also been successfully experimenting with sea farming of cobia species in cages in different locations and initial trails offer promising prospects of sea farming developing into a major enterprise.

Keeping in view the available potential that exists for coastal aquaculture and mariculture, developmental plans with both forward and backward linkages are urgently needed to allow these activities to become significant contributors to production of seafood in the country.

Emerging issues and opportunities: Capture fishery in the coastal waters has almost reached its maximum and the future scope of enhancing production lies either in taking the fleet offshore or promoting both mariculture and coastal aquaculture. Coastal aquaculture has a long history of development in India and the farming sector has gone through several phases of ups and downs. Having resolved many issues ranging from environmental to socio-cultural, shrimp farming now seems to be coming of age. On the other hand, mariculture is relatively a new activity and still under pilot-scale implementation, except mussel farming in certain pockets in Kerala. As mentioned in the foregoing paragraph, CMFRI's indigenous sea cage culture technology also has good prospects of large-scale adoption. On the whole, making both coastal aquaculture and sea farming a sustainable activity would need several issues to be addressed in the coming years. Some such issues are briefly discussed in the following paragraphs.

In coastal aquaculture, quality seed of *P. monodon* has emerged as a major bottleneck. While introduction of *L. vannamei* has reduced the pressure on tiger shrimp, yet the latter being an indigenous species need to be promoted, as it still commands a niche market in the global trade. Further, *L. vannamei* farming is totally dependent on import of SPF seed and this could be a serious bottleneck in the future. While initiation of a brood stock development programme for tiger shrimp is the need of the hour and should be taken up through the concerned research institution(s), there is also a need for establishment of brood stock banks, at least one each in the coastal State to meet the needs of the shrimp farmers.

Similarly, the availability of required quantities of quality seed is a major issue in promotion of finfish cage farming in the country. Commercial level seed production can be achieved if quality brood stock can be maintained. In this regard, a national-level facility for raising brood stock can be developed initially by the CMFRI. The juveniles produced by the facility can be used for distribution among farmers for carrying out sea farming in cages.

In aquaculture feed constitutes a major input cost, ranging in between 40-60 percent. Reduction in feed cost is the key to reduced production costs. The other major bottleneck in the feed sector is the lack of indigenously formulated feed for cage farming of marine species such as sea bass, etc. The imported feeds are raising the cost of farmed product, which is not economically viable for the farmers. Therefore, commercial production facilities have to be developed indigenously for production of cost-effective and good quality feed for the species that are selected for commercial-level farming.

Mariculture development in the country needs further refinement in both farming practices as also cage fabrication technology. The farming practices conducted by the research institutions should now be taken up for front line demonstration so that the fish farmers are convinced of their economic viability. For capture-based aquaculture, better knowledge of the seed resources and the impact of their harvest on the natural populations are required. Better management practices should also be an integral part of the commercial-scale technologies developed.

Increased focus on coastal aquaculture and mariculture also takes us to the issue of Integrated Coastal Zone Management (ICZM) planning, which would necessitate allocation of suitable land and water space for carrying out the activities in co-existence with other users of the coastal areas. In this regard, reassessment of suitable area of brackish water aquaculture development through micro-survey at district level is necessary and should be carried out. This will bring in more confidence in the prospective entrepreneurs to make investments in land-based aquaculture or sea farming. Cluster farming or group farming through farmers' association should be encouraged for the benefit of small farmers. Lastly, it may be necessary to also catalyse/facilitate availability of public finance for aquaculture/sea farming, building skills and capacities at all levels and developing markets, especially for the benefit of small-scale operators.

4.3 Inland fisheries and aquaculture

Inland fisheries resources of India include rivers and canals (1.95 lakh km), reservoirs (>3.0 mha), floodplain wetlands (1.2 mha), estuaries (0.26 mha), etc. These water resources have great potential for enhancing fish production and productivity and providing livelihoods to millions of people. The smaller water bodies in the form of ponds and tanks with a water spread area of 2.41 mha are the major aquatic ecosystem for fresh water aquaculture. These water bodies are both in private and public domain. Resources for coldwater fisheries and aquaculture include rivers (8 253 km), natural lakes (21 900 ha) and reservoirs (29 700 ha). Although, they form smaller component of the inland sector, they too have greater scope for development. The fisheries practices followed in these waters are capture fisheries, culture-based fisheries, extensive to intensive aquaculture and other forms of fisheries enhancement. Multiple use nature of majority of these waters with multiple stakeholders is the major constraint to harness their production potential.

The historical scenario of Indian inland fisheries and freshwater aquaculture reveals a paradigm shift from capture fisheries to aquaculture during the last two and half decades. Freshwater aquaculture with a share of 34 percent in inland fisheries in mid-1980s has increased to about 80 percent in recent years. It is recognized as one of the fastest growing enterprises in agriculture and allied activities and this growth is likely to continue in the coming Plan period too.

4.3.1 Conservation of inland fisheries resources

India is endowed with network of 14 major and 44 minor rivers with innumerable tributaries and streams, harbouring a rich aquatic biodiversity. Besides, a vast network of irrigation canals originating from the river valley projects also exist. Estuaries with a large water expanse abound in the lower reaches of most of the rivers and are important breeding grounds for a variety of commercially important fin and shellfishes. Despite this wealth, inland fish production in the country has gone down drastically in recent decades.

All the major rivers in the country are inter-state in nature. Fish being ambulatory in nature, the benefits of any measure taken for fisheries development (even for the purpose of conservation) in the rivers would naturally not accrue to any single State. As such, State Governments are not inclined to provide funds for riverine fisheries development and resource conservation. This has left the riverine fishery development uncared for and neglected.

The deteriorating environmental status of inland water bodies directly affects the country's fish production system. A multi-pronged strategy would be required to reverse the situation. This would include declaration of identified riverine stretches having considerable fish stock and diverse species as sanctuaries for conservation of fish stocks; replenishment of native stocks through ranching and community mobilization; conservation of breeding grounds; pollution control; training to fishers and stakeholders and mass awareness on the importance of rivers in general and for fisheries in particular. The success of all such efforts will depend on the level of participation of fishing communities and other local stakeholders. In the same vein, the estuaries would require special attention in terms of regulated discharge of freshwater; reduced fishing efforts, particularly with regard to mechanized fishing; controlled collection of natural fin/shellfish seed and mangrove conservation.

With increasing emphasis on irrigation, the canal network is becoming a source for fish cultivation, even to serve as a supplementary resource to riverine fisheries. The canals can be used by the communities by adopting technologies of running water fish culture. Fish culture in enclosures within the canals as also in the submerged areas along the canals is a possibility that deserves attention and investment. Issues to be addressed are ownership and harvesting rights, leasing, duration of water retention and suitable farming practices. However, if communities manage and regulate farming operations in the canals with approval from the irrigation authorities, some of the above-mentioned hurdles can be overcome.

The floodplain wetlands or lakes of the Ganges and Brahmaputra River systems have a water spread of about 1.3 mha and are located in the States of Assam, northern Bihar, West Bengal and eastern Uttar Pradesh. These water bodies are continuum of the parent river/tributary; they harbour a rich biodiversity of fishes and are crucial for the fisheries and ecosystem health of the rivers and their tributaries. The floodplain lakes also play an important role in groundwater recharge, nutrient cycling and most of all sustaining livelihoods and nutritional security of a large population residing on the lake/floodplain margins.

In India the coldwater/hill fishery resources are spread from north-western to north-eastern Himalayan region and some parts of Western Ghats, encompassing about ten States. They include rivers (8 253 km), natural lakes (21 900 ha) and reservoirs (29 700 ha). Considering the diverse natural resource-base and wide climatic diversity, they are ideal for developing food, sport and ornamental fisheries of high value. They can be an important source of livelihoods for the hill people, where other income earning opportunities are less and difficult to practice. In the past Five-Year Plans, the developmental needs of these resources have not been adequately addressed. It is suggested that in the coming Plan period a comprehensive plan may be drawn for fisheries and aquaculture development and wherever required for the conservation of the coldwater resources.

The reservoirs are common landscape of most of the Indian States. The reservoirs are classified as small (<1 000 ha), medium (1 000 to 5 000 ha) and large (>5 000 ha). Most of the Indian reservoirs are located in tropical to sub-tropical regime and hence have immense potential for fish yield enhancement. The endemic fish fauna of the reservoirs is rich and with supplementary stocking and appropriate harvesting norms, fish production and productivity can be optimized. However, the present yield from the reservoirs is low- on an average 30 kg/ha. The yield for different categories of reservoirs adopted under the NFDB assistance during the Eleventh Five-Year Plan has been documented at 174 kg/ha for small, 94 kg/ha for medium and 33 kg/ha for large reservoirs (CIFRI, 2011)[20]. Poor management is one of the main reasons for this low yield. It is seen that the reservoir fishing communities are rarely involved in the management, planning or decision making and play a passive role. Similarly, the interventions of the DoF are also minimal leading to poor management of these water bodies and resultant low yields.

Reservoirs can significantly contribute to inland fish production basket of the country and provide livelihoods to a large number of fishers dependent on this resource. This production potential can be harnessed by providing enabling policy, sound management and technology support and mobilizing active participation of resource user communities in the management of the resource. In this regard, some of the major interventions would include bringing more and more reservoirs under scientific fisheries management practices;

[20] ***CIFRI,2011. Summary and Recommendations: NFDB sponsored project "Mid-term Evaluation of NFDB Programme on Stocking of Fingerlings in Reservoirs and its Impact". Central Inland fisheries Research Institute, Barrackpore, 19 p.***

ownership and leasing of reservoirs on long-term basis; stocking with appropriate number and size of fingerlings of carps and other relevant species; developing adequate rearing space (on/off site) for *ex-situ* fingerling production, *in-situ* seed production in cages and pens; introduction of efficient fish harvesting gear & crafts; support for efficient fish marketing; and HRD for reservoir fisheries managers and fishers.

During the Eleventh Five-Year Plan period, the NFDB implemented schemes for augmentation of fish production in the reservoirs through supplementary stocking and HRD activities. The evaluations conducted by CIFRI, Barrackpore on supplementary stocking of reservoirs in the country have come with positive indications of yield enhancement. In view of CIFRI's findings, NFDB's involvement in development of reservoir fisheries could be increased with focus on supplementary stocking of fingerlings and enhancement of skills and capacities of reservoir fishers to handle stocking and harvesting programmes in a cost-effective manner.

It is widely accepted that the problems in marine fisheries are due to over investment – excess fishing capacity while the problems of inland fisheries are due to gross neglect and poor investment. Riverine and estuarine ecosystems are victims of multiple uses and pollutants entering the rivers and their tributaries from point and non-point sources are on the increase leading to eutrophication of the water bodies and consequent loss of fauna and flora. Among multiple uses, water abstraction for irrigation and power generation is perhaps the biggest reason, causing reduced or no flow in the main channel to support fisheries and other riverine fauna and flora.

Thus, fish production from inland fisheries resources is not commensurate with the size and biological productivity of the resources. Barring reservoirs, where production hikes have been achieved in recent years, production from the other resources such as the rivers and their tributaries, floodplain lakes, upland lakes and rivers and the estuaries is on the decline. In recent years, the increasing presence of exotic fish species in the riverine catches is also a serious issue and some of these species in the long run would threaten the existence of endemic species in the inland open waters.

The water spread area of the floodplains is fast shrinking and their fisheries depleting due to heavy encroachment, siltation, eutrophication, weed infestation, broken connections with the main rivers, *etc*. Considering the importance of floodplains in fisheries and other eco-services, it is necessary to conserve these resources both towards ecosystem benefits for the society at large and for fisheries enhancement. Some of the important steps in this direction would be towards restoration of connecting channels (between the lake and the parent river), desiltation, weed clearance, identification of breeding grounds in wetlands, etc. The floodplain lakes are also ideal for production enhancements through activities such as culture-based fisheries and integration of activities such as eco-tourism, horticulture and aforestation in the catchment areas through community-based management approaches.

4.3.2 Freshwater aquaculture

Freshwater aquaculture contributes maximum to India's fish production and this contribution is likely to increase in the years to come. Freshwater aquaculture is a rural enterprise benefitting small and marginal farmers spread across the length and breadth of the country. With coverage of 2.41 mha of ponds and tanks, number of fast growing endemic and exotic fish species and low input technologies, prospects of doubling of fish production exists through freshwater aquaculture. With a production of 0.37 mmt in 1980, freshwater aquaculture has touched 3.5 mmt mark, with major contributions coming from the carps. The three Indian Major Carp (IMC) species – catla, rohu and mrigal together contribute a lion's share with exotic silver carp, grass carp and common carp forming the next important group. The other important categories of fish, that are picking up in production are *Pangasius* species, native catfishes (*magur* and *singhi*) and freshwater prawn, the last two also fetching high market prices. *Pangasius* is mainly farmed in Andhra Pradesh and its production is growing fast, although in recent years the farm-gate prices are reducing, which is acting as a disincentive to the farmers.

The following paragraphs discuss some of the critical interventions required during the Twelfth Plan to augment production from freshwater aquaculture and make it a vibrant enterprise that can support rural livelihoods, increase income and well-being of the small-scale fish farmers in the country and contribute significantly to the country's protein food basket.

4.3.3 Fish Farmer's Development Agency (FFDA)

As compared to the developments in agriculture and livestock/poultry, fish farming still continues to be practiced on low levels of technology, resulting in poor productivity and production. Where freshwater aquaculture using IMC or combination of IMC and exotic carps can achieve between 6-7 tonnes of fish/ha/yr using moderate levels of input based technology, the present average production from the ponds and tanks under the FFDAs is about 2 850 kg/ha/yr. The ponds and tanks which are yet to receive inputs from FFDAs or adopt scientific practices are yielding much lesser- on an average 1 000 tonnes per/ha/yr. Lack of capital, redundant extension services, lack of improved technologies, shortage of vital inputs such as quality seed and cost-effective and efficient feed, and poor post-harvest infrastructure are the main reasons for the low levels of production from these water bodies in the country.

The FFDAs were set up in the year 1974-75 to popularize freshwater aquaculture in the country by assisting fish farmers in securing bank loans and channelizing the subsidy component; organizing trainings for dissemination of improved fish farming methodologies; facilitating inputs such as feed and seed; and hand-holding until the farmers were confident to adopt the modern scientific methods of fish farming. The FFDAs were responsible for creating a cadre of fish farmers well conversant with the scientific methods of fish farming and in the process helped in ushering the first 'Blue Revolution' in the country. With the initial success, the FFDA programme expanded to cover more States and presently 429 FFDAs are in operation. However, one of the weakest flaws in the FFDA programme was that the agencies were not

institutionalized to mature into self-reliant bodies, and with change in Plan support most of them are now unable to function properly.

Organization of FFDAs and issues before them: The FFDAs were originally set up as district-level agencies (registered as Societies) with the District Collector/Deputy Commissioner as chairperson and the District Fisheries Officer as its Chief Executive Officer. Besides subsidy for assisting the farmers, the FFDA scheme until the Ninth Five Year Plan also assisted each active FFDA in meeting the salary component of one Fishery Extension Officer, One Accountant and one typist. This assistance was limited to Rs. 2 lakh per year per FFDA. The salary component has since been withdrawn.

Out of the 429 sanctioned FFDAs, presently 325 FFDAs are active and 104 do not avail any assistance under any of the components of the Centrally Sponsored Scheme of Development of Inland Fisheries and Aquaculture. Financial constraint is one of the major reasons for the present state of affairs. Most FFDAs have expressed their inability to bear the recurring expenditure on salary and other administrative expenses after the changes effected in the Scheme during the Tenth Five-Year Plan.

Presently, most of the FFDAs are active only at the District level, with a meagre support of Extension Officers, who are responsible for ground-level implementation of both the FFDA programme and other Central/State run schemes. With the absence of support at the Block level, there is lack of effective implementation of the scheme, which is also evident in the lower average productivity of the FFDAs. It is worth mentioning that out of the 29 States, 19 States have less than the national average productivity of 2 850 kg/ha/year.

Besides financial and administrative constraints faced by the FFDAs, the existing subsidy structure under the Scheme is not found lucrative by many States. In fact States like Punjab, Haryana and Andhra Pradesh with a high average productivity of 6 094 kg/ha/yr, 4 370 kg/ha/yr and 3 740 kg/ha/yr respectively avail very little assistance under the Scheme. Many States have felt that the existing subsidy structure does not meet the realistic costs and therefore needs revision. For instance, Jharkhand and Chhattisgarh have suggested that the unit cost for construction of ponds should be enhanced to Rs. 7.00 lakhs from the existing 3.00 lakhs and the rate of subsidy be enhanced to 40 percent of this unit cost from the present rate of 20 percent. Hill States like Himachal Pradesh have suggested that the unit cost for construction of ponds in the hilly areas should be Rs. 15 lakhs.

In recent times many suggestions have emerged to enhance the scope and coverage of the scheme. Jammu and Kashmir has suggested inclusion of trout culture, sport fisheries and masheer fisheries and Nagaland has suggested provision of link roads to facilitate transportation of fish catch on the lines of ‘Agri-Link Roads’. The NE States have suggested that the subsidy should be shared by the Centre and the NE States in the ratio of 90:10 instead of 75:25 as of now. Bihar has suggested that the scheme should be transformed into a Central Sector Scheme instead of Centrally Sponsored Scheme.

In the Eleventh Five-Year Plan, the Centrally Sponsored Scheme on Development of Inland Fisheries and Aquaculture was implemented by the DAHD&F. With the establishment of the NFDB in July 2006, the Board was also assigned with the task for promoting aquaculture through a set of incentives to fish farmers. However, the complexion of the two schemes was not common in many respects, resulting in confusion in the States/UTs and also in the minds of end users. The DAHD&F's scheme failed to pick up because of the non-functioning of most of the FFDAs and also the fact that the amount of assistance available under different components did not match the field-level requirements. Similarly, the NFDB also did not meet with success in implementation of its programme on freshwater aquaculture, first on account of lack of support at the field-level and second the mismatch between the level of assistance proposed under the scheme and the actual requirements.

Therefore, the lesson learned from the two schemes bring us to the conclusion that any programme to promote freshwater aquaculture in the country would need a strong field-level agency to provide necessary support and hand-holding of the millions of small and marginal farmers and the level of assistance should match the ground-level realities. While there are a large number of measures that would be needed for revival of the FFDA programme in the Twelfth Plan, the following paragraphs highlight the most important changes proposed for consideration of the Government.

All schemes on promotion of aquaculture and related activities implemented by the DAHD&F and the NFDB should be handled by a single agency *i.e.* the NFDB and in doing so the FFDAs would be the field-level outfit supporting the NFDB in implementation of the scheme. To make these agencies more productive and also ensuring a better return on investment, it is suggested that these agencies would be assigned all production-oriented programmes at the district level, such as aquaculture (both fresh and brackish), facilitating seed production, stocking in reservoirs, mariculture, ornamental fisheries, development of ox-bow lakes and floodplain fisheries, etc as the case may be. It is envisaged that the FFDAs will re-establish the critically missing link between the primary producers of the sector and the development agencies by functioning as extension services system to facilitate aquaculture and fisheries development. The system will also promote knowledge-based and technology-mediated aquaculture and sustainable fisheries.

While extension of technologies to the farmers and fishers would be the prime task of these agencies, depending on the resources available, they would be performing multiple tasks and provide the much needed field-level support to NFDB, as its trusted arm in the field. Acting as a single window system, these agencies would also be the interface between fisheries sector and other programmes such as MNREGA (Mahatama Gandhi National Rural Employment Guarantee Act) implemented by the Ministry of Rural Development and the Rashtriya Krishi Vikas Yojana (RKVY) promoted by the Ministry of Agriculture (Department of Agriculture & Cooperation). This would allow adequate allocation of funds under the MNREGA and RKVY programme for the fisheries sector and also their implementation at the field-level. In the absence of these field outfits, it would be difficult for either the NFDB or the DAHD&F to ensure

inclusion of fisheries related activities in the other schemes and programmes being implemented by the sister Ministries/Departments in the States/UTs.

