REPORT OF
THE WORKING GROUP ON

FISHERIES

FOR
THE ELEVENTH FIVE YEAR PLAN
(2007-2012)

GOVERNMENT OF INDIA
PLANNING COMMISSION
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GLOSSARY

AFD	Accelerated Freeze Drying
BFDA	Brackishwater Fish Farmers' Development Agency
BOBP	Bay of Bengal Programme
BRD	By-catch Reduction Device
CBO	Community Based Organisation
CCRF	Code of Conduct for Responsible Fisheries
CD	Compact Discs
CIBA	Central Institute of Brackishwater Aquaculture
CICEF	Central Institute of Coastal Engineering for Fishery
CIFA	Central Institute of Freshwater Aquaculture
CIFE	Central Institute of Fisheries Education
CIFNET	Central Institute of Fisheries Nautical and Engineering Training
CIFRI	Central Inland Fisheries Research Institute
CIFT	Central Institute of Fisheries Technology
CMFRI	Central Marine Fisheries Research Institute
CoF	College of Fisheries
CRZ	Coastal Regulation Zone
CSMCRI	Central Salt and Marine Chemicals Research Institute
DAH&D	Department of Animal Husbandry and Dairying
DAHD & F	Department of Animal Husbandry, Dairying and Fisheries
DBT	Department of BioTechnology
DLC	District Level Committe
DRDA	District Rural Development Agency
DoD	Department of Ocean Development
DoF	Department of Fisheries
EDUSAT	Educational Satellite
EEZ	Exclusive Economic Zone
EXIM	Export and Import
FAD	Fish Aggregating Device
FAO	Food and Agriculture Organization
FCR	Feed Conversion Ratio
FFDA	Fish Farmers' Development Agency
FISHCOPFED	National Federation of Fishermen Co-operatives Limited
FMCG	Fast Moving Consumer Goods
FSI	Fishery Survey of India
FRP	Fibre Reinforced Plastic

FTDC	Fisheries Technology Dissemination Centre
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GIS	Geographical Information System
GLC	Ground Level Credit
GPS	Global Positioning System
GRT	Gross Tonnage
HACCP	Hazard Analysis and Critical Control Points
HRD	Human Resource Development
HSD	High Speed Diesel
HP	Horse Power
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
IMO	International Maritime Organisation
ILO	International Labour Organisation
IFP	Integrated Fisheries Project
IRDP	Integrated Rural Development Programmes
IT	Information Technology
IWRM	Integrated Water Resource Management
KL	Kilo Litre
KM	Kilometer
KVK	Krishi Vigyan Kendra
LOP	Letter of Permission
LPG	Liquid Petroleum Gas
LDCL	Lakshadweep development Corporation Limited
LISS	Linear Imaging Self Screening
MANAGE	National Institute of Agricultural Extension Management
MBV	Monodon Baculo Virus
MATSYAFED	Kerala State Cooperative Federation for Fishery Development Limited
MCS	Monitoring Control and Surveillance
MFRA	Marine Fisheries Regulation Act
MoA	Ministry of Agriculture
MPEDA	Marine Products Export Development Authority
NABARD	National Bank for Agriculture and Rural Development
NAFED	National Agriculture Cooperative Marketing Federation of India
NBFGR	National Bureau of Fish Genetic Resources
NCDC	National Cooperatives Development Corporation
NCCT	National Centre for Cooperative Training
NCF	National Commission on Farmers

NDP	Net Domestic Product
NE	North East
NFDB	National Fisheries Development Board
NGO	Non Governmental Organisation
NMLRDC	National Marine Living Resources Data Centre
NORAD	Norwegian Agency for Development
NRCCWF	National Research Centre on Cold Water Fisheries
OAL	Over All Length
PAU	Punjab Agriculture University
PCR	Polymerase Chain Reaction
PHED	Public Health Engineering Department
PRI	Panchayati Raj Institutions
PUFA	Poly Unsaturated Fatty Acids
PFZ	Pelagic Fisheries Zone
SAU	State Agriculture University
SFAC	Small Farmers' Agro Consortium
SHG	Self Help Group
SIRD	State Institute of Rural Development
SLC	State Level Committee
SPS	Sanitary and Phyto-sanitary Agreements
SPF	Specific Pathogen Free
TED	Turtle Excluding Device
ToR	Terms of Reference
ToT	Transfer of Technology
TACT	Total Aquaculture Centre for Technology
TRIFED	Tribal Cooperative Marketing Development Federation of India
TRYSEM	Training *of* Rural Youth for Self Employment
TQM	Total Quality Management
USA	United States of America
UNDP	United Nation Development Programme
UT	Union Territories
VMS	Vessel Monitoring System
VRC	Village Resource Centre
VHF	Very High Frequency
WTO	World Trade Organisation
WSSV	White Spot Syndrome Virus

ACKNOWLEDGEMENTS

Fisheries is a sunrise sector in Indian agriculture, with high potentials for diversification of farming practices, rural and livelihood development, domestic nutritional security, employment generation, export earnings as well as tourism. The possibilities extend from vast seas to high mountains with valued coldwater species. Untapped potentials exist in island systems to ornamental fishes to value added products.

On behalf of all the members of the Working Group on Fisheries for XI Plan, I place on record our thanks to the Planning Commission, Govt. of India, for giving us this opportunity to discuss the issues and prepare this report as a guiding document for the coming years. Representatives of various aspects of fisheries and aquaculture of Fishing, Fish processing, Aquaculture, Marketing and Trade, Research, Development, Extension, Education, Policy and Administration, both from Public and Private sectors came together in the Working Groups and provided valuable inputs for this document, which are thankfully acknowledged. Material has also been drawn from a number of sources, published and unpublished as also practicing individuals in the sector.

Special thanks are due to the Secretary, Animal Husbandry, Dairying and Fisheries and Joint Secretary (Fisheries), DAHD&F, Ministry of Agriculture, Govt. of India for providing information on the progress of the ongoing schemes. I would like to thank Dr. K. K. Vass, Director, Central Inland Fisheries Research Institute, who provided all the logistics support in organizing the meetings and colleagues at the Institute, particularly Dr. P. K. Katiha, Senior Scientist and Shri N. K. Barik, Scientist for their contributions in preparing the Report. It is hoped that the Report would serve as a basic document for planning programmes and activities during the XI Plan for providing 'Fish for All'.

New Delhi
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EXECUTIVE SUMMARY

The Planning Commission, Govt. of India constituted a Working Group on Fisheries to review the progress of schemes/programmes in fisheries sector implemented during X Plan, identify problems and constraints in the implementation of programmes and suggest measures for enhancing fish production in a sustainable manner, along with developmental programmes for the Eleventh Plan.

2.0 India is one of major fish producing countries in the world with third position in fisheries and second in aquaculture. The sector has high potentials for rural development, domestic nutritional security, employment generation, gender mainstreaming as well as export earnings. Indian Fisheries sector has been witnessing a steady growth since First Five Year Plan. The annual fish production rose to over 6.3 million t during 2004-05 from around 0.75 million t in 1950-1951. The marine fish production increased from 0.53 million t in 1950-51 to a maximum of 2.99 million t in 2002-03 and 2.78 million t during 2004-05. The contribution of inland sector has increased at a higher rate, from 0.218 million t during 1950-51 to 3.52 million t in 2004-05. Presently, fisheries and aquaculture contribute 1.04% of the national GDP and 5.34% of agriculture and allied activities. Indian exports and its share in the global trade have shown a steadily increasing trend over the years.

3.0 India is endowed with vast fisheries resources in terms of a coast line of 8,118 km and 2.02 million km^2 of Exclusive Economic Zone, including 0.530 million km^2 of continental shelf. The inland fisheries resources include rivers and canals (1.95 lakh km), reservoirs (3.15 million ha), floodplain wetlands (0.35 million ha), estuaries (0.26 million ha), freshwater waters (2.41 million ha) and brackishwater water bodies (1.24

million ha). These resources are one of the main sources of livelihood for the rural poor, particularly the fisher community. Considering the output of the sector, it can provide livelihood for over 90 lakh at subsistence level of annual income. At present, an estimated 14 million people are engaged in fishing, aquaculture and ancillary activities.

4.0 Demand for fish and fishery products is increasing considerably, both at domestic and export fronts. The projected demand for fish in the country by 2012 is 9.74 million t, that can be met by the projected supply of fish is 9.60 million t by 2012 with major share of 5.34 million t from inland aquaculture followed by 3.10 million t from marine fisheries. Presently, fisheries of the island systems, Andamans and Lakshadweep, as well as the deep sea resources, including the tunas, are highly under-exploited. Further, there is a need of provision for processing for both export and domestic markets and improvement of fishing harbours. Effective marketing system in identified areas is a key requirement for the development of this sector.

5.0 The fisheries of natural waters, including coastal and inland open is under pressure due to high fishing intensities, pollution, open-access, manmade modifications, water abstraction, etc. and lead to problems in maintaining sustainable fisheries. In these waters sustainable exploitation of fish stocks can be achieved through community participation and co-management.

6.0 In the context of increasing concerns of water availability and utilisation in an effective manner, fisheries and aquaculture provide for diversification as well as value addition in farming practies. They enable optimisation of water productivity in different situations including ponds, tanks, lakes, canal systems, water logged and waste lands

derelict waters. In case of aquaculture, scope exists for bringing more candidate fish species under the umbrella of aquaculture, both in fresh and brackish waters with a focus on food fish, high value species, ornamental species and those with potentials for sport and tourism. Ready availability of inputs like seed, feed, fertilizer, medicines, fisheries requisites, etc. is a pre-condition for development. Establishment of 'Aqua-shops', as a single window facility for the purpose is expected to bring about a major change in the sector.

7.0 Seed is a critical input for successful culture and culture-based practices. The projected annual requirement of carp seed is to the tune of 34,000 million carp fry, 10,000 million shrimp and 8,000 million scampi PL and 2 millions seabass. The feed requirements for freshwater aquaculture by the end of next plan is estimated at 3.15 million t for freshwater aquaculture including grow-out and seed production and 0.23 million t for brackishwater aquaculture.

8.0 For all round development of fisheries sector, it is high time to: implement the code of conduct for responsible fisheries; utilize strong traditional wisdom and know-how by active community participation; address gender issues; strengthen the capacities of fishers and aqua-farmers regarding latest technological practices, administrative skills, disaster management, etc.; intensify efforts for treating aquaculture at par with agriculture; explore areas of public-private partnerships; strengthen the institutional credit support and public investments; harmonise fisheries policies in concurrence with the recent developments both at national and international levels; and strengthening the inter and intra linkages between fisheries sector and other concerned departments.

9.0 The nomenclature of Department of Animal Husbandry & Dairying (DAH&D) was changed to Department of Animal Husbandry, Dairying & Fisheries during the X Plan. The Department implemented schemes under two broad heads, 'Development of Inland Fisheries and Aquaculture' and 'Development of Marine Fisheries, Infrastructure and Post harvest operations' during the Plan period, along with some ongoing schemes from the IX plan, modified to some extent. The seven schemes were: Development of marine fisheries, Development of inland fisheries and aquaculture, Marine infrastructure and post harvest operations, Strengthening of database and IT scheme, Welfare of fishermen and training & extension, Fisheries institutes and National Fisheries Development Board. The overall financial achievements indicated that of the allocated budget of Rs 771 crore, the anticipated expenditure is Rs 608.3 crore, which is around 80% of allocation.

10.0 Keeping in view the above scenario and review of the X Plan schemes, it is relevant to look at the prevailing concerns that need to be addressed in order to design intervention points during XI Plan. The concerns pertain to water availability and allocation, biodiversity loss & depletion of fish stocks, excess coastal fishing, enhancing fish productivity, oceanic and deep sea fisheries, impact of climate change on fisheries, trans-boundary fisheries issues, inland & coastal pollution, large-scale sedimentation of rivers, estuaries & lakes/wetlands, effective compliance of code of conduct of responsible fisheries, increasing input costs of water and power, high marine fishing costs & low profitability, mechanization in fisheries and aquaculture, cold chain and hygienic fish handling, quality assurance issues in exports, overseas market fluctuations, disaster management, credit and insurance, inadequate database and poor linkage in domestic marketing. The programmes in the coming plan would need to address these aspects to build in greater resilience and sustainability.

11.0 Further, areas with promise that need to be supported in order to achieve diversification in terms of non-food fisheries are ornamental fisheries, seaweed, pearl culture, aqua-tourism, sport fisheries and molluscan fisheries for ornamental purposes. The strategy for realizing the potentials of the sector are: Ensuring adoption of responsible and sustainable fishery practices and enhancing fish productivity in all cultivable waters, Establishing agro-aqua farms, aqua-shops and fishery estates to incorporate activities from production to consumption, Spreading fish quality literacy among fishers and aqua-farmers, Improving facilities for fish landing and handling at harvest and post-harvest stages, Developing social marketing techniques, Introducing aquarian reforms, with regard to leasing and management of waters, ownership and community management and Training in different aspects of fisheries and aquaculture.

12.0 The main Objectives of the Government of India with regard to development programmes in fisheries and aquaculture during the Eleventh Five Year Plan are: Enhancing the production of fish from Indian waters on an environmentally sustainable and socially equitable basis, Address the hitherto unexplored potentials of Indian fisheries e.g. island fisheries and non-food fisheries, Conservation of aquatic resources and genetic diversity, preservation of health of ecosystems, Increasing profitability of fishers and aqua-farmers through an integrated approach from production to consumption, Promoting fish as health food and meeting the changing requirements of both domestic and export markets, Strengthening of Infrastructure in harvest, post-harvest, value-addition and marketing and Upliftment of fishers and aqua-farmers communities with gainful employment opportunities and capacity strengthening.

13.0 To cater to the objectives, the schemes of X Plan are recommended to continue with few modifications and new components. In Marine Fisheries, the existing components to be continued are Motorization of traditional crafts, Forecasting and resource estimation through PFZ and dissemination of estimates, Provision for Ice boxes for traditional/ small scale sector, Sea safety measures, Installation of Artificial Reefs and FADs. The new initiatives suggested are Diversification/reduction of excess capacity of costal fishing vessels, LPG kits for outboard engines, adoption of Squid jigging technology, Introduction of resource- specific deep sea fishing vessels, MCS/VMS activities and Sea ranching. The new activities suggested under mariculture are Fishfish/shellfish hatcheries, Mariculture development for finfish, open sea cage farming and culture of other commercially important species, Seaweed culture and HRD in modern fishing and open sea mariculture.

14.0 Under the scheme for Development of Inland Fisheries and Aquaculture, ongoing components of Capture fisheries and Aquaculture are recommended for continuation during the XI Plan. The new initiatives suggested under the scheme are: Survey, assessment and evaluation of inland aquatic resources, Improving productivity of inland open-water fisheries including reservoirs; *Magur* breeding, hatchery establishment and seed production Advanced & Upgraded protocols for Carp breeding, Seed certification, Certified Brood banks for food and ornamental fishes under freshwater aquaculture; Hatchery establishment and Seed production of Seabass and Pearl spot under brackishwater aquaculture, Establishment of Mahseer seed production facility, Construction of Community Raceways for Trout Farming in Hilly Regions under coldwater fisheries; Establishment of Centres/Facilities in States for surveillance, monitoring and reporting of fish diseases, Establishment of Fish quarantine centers under Conservation of fish stock and diversity and general activities as Establishment of Aqua- shops, State level soil-water

testing and disease diagnostics laboratories and construction of Aqua-Tech-Park.

15.0 The components suggested under scheme 'Marine Infrastructure and Post Harvest Operations' are: Harvest and post-harvest, Marketing, Processing and Value addition. The harvest activities suggested for the XI Plan are: construction of new and upgradation of existing major and minor fishing harbours and landing centers. The post-harvest activities include construction of processing plants and new model retail fish markets, modernisation of 10 wholesale markets, facilities of Transport & insulated containers to societies, provision for marketing (Kiosk) for women SHGs and value addition for SHGs. The infrastructures required for aquaculture are: facilities for domestication of *Penaeus monodon* and Establishment of SPF- seed multiplication center, Holding centres, PCR labs, sales counters for brood stock and Testing facilities for feed, seed & fish.

16.0 Under the scheme 'Welfare programmes, Governance, Transfer of technology and Capacity building', continuation of ongoing programmes on Development of Model fishers villages, Group accident scheme for active fishers and Saving-cum-Relief under Welfare Programmes and Establishment of Awareness Centers, Training programmes for fishers, Extension literature & Video films, Trainers' training & Refresher courses under Capacity building and Awareness creation is recommended. The new initiatives suggested are: Hut insurance scheme, Group insurance of fishers and farmers Mediclaim policy, Incentives to Fisherwomen groups (SHG), Safety at sea and Assistance to FISHCOPFED under Welfare Programmes; formulation of National Fisheries Development Policy under policy issues, Co-management, CCRF and certification of boatyards and hatcheries under Mangement and governance; Capacity building at the State level Use of IT in ToT, Programmes for EDUSAT, Vocational education in fisheries schools, Capacity building of fisheries co-operative

Associations, NGOs, SHGs, Strengthening of Service delivery system under Human resource development; Revitalization of Co-operatives, Capacity building/training and Demand generation for fish under Co-operatives and Public-Private partnerships; Location-specific field trials and Demonstration units, Trickle down extension and Involving NGOs in ToT under Demonstration and Exhibitions; and Fisheries Technology Dissemination Centres (FTDC) and ToT units at ICAR institutes /SAUs under Co-ordination and Linkages.

17.0 The scheme on 'Strengthening of Database and Information Networking' includes the activities of Sample Survey for estimation of inland fishery resources, their potential and fish production; Census on marine fisheries; Catch assessment survey for inland and marine fisheries; Development of GIS for inland and marine fisheries and Delineation of Brackishwater areas, assessment of productivity & production.

18.0 The scheme for fisheries institutes has four institutes under DAHD&F. Ongoing Schemes recommended for Fishery Survey of India, Mumbai (FSI) are Survey of coastal pelagic resources and Creation of infrastructure facilities. The new initiatives of FSI are Strengthening of Extension Division, Acquisition of new vessels, dredgers slip-way and Mini Dry-dock at Kochi; Resources monitoring in inshore waters ; Development of fisheries forecast models; Surveys and Investigations of Coral Reef Ecosystems and Training of Scientific and Technical personnel. The activities of Central Institute of Fisheries Nautical Engineering & Training, Kochi are mainly strengthening of infrastructure, besides ongoing schemes. The activities of Integrated Fisheries Project, Kochi are: Induction of new generation technologies and processing in post-harvest sector, Extending marketing efforts to cover large segments of consumers, Establishing rural appropriate technology design and dissemination center, HRD Activities in the

fisheries sector, Scheme to strengthen communication and information technology, Capacity building in new technologies among the staff, and Support to on-going and above new activities. The activities of Central Institute of Coastal Engineering for Fisheries are: Engineering and Economic Investigations, Preparation of Techno-Economic Feasibility Reports, Updating of Master Plan for the development of fishery harbours/fish landing centres and Post Investment Evaluation Studies.

19.0 Establsihment of the National Fisheries Development Board (NFDB) during the Tenth Plan is a would give a major fillip to the Indian fisheries sector. It reflects the keen interest of the Government as also the potentials that the sector holds in ensuring domestic nutritional security. The proposed outlay for fisheries development during the XI Plan is Rs 4,013 crores, intended to also include the budgetary allocation made to the NFDB to the extent of Rs 2,069 crores for the XI Plan period. There is a clear delineation of the functions with the Department to focus on marine fisheries programmes, Database and Information networking, Quality broodbank and seed certification, policy and welfare programmes, whereas the Board would address the production-consumption chain, with an emphasis on marketing, in partnerships with Government and private agencies.

20.0 With the pressures on land increasing, the options are in the seas for fisheries as well as a number of high value products. Further, aquaculture being a compatible activity with other farming practices, is able to use waters of different grades, adding value to farming. Opportunities have also emerged for fostering public-private partnerships in a strong manner. Rural prosperity and gender equity through fisheries are clearly achievable goals in the Eleventh Plan.

CHAPTER I

1.0 Working Group and Terms of Reference

1.1 Working Group

In pursuance of the decision taken by the Planning Commission vide order No. Q.13023/1/06-Agri dated 08.05.2006, a Working Group on Fisheries for the formulation of XI Five Year plan was set up, along with co-opting of some members based on the need for specialised inputs. The composition of the Working Group is as follows:

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1.2 Terms of Reference

The Terms of Reference for the Working Group are as follows:

i) To undertake a critical review of the progress of the on-going Central and Centrally Sponsored Schemes/programmes in fisheries sector with reference to their objectives and targets during XI Plan and to recommend their continuation/ discontinuation/modifications/ convergence and also fresh initiatives, if any with tentative investments.

ii) To identify the various problems and constraints in the implementation of the on-going development programmes in the fisheries sector especially in development of deep-sea fishing/distant water fishing, fresh water and coastal aquaculture, infrastructural development including fishing harbours, fish seed hatcheries, processing and marketing network, welfare of fishers, etc.

iii) To suggest measures including policy issues for increasing area and productivity in freshwater/coastal aquaculture, reservoir fisheries, cold water fisheries including uniform long term leasing of suitable water bodies, etc.

iv) To suggest an action plan for production and standardization of adequate quantum of fish seed for freshwater and coastal aquaculture and reservoirs.

v) To suggest concrete measures for supplementing marine fish catch by sustainable exploitation of deep sea fishery resources, reduction of by catch mariculture, resource replenishment programmes like setting up of artificial reefs, etc.

vi) To suggest necessary steps for creation of post harvest infrastructure for fishing harbours, fish landing centers, processing and marketing network including inland fisheries.

vii) To suggest measures for development of non-food fisheries for pearl culture, ornamental fisheries, etc. to supplement production and income from fisheries.

viii) To suggest effective fisheries management measures for ban on fishing during monsoon, standardization mesh sizes in different categories of fishing gear, conservation of aquatic bio-diversity, etc. in accordance with code of conduct for responsible fisheries adopted by FAO, etc.

ix) To review the on-going fisheries training, extension, HRD and welfare measures for fishers and suggest effective steps for strengthening HRD in fisheries and for improving socio-economic and livelihood issues, socio-economic development, etc.

x) To review current availability of extension and information support, institutional credit and suggest measures to augmenting the same.

xi) To develop programmes for strengthening of fishery co-operatives into more organized units and increasing their operational efficiency.

xii) Working group may co-opt any other official/non-official expert/ representative of any organizations member(s), if required.

xiii) The working group may also examine and address any other issues, which may be considered important, but not specifically spelt out in the ToRs and devise its own procedures for conducting its business including meetings.

xiv) The working group will be serviced by the Central Inland Fisheries Research Institute (under ICAR), Barrackpore, Kolkata.

CHAPTER 2

2.0 Indian Fisheries – Status, Potentials and Issues

2.1 Fish for All

India is a major maritime state and an important aquaculture country in the world and Indian fisheries is a sunrise sector. With third position in fisheries and second in aquaculture, the country has high potentials in the sector for rural development, domestic nutritional security, employment generation, gender mainstreaming as well as export earnings, that only few other activities can provide. 'Look to the Seas' is the recent thinking for harnessing the fish-related wealth, as also a number of related products from the waters. This is not only an option, but also a necessity for us to sustain over 16% of the global population, with 2.4% of land and 4.2% of water of the whole world. India, with water ranging from the seas to cold hill streams and over 10% of the fish biodiversity on earth, has high scope for producing fish, along with a high possibility of utilising a variety of wastewaters, also rendering them better in the process of fish cultivation. Non-water-consumptive nature of aquaculture, coupled with its compatibility with other farming systems and neutrality to scale of investments, enable integrated fish farming on a large scale. With a heritage in marine and riverine fisheries, recent innovations, entrepreneurial enthusiasm and a creditable performance in the global market, the sector is poised to make greater contributions in the coming years.

Indian Fisheries sector has been witnessing a steady growth from the First Five Year Plan. The annual fish production was over 6.3 million t during 2004-05 from around 0.75 million t in 1950-1951 (Fig 2.1 & 2.2). The marine fish production increased from 0.53 million t in 1950-51

to a maximum of 2.99 million t in 2002-03 and 2.78 million t during

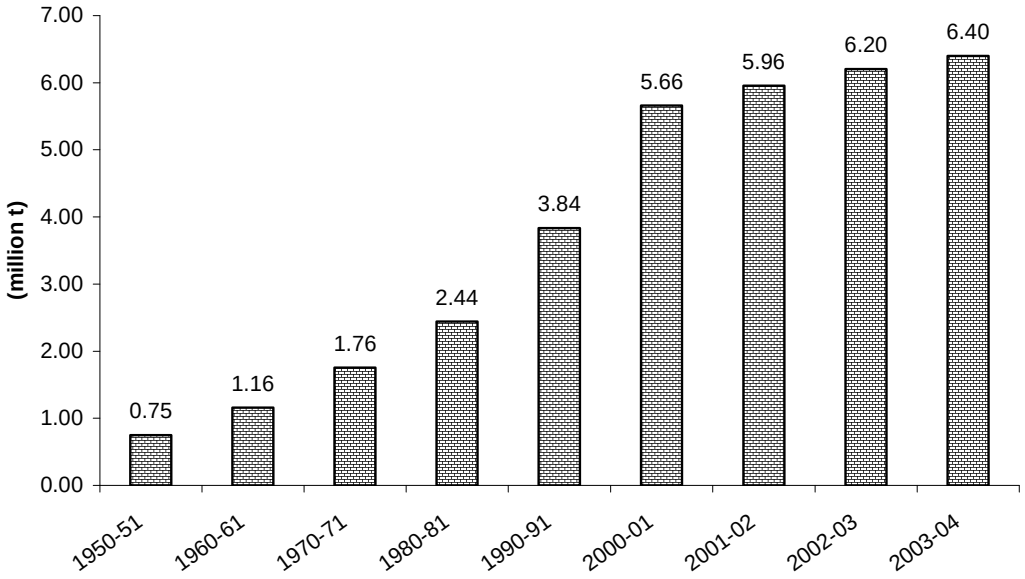

Figure 2.1 Total fish production for past five and half decades
(Source: DAHD&F, 2005)

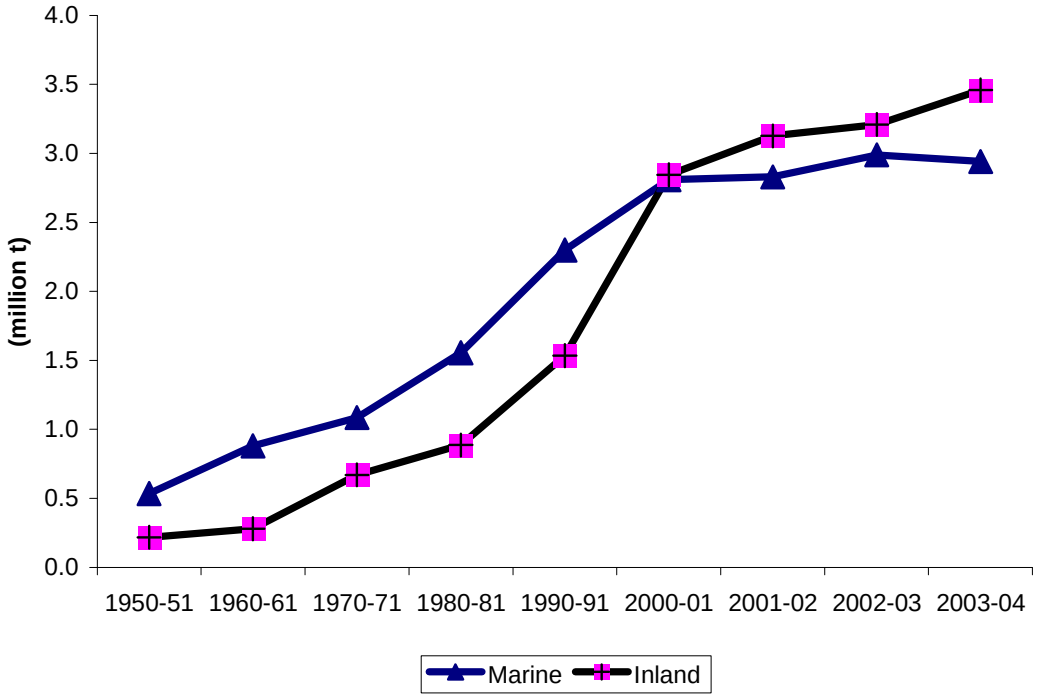

Figure 2.2 Fish production from marine and inland sectors over the last five decades
(Source: DAHD&F, 2005)

2004-05. The contribution of inland sector to the fish basket of the country has increased at a higher rate, from 0.218 million t during 1950-51 to 3.52 million t in 2004-05. Starting from a purely traditional activity, aquaculture and fisheries have transformed to commercial enterprises, throwing up uncommon opportunities for employment generation, contribution to the food and nutrition security and foreign exchange earnings in the country. The GDP of fisheries sector reached at Rs 29,707 crore during 2004-05 from about Rs 245 crores during 1970-71. Presently, fisheries and aquaculture contribute 1.04% of the national GDP of the country and 5.34% of agriculture and allied activities (Figs. 2.3 & 2.4).

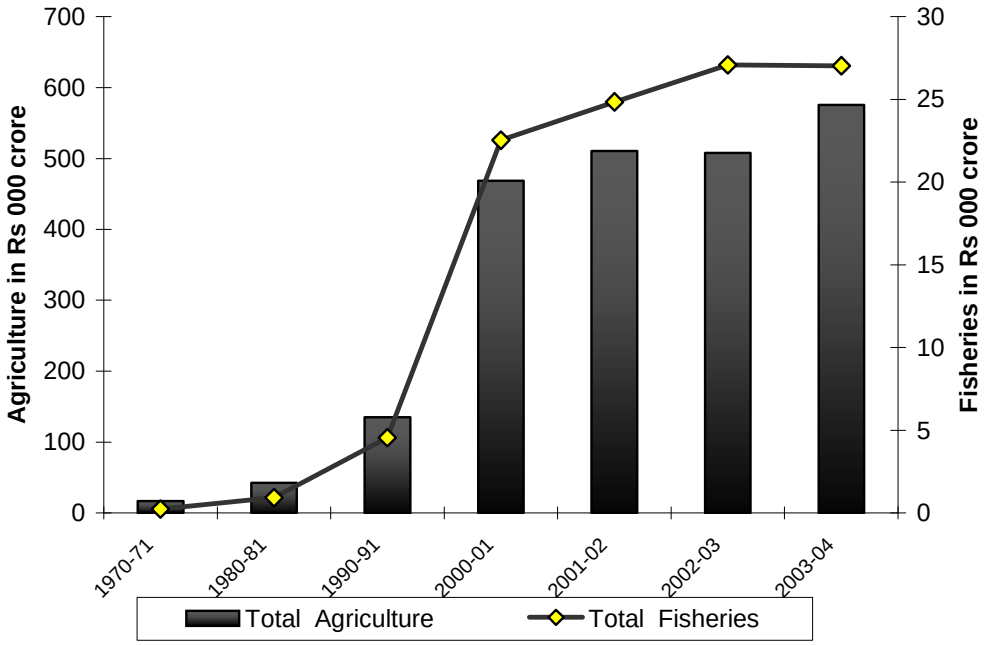

Figure 2.3 Gross Domestic Product of agriculture and fisheries sectors
(Source: DAHD&F, 2005; CSO, 2005)

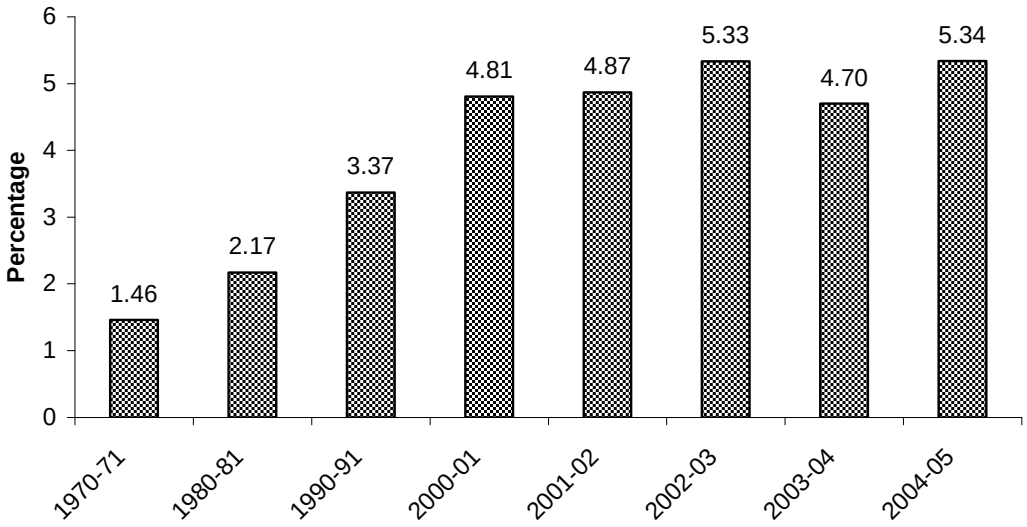

Figure 2.4 Percentage share of fisheries sector in agriculture
(Source: DAHD&F, 2005; CSO, 2005)

Fish as health food and its role in ensuring nutritional security of the country has been appreciated, with non-traditional fisheries states taking to fisheries and aquaculture and large scale movement of fish becoming a reality all over the country. Paradigm shifts from marine fisheries to inland fisheries in terms of production became clear during the last decade, and further increasing contributions from culture practices over capture fisheries in both marine and inland sectors. Diversification has been significant at all stages from production to consumption, whether it is from food fish to ornamental fish, carps to catfish and scampi, exportable items from shrimp to a variety of products and further the overseas markets to a number of countries.