As the mandate of the FFDAs would no longer be restricted to aquaculture in freshwater ponds and tanks, the agencies could be re-christened as Fisheries and Aquaculture Development Agencies or FADA. The existing BFDAs operating in the coastal Districts of the country would also be merged with these agencies to create the FADA. The DAHD&F and NFDB could finalize the structure and functioning of FADA in consultation with the States/UTs. In all likelihoods, the FADAs would hold the key to India's aquaculture and culture-based capture fisheries development in the years to come.

Fish seed production: Production of quality fish seed is a prime requirement for developing aquaculture and culture-based fisheries in reservoirs, etc. The present estimates for fish seed production (mainly carps) from major fish seed producing States are 11 736 million fingerlings and 26 276 million fry (NFDB, 2011) with West Bengal contributing to 84 and 50 percent of fingerling and fry production of the country respectively. This unbalanced seed production scenario does not auger well for the sector. Decentralized seed production and year round availability of quality seed of desired size and species at local level is the critical need for development of fisheries and aquaculture. Ideally seed production centers should be located close to the farming areas to reduce transportation cost, seed mortality and other logistic problems.

Considering the awareness created during last three decades in general and during the Eleventh Five-Year Plan in particular on the importance of good quality seed and impact of appropriate stocking density in final production, it is necessary that quality seed is produced in adequate quantity throughout the country. Keeping in view that both vertical and horizontal hikes in production from aquaculture and also from other resources such as reservoirs and floodplain lakes will require quality seed in adequate numbers, it is essential to lay focus on seed production in the country during the coming Plan period.

The projected demand for fish seed during the Twelfth Five-Year Plan is shown in ***Table 21*** below. Based on the present estimates of 26 276 million fry produced in the country and the annual requirement of 35 100 million fry during the ensuing Plan, the deficit in terms of fry is 8 824 million fry. To meet this huge deficit a multi-pronged strategy would be necessary, otherwise seed would become a major limiting factor in the growth of farmed fish.

Table 21: Annual fish seed (Fingerlings) requirement during the Twelfth Five-Year Plan

Water resource/fish	Area (mha)	Stocking rate (Fingerlings/ha)	Requirement (million fingerlings)
Ponds & tanks (Carps)	2.00	8000	16 000
Reservoirs (Carps)	3.00	1500	4500
Wetlands (Carps)	0.35	3 000	1050
Scampi farming	2.00	2000	4 000

The activities proposed for implementation in the Twelfth Plan period include: promotion of seed production activities in seed deficit States such as Punjab, Haryana, Rajasthan, Madhya Pradesh, Tamil Nadu, etc; establishment of brood banks at the District level/State level and up-gradation of hatcheries for maintaining and holding the brood stock as well as seed; *in situ* production of seed for stocking of reservoirs and other large water bodies; mandatory accreditation and certification of hatchery and seed; import of technology for breeding of commercially important fishes, especially for species holding potential for mariculture; breeding and seed production of indigenous ornamental fishes and rearing of ornamental fishes; public-private partnerships for fish seed production and marketing, *etc*. It would be appropriate to once again reiterate the importance of FADAs in ensuring promotion of seed production activities in the country.

Quality and cost-effective feed: Lack of quality feed for aquaculture and the fast growing cage and pen culture in reservoirs has been a constraint, especially where farmers have intended to take up intensive aquaculture. Good wholesome and cost-effective feed to meet the nutritional requirements at various stages of growth of different fish species and with efficient feed conversion ratio (FCR) is the prime need in aquaculture. Presently, freshwater fish farmers are relying on a crude mixture of rice bran and oil cakes. While these traditional feeds have been useful in extensive and semi-intensive practices, their role in sustainable intensification of aquaculture is limited.

In recent years, the availability of key ingredients such as rice bran and oil cake, especially in the NE States and other hilly regions of the country has become difficult, putting fish farmers in a disadvantageous position. In these circumstances, production of formulated feed is necessary to meet the country-wide requirements of the aquaculture sector. It is estimated that the feed requirements for freshwater aquaculture (including feed required for cage and pen culture) by the end of the Twelfth Plan would be around 10 mmt. However, this demand would depend upon the economic viability of cage fish culture where feed would be the major cost factor. Therefore, development of fish feed mills and scaling up of production from the existing feed mills is necessary and this activity merits support under the Plan. Further, popularization of extruded feed based aquaculture among the farmers through training and result demonstration would also be necessary as this would help in bringing good management practices in freshwater aquaculture operations.

***Disease surveillance and quarantine facilities*:** With the intensification of aquaculture practices and introduction of new species, disease outbreaks are becoming common. The disease outbreaks result in considerable economic loss to farmers and reduction in fish supplies. In general, the awareness levels of farmers on the aquatic animal diseases, health management and their control and treatment is poor and once the disease sets in, farmers are clueless on the treatment procedures or its containment. Further, the infrastructure towards disease surveillance, early warnings, diagnostics and field-level control and treatment is also inadequate. Therefore, the requirement is for an effective programme to improve the health and hygiene in aquaculture through setting up of quarantine facilities; regular surveillance, epidemiological investigations

and networks for early warning; disease diagnostic laboratories and training of field-level workers to assist the farmers in early diagnosis of the problem. Further, networking amongst national-level fisheries institutions and laboratories on scientific investigations, setting up of standard protocols for diagnosis, bio-security, risk assessments and contingency planning in the event of disease outbreaks would also be essential.

Diversification of species in aquaculture: Freshwater aquaculture in India is carp-centric. Estimates indicate that carps (both IMC and exotic) contribute to about 75 percent of the total production from aquaculture, the remaining coming from other species such as *Pangasius*, air-breathing fishes, etc. Amongst carps also there is a single species dominance of *Labeo rohita* or rohu. As per FAO, India utilizes only three bio-categories and 15 species in contrast to 29 species by China, highlighting the needs to diversify aquaculture and ensure sustainability in aquaculture operations.

Introduction of new species into the aquaculture fold will need sound technologies from research Institutions in the country. Presently, experimental trials are on for several species such as murrels, air breathing species, mahseer in the freshwater sector and sea bass, groupers, etc for mariculture. However, a total technology package is yet to be made available. While this work is totally within the competence of ICAR Fisheries Institutions, the DAHD&F or the NFDB can only assist in promotion of the technologies, if made available by the research institutions.

Notwithstanding the availability of technologies on endemic species for broadening the aquaculture species spectrum, the DAHD&F may consider need-based introduction of exotic species that can contribute to increase in fish production, without any adverse impact on the native species and the ecosystem. The Government of India has set up a National Committee on Introduction of Exotic species in the country and this Committee can recommend such species for introduction.

Optimizing water use efficiency in aquaculture: Water is becoming a scarce commodity and there is also an increasing competition for water among various sectors and users. This situation thus calls for harvesting and holding rain water and optimizing its use efficiency in aquaculture. Emergence of re-circulatory aquaculture and recycling of water in intensive aquaculture and hatchery operations are because of this compulsion. There is also a marked intensification trend in aquaculture. All these indicate the critical need for aquaculture engineering inputs to gear the future course of aquaculture. Technologies are required for enhancing water use efficiency that may include systems for removal of metabolites and microbial load, maintenance of higher oxygen regime, minimizing water loss through seepage and percolation, optimizing energy use and application of clean energy, etc. Currently there is only one centre for higher education and research for aquaculture engineering located at the Indian Institute of Technology, Kharagpur, which was established at the recommendation of the National Agriculture Commission in 1976. The unit is required to be strengthened substantially to meet the current

and future needs of qualified aquaculture engineers and researchers and also for developing technologies and tools and machinery.

Use of waterlogged, saline and other degraded land for aquaculture: In India about 2.54 mha of salt affected soils exist, which are unfit or marginally fit for agriculture. There are large tracts of salt affected land (as detailed below) in the semi-arid and arid eco-regions of northern plains and Central High lands in the States of Haryana, Rajasthan, Uttar Pradesh and Gujarat with surface and sub-soil brackish water. These areas can be used for promoting brackish water aquaculture.

Experimental work on use of saline soil was initiated by the Central Institute of Fisheries Education, Mumbai at its Sultanpur and subsequently Rohtak Centres in Haryana. Based on the studies, growth and production of some of the candidate species such as *Chanos chanos* (milk fish), mullet (*Mugil cephalus*), *Etroplus suratensis* (pearl spot) and tiger shrimp (*P. monodon*) was found to be encouraging for taking up culture under monoculture/polyculture and integrated farming in the salt affected areas of the above-mentioned States. It is proposed that suitable schemes to promote utilization of the salt-affected areas may be taken up during the Twelfth Plan period.

4.3.4 Inter-dependence of aquaculture and capture fisheries

Indian aquaculture has strong dependence on capture fisheries. In freshwater farming, the rivers (Ganga and Brahmaputra River systems) are the original home of the Indian Major Carp (IMC) species. Despite perfection in induced breeding of IMC species and also in larval rearing, the original germplasm is still to be sourced from the rivers and their tributaries. For maintaining genetic vigour in the progenies, from time to time, the hatcheries have to use the wild caught brood stock. In case of tiger shrimp farming, the brood stock is sourced exclusively from the wild. Research efforts are yet to completely close the life cycle in case of tiger shrimp and this total reliance on wild caught brood stock will continue until research succeeds in raising quality brood stock in captivity. Despite a ban on collection of juveniles (post larvae) of tiger shrimp from the wild, in some places the juveniles are still caught for stocking the ponds.

Similarly, farming of sea bass, groupers and crabs is largely carried out with juveniles caught from the wild and fattened in sea-based cages or in land-based ponds. So is the case of giant freshwater prawn, where there is still considerable reliance on wild seed for farming of this species. Thus aquaculture impacts the wild stock when large-scale larvae/juveniles/adults are caught from the wild. Further, a significant contribution of capture fisheries is towards fish meal required for farming of carnivorous species. In the absence of quality fish meal such farming operations can become unsustainable. Therefore, the dependence of aquaculture on capture fisheries is significant and aquaculture planning should keep this dependence in mind. It also leads to the point that sustainability of freshwater aquaculture and farming of tiger shrimp will require conservation of wild populations of IMC species, freshwater prawn and tiger shrimp in their natural habitats.

4.3.5 Ornamental fish farming

Promotion of ornamental fish farming is primarily aimed at the export market and also to cater to the growing domestic demand. Presently, many ornamental fish species of high export importance are sourced from the wild, which has adverse impact on the natural resources. For sustainable trade and also for meeting the domestic demand, development of breeding and culture technologies is essential. Around 350 species of attractive freshwater ornamental fishes are available in India, especially in the biodiversity rich Western Ghats and the North Eastern Hills (*e.g.* loaches, barbs, etc). Similarly, a large number of marine ornamentals are also sourced from the wild for exports. Considering the increased popularity of ornamental fishes, captive seed production and rearing technology of many domesticated exotic species and indigenous species having export potential has been standardized. However, to avoid indiscriminate exploitation from the nature, captive breeding and domestication of more native species need to be developed on a priority basis.

To promote development of technologies for breeding new species of ornamental value and also increasing their production, it is necessary to provide appropriate support for capital and other inputs, up-gradation and validation of technology, development of skills of entrepreneurs and dissemination of technologies through efficient extension services. Ornamental fish farming is also an avocation that can provide livelihoods to women in both rural and urban settings. Therefore, the Twelfth Five-Year Plan schemes on ornamental fisheries should contain components which support employment of women and un-employed youth.

In concluding the discussions on proposed support to aquaculture in the Twelfth Plan, it could summed up that developmental strategies for freshwater aquaculture will include both horizontal and vertical increase in production; utilization of new resources such as water logged, saline lands and irrigation canals; diversification of species and intensification of culture practices including integration of aquaculture with agriculture/livestock/poultry. In addition, focus will be on region-specific aquaculture, public- private partnership for scientific aquaculture; fish health management and disease diagnostics and promotion of ornamental fisheries. Finally, the support of field-level agencies is inevitable if the targets are to be achieved.

4.4 Infrastructure

The infrastructural requirements of the fisheries sector are manifold. Ranging from construction of Fishing Harbours (FH) and Fish Landing Centres (FLCs) to establishment of hygienic domestic markets and setting up of cold chains, the prime objective is to ensure that spoilage is reduced and fish reaches to the consumers in the best possible condition. There are various other infrastructural requirements of the fisheries sector, but the following paragraphs will be mainly dealing with the construction and modernization of the FHs and FLCs and setting up of domestic markets and cold chain in the country during the Twelfth Five-Year Plan period.

4.4.1 Setting up of fishing harbours and fish landing centers

Development of infrastructure for providing safe landing and berthing facilities to fishing boats started way back in 1964 (during the Third Five-Year Plan: 1961-66). Over the years, the programme took shape in the form of two major schemes *viz*. (i) a Centrally Sponsored Schemes (CSS) for Development of Minor FHs and FLCs and (ii) a Central Sector Scheme (CS) for development of Major FHs in Major Ports of the country. While the CSS provided 50 percent contributions from the Central Government (Ministry of Agriculture) and the balance 50 percent coming from the State Governments (100 % provided by the Central Government in case of UTs), the CS scheme provided 100 percent funding by the Ministry of Agriculture. In the latter case all the major harbours were constructed and maintained by the Major Port Trusts.

Since inception of the programme in 1964, a total of 06 Major FHs; 44 Minor FHs; and 176 FLCs have been constructed in the country and 18 Minor FHs and 18 FLCs are under various stage of construction[21]. Until the early part of this century, the Central Institutes of Coastal Engineering for Fishery (CICEF) was solely responsible for undertaking techno-economic feasibility studies and surveys for establishment of infrastructure facilities in the country. However, later a number of other agencies, both under public and private sector, have been permitted to carry out the techno-economic feasibility studies and assist the State/UT Governments in development of the infrastructure.

The larger purport of the two schemes until the Ninth Five-Year Plan was to provide capital cost for construction of the facility (depending upon the approved requirements of the project) and towards initial (capital) dredging, wherever required to allow for safe movement of vessels within the FH/FLC basin. The schemes, however, did not cover the subsequent maintenance of the facility. It was envisaged that maintenance cost should come from the revenue accrued from the user charges and other income-generating activities of the harbour. However, this has not happened in most of the facilities constructed under the two schemes, leading to their disrepair and neglect.

Further, the two schemes did not incorporate or strongly enforce setting up of management committees, with larger participation of the user groups and or community mobilization for maintenance or upkeep of the facilities. The initial investments in setting up of the facilities also overlooked the need for skills and capacity development of the user groups in maintaining hygiene and sanitation, overall operation and hand-holding until the users were fully capable of running the facility in a business-mode. Both the States/UTs under whose jurisdiction the Minor FHs/FLCs come and the Port Trusts who are responsible for the Major FHs paid little attention to the issues referred to above resulting in poor condition of the facilities. Starting from the Tenth Plan onwards, some efforts have been made towards renovation and repair of the FHs/FLCs by the Ministry of Agriculture (and also through NFDB) and the Ministry of Commerce and Industries (through MPEDA).

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[21] Handbook of Fisheries Statistics,2008.

Presently, the infrastructure facilities set up in the country for safe landing and berthing of the fishing vessels cater to about 25 percent of the fleet, leading to congestion in most of the FHs/FLCs. The congestion in the FHs/FLCs also brings in delay in discharge of the cargo by the fleet and or loading of the provisions for proceeding on a fishing trip. Usually the turn-around time of a fishing boat at the landing wharf/jetty should be minimum so that other boats do not have to wait beyond a certain period.

Due to the limited number of FHs/FLCs available along the coastline, large numbers of boats land their catch on sandy beaches, where no back-up facilities are available to allow for auction, packing or storing, etc. In many places poor road connectivity is responsible for spoilage of the fish landings, which otherwise would have gone for human consumption. In the given circumstances, it is essential to augment the infrastructural facilities in considerable numbers during the Twelfth Five-Year Plan. Further, the existing facilities that are in utter need of repair/renovation/extension should also be taken up in a planned manner during the ensuing Plan.

Further, it would be appropriate to highlight here that the past oversight of not looking at the managerial aspects of the facilities and the skills and capacities of user groups to operate the FHs/FLCs in a 'business mode' should not be repeated. These aspects are vital for the success of the facility and repair/renovation/extension plans should have these components built into the sanctions. At this juncture it may also be important to state that the marine waters are reaching their maximum sustainable yield and thus our efforts should aim at reducing post-harvest losses and taking the maximum landed catch for human consumption and not for other purposes.

Until a decade back, CICEF was the only specialized institution in the country conducting techno-economic feasibility studies for setting up of FHs/FLCs. In the last one decade or so many additional agencies have been authorized to carry out such studies, reducing the burden on CICEF. A couple of maritime universities have also been established, which can take up work of this nature. While CICEF did some pioneering work in establishing guidelines for techno-economic appraisals and also monitoring/quality control in respect of FH/FLC infrastructure, it did not involve itself much in standard setting for such facilities in the Indian fisheries and coastal environment context.

Except a one-time exercise on preparing master-plan for setting up of FHs/FLCs in the country, regular updating of the master-plan and or other policy advisories have not come from CICEF. It is also reported that CICEF is facing severe human resource crunch and unable to shoulder larger responsibilities. In view of the above, it would be appropriate for the States/UTs also to facilitate development of such expertise in the technical institutions such as the Engineering Colleges located within their jurisdictions. Each State/UT, with the assistance of such technical institutions should develop their own master plans, which can further be consolidated to make a national-level master plan by CICEF or NFDB. Further, CICEF should engage itself more in standard setting and appraisal of larger facilities that would need critical review by the experts.

Until the establishment of the NFDB, the entire range of activities (new construction, renovations/up-gradation, etc) was handled by the Harbour Section of the Fisheries Division of the DAHD&F. However, post 2006 activities such as repair/renovation are also being handled by the Board. At a time when the Harbour Section is thinly staffed, handling of activities such as repair/renovation/modernization by the NFDB is a welcome step. While continuing to handle this work, NFDB may also have to relook at its own technical capacity to handle this work. The Board has little in house expertise in harbor engineering and presently relies on staff having general engineering background. Since harbour engineering has its own peculiar requirements, engineers trained in this area would alone be in a position to evaluate the proposals and oversee/monitor subsequent developments properly.

Looking at this issue in more details, it is seen that presently the fishing harbour matters are being dealt at three places – (i) Harbour section of the DAHD&F responsible for approval of new facilities and also up-gradation of the existing facilities; (ii) NFDB attending to renovation/repair/modernization of existing facilities and (iii) CICEF responsible for conducting techno-economic appraisal of proposals received by the Ministry of Agriculture and also monitoring of the facilities under construction. Such distribution of work, especially bearing in mind the lack of adequate complement of staff competent to handle the harbour engineering matters at all the three places (Harbour Section, NFDB, CICEF), may not auger well for the development of FHs/FLCs in the country. Therefore, a clear-cut decision is needed for consolidation of the available manpower and expertise.

To begin with, first there is a need to re-define the role and function of CICEF to make its output focused and productive. The present restrictions in recruitment of staff may prohibit CICEF to augment its workforce. Therefore, CICEF may restrict its techno-economic feasibility appraisals to larger proposals and leave the smaller FHs/FLCs to engineering institutions and other agencies already enlisted with the DAHD&F or the coastal State/UT Governments.

Second, CICEF may also engage in standard-setting for FH/FLC design; material to be used in various facilities of a modern FH/FLC; maintenance of hygiene and sanitation and equipment required for the purpose; training and skills and capacity development of the user-groups, etc. CICEF from time to time may also impart trainings to State/UT-level agencies for up-gradation of their expertise in conducting techno-economic feasibility investigations, FH/FLC designs, etc. On the whole, CICEF should upgrade itself into a centre of excellence in harbor engineering works in the country and leave the other minor works to State/UT level agencies/institutions. In the longer run this would reduce the State's reliance on CICEF for works of routine nature and enhance their in-house capabilities in harbor engineering works.