2.2 Indian status in global fisheries

Globally, fish production from capture fisheries and aquaculture was over 130 million t in 2000 as compared to nearly 20 million t in 1950. The production declined to 117 million t in 1998 and now recovered. Indian share in global production has reached 4.36% per cent with 9.92% in inland and 2.8% in marine. For inland sector India is ranked second after China. Other major producer countries are China, Japan,

the United States, the Russian Federation and Indonesia. Indian share in the global trade has increased from 6.1% (4.37 million t) in 1992 to 6.5% (6.40 million t) in 2003 (Figs. 2.5 and 2.6). There is a steady increase in the exports indicating a positive trend.

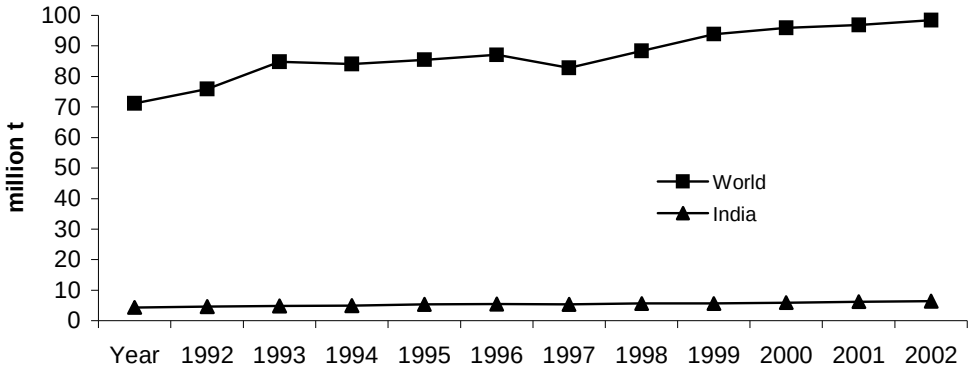

Figure 2.5 Global and Indian fish exports
(Source: DAHD&F, 2005; CSO, 2005, MPEDA, 2006)

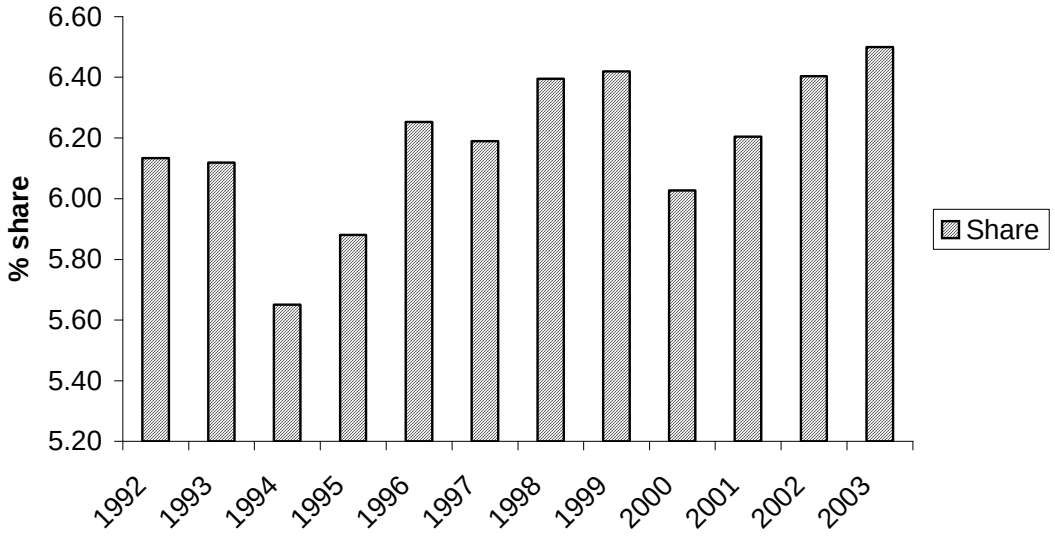

Figure 2.6 Share of Indian fish exports in world trade
(Source: DAHD&F, 2005; CSO, 2005, MPEDA, 2006)

2.3 Livelihood

Fisheries is one of the main sources of livelihood for the rural poor, particularly the fisher community. The country is endowed with enormous inland and marine waters, which provide immense livelihood and employment opportunities. In case of inland waters, fisheries in open waters (Rivers, Reservoirs, Floodplains and Estuaries) are, although, of subsistence type, yet, have high potentials for production enhancement. The fish catches from these waters contribute significantly to their food and nutritional security. Inland aquaculture has witnessed the highest growth rate and emerged as the most important and contributing activity to fisheries sector. The livelihood options exist for both the poor and large fish farmers through horizontal and vertical integration of the enterprise. Similarly, marine fisheries is a major source of livelihood for lakhs of people along the coast. While the inshore fishery has almost attained its potential, immense scope exists in deep sea fisheries, along with mariculture and post-harvest value addition. The total output of fisheries sector was Rs 31,672 crores during 2003-04 with net domestic product valued at Rs 27,026 crores (CSO, 2005). With this level of output, over 90 lakh people may be employed at subsistence level of annual income of Rs 30,000/Fisherman. The share of marine and inland sector is 54 and 46% respectively.

2.4 Employment

The fisheries sector has been providing employment to over nine lakh full time and 11 lakh part time fishermen through fishing operations. The number of people involved in marine fisheries related activities included nearly four lakh in fish marketing, three lakh in repairs of fisheries requisites, around 50,000 in fish processing and four lakh in other ancillary activities. In all, an estimated 31.5 lakh people are engaged in fishing and farming operations directly or indirectly, that is likely to further increase during the XI Plan period.

2.5 Exports

Fisheries exports from India have become an important component of agricultural exports, to the extent of 18%. Over fifty products are exported to as many destinations all over the world and India is making a mark in ornamental fish exports also in the recent years.

Between VIII and IX Five Year Plan, the quantity of fish exports increased by 62% in quantity and over 117% in value (Table 2.1). It improved the share of exports in total output and enhanced the integration of the sector with global market. A trend towards export of high value fish and retention of other fish for domestic market is seen in the recent years. Continuous monitoring of overseas markets and compliance of changing standards to remain competitive needs no emphasis. The projected exports from fisheries sector by end of XI Plan is 1.06 million t in quantity and Rs 15, 000 crore in value (Fisheries Division, 2006a).

Table 2.1 Growth in fisheries exports and integration with international markets

Five Year Plan	Average annual exports		Average annual production		% exports of production	
	Quantity ('000 t)	Value (Rs crores)	Quantity ('000 t)	Value (Rs crores)	Quantity	Value
VIII	287	3094	4819	12359	5.95	25.03
IX	379	5536	5595	24558	6.78	22.54
X	463	6716	6301	32327	7.35	20.78

Source: Estimates based on MPEDA, 2006, CSO, 2000 & 2005

A study conducted by NCAP, New Delhi indicated that although fisheries export has performed well and quite competitive in the global market, the relative competitive advantage has declined in recent years. However, expansion in the world trade is the major determinant of fisheries export from India. The future of fisheries export would be influenced by the consistent compliance with food safety measures (HACCP and SPS standards). Cost of implementation of these

measures has shown a scale biasness and has worked against smaller Plants. This requires government policies and support system to be designed to minimize the cost of compliance with international standards to make smaller plants viable and export-competitive. Steps should be taken to devise appropriate institutional mechanisms to bring scattered small producers and processors under a network to enable them to participate in the emerging processing procedure to reap the benefits of expanding global fish trade.

2.6 Coastal fisheries

It is common knowledge by now that not only in India, but all over the world, that coastal fisheries is under pressures of high fishing intensities. Being open-access, multi-gear and multi-species fisheries, there have been problems in regulating the fishing units and maintaining sustainable fisheries. Added to this are the incidences of pollution of coastal waters and thereby, the need to maintain healthy fish stocks. Interventions like introduction of by catch reduction devices, sea ranching, fish aggregating devices, along with mariculture practices are necessary to compliment and sustain marine fisheries in the coming years.

2.7 Island fisheries

While coastal fisheries are under fishing pressures, the fisheries of the island systems, Andamans and Lakshadweep, as well as the deep sea resources, including the tunas, are highly under-exploited. There is a need for diversified fishing practices, provision of deep sea fishing vessels as well as on-shore facilities for processing, for both export and domestic markets.

2.8 Demand and supply for fish

Demand for fish and fishery products is increasing considerably, both at domestic and export front. This has been caused due to the health concerns and the perception of fish as a healthy food with high levels

of digestible protein, PUFA and cholesterol lowering capabilities. The projected demand for fish in the country by 2012 is 9.74 million t (Fisheries Division, 2006a, NCAP, 2006) including 5.9 million t for domestic market (Fig. 2.7) The current Plan would need to address this demand, along with the quality concerns. Considering the implications of WTO, there will be greater demand for improved and value-added fish and fisheries products. The projected supply of fish is 9.60 million t by 2012 with major share of 5.34 million t from inland aquaculture followed by 3.10 million t from marine fisheries (Fig. 2.8)

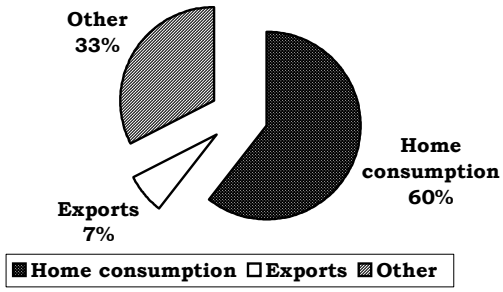

Figure 2.7 Composition of projected fish demands by 2011-12
(Source: Fisheries Division, ICAR, 2006a)

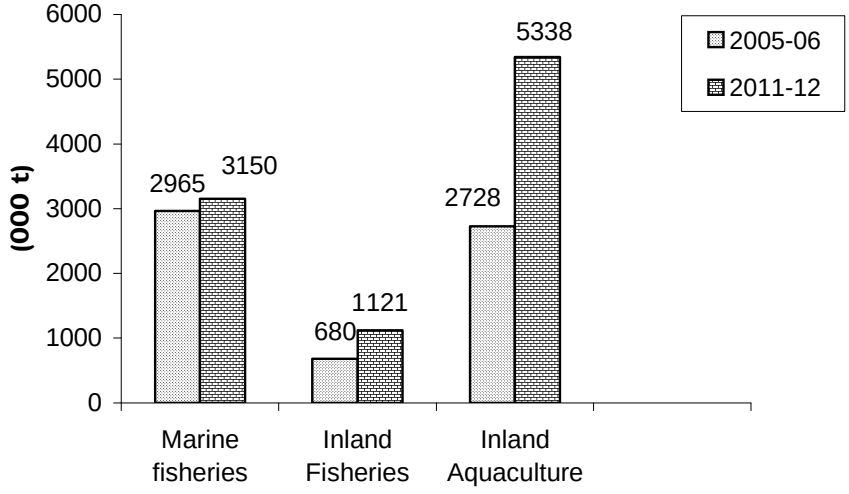

Figure 2.8 Sector wise projected fish supply by 2011-12
(Fisheries Division, ICAR, 2006a; NCAP, 2006)

2.9 Water quality and ownership

India is endowed with vast open large water bodies and small closed waters. These waters have multiple uses, ownerships and stakeholders. At times, these constrain adoption of technologies for realising the full potentials of the waters and result in low levels of fish production. Therefore, concerns of property regime, overexploitation of natural fish stocks, ecosystem degradation, economic losses, etc., require immediate attention. Open waters are also constrained by environmental degradation and manmade modifications through water diversion schemes affecting the fisheries. The multiple ownership of such water bodies for sustainable exploitation of fish stocks can be achieved through community participation and co-management. It is also high time to implement the code of conduct for responsible fisheries.

2.10 Diversification

It is an accepted fact that in inland fisheries, whether capture or culture, the yield gaps are significant and need to be filled in order to realise the full potentials. Besides enhancing the fish production, production activities can be diversified through integration with agriculture and allied sectors. It will help in optimising the water productivity using these farming systems and utilisation of canal systems, water logged waste lands and derelict waters. In case of aquaculture, scope exists for bringing more candidate fish species under the umbrella of aquaculture, both in fresh and brackish waters with a focus on food fish, high value species, ornamental species and those with potentials for sport and tourism.

2.11 Seed

Seed being the critical input for successful culture practices, needs a focused attention with regard to strengthening of the existing infrastructure for production and rearing, transport and quality aspects. The projected requirement of seed of carps, in pond culture,

wetland and reservoir fisheries that are mostly carp-based, is to the tune of 34,400 million annually. Another high value commodity that has shown promise in the recent years is the scampi, the giant freshwater prawn, which would require about 8,000 million seed to achieve the target area coverage of over 0.2 million ha in the XI Plan period. Similarly, in brackishwater aquaculture, the shrimp seed requirement would be of the order of 10,000 million. In the context of increasing diversification, there would be additional requirement of seed of other species like catfishes, seabass and ornamental fishes.

There are also concerns regarding the quality of the seed with reference to size and species. In case of freshwater aquaculture, the need for improved breeds with reference to growth and disease resistance is increasing, as also exotic species, both in case of food fishes and ornamental fishes. Availability of the improved Rohu has raised the productivity levels in freshwater aquaculture and similar efforts in other species and higher levels of dissemination of quality seed are required. Biotechnological means would also be increasingly adopted in the coming years and accordingly, issues of biosafety and Intellectual Property Management and sharing require detailed discussions and relevant measures put in place. In this context, certification of seed and accreditation of hatcheries are of utmost importance. Relevant guidelines in this regard have been prepared, that require to be implemented during the XI Plan.

Box 2.1 Proposals for fish seed certification

Domestication of species and advancements in induced breeding technology have enabled the country to achieve captive propagation of several fish species. The seed demand of aquaculture industry is primarily met through the hatchery systems in the country. Sustainable production of quality seed in quantities that is commensurate to the rising demand is of paramount importance. To ensure the quality of seed, it is essential that production units use broodstock, breeding and husbandry practices as per scientific norms. There is a growing need to develop standard norms for hatcheries and accreditation of hatcheries based on these norms will be essential to maintain the supply of quality seed. A sound seed certification system for seed quality control for the crop plants (Indian Seed Act, 1966) is available, but there is no definite guidelines to ensure proper accreditation of hatcheries in fishery sector Therefore, policy guidelines for quality seed production are urgently needed in the fisheries sector.

Seed certification Process through Accreditation of Hatcheries

Accreditation of hatcheries to produce certified seed could be more practical approach than certification of seed batches. In other words, process certification i.e. certification of hatchery management practices is considered a better way than the product certification alone. Testing of seed for compliance to the norms, could be part of the of hatchery accreditation procedures.

Requisites

The necessary requisites for the certification process are: Identification of fish that are cultured with hatchery bred seed; Appropriate guidelines and criteria of standards for certification of seed producing centres; Designated agency/authority for accreditation of hatcheries with well equipped technical manpower, diagnostic and analytical capabilities

Establishment of an Empowered Agency

MPEDA is entrusted for seed certification of brackishwater fish seed hatcheries species, while for other aquaculture species no agency was empowered for accreditation of hatcheries. The agency will be regulated and monitored by Government of India. The agency would have the responsibilities to: (i) ensure operation of seed certification programme; (ii) develop necessary infrastructure facilities, manpower and financial resources; (iii) establish or recognize testing laboratories; (iv) take up the issues pertaining to legal problem; (v) prescribe the certification fee; (vi) recommend for modification in seed certification standard and procedures; (vi) develop educational programme in association and (vii) prepare detailed manuals on seed production practices and testing procedures

Role of ICAR

The ICAR institutes will play a crucial role towards developing Disease/pathogen diagnostic capabilities, Guidelines for certification, Start-up diagnostic and analytical facilities, Technical backstopping to resolve emerging issues. The ICAR institutes will also provide consultancies to help in establishing technical expertise and infrastructure with the designated certification authorities of the Govt. of India.

General procedures for accreditation of hatchery

Procedures for hatchery accredition include: Registration of hatcheries with the designated agency for accreditation, Necessary verifications and evaluation of prescribed field and production standards by the Agency, Evaluation at various stages of harvesting, packing and transportation, Certification by the accredited hatcheries for compliance of specific norms or quality standards for production of their produce, Separate accredition for hatcheries for various types of species, hybrids and improved varieties and different and stringent norms for verification of hatcheries producing improved varieties and hybrids, Printing of test certificate and sealing tags as per approved format by accredited hatcheries after grant of certificate of accreditation.

Source: Fisheries Division, ICAR, 2006b

2.12 Conservation

Indian fish biodiversity in terms of over 2,200 fish and shellfish species in the marine, brackishwater, freshwater and coldwater environments is a rich and diverse resource available with few countries in the world. With perceptible climatic changes as well as anthropogenic pressures, both fishing and others, it needs to be protected for sustained fisheries and aquaculture. In the seas, coastal overfishing is impacting the fish stocks, requiring measures like reducing fishing capacities as well as ranching. Enhancement measures like Fish Aggregating Devices and Artificial reefs are being initiated that need greater emphasis.

Similar is the situation with inland open waters such as rivers and lakes. Habitat restoration, setting up protected habitats and sanctuaries, ranching of rivers with seed of river-based broodstock require to be undertaken to conserve biodiversity. *Ex situ* conservation of fish germplasm must also receive greater attention. In both the marine and inland ecosystems, implementation of regulations in compliance of the Code of Conduct for Responsible Fisheries (CCRF) is the need of the hour. In this context, the model inland fisheries and aquaculture bill that has been prepared during the X Plan may be enacted.

Box 2.2 Model bill for inland fisheries and aquaculture

The activities of inland fisheries in most of the states are regulated by an Act based on the antiquated Indian Fisheries Act of 1897 and it lack necessary provisions for sustainable development of fisheries and aquaculture. Therefore, Government of India through Model Bill on Inland Fisheries and Aquaculture intends to ensure sustainable fish production to meet future needs of the country. The provisions in the bill for different inland waters are:

Regulations

(i) Inland fisheries

Control, **regulation and ban on destructive gear:** States should adopt precautionary approach to regulate and prohibit use of destructive gear to conserve or protect the biodiversity.

Untenable fishing practices in inland waters: States should check wanton killing of fish juveniles and fish brooders and restriction of movement of fish in any form

Conservation of stock and resources: states should notify closed season in open waters, make inventory of deep pools for protection and maintenance, declare biodiversity sensitive area as protected areas; protect the physical entity of wetlands/floodplain lakes though check on obstruction in connectivity and encroachment. State should make provision for protection of the interest of the traditional fishers.

Leasing/licensing of open-waters: It should be done with long-term management perspective, with lease period above five years, rent fixation should be based on production capacity, lease holders should regulate fishing efforts, stop dumping of solid waste in water bodies.

(ii) Aquaculture

Certification of fish seed: States should take steps for registration of hatcheries, setting up of fish seed committee to monitor and ensure supply of quality seed, restriction on breeding and propagation of banned fish.

Inter-State movement: *State to ensure labelling of the seed consignments, inspection of the consignment, provision for confiscation and destruction of the poor quality seeds.*

Feed quality control and certification: State should take steps to register the feed manufacturing units, certification of feed, labelling of feed composition to be made compulsory.

Use of chemicals, antibiotics, etc.: State to restrict use of hazardous chemicals in aquaculture.

Health monitoring and disease reporting/control: State should monitor the occurrence and containment of diseases, disease diagnostics and reporting procedures

(iii) Coldwater fisheries: The provisions to be made for restriction on: obstructions of the cold water streams, destructive fishing practices, encroachments, pollution, fishing and fish selling in closed season.

(iv) Environmental and human health issues: Systematic environment impact assessments (EIA) shall be made mandatory for all projects related with aquaculture and fisheries. Assessment of health hazards of the fish produced in the waste waters are to be made..

(v) Exotic species: restrictions on introduction, culture or breeding of prohibited exotic species, and strict enforcement of the quarantine norms.

General guidelines

The model bill provides guidelines for successful implementation of activities and issues of: Responsible fisheries and aquaculture, Domestic marketing of fish, Institutional support, Inter-departmental coordination, Stakeholder participation for better management and Conservation and stock enhancement.

2.13 Aqua-shops

A major constraint for aquaculture development, particularly freshwater, has been the ready availability of inputs like seed, feed, fertilizer, medicines, fisheries requisites, etc. Establishment of 'Aqua-shops', as a single window facility for the purpose is expected to bring about a major change in the sector.

2.14 Infrastructure

High perishability of fish coupled with poor post-harvest handling has lead to high losses, even to the extent of 15%, in both marine and inland fisheries. Therefore, strengthening of post-harvest infrastructure in form of better fish landing and handling facilities, cold chains, storage facilities, ice plants, transportation, etc., as well as effective marketing system in identified areas is a key requirement for the development of this sector.

2.15 Capital formation and output

Importance of capital formation for long term growth of any sector is well known. Capital formation may be private or public. The private sector capital formation improves assets and production efficiency and public sector investments provide infrastructure support. Both these are essential for long term growth of output and economy. The gross fixed capital formation in fisheries has increased over the past three Plans (CSO, 2000 & 2005), with the interesting aspect being that there was considerable contribution from the private sector (Table 2.2). It is emphasised that there is a need for greater investment by the public sector in the coming years.

Table 2.2 Capital formation and output of fisheries sector during past three Five Year Plans

Five Year Plan	Average annual Gross Fixed Capital Formation (GFCF) (Rs crores)	Average Annual Output		GFCF/Output Ratio
		Quantity ('000 t)	Value (Rs crores)	
VIII	1561.80	4819.06	12566.40	12.43
IX	3210.60	5594.60	24558.00	13.07
X	4896.00	6299.50	31682.50	15.45

Source: Estimates based on CSO, 2000 & 2005

2.16 Community participation

The country has a strong traditional wisdom and know-how in different aspects of fisheries and aquaculture. While the programmes could benefit greatly by harnessing these, it is also imperative that there should be an active community participation for their successful implementation. In this contenxt, it would be highly beneficial if success stories are disseminated and replicated in other places.

2.17 Gender issues

Traditionally, women have played an important role in the fisheries sector, with much of the post-harvest handling, processing and marketing being carried out by them. Therefore, women need special attention to improve their role and status, particularly, in case of small-scale fisheries, co-operatives, training, awareness-raising, savings and credit schemes, planning, implementing and promotion of alternative income generating strategies.

2.18 Disaster management

Fisheries enterprises are highly prone to natural calamities, in the context of both marine and inland fisheries, in terms of cyclones, floods, landslides as well as the recent tsunami, which struck the coastal India for the first time created havoc and misery for the fishers with regard to their livelihood and infrastructure. Hence, it is imperative to protect the coastal fishers from such disasters in future

for which advance warning systems, timely rescue relief and rehabilitation should be ensured. Necessary safeguards in terms of bio-shields with mangrove plantations along the coasts as well as preparedness and capacity building would need to be built in. Comprehensive insurance schemes and compensation mechanisms are required to provide greater resilience to the sector.

2.19 At *par* with agriculture

The fisheries sector in India is associated with the poor, illiterate and under nourished population belonging to one of the economically weakest sections of the society. The sector immensely caters to the country's protein requirements and registered highest export earnings growth rate among agriculture commodities. Freshwater aquaculture documented one of the highest growth rate in production, while fisheries is providing livelihood and food and nutritional security to the community and deserves greater support of the Government in form of the incentives/concessions as in agriculture. It is a matter of concern that aquaculture is being treated as an industry and concessions available in agriculture are not extended to aqua-farmers. The assistance in form of: (i) Income Tax relief; (ii) Power and water supply at concessional rates; (iii) Loan facility on interest free/differential rate of interest; (iv) Insurance cover and drought and flood relief; (v) subsidy on inputs, transportation, etc. may be provided to the aqua-farmers.

2.20 Public- private partnership

Public-private partnerships, whether formal or informal, have contributed to success stories in agriculture over the years, but they are only a few in the marine sector. Most of the fish stocks in inland and marine sector have either been over-exploited or reached their maximum sustainable yields. For the stocks to recover and continue to provide production at an optimal level, collaboration between fishers and public sector institutions is needed in observing closed

seasons, use of non-destructive craft and gear, establishment of marine protected areas/sanctuaries, etc. that will lead to community-based fisheries management or co-management. Greater collaboration between the Government agencies and fishing/farming communities is required for the development and management of common property resources such as village/panchayat ponds/tanks, etc. There is ample scope for partnerships right from the stage of seed production, culture, post-harvest handling, processing and value addition, marketing, quality control, etc. Specific interventions by the Government in terms of infrastructure development and fishery estates for further operations by the private sector and tax concessions would be needed.

2.21 Capacity strengthening

Sustainable fisheries can only be achieved through improvement of the quality, technical skills and management of human resource managing fisheries in the country, in consonance with the rapidly changing needs. Raising a cadre of officers at various levels to plan and execute fishery development programmes is critically important. For such an effort, adequate funding to strengthen and streamline organisations, infrastructure and manpower would be the basic requirement. Emphasis also needs to be laid on fisher-women co-operatives and self-help groups. Incentive schemes should be introduced to promote fisheries in the co-operative sector, so that the weaker sections are not deprived of their due earnings.

2.22 Finance

While there has been considerable Institutional financing of activities in marine fisheries and fish processing over the last four decades, that in inland fisheries and aquaculture has been largely through middlemen, merchants and traditional money lenders. This is also a major concern for achieving the projected growth rates. The major financing institutions for fisheries sector are NABARD and NCDC. The

ground level credit (GLC) disbursements by NABARD during last three years varied between Rs 539 crores in 2002-03 to Rs 1,301 crores in 2004-05 and the provisional estimates for the current year is Rs 1,720 crores. Enhancement of credit flow is the need of the hour. For this purpose, suitable mechanisms need to be developed. For example, most fishers and aqua-farmers cannot provide security in terms of land/water holdings and several banks do not have the requisite manpower to evaluate the proposals. The projected GLC for XI Plan is to the tune of Rs 13,336 crores as compared to a provisional estimate of Rs 6,198 crores during the X Plan.

2.23 Policy

Fish in waters, whether seas or inland waters, is impacted by a number of processes, both natural and anthropogenic. Fisheries and aquaculture are multi-stakeholder enterprises. Existing laws and regulations with regard to water, environment and natural resource management have high implications on the activities. Further, the country is also a signatory to several international agreements, mostly in marine fisheries. While fisheries is a State subject like agriculture, it is necessary to develop a broad framework for harmonising the various acts under which fisheries is administered. This would enable addressing international issues such as WTO matters on fisheries, Illegal Unregulated and Unreported fishing, quality control of fisheries products, sea safety measures with the inclusion of Code of Conduct for Responsible Fisheries, land leasing, seed availability, insurance, inter-state fisheries management, introduction of exotics fish/shellfish species, treating fisheries and aquaculture at par with agriculture in tariff rates for electricity and water, freight rates for fish and shrimp seed transport, regular monitoring of patterns of subsidy and related aspects. Also, the measures to deal with issues like minimum wages, long working hours, illiteracy, exposure to high risk without protection, etc. could be incorporated in the national level policy document.

2.24 Governance

In view of the fisheries development programmes being knowledge-based, and the rapid developments happening at global level, it is imperative that the staff members of the Fisheries Departments in the States are continuously trained and retrained, to enable better management practices. Greater professionalisation of the Departments is the need of the day.

2.25 Linkages

Development being the mandate of the DAHD&F, provision of enabling mechanisms including infrastructure, technologies and finance, becomes a pivotal function. While technology transfer and extension become important in this context, sorting out problems on a continuous basis in coordination with other Departments assumes importance at the macro-level. As for example, imprisonment of fishermen straying while fishing along the southeast and northwest coasts would need to be taken up with the Ministry of Home Affairs, Defence and External Affairs. Environmental restrictions that are impacting fisheries in several situations would need to be discussed with the Ministries of Environment and Forests and Water Resources. Similarly, there are issues that would need continuous deliberations with the Ministries of Commerce, Food Processing Industries, Rural Development, Panchayati Raj, etc.

2.26 Benefit-cost ratios

Fisheries and aquaculture enterprises are among the most profitable among agriculture and allied activities. Fisheries is primarily labour intensive with average benefit-cost ratio at 3.5 (CIFRI, 2005). Freshwater aquaculture, dominated by carps, has a high share in aquaculture. The average benefit cost ratio for carp grow-out system is 1.87, that is much higher than other farming practices.

2.27 Approach to Eleventh Plan

After an analysis of the resources, growth trends and potentials both within the country and overseas, an action-plan is provided in the document to realise the potentials of the sector in the next five years. This includes specific interventions for infrastructure development, better management practices, quality control mechanisms, policy issues, strengthening of the ongoing schemes including the institutions and coordination with stakeholders and public-private partnerships. The road map envisages high levels of synergy between different players, both Government and Private, to provide fish for all..

CHAPTER 3

3.0 Programmes for Fisheries and Aquaculture during the X Five Year Plan

Fisheries and Aquaculture have come to be recognised as important economic activities in the country. The programmes of the Union Government as well as the State Governments were seen to be having perceptible impacts on the growth of the sector. A positive feature was that the private participation was significant in the context of the partnerships being emphasised. The Department of Animal Husbandry, Dairying and Fisheries (the term 'Fisheries' was added to the nomenclature of the Department during the X Plan) operated the schemes under two broad umbrellas, namely, 'Development of Inland Fisheries and Aquaculture' and 'Development of Marine Fisheries, Infrastructure and Post harvest operations' during the X Plan period, along with some ongoing schemes from the IX Plan, modified to some extent.