The third issue that needs a decision pertains to the consolidation of the activities presently being carried out by the Harbour section of the DAHD&F and the NFDB. For all reasons, activities of similar nature may not be justified to be handled at two different places. Therefore, it is necessary that all matters

related to new proposals and modernization, renovation/repairs be handled at one place. In this regard, the NFDB stands out as the likely choice for various reasons. The Board has a larger flexibility to recruit or hire additional staff it requires on consultancy or on regular basis and experts that may be required for examining the proposals received from the States/UTs.

4.4.2 Improving marketing of fish

It is generally felt that post-harvest infrastructure is grossly inadequate in fisheries sector. As spoilage of fish starts right from the time it is caught, proper storage, preservation and prompt disposal or transport services are essential. Various studies have pointed to the high levels of wastage in the Indian fishery due to spoilage. This is particularly acute during the monsoon, when up to 30 percent of the catch could be lost. This is a vital area to be addressed, and may result in increased economic returns to those dependent on the fishery without any increase in fishing effort. Therefore, strengthening of post- harvest infrastructure such as chilled storage facilities, ice plants, cold chains and freezing/processing units, roads and transportation, modern and hygienic wholesale and retail market outlets etc., as well as effective marketing system in identified areas are the key requirements for the development of this sector. This would ensure higher profit margins to the producers enabling faster fisheries development. This will also promote quality assurance and better food safety standards for fish food for domestic consumers and also for the export market.

Presently, fish markets, both wholesale and retail in the country are in a pathetic condition. Besides, a larger volume of fish is sold through street markets, often on footpaths close to open drains. This unhygienic environment and the fact that fish is seldom kept in ice, results in fast deterioration of the quality of the fish. Mostly whole fish is sold in the market and there is negligible processing/value addition. Further, while marketing, transportation or storage of fish, the standard norms of hygiene and sanitation are least considered, leading to a product that is contaminated and unsafe from food safety point of view.

This core activity has witnessed a slow growth in the country, lagging far behind the production trends. In the Eleventh Five-Year Plan, the NFDB has made efforts to reverse the situation and many States/UTs have availed assistance from NFDB to set up new fish markets, both wholesale and retail or modernize the existing markets. This programme, which has just picked up, needs to be vigorously pursued during the Twelfth Plan also since development of modern hygienic fish markets will improve the acceptability of fish food and also increase its consumption in the country.

Further, the cold chain concept, which again is in rudimentary stages in the country, calls for provisions of integrated facilities to retain the quality of refrigerated or frozen fish from the time of harvesting till it reaches the consumers in distant parts of the country. Development of cold chain system in the country requires the following facilities:

- Adequate supply of ice at landing centres for holding fresh fish before processing;
- Containers for holding fresh fish in ice, cold storage at landing centers;
- Intermediate points on the transit route;
- Insulated/refrigerated vans for transport of fish and fish products
- Processing, marketing and distribution centers; and
- Facilities at retail markets.

In the case of inland fisheries, there are no authentic studies available on the requirement of ice for storage and marketing of fish. Ice has to be mostly transported, often over long distances to the landings centers/villages and ponds at considerable cost. The availability of ice to the producer, especially during non-summer months becomes a serious concern. Some of the constraints in non-availability of ice in the inland sector are constant increase in power tariff; differential charges on ice plants/factories *vis-à-vis* cold storages; hefty security deposits on quarterly basis charged by the Electricity Department; refusal of Banks to advance loan to ice factories on viability grounds; high surcharge rate on ice plants; etc. These issues need to be looked into if availability of ice is to be improved for meeting the requirements of the inland States in the coming years.

The inland sector, although characterized by highly displaced landings, has an advantage in having production sites close to the consumption centers. However, the reservoir fisheries are an exception to this and necessitate strengthening of infrastructure. There is a growing realization that closer ties between primary producers and those engaged in marketing would be mutually rewarding, the former being assured of a ready market for his/her produce at a reasonable price and the later being assured of an uninterrupted supply of raw material for his/her production line.

The Central Sector Scheme implemented till the end of the Eighth Five-Year Plan was re-introduced as a component under the CSS on 'Development of Marine Fisheries, Infrastructure and Post-Harvest Operations' during the Tenth Five-Year Plan with a view to creating necessary facilities to provide remunerative prices to the fish farmers for their produce and making available fresh fish at reasonable prices to the consumers. Under this scheme, State Fisheries Cooperatives, Cooperative Federations and primary cooperatives were assisted in strengthening marketing infrastructure to minimize the post-harvest losses through ideal marketing system. Since re-introduction of the scheme during the Tenth Five-Year Plan, 13 ice plants/cold storages, 29 fish retail outlets/kiosks and 29 insulated/refrigerated vehicles were setup in the country. During the Eleventh Five-Year Plan, 13 fish preservation and processing facilities, 18 fish retail outlets and 98 fish transport facilities were set up in the country.

This scheme needs to be continued during the Twelfth Five-Year plan too, with greater emphasis on improving hygiene and sanitation in the fish markets and establishment of a cold chain for fish marketing in the country. Again NFDB would be in an ideal position to handle this activity along with the setting up of

FH/FLCs in the country. As an added advantage, NFDB would also be able to establish linkages between the harvest and post-harvest activities and promote the 'boat to plate concept'.

4.4.3 Public - Private Partnerships

In the preamble to the National Public-Private Partnerships Policy 2011 (draft), the Government of India (Ministry of Finance) states that the Government of India is committed to improving the level and the quality of economic and social infrastructure services across the country. In pursuance of this goal, the Government envisages a substantive role for Public Private Partnership (PPPs) as a means for harnessing private sector investment and operational efficiencies in the provision of public assets and services.

The preamble further states that India has already witnessed considerable growth in PPPs in the last one and half decade. It has emerged as one of the leading PPP markets in the world, due to several policy and institutional initiatives taken by the Central as well as many State Governments. To provide a broader cross-sectoral fillip to PPPs, extensive support has been extended through project development funds, viability gap funding, user charge reforms, provision of long tenor financing and refinancing as well as institutional and individual capacity building. PPPs are now seen as the preferred execution mode in many sectors such as highways, ports and airports. Increasingly, PPPs are being adopted in the urban sector and in social sectors. Over the years an elaborate eco-system for PPPs has developed, including institutions, developers, financiers, equity providers, policies and procedures. The Draft Policy also states that the government is committed to continue to create an enabling environment for PPPs across the country, through initiatives including enabling funds and schemes, guidelines, institutional structures as well as processes.

While the PPP concept has picked up in many other infrastructure development sectors as mentioned above, it is yet to take roots in the fisheries sector. Establishment of fishing harbours/FLCs and cold chains are some of the areas where PPP mode can work well and the NFDB could facilitate the process. Some of the commonly adopted forms of PPPs include management contracts, 'build-operate-transfer (BOT)' and its variants, 'build-lease-transfer (BLT)', 'design-build-operate-transfer (DBFOT)', 'operate-maintain-transfer (OMT)', etc and these could be used for development of the required infrastructure. In the long run, this would ease the vexing issue of maintenance/repair of the facilities, such as the fishing harbours/FLCs. Further, as many coastal States are facing financial crunch, they would welcome the entry of private sector, through the PPP mode. However, while promoting the PPP route, the NFBD would have to maintain focus on a strong element of service delivery and adequate checks and balances. To ensure accountability and transparency, NFDB may introduce stringent Monitoring and Evaluation (M&E) System and the project specific framework for M&E be made mandatory for each project/ scheme. Secondly, there should be periodical third party led comprehensive assessment of all the projects and schemes and the cost expected to be incurred be incorporated in each project/scheme.

The modalities for private sector involvement in FH/FLC construction/ operation could be worked out by the Government. Besides FHs and FLCs, the PPP mode could also include fish markets and establishment of cold chains. This is likely to improve the marketing infrastructure and help reducing fish spoilage to a considerable extent. It may be relevant to highlight here that in metros like Chennai, a good number of fish markets are owned and operated by private individuals/trusts and their performance *vis-à-vis* the markets operated by the State-run agencies is much better.

Another concept of PPPs with the inclusion of community has its potential in management of reservoirs and other public property resources. In such cases, the Department of Fisheries can provide technical assistance and facilitate overall management; the local fishing communities can undertake management functions such as stocking, harvesting, compliance of rules and regulations, etc; and the private sector entity can contribute by way of investment including procurement of stocking material and marketing. Similar mechanism may have its application in the fisheries management of lakes and floodplain fisheries. The DAHD&F or the NFDB could work out a policy paper on sharing of benefits between public, private and fishing communities.

4.5 Welfare of fisher community and human resource development (HRD)

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- 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.

Although there is dearth of comprehensive studies on the socio-economic aspects of small-scale fishers in the country, the available information does point towards a very low base in respect of most of the vital human development indices, such as education, health, economic well-being, etc. Moreover, their profession, which is akin to hunting in fraught with uncertainties that have been aggravated in recent times due to pollution, intra and inter-sectoral conflicts on resource usage and the impacts of climate change, etc.

A major scheme for welfare of fishermen was launched in 1991-92 by amalgamating two schemes *viz.* 'Janta Personal Accident Policy' (initiated in 1983) and the 'National Welfare Fund for Fishermen' (initiated in 1986-87). A new component on 'Saving-cum-relief (SCR)' was also added to this. Subsequently, the component of 'Training and Extension' (started in 1994-95 after modification of the earlier scheme namely 'Training/Seminar/Workshop)' was also been merged with the Welfare Scheme in 2007-08. The scheme on 'Training and Extension' was a separate scheme till 2006-07. Accordingly, in

the Eleventh Five-Year Plan, the Scheme was operated with the following four components:

(i) Development of Model Fishermen Villages,

(ii) Group Accident Insurance for Active Fishermen,

(iii) Saving-cum-Relief, and

(iv) Training and Extension.

The component on 'Development of Model Fishermen Villages' is aimed at providing basic civic amenities such as housing, drinking water and construction of community halls for fishermen villages. The cost of a house constructed under the scheme was Rs. 30 000 when it was launched in the Seventh Plan, and subsequently revised to Rs. 40 000 during the Ninth Plan period. In the Eleventh Plan, the unit cost has been increased to Rs. 50 000 for house, Rs. 30 000 for tube-well (Rs. 35 000 for NE Region) and Rs. 175 000 for the community hall. About 7 000 houses are constructed on an average per annum under this scheme.

Increasing risk coverage: Keeping in view the low levels of income, which do not create much wealth, the fisher family faces severe hardships in the event of death of the earning member. A similar situation prevails when the fisher meets with an accident and ends up in disability impeding his active life. The Group Accident Insurance for Active Fishermen (GAIS) provides for insurance cover to fishermen actively engaged in fishing. Introduced in the Sixth Plan, the scheme has gone through several modifications and presently the compensation available for death or permanent total disability of the fisher is Rs. 100 000 and Rs.50 000 for permanent partial disability. Accordingly, the upper limit for insurance premium has been increased to Rs. 30 per head, which is subsidized by the Centre and the State on 50:50 basis. In case of UT, 100 percent premium is borne by the Centre. A single policy is taken in respect of all those States/UTs that are participating through FISHCOPFED. More than 30 lakh fishers are covered annually under the GAIS.

Based on the popularity of the scheme and the fact that it provides risk coverage to poor fishers, it may be advisable to continue GAIS in its present form during the Twelfth Plan, except with an increase in the compensation from Rs. 100 000 to Rs. 200 000 on death and from Rs. 50 000 to Rs. 100 000 on disability. In the coming years, it may also be useful to increase the benefits from the existing death/disability to health coverage. There are several examples of low premium, health coverage schemes in the market (Janta Health Plan) and their models could be copied. However, before the GAIS portfolio is enlarged, it may be appropriate to have a clear-cut definition of those who would be eligible under the scheme and also a data base on the fishers and other likely beneficiaries.

The component on Saving-cum-Relief (SCR) is under implementation from the Ninth Plan onwards with the larger objective of conserving the resources and also reducing risk exposure of marine fishers to the perils of the sea in rough weather, mainly during the monsoon months when the sea is rough. The beneficiary has to contribute part of the earnings during non-lean months,

which is matched with equal contributions by the Centre and the State and the accumulated amount is distributed back to the fisher in three/four equal installments. Presently, a contribution of Rs. 600 in 9 months of fishing period is being made by the fishermen and Rs. 1 200 is contributed by the Centre and the States on 50:50 basis. The total sum of Rs. 1 800 is distributed to the fishermen @ Rs. 600 per month for three months of lean period. About 3.5 lakh fishers are benefited under the SCR scheme annually.

The scheme has received mixed reviews in the past. However, on the whole the scheme is meeting its objectives to a certain extent and fishers are largely satisfied with its implementation. They have also desired that the monthly contributions could be increased 2-3 times, since the amount paid to them during the closed season is meager and they are unable to cope with the increasing costs. In fact some States/UTs are topping up the money paid during the closed season with either additional money or in kind (food grain).

It is, therefore, proposed that the SCR may continue during the Twelfth Plan and the monthly contributions be increased to Rs. 450 (Rs.150 each contributed by the fisher, Centre and State), bringing it to a total contribution of Rs. 3 600/4 050 for a saving period of 8/9 month. With this increase in monthly contributions, a total of Rs. 900/1 350 per month would be reimbursed to the fisher for four/three months when fishing would be banned.

Safety at sea of small-scale fishers has been a grey area in the marine fisheries sector, with minor interventions during the Eleventh Five-Year Plan period. Every year hundred of fishers perish while fishing at sea. Most of the accidents can be avoided with proper training, better communication and navigation equipment, sound weather warning and by inculcating a sense of safety among the fishers. Safety at sea is also a function of fisheries management and, therefore, the development programmes need to consider the elements of safety while formulating/implementing a scheme.

Further, occupational safety and health aspects of small-scale fishers are extremely poor and there are very few efforts to address the problems on a county-wide basis. The hygiene and sanitation conditions on board fishing vessels and at shore are pathetic and need considerable improvements. All these issues warrant specific attention and appropriate interventions during the ensuing Plan period.

In the Eleventh Five-Year Plan a scheme on ‘Safety at Sea’ provides subsidy to the tune of 75 percent of the unit cost of Rs.1.50 lakh per kit consisting of GPS, communication equipment, echo-sounder and search and rescue beacon. This component is implemented through State Fisheries Federations/ Corporations and Panchayati Raj Institutions. The scheme did become popular and it has been suggested by fisher groups that the scheme should be continued during the Twelfth Plan period. However, the choice of items should be made flexible and left to the fishers, depending on their need. It is also felt that the scheme components should include floatation devices, which are missing in the kit promoted during the Eleventh Plan.

4.5.1 Human resource development

The scheme on 'Training and Extension' implemented during the Eleventh Five-Year Plan is mandated to provide training to fishery personnel so as to assist them in undertaking fisheries extension programmes effectively. Assistance is provided to fisher folk in upgrading their skills, for setting up/up-gradation of training/awareness centres in the States/UTs. This scheme is being operated with 80 percent Central assistance in the case of States and 100 percent for UTs. The other components include publication of extension material, production of video films on technologies and other significant developments in fisheries and aquaculture, conducting meeting/workshops/ seminars, etc. of national importance. Besides this scheme, training and extension activities have also been undertaken by the NFDB through the States/UTs, Central institutions and other agencies during the Eleventh Plan.

Training and Capacity Building: The development of any sector largely depends on the human resource and programmes that are implemented by trained and skilled personnel are often successful. Therefore, human resource development (HRD) is integral part of development and cannot be overlooked. So far, HRD activities in the fisheries sector in India have been inadequate and do not meet the requirements of the sector, especially in the wake of growing challenges such as social mobilization of the community and their empowerment, getting access to information and services, developing technical and managerial skills, etc, which lead to adoption of good management practices, hygiene and safety, sustainable farming practices, adapting to climate change, etc. The fisheries managers in the DoF are poorly motivated and mostly stagnating in their jobs. Lack of training opportunities and skill refreshments result in their inability to cope with the technical needs of the sector. Their low status compared to counterparts in the agriculture or other allied sectors is also a de-motivating factor, which needs to be addressed, while looking at the overall requirements of the sector.

With the setting up of the NFDB in 2006, the HRD activities conducted at different levels of the stakeholders did receive a boost. However, the NFDB sponsored programmes in imparting training and capacity development appear to have reached a plateau and do not seem to be gaining further momentum. To provide a result-oriented thrust to the HRD needs of the sector in the ensuing Plan period, the training and capacity development programmes need to be re-oriented keeping in mind that that training and skill development are continuous needs and not ad-hoc interventions. The skills and capacity building activities, especially of the fisheries managers, should aim at bringing attitudinal changes to accept the role of a primary producer as a partner in development. Therefore, besides improving the technical skills, social skills also need to be improved. Further, training programmes for fisheries managers should be linked with their career advancement as this would catalyze their interest in availing training as and when opportunities arise.

To ensure that HRD programmes are taken up to meet the needs of the entire range of stakeholders, a comprehensive policy on 'Training and Capacity Building Needs' is required that can effectively address the sectoral needs and

also look into the specific requirements of each state. The larger onus of meeting the training and capacity building needs of the primary stakeholder lies with the State/UT Governments and they need to strengthen their paraphernalia to meet the requirements of the stakeholders. The State should develop precise training need assessment for each group and subject area of training to enable the training agencies to prepare modules and delivery designs. Further, pre- and post-training evaluation should be an integral part of each training programme. Adequate focus is also required on organizational strengthening, including strengthening of extension service system to support the primary producers in developing their capacity for pursuing sustainable fisheries and aquaculture. The Central Institutions and other national–level agencies can cater to more specialized needs and also training of the trainers.

In the Twelfth Five-Year Plan, this programme should be handled by the NFDB in cooperation with the institutions under the Ministry of Agriculture, State Agriculture Universities (College of Fisheries) and the Krishi Vigyan Kendras (KVKs). To ensure conduct of relevant and quality training it is also important that the State should develop precise training need assessment for each group and subject area of training and the same be submitted to the training agencies for preparation of modules and delivery design. Pre- and post-training evaluation should also be introduced for each training programme with post-training follow-up system.

Strengthening fisheries cooperatives: While a large number of fisheries cooperatives exist in the country, their role in sustainable development of the resources is insignificant. Barring a handful of cooperatives, most of the other fisheries cooperatives are either defunct or existing to avail government subsidies and other benefits. In many countries around the world, fisheries cooperative are playing useful role. The Fisheries Cooperatives of Japan are an excellent example in this regard. In the Twelfth Plan period, it would be useful to strengthen the fisheries cooperatives in India and the FISHCOPFED could play a pivotal role in this important task. The Federation should concentrate on building capacity of fisheries cooperatives to ensure that they operate on sound democratic principles and transparency and adopt business models with diversified portfolios, rather than concentrating on just one or two activities. Training in both technical matters and business management would also be one of the most critical needs for revival of cooperatives, but this aspect could be left to the technical/management Institutions. Incidentally, the United Nations has declared 2012 as the ‘International Year of the Cooperatives’ and it would be a good coincidence to begin the revival of the fisheries cooperatives in India in 2012.

4.6 Fisheries information system

A Central Sector Scheme on ‘Strengthening of Database and Geographical Information System for Fisheries Sector’ was launched during 2007-08 by modifying the earlier scheme on ‘Strengthening of Database and Information Networking for Fisheries’. The Scheme has the following components:

- Sample survey for estimation of inland fishery resources and their potential for fish production.
- Census on marine fisheries.
- Catch assessment survey for inland and marine fisheries.
- Development of GIS based fishery management system.
- Assessment of fish production potential in coastal areas.
- Evaluation Studies/professional services.
- Registration of Fishing Vessels.
- Development of database of fisheries cooperative of India.
- Mapping of smaller water bodies.
- Strengthening of Unit at Headquarters.

4.6.1 Database on inland fisheries and aquaculture

The database on inland fisheries and aquaculture resources and their fish production is weak and despite efforts made during the last three and a half decades, the picture on resource size, resource use as well as production is still hazy. Presently, the available figures on inland fisheries and aquaculture in the country are mere estimates with low reliability. During the Tenth Five-Year Plan, inland water bodies of 0.5 ha and above were mapped using satellite images of LISS III in all the States and LISS IV in five States for development of GIS. In the Eleventh Five-Year Plan, CIFRI, Barrackpore used LISS IV/LISS III/PAN images to develop aquatic resource map for twenty States, covering water bodies greater than 0.5 ha. The ground truthing for five states has also been completed.