3.1 Financial achievements

The financial achievements under different schemes are stated in Table 3.1. The anticipated expenditure percentage for the schemes under X Plan ranged between 37 to 104% with the overall expenditure being around 80%. For most of the schemes, the utilization was more than 70%, barring inland fisheries and aquaculture and strengthening of database and information technology (IT).

Table 3.1 Financial achievements of different schemes during X Plan

(Rs crores)

Sl No.	Scheme	Outlay in X Plan	Expenditure till 2005-06	Anticipated expenditure 2006-07	Total expenditure	% utilisation
1	Development of Inland Fisheries and Aquaculture	135.00	67.94	9.0	76.94	56.99
2.	Development of Marine Fisheries	125.00	74.34	14.0	88.34	70.67
3.	Marine Infrastructure and Post Harvest Operations	125.00	60.16	31.0	91.16	72.93
4.	Strengthening of Database and IT Scheme	45.00	11.62	5.0	16.62	36.93
5.	Welfare of Fishermen and Training & Extension	135.00	99.09	22.0	121.09	89.70
6.	Fisheries Institutes	175.00	138.15	45.0	183.15	104.66
7.	NFDB	31.00	-	31.00	31.00	100.00
8.	**Total**	**771.00**	**451.30**	**157.00**	**608.30**	**78.90**

3.2 Marine fisheries

In order to develop marine fisheries, existing programmes of motorization of traditional crafts, subsidy on High Speed Diesel (HSD) oil were in operation during the IX Plan. These were continued and formed a part of the macro scheme, 'Development of marine fisheries, infrastructure and post harvest operations' in X Plan. The scheme encompassed new components also to exploit the deep-sea fishery resources. The achievements under different activities of the scheme are given in Table 3.2. Out of the five components in this scheme, the physical targets were achieved only in one. In other four components, the achievement was 22-43% of targets, which resulted in lower fund utilization (71%). The schemes are recommended to be continued during the XI Plan period in view of the benefits accrued to the marine sector.

Table 3.2 Physical achievements under Marine Fisheries scheme during X Plan

Item/activity	Target	Achievements	% achievement
Motorisation of traditional craft (No.)	10,000	10,910	109.10
Introduction of intermediate craft of improved design (No.)	62	18	29.03
Resources specific Deep sea Fishing vessels including 50 Vessels with VMS (No.)	50	11	22.00
Safety of fishermen at sea (No.)	1,666	500	30.01
Fishermen development rebate on HSD (KL)	166,667	72,000	43.20

Box 3.1 Marine fisheries and Mariculture

1. Crab farming in Kerala

Mr Sylvi Figerado, a farmer in Kerala has succeeded in improving the farm productivity of his 2-acre pond with training imparted on scientific farming on monoculture of juvenile crabs under Institution-Village Linkage Programme of the Indian Council of Agricultural Research. He has earned a profit of Rs 49,500 and Rs 50,000 from a single harvest in the first and second year respectively. Presently, apart from the monoculture juvenile crabs, he is rearing the high-yielding variety of Kuttanad ducks and getting around 40-50 eggs per day at Rs 2.50/egg. He says to other farmers that, "now whenever I am need of money, I just sell the crabs and earn the required amount in no time".

2. Fiberglass canoes for traditional fishing

At the Central Institute of Fisheries Technology, Cochin, a small size fiberglass reinforced plastic (FRP) (length -5.78m, breadth (middle)-0.82m, depth (middle)-0.385m) canoes was designed, developed and constructed, which is suitable for use in backwaters, near-shore waters and beels. Three different types of canoes, which are commonly used in Assam, particularly in Beel fishing, were fabricated after taking out a mould of the original wooden canoes. With this moulds, any number of canoes can be fabricated at a cost of Rs 23,000. This breakthrough has attracted the attention of other state governments in the North eastern (NE) region. The canoes are maintenance-free, long lasting and affordable.

3. Mussel farming in Kerala

The technology of farming edible mussel (*Perna viridis*) developed by CMFRI, Kochi has been adopted on a commercial scale in the villages of Northern Kerala, with the financial assistance from state government under the Swamajayanthi Gramseva Rosar Yojona (SGRY) and Co-operative banks. More and more Women self-help groups (SHGs) are upcoming for mussel farming in the backwaters adjacent to their houses. By adopting this production technology aqua-farmers are producing 0.8 to 1.0 t of mussels in their farms.

Source: NCF, 2005; DARE, 2002-03

3.3 Development of inland fisheries and aquaculture

Under the macro management approach, the scheme was launched under central assistance during the X Plan. The scheme had six components: (i) development of freshwater aquaculture, (ii) development of integrated coastal aquaculture, (iii) development of coldwater fisheries and aquaculture in hilly region, (iv) development of water logged areas into aquaculture estates, (v) utilization of inland saline/alkaline soils for aquaculture and (vi) inland capture fisheries (programme for augmenting productivity of reservoirs, rivers, etc.).

The central assistance of Rs 135 crore was proposed to various States/ UT's to develop inland fisheries and aquaculture across the country. The anticipated expenditure during the Plan is 57%. Under the schemes, 1.3 lakh ha area was brought under improved practices of fish culture and 1.3 lakh fishers were imparted training in aquaculture practices (Table 3.3).

Table 3.3 Physical achievements under Inland Fisheries and Aquaculture scheme during X Plan

Item/activity	Target	Achievement	% achievement
Development of Inland Fisheries and aquaculture			
Area to be brought under Fish cultivation (Lakh ha)	1.6	1.3	81.25
Training of Fish Farmers (lakh no.)	0.67	1.3	135.82

Through this programme, more than 81% of targeted area has been brought under aquaculture and fishers more than the targeted number have been trained. The lower fund utilisation has been mainly due to inability of states to provide their share of allocation. The scheme is recommended to be continued with suggested modifications in components. The central assistance pattern of the schemes was examined critically and the utilisation levels were assessed along with the factors contributing to the observed levels. The revision suggested

in fund allocation under different programmes is given in Tables 3.4 to 3.9. The general suggestion is to enhance the central share to 90%, so that the States need to contribute only 10%, instead of the present pattern of 75:25.

Table 3.4 Development of freshwater aquaculture (FFDAs)

Description of items	Current level of assistance	Proposed level of assistance
Construction of new ponds	Rs 2 lakh per ha in the plain areas	Rs 3 lakh per ha in the plain areas
	Rs 3 lakh/ha in the hill States/Districts and North-Eastern region	Rs 4.5 lakh/ha in the hill States/Districts and North--Eastern region
Reclamation/ Renovation of ponds/ tanks	Rs 60,000/ha	Rs 90,000/ha
Cost of inputs	(i) Finfish Culture – Rs 30,000/ ha	a) Finfish Culture - Rs 60,000/ha
	(ii) Freshwater prawn culture – Rs 1.2 lakh/ha	b) Freshwater prawn culture – Unit cost Rs 1.8 lakh/ha
Running water fish culture in hilly areas as well as in plain areas	Rs 20,000/unit of 100 m^2. The above cost is inclusive of Rs 4,OOO towards inputs	Rs 40,000/unit of 100 m^2. The above cost is inclusive of Rs 8,OOO towards inputs
Integrated fish farming	Rs 80,OOO/ha	Rs1.20 lakh/ha
Aerators/ Pumps	Rs 5O,OOO/unit of two-1 HP aerators/one 5HP diesel pump	Same as earlier
Freshwater fish seed hatchery	Rs 8 lakh for a fish seed hatchery with 10 million (fry) capacity for the plain areas and Rs 12 lakh for same capacity in the hill States/ Districts and North-Eastern Region	Rs 12 lakh for a fish seed hatchery with 10 million (fry) capacity for the plain areas and Rs 16 lakh for same capacity in the hill States/ Districts and North-Eastern Region
Fish feed units	Small Units - Unit cost is Rs 5 lakh with a capacity of 1.2 quintals /day	Small Units - Unit cost is Rs10 lakh with a capacity of 1.2 quintals /day
Training of fish farmers	Stipend @ Rs 100/- per day during training period of 10 days and a lump sum of Rs 100/- towards travel expenses/field visits	Stipend @ Rs 200/- per day during training period of 10 days and a lump sum of Rs 1,000/- towards travel expenses/field visits
Establishment of freshwater prawn seed hatchery	(i) Unit cost of Rs 30 lakh for a large freshwater prawn hatchery with a minimum capacity of 25 million PL/year	(i) Same as earlier

	(ii) Unit cost is Rs 8 lakh for a small hatchery of 5-10 million PL/year capacity	(ii) Unit cost is Rs15 lakh for a small hatchery of 5-10 million PL/year capacity
Establishment of laboratories at State level for water quality and fish health investigations	Unit cost of Rs 30 lakh (Rs 25 lakh for the construction of building and Rs 5 lakh for equipment, glassware & chemicals, etc.)	Unit cost of Rs 35 lakh (Rs 25 lakh for the construction of building and Rs 10 lakh for equipment, glassware & chemicals, etc.)
Provision of soil and water testing kits to each FFDA	Unit cost of each soil and water testing kit at Rs 30,000. The kits are sanctioned once to each FFDA as one time grant	Unit cost of each soil and water testing kit at Rs1,00,000. The kits are sanctioned once to each FFDA as one time grant
Setting up of integrated units, including hatcheries for ornamental fishes	Unit cost is Rs 15 lakh, which include hatchery of 5-10 m (fry) capacity	Same as earlier
Brood banks for ornamental fishes	Not existing	Rs 25 lakh per unit including a farm, transport arrangements for dissemination
Ornamental fish seed certification units	Not existing	Rs 25 lakh per unit including fish holding facilities and disease diagnostic laboratories
Transportation of fish/prawn seed	This will be applicable only for the hill states/districts and North-eastern region	Same as earlier
	Subsidy @ Rs 20 for 1000 fry transported to all FFDAs. Not applicable to individual fish farmers	Subsidy @ Rs 50 for 1,000 fry transported to all FFDAs. Not applicable to individual fish farmers
Purchase of vehicle	50% cost of vehicle for each new FFDA and 50% cost for the replaced vehicle (Second vehicle)	Same as earlier

Note: Existing expenditure on all the above items except purchase of vehicles is shared on 75:25 basis by the Centre and States, which is proposed to be on 90:10 basis, respectively barring vehicles. The above assistance under FFDA programme is available only once to a beneficiary. These are Subsidy for the construction of new ponds and tanks, Reclamation/renovation of ponds/tanks and first year inputs to an individual beneficiary up to 5 ha is available with or without institutional finance in the plain areas and 1.0 ha in the hill States/Districts on pro-rata basis (Source: DAHD&F, 2004b & modified)

Table 3.5 Development of brackishwater aquaculture

Description of items	Current level of assistance	Proposed level of assistance
Renovation or construction of Brackish water fish farms	Beneficiaries will be small shrimp farmers having land holding of 2 ha or less. The assistance is 25% cost subject to a maximum of Rs 40,000/ha as subsidy	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
For training of Shrimp farmers	Training part could be managed by the state government by availing assistance under another scheme on fisheries training and extension or to provide specific/specialized training through the centers of expertise on surveillance centers proposed under the programme at 100% expenditure will be incurred by the Centre	Same as earlier
Establishment of demonstration-cum- training center	One time government of India' share of grant amounting to Rs 5 lakh	Same as earlier
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 Coast 100% expenditure will be incurred by the Centre	Same as earlier
	100% expenditure will be incurred by the Centre	Same as earlier
Network of diagnostic laboratories for aquatic animal health	One time Government of India' s share of grant amounting to Rs 5 lakh	Same as earlier

Note: Existing expenditure on all the above items is shared on 75:25 basis by the Centre and States, which is proposed to be on 90:10 basis, respectively, barring Aquatic quarantine and inspection unit (AQIU) Network of diagnostic laboratories for aquatic animal health for which 100% expenditure is proposed to be borne by the GoI (Source: DAHD&F, 2004b & modified)

Table 3.6 Coldwater fisheries and aquaculture

Description of Items	Current level of assistance	Proposed level of assistance
Preparation of resource survey report/ feasibility report	Rs 5 lakh as one time grant to the State Government	Same as earlier
Short term investigation, breeding or rearing, etc	Rs 5 lakh as one time grant to the State Government	Same as earlier

Construction, renovation, extension or remodeling of fish farms	One time grant. Amount to be decided on the merit of the proposal	Same as earlier
Farming units for cold water fish species and first year inputs	Unit cost of Rs 35,000 (Rs 25,000+ Rs 10,000) for a unit size 15 x 2 x 1 m^3	Unit cost of Rs 1.5 lakh for a unit size 15 x 2 x 1 m^3
Units for running water fish culture	Unit cost including input Rs 42,500	Unit cost including input Rs 60,000
Development of water logged areas	Unit cost Rs 1.25 lakh/ha	Unit cost Rs 3 lakh/ha
Inputs (fish/ prawn) seed, feed, manure, fertilizers, preventing measures for diseases, transportation charges, etc.	Unit cost Rs 75000/ha	Same as earlier
Training	Stipend @ Rs 100 per day during training (maximum period of 10 days) and a lump sum payment of Rs 100 towards travel expenses/field visits per trainee	Stipend @ Rs 200 per day of training (maximum period of 10 days) and a lump sum payment of Rs 1,000 towards travel expenses/field visits per trainee

Note: Existing expenditure on all the above items except purchase of vehicle is shared on 75:25 basis by the Centre and States, which is proposed to be on 90:10 basis, respectively (Source: DAHD&F, 2004b & modified)

Table 3.7 Development of waterlogged areas

Description of Items	Current level of assistance	Proposed level of assistance
Development of water logged areas	Unit cost Rs 1.25 lakh/ha	Unit cost Rs 3 lakh/ha
Inputs (fish/ prawn) seed, feed, manure, fertilizers, preventing measures for diseases, transportation charges, etc,	Unit cost Rs 75,000/ha	Same as earlier
Training	Stipend @ Rs 100 per day during training (maximum period of a period of 10 days) and a lump sum payment of Rs 100 towards travel expenses/field visits per trainee	Stipend @ Rs 200 per day of training (for a period of 10 days) and a lump sum payment of Rs 1,000 towards travel expenses/ field visits per trainee

Note: Existing expenditure on all the above items is shared on 75:25 basis by the Centre and States, which is proposed to be on 90:10 basis, respectively (Source: DAHD&F, 2004b & modified)

Table 3.8 Productive utilization of inland saline/alkaline waters for aquaculture

Description of Items	Current rate of assistance	Proposed rate of assistance
Cost for construction	Unit cost Rs 2.5 lakh/ha	Unit cost Rs 3 lakh/ha
Input cost	Unit cost Rs 1 lakh/ha	Same as earlier
Training	Stipend @ Rs 100 per day during training (maximum period of a period of 10 days) and the lump sum payment of Rs 100 towards travel expenses / field visits per trainee	Stipend @ Rs 200 per day of training (for a period of 10 days) and a lump sum payment of Rs 1,000 towards travel expenses /field visits per trainee

Note: Existing expenditure on all the above items is shared on 75:25 basis by the Centre and States, which is proposed to be on 90:10 basis, respectively (Source: DAHD&F, 2004b & modified)

Table 3.9 Inland capture fisheries (reservoirs/rivers, etc.)