The resources under inland fisheries and aquaculture are highly dispersed and mostly located in inaccessible and difficult terrain. In case of freshwater aquaculture, the resource size is small and often difficult to capture. Therefore, a multi-pronged strategy would be necessary to fulfill this important requirement and *inter alia* would include resource mapping through GIS; regular building and updating of the data-base; manual survey of water resources, etc. Like marine fisheries, census may also be undertaken for inland fisheries during the Twelfth Plan. In case FADAs are set up, these agencies could be useful coordinators in undertaking the task at the district-level.

4.6.2 Database on marine fisheries

Development of reliable and accurate database is a pre-requisite for any developmental activity. Presently, the statistics on marine fish landings are being collected by the DoF of the respective coastal State Governments as well as the CMFRI, Kochi and its centres located in different coastal States of the country. The DoF over the years have diluted their attention on data gathering, resulting in poor data quality as also time lag in providing the information. On the other hand, CMFRI has been continuing with its data collection programme, which unlike the DoF information is more robust and is carried out systematically following standard methodology. However, CMFRI being a specialized national facility may not be required to commit itself to this routine

task of collecting and processing data. On the contrary, CMFRI's advanced facilities should be utilized to undertake detailed biological studies on species of commercial significance and correlating them with fluctuations in the marine ecosystem, including changes that are being brought about by global warming; up-gradation of methodologies and survey designs for data collection and processing, including regular capacity building of DoF staff in taxonomy and data collection and processing methodologies; conduct of census at regular intervals, including socio-economic profiles of marine fishing communities; etc.

The DAHD&F is actively considering entrusting CMFRI the task of providing database on marine fisheries. This proposal is a deviation from the existing practice of the coastal States/UTs providing data on marine fisheries, which is processed by the DAHD&F. This move has both pros and cons. The positive aspect is that CMFRI would be able to use its specialization in the field and provide data that is expected to be statistically robust. The negative aspect is that CMFRI would first seek the entire funding for collection of data from the DAHD&F and second spend a larger part of its manpower in collecting, collating and processing data, which would be more of managerial nature than research-oriented.

As stated in the earlier paragraph, CMFRI as a specialized research agency should pay more attention to the R&D needs of the country, which no other agency in the country can perform. It may also be noted that CMFRI may not have the required manpower and offices to collect data at the national level and at least in the short run it will face the same problem of lack of trained manpower for collection of data as the States/UTs are now facing. Further, as recruitment of new manpower is restricted, CMFRI would be largely relying on contractual staff. Collection of data and its processing is primarily a State task and they should continue to do so. However, the DAHD&F may provide necessary assistance during the ensuing Plan period to strengthen the states' technical capabilities to collect quality data.

The CMFRI with funding assistance from the DAHD&F has completed two censuses on marine fisheries, the first one in the year 2005 and the second in 2010 for the mainland. The censuses for the two Island territories were conducted by the Fishery Survey of India. This has been a useful exercise and need to be continued with inclusion of more parameters, especially on the socio-economic attributes of marine fishing communities to make the census comprehensive.

The use of GIS for mapping existing coastal aquaculture sites including potential areas for aquaculture as well as mariculture would be another useful activity to be taken up during the ensuing Plan period. Further, a National Fisheries Information Grid could also be established involving all the concerned institutions in the country.

The issue of registration of fishing vessels along with other coastal security issues has been greatly emphasized after the terrorist attack in Mumbai on 26.11.2008. It is desirable to have a uniform system for registration of all types of fishing vessels irrespective of their size and tonnage, in lieu of different registration regimes adopted by coastal States/UTs. This component

is implemented in nine coastal States and four UTs besides establishing requisite infrastructure facilities for creation of a centralized database in the DAHD&F. Under this component, 100 percent Central assistance is provided to all coastal States/UTs and National Informatics Centre (NIC) for development of required software and creation of necessary infrastructural facilities. Besides, the entire cost for development of centralized database in New Delhi and its management, maintenance and operation will be met under the scheme. This activity will continue in the ensuing Plan period and could form a part of the proposed scheme on MCS.

4.6.3 Introduction of log book system

While standard sampling programmes for collection of data from the marine fisheries sector would continue, it is also suggested to introduce the log book system for marine fishers. Use of log books for obtaining data is being increasingly practiced and recently the European Union (EU) has also introduced log books as a part of its certification scheme for fish catches destined for the EU member-states. With its pre-dominant small-scale fisheries, use of log books in India would be a daunting task, but a beginning could be made in the Twelfth Five-Year Plan, initially starting with the mechanized fishing vessels. The introduction of log books could also be a part of the scheme on MCS.

4.6.4 Improving networking

Two national information grids, one for marine fisheries and the other for inland fisheries and aquaculture are proposed to be set up during the ensuing Plan period. The modalities for setting up of this grid could be worked out in consultation with the NIC. Modern technologies such as 'cloud computing' could be used for the grids, which would be cost-effective in the long run. The grids will be the repository of all information on marine and inland fisheries sectors; will be a single-window source for all information relating to the sector; and will facilitate networking with all key stakeholders, especially the States/UTs and the Institutions. These grids could also collate information of concern to the sector from the other Ministries/Departments dealing with fisheries-related matters. The grid masters could either be located in the DAHD&F or at the assigned institutions for marine and inland fisheries. These grids will also facilitate computerized reporting system for fisheries data base available on the grids for user groups. This is also likely to bring in more transparency in the fisheries sector.

4.7 Development-enabling fisheries policy, legislative support and institutional strengthening

The Working Group constituted by the Planning Commission for the Fisheries Sector has been mandated with the task of preparing its report on development and management of fisheries and aquaculture in the Twelfth Five-Year Plan period. Since management has been identified as one of the requisites for the fisheries sector during the Twelfth Plan, the following paragraphs deal with the interventions proposed for enabling policy

development, legislative support and institutional strengthening and, or/ restructuring to make fisheries management and governance in the country more effective and meaningful.

4.7.1 Development- of enabling policy and/policy reforms

Appropriate policies provide the required framework for development of any sector. This is all the more important for food production sectors, which involve large number of stakeholders as also institutions. Fisheries developmental programmes in the country have been largely guided by the Five-Year Plans, which define the broad policies for the sector. Other than this, attempts have been made from time to time to formulate policies for individual activities/programme such as deep sea fishing, shrimp farming, etc. The meetings of the Central Board of Fisheries held during the eighties and nineties also spelt out broad policies for the sector. Fisheries being a State subject, many States have also formulated their policies for sustainable development of the sector.

However, at the national level, the 2004 Comprehensive Marine Fisheries Policy (CMFP, 2004) could perhaps be cited as the first policy document in the country. The CMFP, 2004 is now seven years old and keeping in view the contemporary changes in the sector, this policy is outdated in many respects. It is suggested that like the National Agriculture Policy, a National Fisheries Policy (NFP), encompassing both marine and inland fisheries and aquaculture, may be formulated with full involvement of the developmental agencies, Fisheries Institutions and stakeholders, especially the fisher community during the Twelfth Plan period. This policy should take into account the developmental requirements of the sector, inter and intra-sectoral coordination and linkages, institutional strengthening, trade matters, availability of public finances, etc. The NFP should adequately address the challenges before the sector so as to enhance its contributions to the overall economy of the country. Such a policy will also provide important framework and guiding principles to States for developing their own policies based on developmental priorities, nature of available resources and issues confronting the sector.

4.7.2 Legal support

The existing legal support to develop sustainable fisheries in the country is inadequate. The division of responsibilities between the Centre and the States and also the ramification of fisheries related activities within the jurisdiction of several Ministries/Departments at the Centre have posed problems in providing a strong and implementable legal support to the sector. Several examples can be cited in this regard. The present-day Marine Fishing Regulation Act (MFRA) enacted by all the coastal States/UTS is a product of the model Bill circulated by the Central Government in 1979, largely to address the intra-sectoral conflicts in marine fisheries. In the last three decades, since the model Bill was circulated, the marine sector has undergone a sea change, placing much larger responsibilities on the State to manage its marine fisheries resources. However, none of the coastal States have reviewed their MFRA to incorporate the topical needs of the fisheries sector.

Similarly, most of the inland States have repealed the Indian Fisheries Act of 1897, to enact their own law to regulate inland fisheries. Based on an archaic law, the present law regulating inland fisheries in the inland States also remains ineffective and fails to meet the requirements of the sector. In this regard, the Central Government had circulated a Model Bill, which is yet to receive due attention by the concerned States. Further, a conspicuous gap remains in not regulating fishing by wholly Indian owned fishing vessels in the area fully under the competence of the Central Government (*i.e.* beyond Territorial Waters). In this regard, a Bill was circulated to the States seeking their comments, before it was placed before the Parliament for its consideration. However, some States opposed the Bill and the matter still remains inconclusive.

Other than the above-mentioned examples, there are many areas in the fisheries sector where legislation is necessary in the interest of the long-term development of fisheries and aquaculture in the country. In the last two to three decades India has also participated in development of many international instruments of binding and non-binding nature catalyzed by expert UN Organizations like the FAO, International Maritime Organization, etc. To allow India's full participation in these international instruments, it is necessary for the country to accord ratification/accession to such instruments. It is proposed that the DAHD&F may consider the legislative requirements of the sector both in terms of domestic legislation as also international instruments and fulfill the gaps during the ensuing Plan period.

4.7.3 Institutional strengthening

Institutions form the back bone of primary sectors such as fisheries. The institutional structure in support of fisheries sector is comprehensive and covers both development as well as research needs of the sector. At the Central Government-level, the Ministry of Agriculture alone has 08 Research and five developmental Institutions, including the NFDB and one regulatory body. Similarly, the Ministry of Commerce and Industry, the Ministry of Earth Sciences, Department of Science and Technology also have Institutions, whose mandates include support to the fisheries sector. Despite the large number of public-funded institutions, the fisheries sector's requirements are not adequately addressed. The following paragraphs highlight the issues as well as propose interventions for restructuring and strengthening the institutions under the DAHD&F, Ministry of Agriculture, including the Board.

The DAHD&F under the Ministry of Agriculture, in terms of its Allocation of Business, has the mandate to attend to Fishing and Fisheries (inland, marine and beyond territorial waters) and the Fishery Survey of India, Mumbai. It is seen that over the years the mandate and functions of the institutions under the ambit of DAHD&F have remained almost static, without making significant changes to meet the growing needs of the sector. As a result the contributions of these institutions are not meeting the aspirations of the beneficiaries or the primary producers. Further, these institutions have considerably weakened in terms of manpower and wherewithal, leading to inadequate support to the sector. Over the years, the staff strength of the Fisheries Division in the

DAHD&F has also dwindled while the work load has increased manifold. This situation too has not augured well for the sector.

However, with the establishment of the NFDB in July 2006, the workload of DAHD&F was reduced to some extent. During the Eleventh Five-Year, some of the developmental programmes handled by the DAHD&F were either fully transferred to the Board or shared by both.

Strengthening the National Fisheries Development Board

The NFDB, set up as an autonomous body (under the Societies Act of Andhra Pradesh), is mandated to undertake development of the fisheries sector. Its autonomous status provides flexibility in terms of operation, man power development, etc. Conceived largely on the patterns of the National Dairy Development Board, the NFDB has completed five years, but its development seems to be stymied and losing the vigor with which it was set up.

The Twelfth Plan provides an ideal opportunity to the Government to boost the Board's performance. While adequate funding would be a pre-requisite, the Board also needs to be appropriately staffed with quality manpower, capable of delivering the goods. The Board has so far failed to attract talent, as it has opened its doors only for serving Government staff (from the State as well as Central Government) with rigid recruitment rules in terms of age, qualification, etc. The NFDB should have the flexibility to attract talent by changing the recruitment rules to include direct recruitment of at least 75 percent of the staff at appropriate levels and if need be invite qualified staff to come on its payroll, even if they are from the private sector.

With a mandate to develop marine and inland fisheries, promote aquaculture, strengthen infrastructure and undertake HRD activities, the NFDB also need to have adequate institutional support and field- level machinery. To accomplish this, it is suggested that the work programme of the four institutions under the DAHD&F be completely dovetailed with the NFDB so that these institutions provide the necessary technical support for fisheries harvest and post-harvest activities to the Board.

With regard to the field-level machinery, it has been proposed in the earlier chapter(s) that the FFDAs and the BFDAs be merged into a single entity, the Fisheries and Aquaculture Development Agency (FADA) and linked to NFDB as it its field-level arm. The modalities of FADA's structure including manpower requirement, funding, areas of operation and lines of control can be worked out in consultation with the State Governments. These agencies will also perform the important task of extension, which has so far eluded the fisheries sector. Going by the experience of the NFDB during the last 5 years, it is felt that in the absence of any field-level support, it may be difficult for the Board to penetrate effectively at the grassroots.

In view of a major shift in policy and outlook of the States from revenue generation and custodian of fisheries resources to a service providing agency for promoting aquaculture and fisheries for development would require adequate institutional strengthening and organizational restructuring, bringing

enabling policies/policy reforms and supporting legislations. Initial support is proposed to the States for bringing desired institutional and organizational restructuring in conformity with their development priority and goals.

Coming back to the DAHD&F, it may be prudent for the Department to transfer all production-oriented schemes relating to marine and inland sectors, infrastructure development programmes and HRD activities to the Board. The DAHD&F may focus on policy and legal issues; MCS activities in respect of marine fisheries; trade matters; international cooperation; strengthening of data base and information networking; implementation of welfare programmes for fisher communities; and administrative and personal matters of the institutions. Besides, the Department may also perform the important task of coordination with sister Ministries/Departments at the Centre and on critical policy and legal issues with the States/UTs. This allocation of work between the DAHD&F and the NFDB could be a win-win situation for both the organizations as also for the fisheries sector.

Re-organizing fisheries institutions

As mentioned earlier, the DAHD&F has four specialized institutes under its fold, namely:

(i) Fishery Survey of India (FSI)

(ii) Central Institute of Fisheries Nautical Engineering & Training (CIFNET)

(iii) Central Institute of Coastal Engineering for Fishery (CICEF)

(iv) National Institute for Fisheries Post-Harvest Technology and Training (NIFPHATT)

Details on their mandate have been described elsewhere in the document and, therefore, not repeated here. Over the years, these four institutions have also weakened considerably in terms of their manpower and wherewithal. Some of them have also lost their relevance to a considerable extent and are undertaking work that has little impact on the sector *per se*. Presently, a sound review of their performance might conclude that their continuation or otherwise may not have much impact on the fisheries sector.

However, by redefining their mandates and bringing all the four institutes under one umbrella might change the situation. Therefore, it is proposed that all the four institutes be merged into a single institute and be responsible for undertaking (i) fisheries survey in both marine and inland waters (including stock assessment); (ii) coastal engineering for harbours, fish landing centres coastal aquaculture, etc.; (iii) fisheries nautical engineering and training (restricted to actual operators) and safety at sea; and (iv) improvements in post-harvest fisheries, including value addition of species aimed at domestic markets and small-scale processors. The above mentioned four areas of work could also be defined as the four pillars of the new institute, which may be named as the Indian Fisheries Development Institute (IFDI).

This convergence of the four institutions as a single entity will bring the entire manpower under a common pool, which will overcome the present manpower

shortage in the institutions to a considerable extent and also allow lateral movement of staff from one area to the other. The pooling of wherewithal will optimize their use and reduce wastage of the facilities created so far. In the process some of redundant activities carried out by these Institutes could be stopped and only need-based activities would be allowed. The new institute will also be a hub of human resource development, especially for training the trainers and providing an important support to the NFDB. The work programme of the new institute for the twelfth Five-Year Plan could be decided in tune with the requirements of the Board.

The modalities of merging the four institutions and charting the mandate of the new institute could be finalized after detailed discussions at the DAHD&F level. In all probability this convergence of manpower and resources would also be a win-win situation for the Government as well as for the fisheries sector.

Finally, the States as the custodians of fisheries resources shall also be required to undertake their institutional strengthening and re-organization wherever considered necessary.

4.8 Coordination and linkages

4.8.1 Inter-Ministerial/Departmental coordination

Amongst all the primary production sectors, fisheries is perhaps one such sector that has maximum cross-sectoral linkages, necessitating effective coordination to safeguard the interests of the sector. In the case of inland fisheries and aquaculture, competing requirements for resources have often relegated fisheries needs to the background. Similarly, in the marine sector lack of coordination has led to adverse impacts on fisher communities. In this regard, the exclusion of fishers from the MPAs stands out as an example.

With the increasing demand on finite resources such as fisheries, it is likely that inter-sectoral competition for resources would aggravate. In such a situation, the fisheries sector cannot work in isolation. Rather effective coordination and consultation with other concerned Ministries/Departments at the Centre and a similar exercise at the State level would be necessary to ensure that the fisheries sector's needs are not compromised. With the shifting of production–oriented and infrastructure development schemes to the NFDB, it would be easier for the DAHD&F to concentrate on works of normative nature and undertake effective coordination/consultation and wherever necessary negotiations to ensure that the requirements of the fisheries sector are adequately considered along with the requirements of the other competing sectors in the country.

4.9 Programme monitoring and evaluation

During the Five-Year Plans the Government of India implements several schemes for fisheries development. Many schemes have also been carried forward from one Plan to the other. From time to time some of the schemes are subject to review and changes are made on the basis of the recommendations contained in the review. Further, the physical and financial

progress of these schemes is also regularly ascertained, based on which funds are released to the States/UTs or other implementing agencies. However, there is no mechanism to conduct regular Monitoring and Evaluation (M&E) of these schemes either by the Government itself or through third parties.

It is needless to state that regular M&E of the schemes can result in ascertaining the progress of the scheme comprehensively rather than just looking at the physical and financial progress. Further, regular M&E can bring in greater accountability and transparency in operation of the scheme. Finally, it can also facilitate mid-term corrections, if things are going wrong.

In view of the above, it would be essential if all the schemes implemented during the Twelfth Five-Year Plan have in-built mechanisms for M&E and also periodical assessment to be carried out by third parties. To make the M&E objective and free from bias, the administrative approvals issued for each scheme may also list the term of reference for M&E. Appropriate budget may be earmarked in each scheme for this important function. To bring efficiency with ease, suitable software should be developed and introduced in all the States and other concerned agencies and linked to the websites of DAHD&F and NFDB. Option for availing cloud computing mode for such operations can also be considered.

4.10 Research development interface

Sustainable development of any sector, whether it is industrial or food production, requires constant inputs from the research arena. In the case of capture fisheries and aquaculture, regular inflow of sound technology and up-gradation of data base can ensure steady growth of the sector and help in contribution to the food basket as well as economy of the country.

To ensure the above development to take place, it is also essential that the research institutions and development agencies move in unison like the two wheels of a cycle. A sound interface and seamless channels of communication between the two can bring in the best results that can feed into the system and finally reach the primary producers, who are also the ultimate beneficiaries of technology or information. Presently, there is poor flow of technology from research institutes to the development departments and also poor promotion of technology. This deadlock needs to be broken.

In the early seventies, close cooperation between research and development in the fisheries sector did result in the sector becoming vibrant and dynamic, especially in aquaculture. The All India Coordinated Research Projects (AICRPs) implemented by the Indian Council of Agricultural Research (ICAR) allowed the composite fish culture or poly culture of carps to reach the small farmers across the length the breadth of the country. Similarly, the AICRP on Air breathing Fish Culture, Brackish water Fish Farming and Reservoir Fisheries provided boost in their respective areas. During the same time the establishment of FFDAs by the Ministry of Agriculture at district level in the country allowed the technologies generated by the research institutions and promoted under the AICRP to reach the farmers all over the country. Later a similar story was repeated in the brackish water farming areas along the

coastline of the country. All this culminated in the first 'blue revolution' that the country witnessed in the late seventies and is still continuing, albeit with reduced speed.