Description of Items	Current rate of assistance	Proposed rate of assistance
Fish seed rearing units	Unit cost Rs 2 lakh/ha	Unit cost Rs 3 lakh/ha
Pens with inputs	Unit cost Rs 15,000/0.1 ha	Unit cost Rs 60,000/0.1 ha
Cage with inputs	Unit cost Rs 15,000/ per unit	Rs 4,50,000/battery of 16 cages (3 x 3 x 2 m^3 per cage)
Input cost (seed, feed, manures, fertilizers, preventive measures for disease etc.)	Unit cost Rs 30,000/ha (one time)	Same as earlier
Training	Stipend @ Rs 100 per day during training (maximum period of a period of 10 days) and the lump sum payment of Rs 100 towards travel expenses/field visits per trainee	Stipend @ Rs 200 per day of training (for a period of 10 days) and a lump sum payment of Rs 1,000 towards travel expenses/ field visits per trainee
Craft and gear (net, boat, etc)	Unit cost of Rs 15,000	Unit cost of Rs 1 lakh
Construction of landing Centre	Unit cost Rs 1 lakh per landing centre, Assistance to state government	Unit cost Rs 5 lakh per landing centre, Assistance to state government
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	Same as earlier

Note: Existing expenditure on all the above items is shared on 75:25 basis by the Centre and States, which is proposed to be on 90:10 basis, respectively (Source: DAHD&F, 2004b & modified)

Box 3.2 Inland Fisheries and Aquaculture

1. Success of carp Farming in Andhra Pradesh, Haryana and Punjab

Andhra Pradesh, Haryana and Punjab have emerged as progressive states with respect to the development of freshwater fish farming of the country. While Andhra Pradesh to some extent is a traditional fish farming state, Haryana and Punjab are non-traditional states and fish farming started only during early seventies. Today, freshwater fish from Andhra Pradesh is marketed in almost every state of the country and also in the neighbouring countries like Bangladesh, Bhutan and Nepal. Similarly fish produced in Punjab and Haryana is marketed in the neighbouring states after meeting their own requirements.

The Krishna and East and West Godavari district of Andhra Pradesh is the hub of freshwater fish farming. Besides, Indian Major Carps such as Catla, and Rohu, farmers also raise catfishes. The average productivity from the farms in Kolleru lake area is around 5-6 t per ha and scientific method of farming are deployed to maximize the returns from the ponds. The seed and feed inputs supply systems are well organized in the area, which is a big support to the fish farmers. Similarly, the marketing infrastructure is also well knit that takes care of the fish packaging and transportation by refrigerated vans to far-flung areas of the country. Per hectare production in Haryana and Punjab is close to 4 t and besides Indian Major Carps, the farmers are also raising freshwater prawn. In these two states, the markets are close to the production centres and, therefore, the per kilogram realization to the fish farmer is much higher as compared to what the farmers get in Andhra Pradesh.

2. Reservoir Fisheries in Govind Sagar, Himachal Pradesh

Govind Sagar reservoir is located in Bilaspur district of Himachal Pradesh. The reservoir is formed on the river Sultez and covers an area of about 10,000 ha at effective storage level. The water spread at full storage level encompasses 16,000 ha. Govind Sagar is one of the well managed reservoirs in the country from the fisheries point of view. The average fish production from the reservoir during the last five years was about 1,000 t per annum or 100 kg/ha/year. The maximum yield obtained from Govind Sagar has been to the tune of 122 kg/ha/year, which is highest in the country for a large reservoir.

The reservoir has a predominant fauna of the exotic Silver Carp followed by Indian Major Carps, Mahseer and Minor Carps. Catla dominates the Indian major carps. The Department of Fisheries, Government of Himachal Pradesh implements several welfare and production oriented scheme for the benefit of the reservoir fisherman. These Centrally sponsored schemes include, Saving-cum-relief Scheme, Group Insurance, scheme for Active Fishermen and the Housing Scheme. The schemes implemented under the state Plan include Risk Fund Scheme and a Calamity Relief Scheme.

Besides closed season, which is implemented in the reservoir for two months (1st June through 31st July) every year, areas suitable for natural breeding in the reservoir are also protected to allow the fishes to breed and thereby help in auto stocking of the reservoir. To maintain species balance, supplementary stocking is done from time to time.

Box 3.2 continued

... continued Box 3.2

About 3,000 registered fisherman inhabit in the periphery of the reservoir of which about 1,900 are active. These fishermen are grouped into 16 co-operative societies, which are then grouped into an apex body called the Bilaspur Fisheries Marketing and Supply Federation. The Federation assists the fishermen in sale and marketing of fish and its assets include a cold storage, an ice plant and refrigerated vans. The Govind Sagar fish is marketed in major towns / cities in Punjab, Jammu and Kashmir and Delhi and also the bordering areas in Uttar Pradesh and Haryana. Govind Sagar is an excellent example of a well managed large reservoir and the practices adopted need to be replicated in other large and medium reservoir of the country.

3. Trout Farming in private sector in Himachal Pradesh and Jammu & Kashmir

Over the years, rainbow trout farming in the states of Jammu and Kashmir and Himachal Pradesh has become an enterprise. The farming of rainbow trout (*Oncorhynchus mykiss* on commercial scale has been made possible in the hill states of the country. The farming system demonstrated in the state run farms have generated tremendous enthusiasm among the local unemployed youth to take up farming of trout fish as a means of livelihood. With the support, motivation and know-how by the extension wings of the State Governments, better farming units have come up even in the remote hill pockets of the States of Himachal Pradesh, Uttaranchal and Sikkim.

The main reasons attributed to the upfront acceptance of the technology success by the growers are:

(i) Import of quick growing European/ Swedish strains of rainbow trout.

(ii) Modernization of trout hatcheries *vis-à-vis* easy and adequate availability of troutlings to private trout growers.

(iii) Evolvement of compounded palletized feed for all the stages of trout with high FCR, appetence value and stability factor.

(iv) The bulk quantities of farm-reared trout seed and its transplantation in rivers and streams have contributed significantly in the revival of sport fisheries in the states.

Country's trout farming programmes need strengthening both in strength and scale. Against the current production of 150 t farm-reared rainbow trout annually, the production could be raised ten fold within a short period. The success achieved in the sates of Himachal Pradesh and Jammu & Kashmir in trout farming is worth emulating by other states for generating employment and raising proteinous food for hill inhabitants.

Box 3.2 continued

…. continued Box 3.2

4. Ornamental Fish Culture and Trade in Chennai

Kolathur village on the outskirts of Chennai is famous for ornamental fish cultivation by small scale producers. There are about 600 families earning their livelihood through ornamental fish cultivation in Kolathur and on an average each household in the village earns over Rs 5,000 per month through ornamental fish farming. About 45 km from Kolathur, Gummidipoondi village is another hub of ornamental fish production where women SHGs have successfully taken up breeding and raising of ornamental fish to earn their livelihoods.

On the commercial front, the ornamental fish trade is a growing business with Chennai and Kolkata turning out to be the major production and export centres. The domestic trade is a mix of medium and small ornamental fish farmers. In Chennai, many farmers grow fish in their backyards and sell the stock to bigger companies, which are engaged in export business. The State Government undertaking Tamil Nadu Fisheries Development Corporation (TNFDC) joined the field in the year 2000. It rears popular varieties like Goldfish, Angel Fish, Mollies and Fighters in its farm near Coimbatore. These fishes are sold in the local markets.

The global trade in the ornamental fish is estimated at Rs 5,000 crore, of which India has a minuscule Rs 2 crore. This is despite the country's tropical climate, varied freshwater sources and 8,000 plus km coast line. However, the growing demand for ornamental fisheries and the growing interest in aquarium may change all this very soon.

Singapore and other South East Asian countries account for 80 percent of the global trade. The main markets are the US, the UK, Belgium, Italy, Japan, China, Australia, and South Africa. According to industry estimates, India's domestic annual turnover is about Rs 15 crore, but the global market is much bigger. With its tropical climate, India can become a key player in this field. Many Indian species like Catfish, Dwarf, and Giant Gouramis, and Barbs are popular abroad and fetch good prices.

To popularize ornamental fish production and trade, Kolathur is an excellent example to emulate. It provides a good mix of both domestic as well as commercial –scale production, which largely cater to the export markets.

5. Pen and cage culture in Wetland and small reservoir in Asom

The Central Institute of Fisheries Research Institute, Barrackpore, has successfully developed package of practices to raise the carp and freshwater prawn seed and to grow them to table size in enclosures, viz., pens and cages installed in small reservoirs and wetlands. In Asom, 100 pens ranging from 37.5 to 1100 m^2 covering 2.73 ha were installed in beels (floodplain wetlands), viz, Shankar, Goruchara, Samaguri, Charan, Kumri, Haribhanga,46 Morakollang,, Rowmari, Borghuli and Dek in the district of Golaghat, Nagaon, Morigaon and Goalpara of Asom. This technology was used to raise the right size of seed for stocking in the beel for improving its fish yield. In the pens, different species of carps, viz *Labeo rohita*, *Catla Catla*, *Cirrhinus mrigala*, *labeo gonious* registered a maximum individual growth of 295g, 265g, 110g and 75g, respectively, in 3-5 months. The beels were managed by the co-operative societies. In Assam, pen culture of carps in beels was promoted for micro financing and is now accepted as

... continued Box 3.2

6. Exotic carp farming in mid-hills

Previously standardized exotic carp farming technology for mid-hills, involving three species combination of grass carp, silver carp and common carp was successfully demonstrated in farmers ponds situated at different altitudes in two districts of Uttaranchal. One of the fish farmers from Toli village achieved highest estimated fish production of (6942 kg/ha/year) by harvesting 162 kg fish from 300 m^2 pond, with an additional income of Rs11340 from the same area. This supplements the income from small farm holdings, in which cereals, vegetables, and fruits are produced. This integration of crops and fish makes hill farming remunerative and sustainable. All the ponds in two districts under this programme registered an estimated average fish production of 3508 kg/ha/year with actual harvest in the range of 0.012 to 0.39 kg/m^2/year in ponds ranging in size between 125-500m^2 .The programme motivated more farmers especially in districts of Champawat and Nainital to take up fish culture. A self-help group has been organized in the village Toli to transfer this technology to farmers from other adjoining villages in the region.

Source: NCF, 2005; DARE, 2003, 2004, 2005, 2006

3.4 Development of marine infrastructure and post harvest operations

In order to develop marine infrastructure and post harvest operations, existing programmes of construction of fishing harbour and fish landing centre were continued after IX Plan period. These formed a part of the macro scheme namely 'Development of marine fisheries, infrastructure and post harvest operations' in X Plan. During the X Plan, central assistance of Rs 125 crore was provided under various components of the aforesaid scheme for development of marine fisheries infrastructure. The expected fund utilization is about 73%. Since inception of the scheme on establishment of fishing harbours and fish landing centres, six major fishing harbours, 58 minor fishing harbours and 189 fish landing centres were taken up for implementation (Table 3.10). Of these, six major fishing harbours, 40 minor fishing harbours and 151 fish landing centres have been completed and put to use. The remaining 18 fishing harbours and 37 fish landing centres are at various stages of construction. Considering the importance of the scheme for marine fisheries development the scheme is recommended to be continued during the XI Plan.

Table 3.10 Physical achievements under Development of Marine Fisheries Infrastructure and Post Harvest Operations scheme during X Plan

Item/activity	Targets	Achievements	% achievement
New projects			
Major fishing harbours (No.)	6	6	100.00
Minor Fishing harbours (No.)	58	40	68.97
Fish Landing Centres (No.)	189	150	79.37
Repair and Renovation			
Major fishing harbours (No.)	1		
Minor Fishing harbours (No.)	6	5	83.33
Fish Landing Centres (No.)	9	3	33.33
Maintenance of Dredger (In cubic m)	800,000	183,618	22.95

Success Stories

Box 3.3 Infrastructure Development

1. Utilization of Prawn Shell Waste

At the Central Institute of Fisheries Technology, Kochi, a technology for production of chitin, chitosan and glucosamine hydrochloride from prawn shell waste was developed. The chitin, chitosan and glucosamine hydrochloride are used as a dietary supplement for controlling obesity and arthritis, as a polymer flocculent, dye fixing and water treatment. The technology has been transferred to private sector in India and abroad. A patent has already been filed for production of high bulk density chitosan and high purity glucosamine hydrochloride from shrimp shell waste.

2. Ready-to-serve fish curry in flexible pouches

At the Central Institute of Fisheries Technology, Kochi, the process of production of fish curry in retortable flexible pouch using over pressure autoclave was successfully developed and standardized. The flexible pouch can perform the packaging function equally well as metal cans, and is free from the disadvantages met within them. The technical guidance on production of retort pouch products has been given by the institute to private sector for commercial exploitation.

Source: NCF. 2005: DARE. 2003. 2004. 2005. 2006

3.5 Welfare programmes/ policy issues/ human resource development

The scheme has two components, 'National Scheme for Welfare of Fishermen' and 'Fisheries Training and Extension'. Under these components, a number of activities have been taken up. The budget allocation for the scheme was Rs 135 crore and the anticipated expenditure is over Rs 121 crore, accounting for 89% of target outlay.

3.5.1 National Scheme for Welfare of Fishermen

The centrally sponsored national scheme of Welfare of fisherman has broadly three components, as follows:

3.5.1.1 *Development of Model Fisherman Villages*

The objective of this component is to provide basic civic amenities, such as housing, drinking water and construction of community hall for fisherman. The villages were to be provided with tube wells at the rate of one tube well for every 20 houses. For recreation and common working place, a fisherman village with at least 75 houses is eligible to avail financial assistance for construction of a community hall. The Unit costs under the scheme since 2000-01 have been Rs 40,000 for a house, Rs 30,000 for tube well and Rs 1,75,000 for community hall. The expenditure is shared equally between Central and State governments. The present level assistance for house at Rs 40,000 that needs to be enhanced to Rs 1,00,000 in view of cost escalations.

3.5.1.2 *Group accident insurance scheme for active fisherman*

The objective of this component is to provide insurance cover to fishermen for Rs 50,000 against accidental death or permanent total disability and Rs 25,000 for permanent partial disability. The upper limit for insurance premium is Rs 15 per head. The Central and State Governments are to share the annual premium on 50:50 basis and in case of Union Territory, 100% premium is borne by the

Government of India. Single policy is taken in respect of all those states/Union Territories who are participating through National Federation of Fishermen Co-operatives Limited (FISHCOPFED).

3.5.1.3 *Saving -cum –relief scheme*

The objective of this component is to provide financial assistance to fishermen during lean fishing season. Under this component, the beneficiary has to contribute a part of earnings during non-lean months. The monthly contribution for marine fisheries is Rs 75 for eight months, while that of inland fisher is Rs 50 for nine months. A matching amount is provided with equal contribution from Central and State government and the accumulated amount is distributed back to fishers in four/three equal installments at the rate of Rs 300 per month to marine/inland fishers. In case of UTs, entire matching share is borne by the Central Government.

During the first four year of X Plan, central assistance of Rs 93.06 crore was extended to States/UTs/FISHCOPFED to implement the scheme.

3.5.2 Scheme on Fisheries Training and Extension

The main objective of the scheme is to provide training to fishery personnel to enable them to undertake fisheries extension programmes effectively. The scheme also provides assistance to fisherfolk in upgrading their skills. To enhance training facilities, the scheme also provides assistance for setting up or upgrade training centres in States/ Union territories. The achievements under various components of the scheme are given in Table 3.11.

Table 3.11 Physical achievements under Welfare Programmes/ Policy Issues/ Human Resource Development scheme during X Plan

Item/ Activity	Targets	Achievements	% achievement
Welfare schemes			
Fishermen houses (No.)	26,000	64,831	249.35
Saving-cum-relief (lakh No.)	12.25	16.04	130.94
Insurance (lakh No.)	56.01	63.08	112.62
Fisheries Training & Extension			
Human Resources Development (No.)	12,000	19,608	163.40
Establishment of Training Centre (No.)	60	28	46.67
Establishment of Awareness Centre (No.)	20	9	45.00

This is an important programme for fishers, where accomplishments against the set targets have been satisfactory. The scheme is recommended to be continued.

Box 3.4 Welfare programmes/ policy issues/ human resource development

1. Self-help groups in Fisheries in Tamil Nadu

The Southern Districts of Tamil Nadu have witnessed significant increase in the number of fisherwomen Self help Groups (SHGs). Punnakkayal village has the largest number of SHGs in an Indian village with over 50 groups consisting exclusively of fisherwomen.