The above developments do stand out as 'success stories' in the annals of Indian fisheries sector and such success stories need to be replicated to provide the sector a second dose of 'blue revolution'. The lessons learnt from the excellent connections and rapport between research and development in the past need to be replicated in future also. The big challenge before us in the coming years is to bridge the above gap and once again create a seamless path where technology generated in the research institutions flows to those who need them. The eight ICAR Fisheries Research Institutes, with 'state-of-the-art' facilities, are mandated to undertake research and provide necessary guidance to the development agencies on one hand and directly to the farmers on the other hand. The technologies generated in these institutes should be put to rigorous piloting or demonstration as done earlier in the seventies and eighties.

Moving to capture fisheries, there is lot of scope for development of technologies, which can be adopted by the primary producers, but mainly constrained owing to multiuse nature of the water bodies. In capture fisheries, where fishers constantly grapple with the uncertainties of nature, it is all the more essential that good data, which is based on well researched material, flows to the fishers as well as to the Governments to enable them to take considered decisions.

One of the main reasons for this weak linkage between research and development is weak feedback loop. There is increased need of taking research decisions in tune with the requirements of the primary producers. The fisheries research needs to be made more demand driven. Fisheries being a specialized area, it is necessary to allocate resources efficiently as people trained by the system attract low employment scope outside the sector.

In the Twelfth Five-Year Plan, it would be appropriate if steps are taken to improve this situation, by formalizing the research-development interface and also by bringing in more accountability in the process. Since it is proposed to transfer all the production-oriented schemes to the NFDB, the Board may consider setting up of a National-level Committee involving all the concerned players, including the user groups to develop a feedback loop. A committee of this nature is likely to benefit both the researchers as well as the fisheries managers in the country.

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CHAPTER 5.0

5.0 Twelfth Five-Year Plan: Programmes and strategies

5.1 Objectives

The proposed programmes and strategies for fisheries and aquaculture development in the Twelfth Five-Year Plan aim at holistic development of the sector. It is now widely acknowledged that fisheries have a major role in supply of nutritious protein for the growing population and in accelerating the overall economy of the country. To achieve this, it is essential that both increase in production and resource sustainability would go hand-in-hand. In this regard, the objectives for development and management of fisheries and aquaculture in the Twelfth Five-Year Plan are proposed as follows:

- Enhancing production of fish on an environmentally sustainable and socially equitable basis;
- Ensuring optimum exploitation of fisheries resources in the Indian Exclusive Economic Zone in a manner consistent with the principles of ecologically sustainable development;
- Conserving aquatic resources and genetic diversity and preservation of health of ecosystems while ensuring bio-security;
- Maximizing net economic returns to the fishers and fish farmers through technological support and implementing efficient and cost -effective aquaculture and fisheries management practices;
- Strengthening infrastructure in harvest, post-harvest, value-addition and marketing;
- Increasing the per capita availability and consumption of fish to about 11 kg/capita/annum;
- Augmenting export of fish and fish products;
- Securing and increasing employment opportunities in the sector;
- Improving safety and labour conditions in fisheries and aquaculture;
- Uplifting the social and economic conditions of fishers and fish farmers and ensuring their welfare; and
- Improving overall governance and management of fisheries sector in the country through institutional strengthening and human resource development.

5.2 Programmes and strategies

The programmes and strategies for fisheries and aquaculture development in the country during the Twelfth Five-Year Plan have been developed keeping in view the objectives identified for the sector. While most of the programmes implemented during the Eleventh Five-Year Plan are proposed to be continued, greater emphasis will be on quality execution of the programmes in the ensuing Plan with an equally strong focus on management and conservation of

the resources. The following paragraphs highlight the programmes and strategies for fisheries development and management in the Twelfth Five-Year Plan.

5.2.1 Development of marine fisheries, infrastructure and post-harvest operations

Development of marine fisheries, infrastructure and post-harvest operations would be taken up during the Twelfth Plan through a set of programmes aimed at both increasing production and optimum utilization of the resources. While most of the activities are carried forward from the Eleventh Plan with some changes in the unit cost and subsidy components, some new components/programmes have also been added to meet the growing requirements of the sector and removing institutional weaknesses. ***Table 22*** below provides a snap-shot of the activities to be implemented during the Twelfth Five-Year Plan. Details on the unit costs and funding pattern are provided in ***Annexures 16 - 18***. All the activities under this scheme would be implemented by the NFDB.

Table 22: Components under development of marine fisheries, infrastructure and domestic fish marketing

Development of marine fisheries	Development of infrastructure	Development of domestic fish marketing
Motorization of traditional craft	Construction and expansion of Minor Fishing Harbours (FHs) and Fish Landing Centres (FLCs)	Modernization of wholesale fish markets
Fishermen development rebate on HSD oil	Modernization of FHs and FLCs	Modernization of retail markets
Use of sail in motorized boats	Strengthening of post-harvest infrastructure	Construction of new retail market with 10-20 stall capacity
Conversion of trawlers to resource specific fishing vessels	Developing fish preservation and storage infrastructure	Setting up of retail fish outlets /kiosks
Safety of fishermen at sea	Assistance for maintenance dredging of FHs and FLCs.	Cold chain development and preparation of value added products. Establishment of ice plant.
Development of Monitoring Control and Surveillance system for marine fisheries	--	Campaign for promotion of fish products and increased consumption of fish and fish products
Management of marine fisheries	--	Organization of fish festival/fish mela
Production enhancement through mariculture	--	Setting up of model fish dressing units
--	--	Hygienic drying of fish
--	--	Fish transportation from FH/FLC to markets by women SHGs

In the marine sector a new scheme on Monitoring, Control and Surveillance (MCS) will be introduced to largely regulate the fishing fleet and bring in orderliness in their operations. Since this scheme would be of regulatory nature and being implemented for the first time, it is proposed that this scheme be handled by the DAHD&F directly in association with the Department of Fisheries (DoF) of the coastal States/UTs and other concerned agencies. The proposed scheme will deal with the following activities:

- Regulation for access to waters and resources, including authorization schemes for vessels;
- Maintenance of records of all vessels (through appropriate registration and licensing) and their current owners and operators authorized to undertake fishing subject to their jurisdiction;
- Maintenance of records of all boat building yards and their operation and construction of boats as per specified norms and guidelines;
- Implementation of log book system, as appropriate for particular category of fishing vessels;
- Implementation of Vessel Monitoring System (VMS), where appropriate, in accordance with the relevant national, regional or international standards, including the requirement for vessels under their jurisdiction to carry VMS on board;
- Implementation of observer programmes, where appropriate, in accordance with relevant national, regional or international standards, including the requirement for vessels under their jurisdiction to carry observers on board;
- Provision of training and education to all persons involved in MCS operations;
- Planning, funding and undertaking MCS operations in a manner that will maximize their ability to prevent, deter and eliminate IUU fishing from the Indian EEZ;
- Promotion of industry knowledge and understanding of the need for, and their cooperative participation in MCS activities to prevent, deter and eliminate IUU fishing;
- Promotion of knowledge and understanding of MCS issues within national judicial systems;
- Setting up of MCS Division at the Central level (Ministry of Agriculture-MoA) and in each coastal State and Union Territory for effective implementation of the scheme;
- Establishment and maintenance of systems for acquisition, storage and dissemination of MCS data, taking into account applicable confidentiality requirements;
- Ensuring effective implementation of national and, where appropriate, internationally agreed boarding and inspection regimes consistent with international law, recognizing the rights and obligations of masters and of inspection officers, and noting that such regimes are provided for in certain international agreements, such as the 1995 UN Fish Stocks Agreement, and only apply to the parties to those agreements.

5.2.2 Development of inland fisheries and aquaculture

Developmental programmes and strategies for inland fisheries and aquaculture during the Twelfth Five-Year Plan aim at inclusion of all available resources for augmentation of fish production. The schemes include a judicious mix of production enhancement and resource conservation programmes for ensuring sustainability. In inland capture fisheries, the rivers and their tributaries (including cold water resources), the floodplain wetlands and the estuarine resources have been overlooked in the past Plans leading to resource deterioration and fall in production and productivity. As the future of these resources largely lies in conservation and habitat restoration (wherever permissible), the focus will be on the following activities:

- Identification of riverine stretches for conservation as sanctuaries, primarily for maintaining brood stock populations and genetic biodiversity;
- Replenishment of depleted stocks through river ranching in selected stretches;
- Conservation/protection of breeding grounds of commercially important fish species;
- Habitat improvements in floodplain lakes and wetlands and supplementary stocking in identified water bodies for stock enhancement; and
- Community mobilization for increased participation of local communities in implementation of conservation and habitat improvement programmes.

While implementing the above-mentioned programmes, it would be ensured that the ecological functions of these resources are not altered. Besides, several policy and inter-Ministerial/Departmental initiatives would also be made to reduce pollution load into the inland capture fisheries resources, promote aforestation programmes in the catchment areas to reduce siltation, conduct vulnerability assessment of these water bodies for climate change, enhance involvement of community participation in developmental processes and strengthen the legal base to meet the growing requirements of the inland fisheries sector.

The reservoirs, with their large water-spread area and the fact that most of them are located in tropical to sub-tropical climate zones, are likely to be main fish production centers in the years to come. The input-output ratio in reservoir fisheries *vis-a-vis* other production sectors such as marine fisheries or aquaculture is the best. In reservoirs, with minimum capital inputs and with appropriate management norms, production levels can be highly remunerative. The proposed interventions for the reservoirs during the ensuing Plan period are aimed at supplementary stocking with quality seed of Indian Major Carps; creation of adequate rearing space for *ex-situ/in-situ* seed production; efficient fish harvesting gear and craft; support for creation of improved fish marketing paraphernalia; bringing more and more reservoirs under scientific fisheries management practices; ownership and leasing of reservoirs on long-term; and continuous programmes for HRD of reservoir fisheries managers and fishers.

Aquaculture, both in fresh and brackish waters would be another important area of increasing fish production during the Twelfth Five-Year Plan. The schemes proposed for aquaculture aim at horizontal and vertical expansion of the farming area; optimizing productivity of existing waters including cold waters, water logged, saline and waste waters; canals; diversification of species and intensification of culture practices including integration of aquaculture with agriculture/livestock; fish health management and disease diagnostics and strengthening of field-level extension machinery.

Fish production and productivity from aquaculture would largely depend on availability of quality seed in sufficient quantities. Therefore, aquaculture programmes will also focus on achieving local-level fish seed self sufficiency to cater to the needs of the sector in different parts of the country. Presently, seed production in the country is West Bengal centric and seed supplies are made to many parts of the country. This results in considerable mortality of seed on account of long-distance transportation. Popularization of seed production in other States with potential for aquaculture will ease the situation, both in terms of quality as well as quantity.

Similarly, adequate thrust would also be given to quality feed production so that aquaculture practices are not hampered on account of non-availability of good feed. Presently carp culture is largely dependent on crude mix of oil cakes and rice bran, and this raw material is also in short supply in many parts of the country, especially in the North-Eastern States. Promotion of feed manufacturing units can ease this problem to a large extent. Poor health management and disease outbreaks take a sizeable toll of farmed fishes. This puts enormous burden on the farmers, who at times resort to quick remediation to save the stock. To reduce the incidence of disease outbreaks and also provide advance warnings to fish farmers, efforts will be made towards fish health management and a sound surveillance mechanism on disease outbreaks and their containment.

The Twelfth Plan Programmes aim at revival of the FFDAs and the BFDAs. These agencies are proposed to be merged into one district-level agency (Fisheries and Aquaculture Development Agency or FADA) to attend to the developmental needs of the sector and provide a single-window source for assistance to the fishers and fish farmers. The FADA will also meet the extension needs of the fish farmers and fishers (especially the reservoir fishers), which is so far very weak. Adequate funding would be required for setting up of FADAs and their operation during the Twelfth Plan.

In the non-food sector, it is proposed to promote ornamental fisheries in both rural and urban areas. The focus in this area would be on development of entrepreneurial skills among women and unemployed youth to take up ornamental fish farming and other activities associated with it, such as manufacturing of aquaria, marketing of other aquaria accessories, etc. On the technical front, assistance is proposed to be provided for breeding of native varieties of ornamental species that have export market and can also reduce pressure on wild ornamental species.

Table 23 below provides a list of activities proposed to be implemented during the Twelfth Plan. Details on the unit costs and funding pattern are provided in ***Annexures 19 - 25***. All these schemes would be implemented by the NFDB.

Table 23: Components under inland fisheries and aquaculture development

Development of freshwater aquaculture	Development of brackish water aquaculture
Construction of new ponds in Plains	Construction of brackish water fish and shrimp farms
Construction of new ponds in Hill States/North-East Region	Renovation of brackish water fish and shrimp farms
Reclamation/ renovation of ponds/tanks in Plains	First year inputs for culture of *Penaeus monodon* and *Littopenaeus vannamei* and fin fish
Reclamation/ renovation of ponds/tanks in hilly areas	Aquatic Quarantine and Inspection Unit (AQIU)
Input cost for composite fish culture	Assistance to Specific Pathogen Free shrimp culture farms for additional infrastructure to cater to bio-security and waste management.
Input cost for integrated fish farming (with agriculture, horticulture)	Disease surveillance
Inputs for integrated fish farming– Livestock (poultry, ducks, pigs)	--
Freshwater fish seed hatchery	--
Small-scale seed unit (spawn)	--
Fish seed rearing units (ponds with water supply)	--
Renovation/re-modeling of rearing space/nursery pond with brood stock maintenance and rearing in hatcheries of government/ private sector	--
Input cost for fish seed rearing (up to fingerling)	--
Fish feed units	--
Establishment of freshwater prawn seed hatchery	--
Development of Brood stock Bank for raising quality brood stock of freshwater fish and prawn species including development of ponds/farm and transport arrangements	--
Disease surveillance	--

Development of coldwater fisheries/aquaculture	Development of saline waterlogged/saline land areas for aquaculture
Preparation of resource survey report/feasibility report	Development of water logged areas
Construction of raceway	Inputs – seed, feed, etc.
Input cost	--
Running water fish culture in hilly areas including cost of inputs	--
Hatcheries	--
Capacity: 5.0 million eyed ova/year	--
Capacity: 0.4-0.5 million fry/year	--

Development of reservoir fisheries	Development of inland capture fisheries in rivers, floodplain lakes, etc.	Development of ornamental fisheries
Stocking of fingerlings in small, medium and large reservoirs.	Riverine fisheries conservation and awareness programme	Backyard hatchery
Pen/cages/rearing ponds for fish seed raising	Stocking of floodplain wetlands (mauns/beels/chaurs)	Small hatchery
Craft and gear for reservoir fishers.	Restoration of floodplain wetlands (mauns/beels)	Commercial unit
Construction of landing centre.	Restoration of river connecting channels and water regulatory structures (Mauns/beels)	Aquarium fabrication, accessories and service Unit
Assistance for fish marketing	Development of seed rearing units	--

5.2.3 National scheme for welfare of fishermen and fisherwomen

Being poorest of the poor, the welfare of fisher community in India is of utmost importance. Thus the welfare schemes implemented for the fisher community during the Eleventh Five-Year Plan are also proposed to be continued during the ensuing Plan. However, changes have been proposed in some schemes to make them more useful and comprehensive. The components that are proposed to be continued are as follows:

- Development of Model Fishermen Villages
- Group Accident Insurance for Active Fishers
- Saving-cum-Relief

Since fisher women have been playing a pivotal role in the sector, it is proposed to extend the Group Accident Insurance and Saving-cum-Relief components to women also. Similarly, the contribution of migrant fish workers is increasing and their welfare too needs attention. A large number of mechanized fishing vessels, especially in States such as Gujarat are engaging migrant fish workers from other States (*e.g.* Orissa, Andhra Pradesh).

However, guidelines for including this category of workers in the ambit of welfare programmes would have to be worked out before a final decision is taken. It is proposed that DAHD&F may implement the welfare schemes with the active involvement of National Federation of fishermen's Cooperatives Limited (FISHCOPFED). The components proposed to be assisted during the Twelfth Five-Year Plan are given in ***Annexure 26***.

The HRD programme for the Twelfth Five-Year Plan will include a wide range of activities aimed at capturing the HRD needs of the entire gamut of stakeholders, from fishers to managers. The HRD activities would broadly include a range of training programmes, exposure visits and trainer's training. It is proposed that a 'Need Analysis' be undertaken by the NFDB, which is also the implementing agency for the scheme during the ensuing Plan period. This study will bring out the training needs for the sector, the training institutions/agencies and other modalities for conducting the training programmes. The study will also focus on strengthening the capacities of the State/UT Governments to undertake HRD programmes at their level on a continuing basis. The unit costs and other details will be worked out by the Board based on the 'Need Analysis'.

5.2.4 Central Sector Scheme on strengthening of database and Geographical Information System for fisheries sector

Reliable and robust database is a pre-requisite for undertaking any developmental programme or for formulating policies and plans. This is all the more important for countries like India, which is not only of continental proportions but also has a huge diversity in terms of fisheries resources and their production and productivity levels. The situation is further compounded with pre-dominant small-scale fisheries, which is widely dispersed in both marine and inland sectors. To enable this diversity to be captured in both time and scale, the on-going Central Sector Scheme (Strengthening of Database and Geographical Information System for Fisheries Sector), which covers inland and marine sectors is proposed to be continued with the following components:

- Strengthening of data-base and resource mapping of water bodies using GIS platform;
- Documentation of all water bodies through satellite imagery data and revalidation through manual survey;
- Socio-economic status of fishers covering parameters such as assessment of literacy, income and health status, etc.;
- Quinquennial census of marine and inland fisheries sectors. Special drive to be undertaken to map the cold water fisheries resources; and
- Vulnerability assessment of marine and inland fisheries and aquaculture resources for climate change.

It is proposed that this scheme be handled by the DAHD&F since some of the activities under the scheme may require coordination with other Ministries/ Departments at the Centre and with the DoF in the States/UTs. It is also

suggested the DAHD&F may take a decision on the agency that would be responsible for marine fisheries data collection. The issue has been discussed in Chapter 4.0 of this Report.

5.3 Fisheries institutions

In Chapter 4.0 it was proposed that the four institutions under the DAHD&F be merged into one institute (Indian Fisheries Development Institute – IFDI) and be placed under the NFDB to provide technical support to the Board in implementation of its activities. The activities to be undertaken by the new Institute may be worked out by the Board in consultation with the Institute and the allocation of budget be done accordingly.

5.4 Institutional strengthening including capacity building, policy and legislative support

Sound policies and comprehensive legislative framework form the back bone of good governance. In the fisheries sector, policies have been largely restricted to the Five-Year Plan documents or occasional stand-alone policies (*e.g.* the 2004 Comprehensive Policy on Marine Fisheries). The entire fisheries sector has so far not been covered with a sound policy framework, as was done for the agriculture sector in the past. In fact a comprehensive policy on fisheries sector can be a guiding factor for all the States/UTs and help them in shaping their policies and programmes from time to time.

The Twelfth Five-Year Plan provides an ideal opportunity to the DAHD&F to plug this vital gap and prepare a comprehensive policy at the central level and also guiding principles for states to develop their own comprehensive fisheries policies for the sector. During the discussions of the Sub-Groups and also in the two meetings of the main Working Group, several areas that needed policy initiatives were discussed. The following list details some of the important areas that would need policy-level interventions during the ensuing Plan:

- Treating fisheries and aquaculture at par with agriculture;
- Leasing of inland natural and manmade waters such as rivers, reservoirs, floodplain lakes, etc for fisheries and aquaculture purposes;
- Conservation and habitat restoration of inland water bodies, maintaining minimum flow levels in rivers and allocation of water for aquaculture purposes through cross-sectoral policy interventions;
- Introduction of exotic aquatic species;
- Insurance for aquaculture and capture fisheries' assets such as boats, nets, etc;
- Reducing pollution load in inland water bodies;
- Deep sea fishing;
- Leasing of coastal waters for mariculture purpose;
- Occupational safety and health aspects of fishers;

- Cross- sectoral issues in coastal and marine fisheries such as displacement of fishers due to setting up of national parks and marine sanctuaries, manmade disasters such as oil spills and due to other economic activities (oil exploration, commercial ports, etc.) and national security purposes;
- Habitat restoration by Installation of Artificial Reefs and FADs, bio-inventorying and biodiversity preservation in marine ecosystem;
- Vulnerability reduction of coastal fishers from natural disasters, including climate change and developing their adaptive capacities;
- Strengthening of fisheries cooperative societies;
- Human resource development in fisheries sector;
- Promotion of co-management regime for management of common pool public property fisheries resources;
- India's accession to international binding instruments and implementation of their provisions;
- Safe and hygienic fish and fish products thorough zero use of banned drugs and chemicals in aquaculture, improved sanitation and hygienic conditions in all post-harvest operations, etc; and
- Encouraging public, private and community participation in fisheries sector for attracting investment and better use of available resources.

Similarly, on the legislative front the sector may need several inputs to plug the legal void for strengthening of the sector. Some of the important requirements in this area are listed below:

- Revision of the Marine Fishing Regulation Acts (MFRAs) through a Model Bill that takes care of the topical requirements of the sector from both national and international perspectives;
- Renewed emphasis on the Model Bill prepared for Inland fisheries and aquaculture; and
- New legislation to regulate fishing by wholly Indian owned fishing vessels in the Exclusive Economic Zone.

Fisheries and aquaculture is a State subject and the activities are primarily multi-stakeholder. Therefore, it would be essential that both policy formulation and legislative framework is carried out through extensive stakeholder consultations at each and every stage. This would ensure a stakeholder-based approach and the policies and legislations would be well-accepted by the stakeholders resulting in higher level of compliance.

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CHAPTER 6.0

6.0 Proposed targets and outlays for the Twelfth Five-Year Plan

6.1 Summary of targets set for the Twelfth Five-Year Plan

Marine capture fisheries production reached new heights by the end of Eighth Five-year Plan and then declined during the Ninth Five-Year Plan. In the Tenth and Eleventh Plan periods, marine production registered a steady growth and it is expected that this growth would continue in the Twelfth Plan period also, albeit with appropriate incentives and a set of checks and balances.

While motorization of traditional fishing crafts and development rebate on HSD oil programme for fishing vessels are expected to continue, new incentives would be towards harnessing of the deep sea resources, use of Fish Aggregating Devices and Artificial Reefs for stock enhancement, mariculture, etc. The implementation of Monitoring, Control and Surveillance as a new programme in the ensuing Plan is expected to bring more discipline and orderliness in the sector and regulate the activities so as to maintain the growth in a sustainable manner.

In addition, infrastructural development undertaken during the Eleventh Five-Year Plan and further development of infrastructure during the Twelfth Five-year Plan will reduce post-harvest losses and improve operational efficiency. Further, with improved marketing support this will also add to the availability of more fish for human consumption.

Keeping the above in view, it is expected that during the Twelfth Five-Year Plan, marine fisheries will grow at 2.0 percent annually.

With the growth rate of 2.0 percent annually, it is estimated that 3.669 mmt of fish would be harvested at the end of Twelfth Five-Year Plan (2016-17). With this production, the country will be exploiting about 83 percent of its potential harvest of 4.419 mmt. This rate of exploitation of the resources is within the range of precautionary limits because a part of this harvest would also be contributed by mariculture.

While inland fisheries have grown in absolute terms, the rate of growth in terms of potential is not yet achieved. This can be attributed to less focus on sustainable development of inland capture fisheries in the past Plans; increasing pressure on inland resources, including habitat degradation; and multiple-use of inland water-bodies with least priority to the needs of fisheries sector. In aquaculture, the gradual decline of FFDAs and BFDAs and also their resultant poor performance, limited availability of quality seed and feed in many parts of the country and extremely weak extension services has impacted the overall growth of aquaculture in the country.

However, with the establishment of the NFDB in July 2006 and major initiatives on inland capture fisheries (mainly reservoirs) and aquaculture during the

Eleventh Five-Year Plan, some positive developments are visible. Many inland States are now keen to harness the reservoir productivity through a judicious mix of supplementary stocking and good management practices. Therefore, there is a general realization that future hikes in fish production in India are likely to come from inland fisheries and aquaculture.

Keeping in mind the recent developments and trends in production during the past Plan periods, it is expected that a growth rate of 8.0 percent can be achieved by the inland sector. With this growth rate, it is estimated to reach a fish production target of 7.910 mmt by the end of the Twelfth Plan Period (2016-17).

While reservoirs and freshwater aquaculture would be the two main pillars of fish production from inland sector, other resources such as upland water bodies, floodplain lakes and wetlands, irrigation canals, saline and waterlogged areas would be gradually mainstreamed to start contributing to the production.

Rejuvenation and consolidation of the two field-level agencies (FFDAs and BFDAs) into one single agency – Fisheries and Aquaculture Development Agency or FADA is expected to catalyze the process to a large extent. It is proposed to link this new agency with the NFDB so that it can provide all field-level functions such as extension, developing linkages and coordination and monitoring of the activities for the benefit of the States as also the Board. A State-level coordination and monitoring unit will facilitate linkages between FADAs in the State and the NFDB.

Programmes aimed at decentralized production and distribution of quality seed and feed for aquaculture and also culture-based-capture fisheries would complement the overall efforts aimed at optimizing production and productivity from inland fisheries and aquaculture in the country.

On the institutional front, strengthening of NFDB; bringing all development-related schemes under one agency; and restructuring of the fisheries institutions will be a major step in consolidating the wherewithal available with the Government. Further, need-based Human Resource Development programmes at all levels (fishers to managers) are also likely to contribute to improved management of the resources. HRD proposals, both content and mode of delivery with in-built system for pre- and post-evaluation be made flexible as per the need assessment conducted by the States/UTs.

On the policy and legal front, the DAHD&F with its new charter of work will be able to concentrate more on normative activities, formulation of policies and legislation to meet the growing needs of fisheries and aquaculture and intra- and inter-Ministerial/Departmental coordination to make the sector's foundation more robust and sustainable. The DAHD&F will also develop guiding principles for the States and encourage and support them to bring necessary development enabling policy reforms. In the revised distribution of work between NFDB and DAHD&F, the Department will also be able to focus more on welfare of the fisher community, strengthen fisheries database, improve MCS, and build stronger linkages between research and development.

With the scenarios for inland and marine fisheries described in the foregoing paragraphs, the total fish production during the Twelfth Five-Year Plan is likely to grow around 6.0 percent on an average per year. Given the growth rate of population, such a growth rate in fisheries will ensure the scope of increasing nation's footprints in the international market while meeting the domestic demand.

Table 24 and Table 25 below provide snap shots of the past performance and projections for the Twelfth five-Year Plan period.

Table 24: Past Performance of the fisheries sector

Plan Period	Production at the end of the period (000 tonnes)			Average Annual Growth Rate during the Plan (%)		
	Marine	Inland	Total	Marine	Inland	Total
VII (1985-90)	2 275	1 402	3 677	6.49	4.92	5.75
VIII (1992-97)	2 967	2 381	5 348	3.98	6.87	5.18
IX (1997-2002)	2 380	3 126	5 506	-0.83	5.65	2.23
X (2002-07)	3 024	3 845	6 869	1.44	4.25	2.92
XI (2007-12)						
2007-08	2 920	4 207	7 127	-3.44	9.41	3.76
2008-09	2 972	4 636	7 608	1.78	10.20	6.75
2009-10	2 689	4 862	7 551	-9.52	4.87	-0.75
2010-11 (Provisional)	3 220	5 068	8 288	19.75	4.24	9.76
2011-12 (Projected)	3 323	5 383	8 706	3.19	6.22	5.04

Table 25: Projections for Twelfth Five-Year Plan

Year	Targeted Production (000 tonnes)			Expected Annual Growth Rate (%)		
	Marine	Inland	Total	Marine	Inland	Total
2012-13	3 389	5 814	9 203	2	8	5.71
2013-14	3 457	6 279	9 736	2	8	5.79
2014-15	3 526	6 781	10 307	2	8	5.87
2015-16	3 597	7 324	10 920	2	8	5.95
2016-17	3 669	7 910	11 579	2	8	6.02

6.2 Summary of budget outlay (Scheme-wise)

During the Eleventh Five-Year Plan six schemes were implemented, which also included the NFDB. During the Twelfth Five-Year Plan, it is proposed to implement eight schemes. The two additional schemes include (i) Human Resources Development (HRD) in fisheries sector and (ii) Monitoring, Control, Surveillance (MCS), strengthening of policy and legal frameworks and other need-based interventions. In the Eleventh Plan the schemes on HRD were part of the National Scheme on Welfare of Fishermen. Besides, the NFDB also implemented various HRD programmes through its schemes. Keeping in view

the focus on HRD in the Twelfth Plan, it is proposed to have a separate scheme on HRD in fisheries sector, to be implemented by the Board.

The second scheme on MCS, strengthening of policy and legal frameworks and other need-based interventions is a new addition for ensuring sustainable growth of the fisheries sector. The DAHD&F proposes to implement a comprehensive programme on MCS during the Twelfth Plan with the active involvement of all coastal States/UTs. This would be a good move to bring discipline and orderliness in the sector. As mentioned in the earlier chapters it is proposed that all developmental schemes may be implemented by the NFDB and the schemes on welfare, strengthening of data base and MCS by the DAHD&F. For all work related purposes, the Fisheries Institutions shall be attached to NFDB. However, the personal and policy related matters of the institutions shall be handled by the DAHD&F.

A total outlay of the Rs.6 000.00 crore has been proposed for the Twelfth Plan and the ***Table 26*** provides a break-up of the proposed outlays for each of the eight schemes to be implemented during the ensuing Plan period:

Table 26: Projections for the Twelfth Five-Year Plan

Sl. No.	Proposed Schemes	Implementing Agency	Estimated Outlay (Rs. crore)
1.0	Development of Marine Fisheries, Infrastructure and Post-Harvest Operations	National Fisheries Development Board (NFDB)	1 000.00
2.0	Development of Inland Fisheries and Aquaculture	-do-	1 200.00
3.0	Human Resource Development in Fisheries Sector	-do-	300.00
4.0	National Scheme on Welfare of Fishermen and Women	Department of Animal Husbandry, Dairying & Fisheries (DAHD&F)	800.00
5.0	Strengthening of Data base in Fisheries Sector	-do-	300.00
6.0	Monitoring, Control & Surveillance; Strengthening of Policy and Legal Frameworks and other Need-based Interventions.	-do-	800.00
7.0	Assistance to Fisheries Institutions	NFDB & DAHD&F	600.00
8.0	National Fisheries Development Board	NFDB	1 000.00
9.0	**Total**		**6 000.00**

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Annexure 1: Marine fisheries and mariculture schemes

Scheme component	Existing funding pattern
Motorization of traditional craft	50% of the unit cost with ceiling of Rs.30 000/ OBM/IBM.
Safety of fishermen at sea	75% of the unit cost (Rs.1.5 lakh) of the safety kit.
Fishermen development rebate on HSD Oil	50% of sales tax relief granted by State/UT with ceiling of Rs. 3.00/litre with a ceiling of 500 litre/boat/month during fishing.
Conversion of trawlers to resource specific fishing vessels	New
Management of marine fisheries	To bear expenses for conducting awareness programmes. 100% consultancy for implementing CCRF. 100% for capacity evaluation. 100% cost for community outreach programmes on sustainable fisheries. 100% cost for production of audio visuals on overfishing/over capacity.
Enhancement of production through mariculture	New

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Annexure 2: Components assisted under the scheme on 'Development of Infrastructure and Post-Harvest Operations'

Scheme component	Existing funding pattern
Construction and expansion of Minor Fishing Harbours (FHs) and Fish Landing Centres (FLCs)	75% to coastal States, Port Trusts and others for new minor FHs and FLCs including expansion and modernization of the existing ones. 100% for major FH to States, UTs, Port Trusts and others. 50% to private entrepreneurs for new FHs on BOOT basis.
Modernization of FH and FLCs	New
Strengthening of Post-Harvest Infrastructure (i) Developing fish preservation and storage infrastructure	(a)100% for Government undertakings, Corporations, etc. (b) 75% to NGOs, Cooperatives in NE Region, Fisher SHGs, SHGs of SC/STs, Fisher Cooperatives, SHGs of women. (c) 50% for NGOs, Cooperatives, SHGs other than (b) above, private companies of SC/STs and fishermen. (d) 25% to Private companies/organizations other than (c) above. (e) 50% to Municipal Corporations and Marketing Boards for development of central fish markets.
Assistance for maintenance dredging of fishing harbours and FLCs	(a) 50% to coastal States, Port Trusts and 100% to UTs for maintenance dredging of existing FHs and FLCs. (b) 100% for maintenance of dredger covering insurance, dry docking, repair and up-gradation of the Dredger TSD Sindhuraj (owned by DAHD&F).

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Annexure 3: Infrastructure development for harbours and landing centres

Scheme component	Existing unit cost & funding pattern
Renovation/up-gradation of existing fishing harbours	As per the recommendation of CICEF, Bangalore; 100% grant to State Governments/Port Trusts.
Renovation/up-gradation of existing FLCs	As per the recommendation of CICEF, Bangalore; 100% grant to State Governments/Port Trusts.

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Annexure 4: Development of domestic fish marketing

Scheme component	Existing unit cost & funding pattern
Modernization of wholesale fish markets	Rs.250.00 lakhs/50 stalls. 90% of capital cost as grant to Fisheries Departments, quasi Government organizations, Local Civic Bodies, and Research Institutes.
Modernization of retail markets	New
Construction of new retail markets with 10-20 stall capacity	Rs.50.00 lakhs to 100.00 lakhs for establishment of major retail markets (20 outlets) and up to Rs. 50.00 lakhs for minor retail markets (10 outlets). 90% of capital cost as grant to Fisheries Departments, quasi Government organizations, Local Civil Bodies, Research Institutes, 25% of capital cost as subsidy to entrepreneurs and 30% to SC/ST, Women and NE beneficiaries.
Setting up of retail fish outlets/kiosks	Up to Rs.10.00 lakh subsidy @ 25 % of approved project cost to entrepreneurs (30% subsidy for SCs/STs/NE region).
Cold chain development and processing of value added and products Insulated vehicle for fish transport Establishment of Ice plants	Unit cost to be decided/appraised on case to case basis. 90% of capital cost as grant to Department of Fisheries, Fisheries Corporations/Federations; 40% of capital cost as subsidy to Entrepreneurs.
Campaign for promotion of fish products and consumption	Each proposal will be examined and appraised on case to case basis. 100% grant to Government Departments, Research Institutions and quasi Government organizations.
Organization of fish festival/fish mela	Up to Rs. 50.00 lakh; 50% of the expenditure to Government Departments/quasi Government organizations.
Model Fish Dressing Unit	Up to Rs. 150.00 lakh; 90% grant to the Government Departments/quasi Government organizations.

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Annexure 5: Development of freshwater aquaculture

Scheme component	Existing unit cost & funding pattern
Construction of new ponds	Rs. 3 lakh per ha in the plain areas. Subsidy @ 20% with a ceiling of Rs. 60 000/ha for all farmers except SCs/STs for whom it will be Rs. 75 000/ha (25%).
	Rs. 4 lakh/ha in the hill States/Districts and NE region. Subsidy @ 20% with a ceiling of Rs. 80 000/ha for all farmers except SCs/STs for whom it will be Rs1 00 000/ha (25%).
Reclamation/Renovation of ponds/ tanks Plain areas	Rs. 75 000/ha. Subsidy @ 20% with a ceiling of Rs. 15 000/ ha for all farmers except SCs/STs for whom it will be Rs.18 750/ha (25%).
Cost of inputs	Rs. 50 000/ha. Subsidy @ 20% with a ceiling of Rs. 10 000/ ha for all farmers except SCs/STs for whom it will be Rs. 12 500/ha (25%).
Input cost for integrated fish farming: Inputs for integrated fish farming – Livestock	New
Freshwater fish seed hatchery	Rs.12 lakh for a fish seed hatchery with 10 million (fry) capacity for plain areas and Rs.16 lakh for same capacity in the hill States/Districts and NE Region. Subsidy @ 10% with a ceiling of Rs. 1.2 lakh and Rs.1.6 lakh in the plain and hilly areas respectively to entrepreneurs only.
Small-scale seed unit (spawn)	Revised
Fish seed rearing units	Unit cost Rs. 3 lakh/ha.
Renovation/re-modeling rearing space/nursery pond with brood stock maintenance and rearing in hatchery government/ private sector (aged about 3 years and above)	Rs. 4.00 lakh/hatchery of 7-8 million fry production/year State Fisheries Departments will receive 90% one-time grant only.
Input cost for fish seed rearing (Up to fingerling)	Rs. 0.5 lakh/ha
Fish feed units	Small Units- Unit cost is Rs. 7.5 lakh with a capacity of 1.2 quintals/day. The subsidy would be @ 20% with a ceiling of Rs. 1.5 lakh per unit to entrepreneurs.
Establishment of freshwater prawn seed hatchery	(i) Unit cost is Rs. 30.0 lakh for a large freshwater prawn hatchery with a minimum capacity of 25 million PL/year. This would be one time grant for States to establish hatchery at State level.
	(ii) Unit cost is Rs. 12.0 lakh for a small hatchery of 5-10 million PL/year capacity. Subsidy @ 20% with a ceiling of Rs. 2.40 lakh to entrepreneurs as one time grant.
Brood stock bank development for cultivable freshwater fish and prawn	Rs. 25.00 lakh including a farm, transport arrangements for dissemination. Full grant to Government Agencies/Government

species including development of pond, farm and transport arrangements	institutions only.
Establishment of laboratories at State level for monitoring soil and water quality and environment and fish health investigations	Unit cost of Rs. 35 lakh (Rs. 25 lakh for construction of building and Rs. 10 lakh for equipment, glassware & chemicals, etc.)
Transportation of fish/prawn seed.	This will be applicable only for the hill States/districts and NE region.
	Subsidy @ Rs. 30 for 1 000 fry transported to all FFDAs. Not applicable to individual fish farms.
Purchase of vehicle Transportation of fish/prawn seed.	50% cost of vehicle for each new FFDA and 50% cost for the replaced vehicle (Second vehicle).
	This will be applicable only for the hill States/districts and NE region.

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Annexure 6: Development of brackish water aquaculture

Scheme component	Existing unit cost & funding pattern
Construction of Brackish water fish and shrimp farms	Beneficiaries will be small shrimp farmers having land holding of 2 ha or less. The assistance would be 25% cost subject to a maximum of Rs. 60 000/ha as subsidy.
Renovation of Brackish water fish and shrimp farms	Beneficiaries will be small shrimp farmers having land holding of 2 ha or less. The assistance would be 25% cost subject to a maximum of Rs. 60 000/ha as subsidy.
First year inputs for culture of *P. monodon* and fin fish	New
Aquatic quarantine and inspection unit (AQIU)	Unit head quarter at Delhi and supporting staff at NBFGR (ICAR Institute) and nodal units one each on east and west Coasts. 100% expenditure will be incurred by the Centre.
Assistance to Specific Pathogen Free shrimp culture farms for additional infrastructure to cater to bio-security & waste management	Rs.15.00 lakh for 5 ha. Water spread area and above: 1. Back ended subsidy of 25% on the capital cost. 2. Back ended subsidy of 30% on the capital cost to SCs/STs.