Today, there are several examples of successful fisherwoman SHGs in the region and their experiences need to be promoted in other states also. The fish market at Nilankarai is managed by fisherwomen belonging to 12 SHGs. The management practices established by this group demonstrate their efficiency and unity. Similarly, The SHGs formed by fisherwomen in Vellapatty village in Tuticorin has enabled its members to conduct individual business involving a wide range of activities, including fattening of crabs for sale in the local market. These SHGs also have good linkages with the NGOs who helped them in the promotion of their business.

2. Mudialy Fishermen's Co-operative Society, Kolkata

The Society, registered in 1961, obtained 70 ha of waterlogged wasteland – cum- garbage dump from Calcutta Port Trust and 10 ha from the State Government. The Society has since engaged in production of fish in the sewage water and has also set up a Nature Park involving growth of an eco-tourism centre and extensive plantations of fodder plants, dust absorbing plants, canopy trees and agri-horticulture plants. In the process, the society has not only been successful in treating 25 million litres of waste water through biological means of pisciculture, but has also provided various facilities to its members like daily-wage medical and educational assistance, funeral aid, marriage aid and Housing advance. The integrated and mutually beneficial nature of these activities has converted a stinking, disadvantaged area into an ecologically friendly expanse of greenery. The Society has successfully cultured Indian major carps as well as many exotic carps and successfully demonstrated the technology for sewage water fisheries. The work of the society has won it the National Productivity Award twice as well as Indira Priyadarshini Brikshamitra Award, award for overall performance in pisciculture and Award for overall excellence from NCDC. The "Mudialy Model" has successfully demonstrated the feasibility of production of fish and establishment of an eco friendly facility even while utilizing industrial wastewater and disadvantaged wetland.

Box 3.4 continued

….. continued Box 3.4

3. Farmer's Associations or Aqua clubs in Thanjavur and Bhimavaram

(i) Thambikottai-Vadakadu Shrimp Farmers' Association in Thanjavur District, Tamil Nadu

In Tamil Nadu, shrimp farmers in Thanjavur district have formed village level associations and organize regular meetings to follow good management practices for achieving eco-friendly and sustainable shrimp farming. One of the best examples of this association is the Thambikottai-Vadakadu Shrimp Farmer Association. The members of this Association consult themselves before initiating pond preparation, introducing water in their ponds, selection and stocking of seed, feed management, shrimp health management, prevention of disease, formation of separate channels for draining out waste water, time for harvest of the crop, fixing of price, etc.

The Association members also inspect the shrimp hatcheries located at Chennai and Marakanam areas and collect seed samples for testing in at least three PCR laboratories to ascertain the presence/ absence of pathogens. The tested seed is purchased in bulk, which is then divided amongst the members of the Association as per their requirement. If a viral disease affects any farmer's crop, all precautionary measures are taken to prevent the spread of the disease to the other ponds. The Association also suitably compensates the affected farmer's loss. The Association takes the responsibility of road laying and providing other infrastructure like drainage canal and street lamps to the village adjacent to shrimp farm cluster. The Association organizes meeting of the members on fortnightly basis and discusses and solves their problems with mutual consent.

(ii) Sri Subrahmanyeshwara Aqua Club in West Godavari District, Andhra Pradesh

To promote co-operative approach in management of shrimp farming activities and other common issues that commonly arise in cluster-based shrimp farms, aqua clubs have been set up in Andhra Pradesh. A total of 128 aqua clubs with a membership of 3367 farmers is now existing in the state. However, one of the best initiative of this kind is the Sri Subrahmanyeshwara Aqua club in Mogalthur Village is West Godavari district of Andhra Pradesh. The SS Aqua Club comprises 58 farmers with 108 ponds spread over 58 ha and the farmers involved are mostly small-scale, practicing improved traditional farming with low investments. Based on the technical inputs provided by the Network of Aquaculture Centres in Asia-Pacific (NACA), Bangkok and the Marine Products Export Development Authority, Kochi, the farm level 'better management practices' or the BMPs were demonstrated in the shrimp ponds of the SS Aqua Club with great success.

The above two initiatives by the shrimp farmers in the Tamil Nadu and Andhra Pradesh need to be replicated in the other coastal states also where shrimp is fast developing on commercial-scales.

Source: NCF, 2005; DARE, 2003, 2004, 2005, 2006

3.6 Centrally sponsored Scheme on strengthening of database and information networking for the Fisheries sector

The scheme is implemented with the objectives: (i) to improve database of inland and marine fisheries resources and catch of fish by adoption of standardized methodology of data collection through sample survey for estimation of inland fisheries; and (ii) to improve information technology systems in the States/Union Territories as well as national level fishery institutes so that data collection and their analysis can be done efficiently and effectively. Accordingly, the components of the scheme are: catch assessment surveys on inland fisheries, information technology, development of geographical information system, census of inland fisheries, census of marine fisheries, catch assessment surveys on marine fisheries and strengthening of head quarter at center. The budget outlay for the scheme was Rs 45 crore, of which the anticipated expenditure is Rs 16.62 crore (37%). It is comparatively on lower side as compared to other schemes.

The marine fisheries census has already been completed by CMFRI, Kochi and document is published. In case of catch assessment survey for estimation of inland fish catch, CIFRI, Barrackpore provided training on the methodologies of data collection and analysis to staff from 24 States. A software has also been developed and distributed to the states for data entry and analysis for computing catch estimates from various resources. For development of GIS for inland water bodies in India, mapping of water bodies with monsoon and post-monsoon data was completed. The process of Inland fisheries census is underway.

The contribution of the scheme is significant in generating valuable fishery data across the country. There is however a shortfall in fund

utilization. Considering the importance of the scheme, it is recommended to be continued scheme with greater emphasis on GIS.

3.7 Fisheries Institutes

3.7.1 Fishery Survey of India

The Fishery Survey of India (FSI) was established by the Government of India at Bombay in 1946 under a different name, the Deep Sea Fishing Station (DSFS). The FSI is presently responsible for the survey and assessment of marine fishery resources of the Indian Exclusive Economic Zone (EEZ), which it undertakes by deploying a total of 13 ocean-going survey vessels along both the coasts as well as the Andaman & Nicobar islands. Besides resource surveys, the work of FSI includes monitoring of fishery resources for the purpose of regulation and management, assessment of suitability of different types of craft and gear for deep-sea and oceanic fishing, providing in-vessel training to CIFNET/Polytechnic trainees, dissemination of information on fishery resources through various media to the fishing community, industry and other end-users. The survey fleet of the institute undertakes bottom trawl survey, midwater/columnar resource survey and long line survey for demersal, columnar and oceanic tunas and allied resources and also for oceanic sharks.

As against the X Plan outlay of Rs 130 crore, the Institute has incurred an expenditure of Rs 123.85 crore during first four years of the Plan and during the current year Rs 35.07 crore allocation was received, against which the expenditure anticipated is Rs 29 crore, indicating satisfactory fund utilisation. The Physical targets and achievements of the Institute during the X Plan are furnished below (Table 3.12):

Table 3.12 Physical achievements of FSI during X Plan

Particulars	Targets	Achievements*	% achievement
Days out at sea	13,472	11,701	87
Days fished	10,654	8,031	75
Survey efforts			
Trawl Surveys (hrs) (demersal & pelagic)	37,389	24,891	67
Long line Surveys (hrs) (Tuna long line & bottom set long line)	1,620,250	1,072,259	66
Experimental projects undertaken	Trap fishing for groupers and deep sea lobster. Squid jigging for neritic and oceanic squid species and hand line fishing for groupers.		

* Including projected achievements during 2006-07.

The physical achievements of FSI was nearly two third of the plan target for survey efforts. The percentage for number of days of fishing and in the sea was comparatively higher than number of hours of survey, suggesting the need for spending more time in the effort while at sea.

3.7.2 Central Institute of Fisheries Nautical and Engineering Training (CIFNET)

The CIFNET was established under the Department of Animal Husbandry & Dairying, Ministry of Agriculture, at Kochi in 1963 for developing technical manpower for manning large fishing vessels operating within the Indian EEZ. Subsequently, two sub-centres of CIFNET were established at Chennai in 1968 and at Vishakhapatnam in 1981, for meeting the requirements of additional manpower necessitated for the ever-growing fishing fleet.

The Institute has already upgraded two 18-month training courses to 24-month courses in view of the directions of the Director General, Shipping. The Institute is starting a 4-year Degree course in Fishing and Nautical Science and plans to initiate a Diploma Course in Marine Engineering. However, the Institute had incurred by the end of the

fourth year of the X Plan an expenditure of Rs 8.78 crore only as against an allocation of Rs 38.85 crore. This indicates that the Institute would first need to equip itself with the required manpower and infrastructure, before embarking on the new programmes as proposed. The physical targets and achievements of the Institute during the X Plan are furnished in Table 3.13.

Table 3.13 Physical achievements of CIFNET during X Plan

	Item/Activity	Targets	Achievements	% achievement
1	Training of Fishermen and students (nos.)	3,355	4,857	144.77
2	Institutional trainee days (nos.)	13,440	10,476	77.95
3	Post Institutional Trainee days (nos.)	14,028	14,657	104.48

At present, the Institute is having three training vessels stationed at Kochi, Chennai and Vishakhapatnam, excluding one old vessel transferred from Integrated Fisheries Project in October 2005 for imparting practical training to the candidates. All the three vessels are more than 25 years old and require frequent repairs. The dry-docking expenses have also increased considerably. It is therefore proposed to replace the two old vessels with new training vessels equipped with modern machinery and sufficient accommodation during the XI Plan.

The Institute needs to upgrade the skills of its personnel, for which the training areas identified are: (i) Fishing gear design and fabrication; (ii) Safety at sea with International Maritime Organisation (IMO) regulations; (iii) Marine pollution & marine environment; and (iv) Marine refrigeration. The countries where the proposed training programmes can be arranged are Japan, France, Norway, South Korea and Italy.

3.7.3 Integrated Fisheries Project (IFP), Kochi

The IFP was established as Indo-Norwegian Project during 1952 and renamed as Integrated Fisheries Project in 1972. This pioneer institute under the Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, is engaged in the development of technologies for harvesting of marine fish resources. The Institute has an outreach centre at Vishakhapatnam besides the headquarters at Kochi.

The IFP has been spearheading and pioneering the technological advances in the fish processing sector in the country. As part of the diversification and specialization Plan, the activities of IFP have been reorganized and its mandate redefined. Under the new mission and revised objectives, IFP's activities have been more focused on post-harvest sector. Most of the X Plan targets were achieved by IFP barring quantity of processed fish (88%). It is now looking for marketing of processed fish products in Indian metros, establishment of low cost processing units for women SHGs, use of Communication and Information Technology and advanced training for its personnel.

While it had an allocation of Rs 5.60 crore during the X Plan, the IFP could incur an expenditure of Rs 2.62 crore only by the end of the fourth year of the X Plan. In view of various new initiatives to be undertaken, it is necessary to rationalize the outlay for next Plan according to demands as per new activities. The physical targets & achievements of IFP during the X Plan are mentioned in Table 3.14.

Table 3.14 Physical targets & achievements of IFP during the X Plan

	Item/Activity	Targets	Achievements	% achievement
1	Fish Processing (t)	650	422	88
2	Fish Marketing (t)	420	414.48	99
3	No. of Trainers Trained	1,559	2,955	190
4	No. of Training days	9,000	11,531	128

3.7.4 Central Institute of Coastal Engineering for Fishery (CICEF), Bangalore

The Central Institute of Coastal Engineering for Fishery was initially named as 'Pre-Investment Survey of Fishing Harbours (PISFH)'. It was established under the Department of Animal Husbandry & Dairying, Ministry of Agriculture, Government of India, in January, 1968 at Bangalore, with the primary objective of carrying out engineering and economic investigations and prepare techno-economic feasibility reports for the development of fishery harbours at suitable sites along the Indian coasts and to provide fishery harbour facilities to mechanized fishing vessels. In August 1983, it was renamed as Central Institute of Coastal Engineering for Fishery.

The mandate of the Institute is almost the same as earlier, to conduct necessary pre-investment studies to identify priority sites for development of fishery harbours and to prepare techno-economic feasibility reports covering construction plans for these harbours and their support facilities. The Institute monitors the progress of construction of ongoing fishery harbours sanctioned under the Centrally Sponsored Scheme by the Department and renders technical guidance to the Maritime State/Union Territories in the implementation of the projects. The physical targets & achievements of the Institute during the X Plan are contained in Table 3.15.

Table 3.15 Physical targets & achievements of CICEF during the X Plan

	Item/Activity	Targets	Achievements	% achievement
1	Investigation of Fisheries Harbour sites (Nos.)	9	9	100
2	Preparation of TEFRs for Fishing Harbours (No.)	15	24	160
3	No. of sites for which reconnaissance survey done (No.)	40	100	250

3.8 National Fisheries Development Board (NFDB), Hyderabad

The National Fisheries Development Board (NFDB), a registered body under the administrative control of the Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt. of India, was registered on 10th July, 2006. The aim of the Board is to realize the full potentials of Indian fisheries through coordination of different agencies and public-private partnerships. The objectives of the NFDB are:

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

The Board has total budget of Rs 2,100 crore during 2006-2012; with current year outlay of about Rs 31 crore. The activities of the Board and their budget provisions are summarized in Table 3.16.

Table 3.16 Summary of Activities and Budget Provisions for 2006-2012 and 2006-07

Sl. No.	Activities	Budget for 2006-12 (Rs crores)	Budget for 2006-07 (Rs crores)
1	Intensive Aquaculture in Ponds and Tanks	620	10
2	Reservoir Fisheries	400	10
3	Coastal Aquaculture	15	2
4	Deep Sea fishing and Tuna Processing	6	-
5	Mariculture	105	1
6	Sea Ranching	11	-
7	Seaweed Cultivation	30	1
8	Infrastructure for Post-harvest Processing	600	5
9	Fish Dressing Centres and Solar Drying of Fish	22	-
10	Domestic Marketing	250	-
11	Other Activities	14	-
12	Administrative Expenses	27	2
	Total	**2,100**	**31**

The activity wise targets, anticipated benefits and Budget of the board are presented in Table 3.17.