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Annexure 7: Coldwater fisheries and aquaculture

Scheme component	Existing unit cost & funding pattern
Preparation of resource survey/feasibility reports	Rs. 5 lakh as one time grant to the State Governments.
Construction of raceway	Trout culture-Unit cost Rs. 1 lakh/raceway (45 m^3). Subsidy @ 20% with a ceiling of Rs. 20,000/per ha. For SC/ST it will be Rs. 25 000/ha @25%.
Input cost	Trout culture- Unit cost Rs. 1.8 lakh/ha. Subsidy @ 20% with a ceiling of Rs. 36 000/ per ha except for SC/ST for whom it will be Rs. 45 000/ha @ 25%.
Running water fish culture in hilly areas including cost of inputs	Rs.40 000/unit of 100 m^3. The above cost is inclusive of Rs. 8 000 towards inputs.
Short term investigation, breeding or rearing, etc	Rs. 5 lakh as one time grant to the State Government.
Construction, renovation, extension or remodeling of fish farms	One time grant. Amount to be decided on the merit of the proposal.
Farming units for cold water fish species and first year inputs	Unit cost of Rs. 50,000/- for a unit size – 15m x 2m x 1m. Subsidy to beneficiaries @ 20% with a maximum ceiling of Rs.10 000/- per unit.
Units for running water fish culture	Unit cost including input Rs. 60 000.
i) Capacity:5.0 million fry/year	Rs. 30.00 lakhs/unit. One time grant to the States/ ICAR Institutions/Quasi Government Organizations.
ii) Capacity:0.4-0.5 million fry/year	Rs. 12 lakhs/unit;20% subsidy for farmers/entrepreneurs
Feed mill (Extruded floating pelletted feed of 1 tons/hour production capacity	Rs.10 crore. 40% equity on machinery and equipment in respect of listed companies; (or) 40% soft loan (with 5% interest) through commercial banks for entrepreneurs/Profit making Fisheries Federations/Corporations.
Feed mill of 2 tons/day.	Rs. 25.00 lakhs/unit 40% Soft loan on the capital cost (excluding land cost) @5% interest rate through nationalized Banks.

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Annexure 8: Development of saline waterlogged/saline land areas

Scheme component	Existing unit cost & funding pattern
Development of water logged areas other than floodplain lakes	Unit cost Rs. 2 lakh/ha with 20% subsidy.
Inputs (fish) seed, feed, manure, fertilizers, preventing measures for diseases, transportation charges, etc.	Unit cost Rs. 75 000/ha.
Inputs (prawn) seed, feed, manure, fertilizers, preventing measures for diseases, transportation charges, etc.	Unit cost Rs. 75 000/ha.
Cost for construction	Unit cost Rs. 3.0 lakh/ha. Subsidy @ 20% with ceiling of Rs. 60 000/ha.

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Annexure 9: Inland capture fisheries (reservoirs, rivers, wetlands, etc.)

Scheme component	Existing unit cost & funding pattern
Fingerling Stocking in reservoirs @ 500/ha for large, 1000/ha for medium sizeand large reservoirs. Fingerling stocking in small reservoirs @ 2000/ha.	Rs. 1/- per fingerling of 80 - 100 mm. IMC and other species indicated in the guidelines. This cost would include rearing of seed *in situ*/*ex situ* and transportation. 100% grant for stocking of fingerlings. Implementing agency shall pay 25% lease/license amount to NFDB.
Pen for fish seed raising	Unit cost Rs. 60 000/0.1 ha.
Craft and gear (net, boat, ice box out board engine, etc) per fishing unit of two fisher	Unit cost of Rs. 1 lakh.
Construction of landing Centre	Unit cost Rs. 5 lakh per landing centre. Assistance to state government.
Marketing	New.
Riverine fisheries conservation and awareness programme	Financial assistance to State Government for conservation/ river ranching, etc with a maximum ceiling of Rs. 2 lakh in a year.
Stocking of floodplain wetlands (mauns/beels/ chaurs) @ 2 000 fingerlings/ha.	Rs.3/fingerling with 100% grant to the State Government.
Restoration of floodplain wetlands (mauns/beels)	Rs. 10 000/ha for three years, with 90% subsidy; the balance to be borne by the State Government.
Restoration of river connecting channels and water regulatory structures (Mauns/ beels / chaurs)	Rs. 5 lakh/km for restoration of channel with maximum of Rs.10 lakhs and maximum of Rs. 20 lakh for providing water regulatory structures. In both cases the subsidy component shall be 90%, the balance to be borne by the State Government.

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Annexure 10: Ornamental fisheries

Scheme component	Existing unit cost & funding pattern
Backyard hatchery	Rs. 1.50 lakh; 50% unit cost as subsidy to entrepreneurs, members of Women SHGs/Fisherwomen Cooperative Societies.
Small hatchery	New
Commercial unit	Rs. 4.00 lakh; 50% unit cost as subsidy to beneficiaries.
Integrated Ornamental Fishery Units	Rs. 15.00 lakh. 90% Subsidy to the Government Agencies/Government institutions and 50 % unit cost as subsidy to entrepreneur.
Aquarium Fabrication, accessories and service Unit	Rs. 1 lakh/person with 50% subsidy for women and 25% for entrepreneur.
Setting up of Aquarium fabrication units	Rs. 1.00 lakh; 50% unit cost as subsidy to members of Women SHGs/ Fisherwomen Cooperative Societies and 25% unit cost as subsidy to individual persons.

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Annexure 11: Need-based financial assistance for development and demonstration of innovative/new technologies

Scheme component	Existing unit cost & funding pattern
Cage culture in reservoirs GI Pipe Modular cages	New
Input cost	New
For increasing fish production/ productivity as broodstock development,	Unit cost to be recommended by the Central Fisheries Institute concerned. Onetime 100% grant to the Central/State Government Organizations/Federation.
New species, Low cost feed with high nutritive value, New farming practices (cage/ pen culture), etc Revised to pilot-scale demonstrations, field trials, up-scaling of programmes and activities developed by R&D institutions and other agencies	Unit cost to be recommended by the Central Fisheries Institute concerned. Subsidy on 40% of the project cost as promotional incentive on capital cost as back-ended subsidy to the entrepreneurs.
Development of fish breeding/nursery grounds through mangrove plantations	Unit cost to be approved by the competent institution 75% grant to meet the cost of mangrove sapling, transplantation and rearing and remaining; 25% cost of labour component to be met through MNREGA Scheme.

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Annexure 12: Scheme for welfare of fishers

Scheme component	Existing unit cost & funding pattern
Development of adaptive capacity of fishing villages Revised from Development of Model Fishermen Villages	In case of 1st three component of Scheme the assistance is shared on **50:50** basis by the Centre and State Government and in case of UT Admn., 100% Assistance is born by the Government of India.
Group Accident Insurance for Active Fishermen; Saving-cum-Relief; Construction of houses; Training & Extension	In case of North Eastern States, the assistance is shared on 75:25 basis between centre and the State. The assistance for Training & Extension is shared n 80:20 basis by the Centre and the State Government and in case of UT Administrations/ FISHCOPFED 100% assistance is given by the Government of India.

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Annexure 13: Human resource development programmes

Scheme component	Existing unit cost & funding pattern
Training programme on different aquaculture practices, processing and extension activities to farmers/master trainers/government officers at induction level	To be decided on case to case basis: i.20 participants per batch ii. period of training 10 days iii. TA will be provided on request from the organizing institute after submission of travel documents iv. No DA is eligible to the participants since boarding and lodging facilities being provided by the concerned training institutes with the funding support of NFDB v. Funding support will be provided to the training organizing institutes towards course fee, honorarium and TA to the resource personnel, publication, local visit and miscellaneous expenditure, where justified. vi.100% financial assistance to Government as per the guidelines of NFDB.

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Annexure 14: Financial and physical progress under schemes operated by NFDB

Sl No.	Scheme component/sub-component	Physical Progress	Financial Progress
1.0	Intensive Aquaculture in Ponds and Tanks with the following components: • Construction/renovation of fish ponds • Establishment of Fish Seed Hatcheries • Renovation of Government Fish Seed Hatcheries • Renovation of fish seed rearing farms in Government/private sector	• 7 916 ha developed in 11 states. • 39 fish seed hatcheries and 3 freshwater prawn hatcheries in 11 states. • 25 units in Assam, Chhattisgarh, Nagaland, Haryana, Maharashtra, Jammu Kashmir, Goa and Mizoram with a production capacity of 72 million fry/ year. • Renovation of 81 seed farms with 388.75 ha water spread area in Maharashtra, Mizoram, Madhya Pradesh, Nagaland & Odisha.	• Rs. 31.96 crore sanctioned. • Rs. 3.06 crore sanctioned. • Rs. 0.81 crore Sanctioned. • Rs. 4.83 crore sanctioned.
2.0	Training and demonstration programmes for increasing production and productivity through intensive farming of fish in tanks and ponds	Trained 67 971 farmers from various states.	Released Rs. 16.32 crore.
3.0	Implementation of Technology Up-gradation schemes	Assisted ICAR fisheries research institutions and universities for undertaking the following 9 technology up-gradation projects: Genetic conservation and live gene bank of Mahseer; captive brood stock bank of Scampi; establishment of hatchery and seed production facilities of *Pangasinodon hypophthalmus* (Striped Cat fish) by CIFA in Andhra Pradesh; brood stock development of common carp *Cyprinus carpio* (Amur) by KVAFSU, Bida;, fish culture in derelict water bodies such as chaurs & mauns in Bihar and cryo-preservation technology for milt.	Released Rs. 3.68 crore.
4.0	Reservoir Fisheries Development	Fingerlings stocked in 3 411 reservoirs in 20 States covering 15.57 lakh ha of effective water spread area. Trained 46 000 fishermen from	Sanctioned Rs. 95.87 crore.

		these reservoirs.	
5.0	Cold water fisheries	219 new trout raceway units, 300 running water fish culture units, renovation/up-gradation of 3 trout farms, 9 trout seed hatcheries, one trout feed mill sanctioned for establishment in Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir and Sikkim. In addition, 561 farmers were trained on trout farming practices.	Sanctioned Rs 10.47 crore.
6.0	Coastal Aquaculture • Training and Demonstration • Providing additional infrastructure for SPF shrimp culture farms • Establishment of Aquatic Quarantine Facility at Chennai • Demonstration of Seabass Culture • Marketing Study on Asian Seabass • Monitoring culture and disease surveillance of *L. vannamei*	• Training imparted to 6 430 beneficiaries in the coastal states in adoption of GMP's in shrimp farming, mud crab fattening, marine ornamental fish culture, seaweed culture, crab and lobster fattening, seabass culture and alternative livelihood for shrimp and crab collectors. • Two farmers from Andhra Pradesh assisted for establishing additional infrastructure for SPF shrimp farms (SPF *L. vannamei*) in an area of 30.04 hectares. • Aquatic Quarantine Facility established for regulating import of SPF *L. vannamei* brood stock. So far 25 000 SPF *L. vannamei* brood stock quarantined. • Funded demonstration of techno economic viability of culture of Seabass (*Lates calcarifer*) in farmer's ponds in Tamil Nadu, Andhra Pradesh, Karnataka and Maharashtra states. • Prospective study on marketing and value chain improvement strategies for promoting Sea bass. • To monitor disease occurrence of *L. vannamei* species in hatchery and culture systems; to evolve	• Released Rs. 1.57 crore. • Released subsidy of Rs. 17.09 lakh. • Sanctioned Rs. 289.90 lakh for setting up the facility and Rs. 59.44 lakh as revolving funds. • Released Rs. 141.15 lakh. • Released Rs. 13.60 lakh. • Released Rs. 31.00 lakh and Rs. 15.00 lakh.

		effective measures to contain the spread of the disease.	
7.0	Mariculture • Open sea cage culture • Setting up of Demonstration of Marine Ornamental fish Hatchery and Brood stock bank	• To demonstrate the techno-economic viability of open sea cage farming of Asian sea bass, lobsters, etc to fishermen in 14 locations. • Setting up of demonstration hatchery for marine ornamental hatchery at Parangipettai, Tamil Nadu & development of broodstock for breeding of 25 different marine ornamental fishes.	• Released Rs. 115.00 lakh. • Released Rs. 37.00 lakh.
8.0	Infrastructure for post-harvest processing • Establishment of Fish Net Making Factory in Kerala • Modernization of fishing harbours and fish landing centres • IQF Project at the factory of M/s Sasoondock Matsyodhyog Sahakari Sanstha Ltd., Sasoondock, Mumbai • Shrimp Seed Multiplication Centre at Srikakulam District, Andhra Pradesh-Jumpstart Programme.	• Establishment of Fish net factory at Azheekkal, Kannur District, Kerala. The factory has commenced production of fish net material. • Modernization of 23 FHS and FLCs in Andhra Pradesh, Karnataka, Kerala, Orissa, Tamil Nadu and Gujarat States. Modernization of a fishing harbour in Karwar, Karnataka is completed. • The Sanstha was assisted to install the IQF machinery in their processing plant as 20% equity participation. The plant has started producing 7-8 value added products of IQF shrimp and other products for export to EU countries - both in raw and cooked form. • A Memorandum of Agreement signed between NFDB and M/s Moana Technologies India (Private) Ltd. (MTIPL) for establishment of SPF-Shrimp Seed Multiplication Center. A Jump start programme was taken up by the MTIPL by importing 3.00 lakh SPF- Post Larvae (PL) of *P. monodon* from Hawaii, USA for rearing up to brood stock. The MTIPL has supplied around 50 million SPF-seed to the farmers in Andhra Pradesh, Tamil Nadu, Gujarat and Maharashtra.	• Rs. 10.00 crore released as soft loan. • Rs. 36.36 crore released. • Rs. 155.20 lakh released. • Rs. 3.20 crore released to M/s Moana Hong Kong Limited (MHKL). Rs. 2.29 crore released for acquisition of 97.45 acres of land and obtaining the final blue prints of the multiplication centre from MHKL. Rs. 0.45 crore utilized for installing a 5KW power supply at the project site and building an approach road from National Highway to project site.

9.0	Deep Sea Fishing and tuna processing • Tuna processing facility at National Institute for Fisheries Post-harvest Technology and Training, (NIFPHATT), Visakhapatnam. • Training	• Establishment of common facility centre for export processing of sashimi grade tuna. • To train 1881 fishermen in tuna fishing by using long lines, deep sea fishing and maintenance and repair of outboard diesel engines installed in FRP boats and improving livelihoods of fisher folk using satellite based navigation methods.	• Released Rs. 185.00 lakh to NIFPHATT as equity participation. • Released Rs. 43.41 lakh to Fishery Survey of India, Fishery Institute of Technology and Training, Tamil Nadu and M S Swaminathan Research Foundation, Chennai.
10.0	Domestic marketing • Modernization/Construction of whole sale markets, retail fish markets and retail fish outlets • Cold Chain Development and processing of value added fish products & Setting up of solar fish drying units. • Technology up-gradation, training on hygienic handling and value addition of fish products. • Organization of Fish Festivals/Campaign.	• Modernization of 44 wholesale fish markets, 36 retail markets, 23 retail outlets and 20 kiosks in Andhra Pradesh, Chhattisgarh, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Nagaland, Orissa, New Delhi, Pondicherry, Rajasthan, Tamil Nadu and West Bengal. A fish market in Nellore, Andhra Pradesh has been completed. • Establishment of a unit for value added products from fresh water fish in Haryana and construction of a 100 MT capacity ice plant in West Bengal. • Technology up-gradation project to Central Food Technology Research Institute, Mysore for production of value added fish products and the Directorate of Research on Women in Agriculture, Bhubaneswar for training 9 880 fishers on 'hygienic handling of fish'. • Organized Indian Fish Festival – INFISH 2009 and INFISH 2010 at Hyderabad. In addition, provided financial	• Rs. 58.51 crore released. • Rs. 1.47 crore released. • Sanctioned Rs. 132.82 lakh. • Rs. 3.13 crore released.

		assistance to conduct 25 fish festivals in Andhra Pradesh, Assam, Karnataka, Jharkhand, Kerala, Maharashtra, Nagaland, Puducherry, Tamil Nadu, Uttar Pradesh and West Bengal.	
11.0	Fish dressing centers and solar drying of fish	Establishment of 3 model fish dressing centres, 30 solar drying units/platforms and to train 300 fishers on hygienic handling of fish, solar fish drying and value addition in Tamil Nadu, West Bengal and Kerala.	Released Rs. 2.87 crore.
12.0	Ornamental Fisheries	For setting up of 734 integrated ornamental fisheries unit and backyard hatcheries in Andhra Pradesh, Gujarat, Jammu & Kashmir, Kerala and Odisha. Training imparted on ornamental fish keeping, breeding and 12 aquarium fabrication units to 2 720 beneficiaries in Jammu & Kashmir, Kerala, Mizoram, Odisha, Tamil Nadu and West Bengal.	Sanctioned Rs. 5.70 crore.
13.0	Human Resource Developmen	Capacity building programmes conducted for 1 273 fisheries officials across the country to train farmers, fishers, master trainers, officers of the public sector units concerned with fisheries development in States and UTs.	Expenditure of Rs. 2.02 crore.
14.0	NFDB Office Complex	For establishment of NFDB campus, 5.13 acres of land situated at Rajendranagar, Hyderabad was acquired from Sri Venkateswara Veterinary University, Tirupati on lease basis for 30 years for construction of administrative building and staff quarters. Construction of administrative building is in its final stages of completion. Simultaneously construction of quarters is also nearing completion.	Rs. 13.86 crore released.

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Annexure 15: Eleventh Plan and Annual Plan Allocations for Centrally Sponsored Schemes and Central Sector Schemes on Fisheries Sector of the DAHD&F

Financial Performance:

(Rs in crores)

Fisheries Schemes & 11th Plan outlay	**2007-08**			**2008-09**			**2009-10**			**2010-11**			**2011-12**	
Centrally Sponsored Schemes (Scheme-wise 11th Plan Approved outlay)	**BE**	**RE**	**Actual Exp.**	**BE**	**RE**	**Actual Exp.**	**BE**	**RE**	**Actual Exp.**	**BE**	**RE**	**Actual Exp.**	**BE**	**Exp. as on 31.12.2011**
Development of Inland Fisheries & Aquaculture **(Rs 300 crore)**	9.00	12.03	12.84	12.00	12.90	13.60	17.90	19.00	20.75	18.50	21.35	22.9431	24.00	26.2680
Development of Marine Fisheries, Infrastructure & Post-Harvest Operations **(Rs 350 crore)**	32.00	40.50	41.49	45.00	44.99	49.56	60.00	61.00	61.61	62.80	75.74	78.1143	71.00	47.4209
National Scheme of Welfare of Fisheries **(Rs 180 crore)**	18.38	20.88	21.38	25.00	25.00	25.15	33.00	36.00	36.23	34.20	42.25	41.9448	39.00	28.1772
Total CSS (Fisheries) **(Rs 830 crore)**	59.38	73.41	75.71	82.00	82.89	88.31	110.90	116.00	118.59	115.50	139.34	143.0022	134.00	101.8661
Central Sector Schemes														
Strengthening of Database & GIS of Fisheries Sector **(Rs 25crore/48 crore)**	2.80	2.80	2.53	3.00	3.00	2.40	5.00	10.00	10.08	10.15	10.55	9.4702	10.00	3.4593
Assistance to Fisheries Institutes **(Rs 371 crore)**	43.00	41.93	33.92	55.00	47.60	40.92	47.60	45.40	45.76	44.49	52.06	45.3523	46.00	27.5769
• Central Institute for Fisheries Nautical & Engineering Training	11.50	10.30	4.39	10.00	7.00	7.18	7.00	5.85	4.95	7.30	7.96	6.4376	9.00	3.8841
• Central Institute for Coastal Engineering for Fisheries	0.00	0.00	0.00	0.10	0.10	0.13	0.10	0.10	0.10	0.10	0.10	0.0999	0.00	0.00
• National Institute for Fisheries Post-Harvest Technology & Training	1.50	1.59	1.40	1.90	2.00	1.74	2.00	1.95	1.96	2.00	2.00	1.8277	2.00	1.4993
• Fishery Survey of India (FSI)	30.00	30.04	28.13	43.00	38.50	31.87	38.50	37.50	38.75	35.09	42.00	36.9871	35.00	22.1935
National Fisheries Development Board **(Rs 1 550 crore)**	100.50	50.00	50.00	75.00	46.90	46.90	135.00	100.00	100.00	92.30	92.30	92.3000	108.00	72.00
Total CS (Fisheries) (Rs1946 crore)	146.30	94.73	86.45	133.00	97.50	90.22	187.60	155.40	155.84	146.94	154.91	147.1255	164.00	103.0362
TOTAL FISHERIES (CSS & CS) (Rs 2 776 crore)	205.68	168.14	162.16	215.00	180.39	178.53	298.50	271.40	274.43	262.44	294.25	290.1247	298.00	204.9023

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Annexure 16: Development of marine fisheries and mariculture

Components	Proposed unit cost and funding pattern
Motorization of traditional craft	Cap on motorization restriction to 20 000 units with emphasis on States/UTs where the present motorization of traditional crafts is low. The unit cost is fixed at Rs. 70 000 per OBM/IBM with subsidy component of 50% of the unit cost. The existing provision of providing second dose to beneficiary to be discontinued.
Fishermen development rebate on HSD Oil	Subsidy will be provided to all vessels less than 10meter overall length (LoA). 50% subsidy on the Central Excise Duty subject to a maximum of Rs.6/litre to States with a ceiling of 500L/boat /month.
Use of sail in motorized boats	To promote use of sails in motorized boats, one-time 100 % subsidy will be provided. The unit cost may be fixed at Rs. 2 500/sail.
Conversion of trawlers to resource specific fishing vessels	The unit cost for conversion is proposed up to Rs. 20 lakh with a subsidy component of 30%. To avail this assistance, the existing trawl unit with the boat should be destroyed.
Safety of Fishermen at Sea	Sea safety measures like VHF, Emergency Position Indicating Radio Beacon (EPIRB) and Distress Alert Transmitter (DAT), FRP floats, etc. to be made available to registered mechanized fishing vessels (MFVs). The unit cost for the above items may be limited to Rs. 2.5 lakhs, with a subsidy of 50%. The fishers will have the option to choose the items, if the full package is not required. The unit cost for floatation devices for motorized boats may be Rs.10 000/boat, with 50% subsidy. The assistance towards sea safety may be linked to the Group Insurance for Active Fishermen Scheme for better compliance. This would also ensure the safety of fishers on board MFVs.
Development of Monitoring Control and Surveillance (MCS) system for marine fisheries	The proposed new scheme on Monitoring, Control and Surveillance will *inter alia* have the following components: • Setting up of an MCS Division in the Department of Animal Husbandry, Dairying & Fisheries (DAHD&F), Ministry of Agriculture; • Setting up of an MCS Division in Department of Fisheries of States/UT Administrations; • Issue of biometric cards to marine fishers; • Development of national fishermen database; • Mandatory registration and licensing of all fishing vessels including artisanal vessels; • Implementation of color coding for all fishing boats; • Fitment of distress alert transmitters, GPS and other safety devices; • Fitment of automatic identification system for tracking and

	regulating fishing vessels; • Registration and licensing of boat building yards and development of a centralized data base; • Setting up of harbor based MCS Units; • Setting up of fishermen MCS committees at Fishing Harbours (FHs), Fish Landing Centres (FLCs) and fishing villages; • Awareness campaign , outreach and educational programmes and capacity building at all levels; and • Data compilation processing and dissemination. Unit costs are not suggested at this stage as details have to be worked out.
Management of Marine Fisheries	Programmes for management of marine fisheries will include popularization of the Code of Conduct for Responsible Fisheries and implementation of its provisions; outreach programmes on community mobilization for sustainable management of fisheries, including development of community-based fisheries management approaches; production of audio-visual material to aid fisheries management; and capacity development of community. It is suggested to provide 100 % funding support to the activities under this scheme and the units costs may be fixed after assessing the requirements.
Enhancement of production through mariculture	***Open sea cage culture:*** Rs. 6 lakh/cage including input cost with 30% subsidy; 40% subsidy for SC/ST beneficiaries. ***Establishment of National brood stock bank for marine fin fishes:*** Rs.15.00 crore/centre for development of brood stock bank and egg production centre is proposed. Full grant to Government Agencies/ Institutions, including Research Institutes. ***Seed banks:*** 10 seed banks for marine fin fishes in the maritime States/UTs. Rs. 2.00 crore per seed bank is proposed. Full grant to Government Agencies/ Institutions, including Research Institutes. ***Installation of Fish Aggregating Devices (FADS) and Artificial Reefs (ARs):*** One time grant of Rs. 2.0 crore per State and Rs. 2.0 crore per UT for installing FADs/ARs is proposed. ***Bivalve culture:*** Unit cost to be decided by the NFDB. Subsidy component of 30% for general category farmers and 40% for SC/ST beneficiaries is proposed. ***Seaweed culture:*** Unit cost to be decided by the NFDB. Subsidy component of 30% for general category farmers and 40% for SC/ST beneficiaries.

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Annexure 17: Development of infrastructure and post-harvest operations

Components	Proposed unit cost and funding pattern
Construction and expansion of Minor Fishing Harbours (MFH) and Fish Landing Centres (FLCs)	Unit cost of approximately Rs. 50 crore for MFH and Rs. 4 crore for FLC proposed with provision of 75% subsidy to coastal States and 100% for UTs. In case of private sector opting to construct MFH/FLC on BOOT/BOT basis, the cost sharing is proposed on 50:50 basis.
Modernization of Fishing Harbours and FLCs	100% grant to States/UTs @ 10 crore for a MFH and Rs. 1 crore for FLC is proposed.
Strengthening of Post-Harvest Infrastructure Developing fish preservation and storage infrastructure	i) Ice plants @ Rs. 50 lakh for 20 t capacity and Rs. 30 lakh for 10 t capacity is proposed. Subsidy @ of 90% for Government/ Co-operatives and 30% for private entrepreneurs. In case of SC/ST entrepreneurs, the subsidy will be 40 %. ii) Cold storage and processing units of 200 tonne capacity @ 10 crore/unit is proposed. Subsidy component will be as above.
Assistance for maintenance dredging of fishing harbours and fish landing centres.	It is proposed that maintenance dredging of existing MFHs and FLCs be subsidized @ 75% of the cost to coastal States and 100% to UTs. Terms and conditions for assistance to be finalized by the NFDB.

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Annexure 18: Development of domestic fish marketing

Components	Proposed unit cost and funding pattern
Modernization of wholesale fish markets	Rs.300 lakhs/50 stalls; of which 5 lakhs will be towards capacity building of user associations and management operations. 90% of the capital cost as grant to State Government, quasi Government organizations and Local Civic Bodies.
Modernization of retail markets	Unit cost ranging from Rs. 60 lakhs to Rs.120.00 lakhs, depending on the work involved. Of the sanctioned amount, Rs. 5 lakh will be towards capacity building of user associations and management operations. 90% of capital cost as grant to State Government, quasi Government organizations and local civic bodies.
Construction of new retail market with 10-20 stall capacity	Unit cost ranging from Rs. 75 lakhs to 150.00 lakhs depending on the work involved. Of the sanctioned amount, Rs. 5 lakh will be towards capacity building of user associations and management operations. 90% of capital cost as grant to State Government, quasi Government organizations and local civic bodies.
Setting up of retail fish outlets /kiosks	Up to Rs.10.00 lakhs. Subsidy @ 30 % of approved project cost to entrepreneurs/SHG/Fisheries Professionals. 50% subsidy for traditional fisher women/SCs /STs/North-Eastern (NE) States.
Cold chain development and processing of value added products. Establishment of Ice plant	Transportation of fish from landing centre/arrival point to the wholesale/retail market. Unit cost of Rs. 4 lakh with 40% subsidy component. As per the proposed assistance under ***Annexure 17***.
Campaign for promotion of fish products and increased consumption	Up to Rs. 2.0 lakhs. Each proposal will be examined and appraised on case to case basis. 100% grant to Government Departments, Research institutions, and quasi Government organizations.
Organization of fish festival/fish mela	Up to Rs. 60.00 lakhs. Each proposal will be examined and appraised on case to case basis. 50% of the expenditure to Government Departments, quasi Government organizations.
Model Fish Dressing Unit	Up to Rs.150.00 lakh unit. 90% grant to the Government Departments /quasi Government organizations.
Sun drying of fish on racks (Unit of 20 racks)	Rs. 20 000/unit to be given to fisher women with 50% subsidy.
Fish transportation from FH/FLC to markets by women SHGs	Rs. 400 000/unit to be given to women SHGs with 50% subsidy.

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Annexure 19: Development of freshwater aquaculture

Description of items	Proposed unit cost and funding pattern
Construction of new ponds in Plains	Rs. 4.5 lakh/ha with a subsidy component of 30%. In case of SC/ST, women and beneficiaries from disturbed and disadvantaged areas the subsidy component would be 40%.
Construction of new ponds in Hill States/NE Region	Rs. 6 lakh/ha in the hill States/Districts and NE region with a subsidy component of 30%. For women, SC/ST and beneficiaries from disturbed and disadvantaged areas, the subsidy component will be 40%.
Reclamation/renovation of ponds/tanks in Plains	Rs. 1.5 lakh/ha. Subsidy @ 30% with a ceiling of Rs.45 000/ha for all farmers. For SC/ST and beneficiaries from disturbed and disadvantaged areas, the subsidy will be @ 40% with a ceiling of Rs. 60 000/ha.
Reclamation/renovation of ponds/tanks in hilly areas	Rs.1.5 lakh/ha. Subsidy @ 30% with a ceiling of Rs.45 000/ha for all farmers. For SC/ST and beneficiaries from disturbed and disadvantaged areas and NE region, the subsidy will be @ 40% with a ceiling of Rs. 60 000/ha.
Cost of inputs for composite fish culture	Rs.1.5 lakh/ha with subsidy @ 30% for all farmers except women, SCs/STs and beneficiaries from disturbed and disadvantages areas for whom it would be 40%.
Input cost for integrated fish farming (with agriculture, horticulture) Inputs for integrated fish farming – Livestock (poultry, ducks, pigs)	Rs.0.60 lakh/ha for seed stocking with subsidy @ 30%. For SC/ST, Hill and NE region and beneficiaries from disturbed and disadvantaged areas, the subsidy will be 40%. Rs. 2.5 lakh/ha for livestock juveniles. Subsidy @ 30%, except for SC/ST, Hill and NE region and beneficiaries from disturbed and disadvantages areas for whom it will be 40%,
Freshwater fish seed hatchery	Rs.16 lakh for a fish seed hatchery with 15 million (fry) capacity for plain areas and Rs. 20 lakh for same capacity in the Hill States and NE Region and beneficiaries from disturbed and disadvantaged areas. Subsidy @ 50% to entrepreneurs and 90% for State Government/quasi Government organizations.
Small-scale seed unit (spawn)	Rs. 3 lakh for a small-scale fish seed hatchery with 3 million fry capacity for Plains and Rs. 4 lakh for NE region and hilly States. Subsidy @ 50% to entrepreneurs only.
Fish seed rearing units with water supply	Unit cost Rs. 6 lakh/ha including water supply. Subsidy @ 50 to entrepreneurs and 90% for State Government/quasi Government organizations
Renovation/re-modeling of rearing space/nursery pond with brood stock maintenance and rearing in hatchery of government/private sector (aged about 3 years and above)	Rs. 2.00 lakhs/ha for rearing ponds with 40% subsidy for private entrepreneurs. 90% onetime grant for State Governments.

Input cost for fish seed rearing (up to fingerling)	Rs. 1.5 lakh/ha with subsidy @ 50% for entrepreneurs and 90% for State Government.
Fish feed units	Small Units: Unit cost of Rs. 10 lakh with a capacity of 2 quintals/day. The subsidy would be @ 30% to entrepreneurs and 40% for SC/ST, beneficiaries from disturbed and disadvantaged areas.
	Medium Units: Unit cost of Rs.50 lakh with a capacity of 5 tonne/day. The subsidy would be @ 30% to entrepreneurs and 40% for SC/ST, beneficiaries from disturbed and disadvantaged areas.
Establishment of freshwater prawn seed hatchery	Unit cost is of Rs. 100.0 lakh for a large freshwater prawn hatchery with a minimum capacity of 10 million PL/yr. Subsidy @ 30% to entrepreneurs and 40% for SC/ST, beneficiaries from disturbed and disadvantaged areas.
	(ii) Unit cost is of Rs. 50.0 lakh for a small hatchery of 5 million PL/yr capacity. Subsidy @ 30% to entrepreneurs and 40% for SC/ST, beneficiaries from disturbed and disadvantaged areas as one time grant.
Brood Bank Development for freshwater fish &prawn species including development of ponds/ farm and transport arrangements	Rs. 50.00 lakhs including a farm, transport arrangements for dissemination. Full grant to Government Agencies/Government institutions only.
Establishment of laboratories at State level for monitoring soil and water quality and environment and fish health parameters	Unit cost of Rs. 100 lakh (Rs.40 lakh for construction of building and Rs. 60 lakh for equipment and other infrastructure in coastal states. This would be one time grant to the States/other fisheries organizations/Public-Private Partnership for fisheries professional.

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Annexure 20: Development of brackishwater aquaculture

Description of items	Proposed unit cost and funding pattern
Construction of brackish water fish and shrimp farms	Rs. 6 lakh with 30% subsidy; 40% for SC/ST and beneficiaries from disturbed and disadvantaged areas for small fish and shrimp farmers having land holding of 2 ha or less.
Renovation of brackish water fish and shrimp farms	Rs. 3 lakh/ha with 30% subsidy; 40% for SC/ST and beneficiaries from disturbed and disadvantaged areas for small fish and shrimp farmers having land holding of 2 ha or less.
First year inputs for culture of *Penaeus monodon* and *Littopenaeus vannamei* and fin fish	Rs. 2.5 lakh/ha 30%, 40% for SC/ST and beneficiaries from disturbed and disadvantaged areas for small fish and shrimp farmers having land holding of 2 ha or less.
Aquatic Quarantine and Inspection Unit	Setting up of three additional centres at Mumbai, Kochi and Kolkata. 100% expenditure will be borne by the DAHD&F/NFDB.
Assistance to Specific Pathogen Free shrimp culture farms for additional infrastructure to cater to bio-security and waste management.	Rs.10.00 lakh/ha subject to a maximum of 50 lakh for a cluster of minimum of 5 ha water spread area, with subsidy of 30% on the capital cost for general beneficiaries and 40% for SC/ST beneficiaries.

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Annexure 21: Coldwater fisheries and aquaculture

Description of Items	Proposed unit cost and funding pattern
Preparation of resource survey report/feasibility report	Rs.10 lakh as one time grant to the State Governments to prepare status paper on the resource available in the State.
Construction of raceway	Trout culture- unit cost @ Rs.1.5 lakh/raceway (50 m^3) with a subsidy component of 40%.
Input cost	Inputs for trout culture- @1.5 lakh/raceway (50 m^3) with a subsidy component of 40%
Running water fish culture in hilly areas including cost of inputs	Rs. **6**0 000/unit of 100 m^3. The above cost is inclusive of Rs.10 000 towards inputs with a subsidy of 40%.
Hatchery: i) Capacity: 5.0 million fry/ year (supply of eyed ova) ii) Capacity: 0.4-0.5 million fry/year	Rs. 3 crore/unit; one time grant to State Government organizations. Rs. 30 lakh/unit; 40% subsidy for farmers/ entrepreneurs
Feed mill (Extruded floating pelletted feed of 1 tonne/ hour production capacity	Rs. 2 crore/unit; 40% subsidy on machinery for entrepreneurs and 90% subsidy for State Government.
Feed mill of 2 tonne/day.	Rs. 50.00 lakh/unit; 30% subsidy for entrepreneurs.

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Annexure 22: Development of saline and saline waterlogged areas for aquaculture

Description of Items	Proposed unit cost and funding pattern
Development of saline water logged areas, other than floodplain wetlands	Unit cost Rs.5 lakh/ha with subsidy of 30% for general beneficiaries and 40% for SC/ST.
Inputs (fish) seed, feed, fertilizers, fish health management, transportation charges, etc.	Fin/shell fish Culture – Rs. 2.0 lakh/ha. Subsidy @ 30% for all farmers except. 40 % for SCs/ST beneficiaries.

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Annexure 23: Development of reservoir fisheries

Description of Items	Proposed unit cost and funding pattern
Stocking of fingerlings in reservoirs @ 500/ha for large and 1000 /ha for medium and 2000/ha for small reservoirs, with the following guidelines: • I year: 100% *ex-situ* stocking and development of community plan and capacity building for *in situ* stocking in reservoirs. • II year: 100% *ex-situ* stocking and development of infrastructure for *in-situ* seed production. • III year: 100% *in-situ* seed stocking. • The funding for stocking will be for the first two years only.	Rs. 3 per fingerling of 80 - 100 mm of Indian Major Carps or other species as indicated in the guidelines. The cost includes rearing of seed *in-situ*/*ex-situ* and transportation. 100% grant for stocking of fingerlings. Implementing agency shall pay 25% lease/license amount to NFDB.
Pen for fish seed raising	Rs.10 lakh/ha for construction, input material, boat and support to Co-operative/ SHG/ similar operative group for community plan and capacity building.
Craft & gear (net, boat, ice box, OBM, etc) per fishing unit of two fishers	Unit cost of Rs.1 lakh with 50% subsidy per unit.
Construction of landing centre	Unit cost Rs. 30 lakh per landing centre (Jetty, fish handling and storage, flake ice machine and sanitary facility). Expenditure to be shared on 75:25 basis between Centre and the State.
Assistance for fish marketing	Rs.5 lakh/landing centre for insulated van, small kiosk with subsidy of 50 %.

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Annexure 24: Development of inland capture fisheries

Description of Items	Proposed unit cost and funding pattern
Riverine fisheries conservation and awareness programme	Financial assistance to State Government for conservation with a maximum ceiling of Rs. 2 lakh/ km of identified river stretch as per guidelines of CIFRI, Barrackpore.
Stocking of floodplain wetlands (beels/ chaurs) @ 2000 fingerlings/ha.	Rs.3/fingerling with 100% grant to the State Government.
Restoration of floodplain wetlands (mauns/beels)	Rs. 10 000/ha for three years, with 90% subsidy; the balance to be borne by the State Government.
Restoration of river connecting channels and water regulatory structures (Mauns/beels/chaurs)	Rs. 5 lakh/km for restoration of channel with maximum of Rs.10 lakhs and maximum of Rs. 20 lakh for providing water regulatory structures. In both cases the subsidy component shall be 90%, the balance to be borne by the State Government.

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Annexure 25: Development of ornamental fisheries

Description of Items	Proposed unit cost and funding pattern
Backyard hatchery	Unit cost of Rs. 1.5 lakh with a subsidy component of 50% to entrepreneurs, members of women SHGs/ Fisherwomen Cooperative Societies.
Small hatchery	Rs. 30 lakh for SHGs or Co-operatives of 20 or more members with 50% subsidy and additional Rs. 10 lakh for common infrastructure.
Commercial unit	Rs. 20.00 lakhs with 30% subsidy for individual beneficiaries.
Aquarium fabrication, accessories and service unit	Rs. 5 lakh for women SHG with 50% subsidy.

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Annexure 26: National scheme for welfare of fishermen and fisherwomen

Components	Proposed unit cost and funding pattern
Development of Model Fishermen Villages	The Scheme may continue with the existing unit cost and funding pattern. The scheme may be dovetailed with the Indira Awas Yojana, wherever feasible.
Group Accident Insurance for Active Fishermen	The insured amount may be raised from Rs. 1.0 lakh to Rs. 2.0 lakh for death and total disability and from Rs. 50 000 to Rs. 1 lakh for partial disability. Modalities may also be worked out to include migrant workers and fishers (men and women) engaged in post-harvest sector. The scheme may also be linked with safety of fishers at sea, in rivers and reservoirs.
Saving-cum-Relief	The monthly contributions may be increased to Rs. 150:150:150 (by fisher: Centre: State). The scheme may also extend to inland States exercising conservation measures and to migrant fish workers and women engaged in post-harvest operations.

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