Table 3.17 Activity wise targets, anticipated benefits and Budget of the NFDB

Sl. No	Activity	Target	Anticipated benefits	Budget & items
1	Intensive Aquaculture in Ponds and Tanks	50,000 ha of new area; Pond fish productivity of 5 t/ha/ year in 8 lakh ha	Additional annual fish production of 26.5 lakh t and employment for 18 lakh people	Rs 620 crores Training & Demonstration; Capital requirement through banks
2	Reservoir Fisheries	Productivity of 150 kg/ha/year in 15 lakh ha	Additional annual fish production of 2.25 lakh t and	Rs 400 crores Training &

			employment for 7.5 lakh people	Demonstration; Provision of total input costs in reservoirs leased on competitive basis for five years
3	Coastal Aquaculture	Additional one lakh ha under shrimp farming and 50,000 ha for brackish finfish culture	Good practices and diversified production from coastal aquaculture; Enhanced foreign exchange and employment for 7.5 lakh people	Rs 15 crores Training & Demonstration
4	Deep Sea Fishing and Tuna Processing	Facilitating Tuna fishing and value addition	Additional annual fish production of 2 lakh t; Optimal utilization of tuna resources and enhanced exports	Rs 6 crores Training & Demonstration
5	Mariculture	Facilitating mariculture for supplementing marine fisheries	Additional annual fish production of 5 lakh t and production of high value sea food	Rs 105 crores Training & Demonstration
6	Sea Ranching	Stocking of seed of selected fin fish/shell fish species as a conservation activity	Sustained marine fish production	Rs 11 crores; Training & Demonstration
7	Seaweed Cultivation	Diversified activity in mariculture for utilizing the coastal areas	Diversified marine products and activity for fishers; Export potentials, Employment for coastal population	Rs 30 crores Training & Demonstration; Provision of total input costs; processing and market linkages
8	Infrastructure for Post-harvest Processing	Improvement of fish landing and handling facilities	Better fish handling facilities and access to quality shrimp seed	Rs 600 crores Infrastructure development and improvement, with Government and private

				agencies on a cost sharing basis
9	Fish Dressing Centres and Solar Drying of Fish	Model fish dressing centres and solar drying units	Hygienic handling of fish; Better dry fish for domestic consumption as well as export; Reduction in post-harvest losses	Rs 22 crores Training & Demonstration; Provision of total input costs
10	Domestic marketing	Upgradation of wholesale fish markets and establishment of quality retail outlets	Hygienic marketing of fish; Better quality fish to the consumers; Stability in prices; Reduction of post-harvest losses	Rs 250 crores Partnerships with Government and private agencies, with equity participation up to 20%
11	Other Activities	Innovative areas in fisheries and aquaculture	Innovative fisheries and aquaculture models	Rs 14 crores Evaluation of interventions, Workshops, Interaction meetings, new concepts and designs

3.9 National Co-operatives Development Corporation (NCDC), New Delhi

Major thrust of NCDC activities is on promotion of programmes for weaker sections including scheduled castes and scheduled tribes. The Corporation started promotional and financial programmes in the field of dairy, poultry, fishery and handloom development in 1974. It adopted two-fold strategy: i) Strengthening of existing co-operatives by providing assistance on liberal pattern for expansion of their activities; and ii) development of potential areas by organising functional co-operatives in these sectors.

The Corporation has formulated specific schemes and pattern of assistance for enabling the fishery co-operatives to take up activities relating to production, processing, storage, marketing, etc. Assistance

was provided to fisheries co-operatives on liberal terms treating the activity as weaker section programme for: purchase of operational inputs such as fishing boats, nets, and engines, creation of infrastructure facilities for marketing, transport vehicles, ice plants, cold storages, retail outlets, processing units, etc., development of inland fisheries, seed farms, hatcheries, etc., preparation of feasibility reports and integrated fisheries projects. Till 2005-2006, the Corporation sanctioned an assistance of Rs 948.39 crore and released Rs 716.29 crore for fisheries development through co-operatives in different States and UTs. NCDC supported fisheries co-operatives as under:

(i) Centrally Sponsored Scheme for development of co-operative storage, processing & marketing for the co-operatives situated in co-operatively under/least developed States/UTs. Under the scheme, Rs 355.21 crore was sanctioned for six projects/units and Rs 33.25 crore was released.

(ii) An assistance of Rs 10.26 crore was sanctioned for 44 projects/units and a much higher amount of Rs 37.65 crore was released under Corporation Sponsored Scheme for fisheries co-operatives in co-operatively developed States/UTs. It was because of better prospects for development in these states.

(iii) Under Corporation Sponsored Scheme for Integrated Fisheries Development Projects, all the activities from production to final marketing are integrated with forward and backward linkages. The main components of such projects are fishing inputs, infrastructure, marketing support, project management, extension, training, computerisation, etc. Under these projects, special emphasis is laid on improving skill of fishermen, member education of the societies, creation of infrastructure for production, storage, processing and marketing of fish. Under this scheme NCDC assisted in co-operatively developed States/UTs. During 2005-06, an amount of Rs 5.52 crore was released against ongoing

projects under this scheme. Till March, 2006 NCDC has assisted 48 Integrated Fisheries Development Projects (29 in marine sector and 19 in inland sector) at the cost of Rs 645.91 crore.

The impact of the schemes was realised in terms of increase in marine fish catch of co-operatives in the States of Gujarat, Kerala, Maharashtra and West Bengal; benefits for a large number of fishermen from Integrated Projects, estimated additional fish production over 3.60 lakh t per year, democratic management and functioning of co-operatives, higher income for beneficiary fishermen than non-beneficiaries, etc. NCDC's assistance has helped fishermen by reducing drudgery of work, increase in the number of fishing days and thereby increase in fish catch of fishermen. Fish marketing infrastructure helps the fishermen's co-operatives in realising better value for fish catch in the market. The increased fish catch by the fishermen and its better remuneration has improved the socio-economic conditions of the fishermen perceptibly.

3.10 National Federation of Fishermen's Co-operatives Limited (FISHCOPFED), New Delhi

National Federation of Fishermen's Co-operatives Ltd. (FISHCOPFED) established in 1980, is the apex organization of fishermen co-operatives in the country. Its activities could be classified mainly into two categories: promotional and welfare. Promotional activities of FISHCOPFED include organization of conferences, supporting capacity building initiatives at various levels, transfer of technology to stakeholders, liaison with member organizations and agencies, etc. Welfare activities of the federation include implementation of the centrally sponsored Group Accident Insurance for Active Fishermen scheme, etc.

While the co-operatives, FISHCOPFED has been in existence for decades and shown benefits from their existence, yet the co-operatives

are not been operating at optimum level due to various reasons. The co-operatives in marine sector are slightly better organized than in case of freshwater capture fisheries (in rivers, reservoirs, common property ponds/tanks in villages, etc.). The problems besetting the operation of co-operatives at optimum levels are weak collaboration/coordination among various institutions involved in management and operation of co-operatives at primary, district and state level; rivalry among individuals/groups, lack of adequate infrastructure; lack of human and financial resources, lack of skills among the management workers and fishers. FISHCOPFED can play important role in strengthening the linkage and co-ordination among co-operative at various levels.

The Working Group on Fisheries for the X Plan has suggested allocation of Rs 229 crore for FISHCOPFED for human resource development, freshwater aquaculture, marketing, social security and Housing. However, this was not provided. The component may be supported in XI Plan with a rational financial assistance. In addition, FISHCOPFED may be provided Rs 10 crore as grant-in-aid like other fisheries institutes under the administrative control of DAHD&F to take up activities for the socio-economic development of over two million fishers. Following suggestions are made for working of FISHCOPFED:

- Centrally sponsored group accident insurance scheme for active fishermen, with a provision of Re 1/fisher as assistance to FISHCOPFED being the implementing agency.
- Provision is made for administrative expenses @17% for FISHCOPFED in funds allocated for capacity building programs in fisheries co-operatives.
- Hardly any statistical information is available on the fisheries co-operatives in the country. Assistance to be provided to

FISHCOPFED for developing database and information networking.

3.11 National Bank for Agriculture and Rural Development (NABARD), Mumbai

The National Bank came into existence in 1982. NABARD was established as a Development Bank, for providing and regulating Credit and other facilities for the promotion and development of agriculture, small scale industries, cottage and village industries, handicrafts and other rural crafts and other allied economic activities in rural areas with a view to promoting integrated rural development and securing prosperity of rural areas. NABARD is an apex institution, accredited with all matters concerning policy, planning and operations in the field of credit for agriculture and other economic activities in rural areas in India.

The Bank has credit plans for: investment in marine (Motorisation of traditional crafts, introduction of mechanised vessels, introduction of item specific vessels), inland (renovation of existing ponds for fish farming, creation of new ponds for fish farming, carp hatcheries, fresh water Prawn farming, fresh water prawn hatcheries, integrated fish farming in the inland sector, ornamental fish breeding and rearing, reservoir fishing units), coastal aquaculture (shrimp farming, shrimp hatcheries and mariculture units) and others including processing and cold storage plants, feed mills and infrastructure development.

The trend of ground level credit disbursements by NABARD for fisheries sector during X Plan are indicated in Table 3.18.

Table 3.18 Ground level credit disbursements for fisheries by NABARD during X Plan

(Rs crores)

Year	GLC in Fisheries Sector
2002-2003	539
2003-2004	1142
2004-2005	1301
2005-2006	1496*
2006-2007	1720*

* Provisional

Considering the GLC growth in fisheries during X Plan, it is estimated that the ground level credit at the end of XI Plan would touch Rs 13,337 crore. The estimated share of sub sectors would be marine (10%), brackish (25%), inland (50%) and agro-processing (15%), including infrastructure for exports. The year wise credit estimates for XI Plan are given in Table 3.19.

Table 3.19 Ground level credit (GLC) estimates for fisheries for the XI Plan period

(Rs crores)

Sub sectors	2007-08	2008-09	2009-10	2010-11	2011-12	Total
Marine	198	227	262	301	346	1,334
Brackish	495	569	654	752	865	3,335
Inland	989	1,137	1,308	1,504	1,730	6,668
Agro- processing	297	341	392	451	519	2,000
Total	**1,979**	**2,274**	**2,616**	**3,008**	**3,460**	**13,337**

With good experience of microfinance in the recent years, NABARD is planning to implement micro-financing schemes in a big way for increasing access of women to credit, engineering credit delivery system and addressing capacity building needs in fisheries sector.

3.12 Coastal Aquaculture Authority, Chennai

The Coastal Aquaculture Authority is mandated to protect the ecologically fragile coastal areas, seashore, waterfront and other areas through regulation of shrimp culture in coastal States and Union

Territories of India. The Authority promotes development of sustainable and responsible shrimp farming practices within and outside the Coastal Regulation Zone.

The functions of the Authority are: (i) to ensure that no shrimp culture pond can be constructed (or) set up within Coastal Regulation Zone and up to 1,000 m of Chilka lake and Pulicat Lake; (ii) to ensure and give approval to the farmers who are operating traditional and improved traditional systems of aquaculture for adopting improved technology for increased production; (iii) to ensure that the agricultural lands, salt pan lands, mangroves, wet lands, forest lands, land for village common purposes and the land meant for public purposes shall not be used (or) converted for construction of shrimp culture ponds; (iv) to implement the "Precautionary Principle" and the "Polluter Pays Principle" in coastal shrimp aquaculture activities; (v) to regulate and give the necessary approvals/ authorisation for shrimp activities outside Coastal Regulation Zone areas and 1000 m from the Pulicat lake and Chilka lake; (vi) to frame scheme/schemes for reverting the damages caused to the ecology and environment by pollution in coastal States/ Union Territories; (vii) to ensure the payment of compensation to the workmen employed in the shrimp culture industries; (viii) to comply with the relevant orders issued by the concerned High Courts and Supreme Court from time to time; and (ix) to deal with any other relevant environment issues pertaining to coastal areas with respect to shrimp culture farming, including those which may be referred to it by the Central Government in the Ministry of Environment and Forests.

For discharging the above functions, the Authority has constituted State Level Committees (SLCs) and District Level Committees (DLCs). DLCs receive the applications from shrimp farmers and after scrutiny and verification of the information, etc., forward to the SLCs for consideration. The applications after recommendation of the SLCs are forwarded to the Authority for consideration for issue of approvals.

The Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture in the Government of India, places the required funds at the disposal of the Authority from its annual budget to meet the day to day expenditure and implementation of schemes and programmes for achieving sustainable shrimp aquaculture development in the country.

3.13 Indian Council of Agricultural Research, New Delhi

Indian Council of Agricultural Research is the apex body for research and education in all aspects of agriculture including for fisheries in the country. The thrust areas of fisheries research are: Stock assessment and monitoring of commercially important marine fishery resources, Development of fuel-efficient fishing crafts and gears for deep sea fishing, Prevention of post harvest losses, Development of value-added fishery products for domestic and export markets, Extraction, production and evaluation of bio-molecules from marine organisms and plants for industrial and pharmaceutical applications, Upgradation of fish processing technologies, Mariculture of fish and shellfish, Introduction of HACCP in seafood processing, Fishery resource inventory of inland waters on GIS format, Estimates of environmental flows in river systems, Environmental impact assessment (EIA) of open waters with regard to different developmental protocols, Utilization of inland saline water for aquaculture, Enhancement of fish productivity from reservoirs, Rural aquaculture and integrated fish farming, Development of vaccines for fish diseases, Brackishwater aquaculture, Aquatic Biodiversity and conservation of endangered fish species, Development of Coldwater fisheries, Organic fish farming and Genetic characterization of aquatic animals of commercial importance.

These are being addressed by the ICAR through a network of eight resource-specific Fisheries Research Institutes, as follows (also with a number of other organisations in a network mode):

- Central Marine Fisheries Research Institute (CMFRI), Kochi conducts research on a marine fisheries resources and their exploitation, besides related training and extension programmes.
- Central Inland Fisheries Research Institute (CIFRI), Barrackpore has research, extension and training activities on inland open water systems (rivers, reservoirs, wetlands/lakes and estuaries).
- Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar deals with research, extension and training programmes on production and productivity in freshwater aquaculture.
- Central Institute of Brackishwater Aquaculture (CIBA), Chennai concentrates on research, extension and training programmes on brackish water aquaculture for shrimp and fish.
- Central Institute of Fisheries Technology (CIFT), Kochi conducts R&D programmes on design of fishing crafts and gears, fishing technology, fish processing, preservation. It also helps in Quality Control certification for export of fishery products.
- National Research Centre on Coldwater Fisheries (NRCCWF), Bhimtal carries out research on coldwater fishery resources and biology, breeding and developing hatchery and aquaculture for indigenous and exotic coldwater fishes.
- National Bureau of Fish Genetic Resources (NBFGR), Lucknow conducts work on genetic characterization, gene-banking, bio-diversity database and conservation of fish species.
- Central Institute of Fisheries Education (CIFE), Mumbai, a 'Deemed University' underakes fisheries education at post-graduate level and also conducts speicalised training programmes.

The research achievements of the ICAR Fisheries Research Institutes during the X Plan have contributed to the Increase in total fish

production to a level of about 6.4 million t in 2004; Cataloguing of fish genetic resources of India; Database on marine fisheries resources of India; Assessment of mangrove diversity in Sundarbans; Development of seed production technology for catfishes, freshwater prawns and ornamental fishes; Pen culture technology for flood plain lakes; Genetically improved *Jayanti* rohu (CIFA IR-1) with enhanced growth; Development of milt cryopreservation technique for carps; FRP portable hatchery for carp seed; Nested PCR kit for the rapid detection of White Spot Syndrome Viruses (WSSV); Indigenous design of fishing crafts and gears for marine and inland waters; Development of value added fishery products for domestic and export markets; Culture of freshwater and marine ornamental fish; Design and fabrication of Turtle Excluder Device (TED) and Bye Catch Reduction Device (BRD); *In-vitro* marine pearl production through tissue culture techique in the Indian pearl oyster *Pinctada fucata* and abalone *Haliotis varia;* Breeding of sand lobster *Thenus orientalis* in captive condition; Breeding of yellow catfish, *Horabagrus brachysoma* and freshwater eel, *Mastacembalus aculeatus* in captive conditions; Design and fabrication of a boat of 5.22 m OAL made of aluminium alloy for fishing in island and reservoirs; and National Marine Fisheries Census – 2005.

3.14 Marine Products Export Development Authority (MPEDA), Kochi

The Marine Products Export Development Authority (MPEDA) was constituted in 1972. The role envisaged for MPEDA is comprehensive - covering fisheries of all kinds, increasing exports, specifying standards, processing, marketing, extension and training in various aspects of the industry. MPEDA functions under the Ministry of Commerce, Government of India and acts as a co-ordinating agency with different Central and State Government establishments engaged in fishery production and allied activities.

The Plan schemes of the Authority are implemented under four major heads: (i) Export production - capture fisheries; (ii) Export production - culture fisheries; (iii) Induction of new technology and modernisation of processing facilities; and (iv) market promotion.

The work programme of MPEDA includes: (i) Registration of infrastructure facilities for seafood Export trade; (ii) Collection and dissemination of trade information; (iii) Projection of Indian marine products in overseas markets by participation in overseas fairs and organising international seafood fairs in India; (iv) Implementation of development measures vital to the industry like distribution of insulated fish boxes, putting up fish landing platforms, improvement of peeling sheds, modernisation of industry such as upgrading of plate freezers, installation of IQF machinery, generator sets, ice making machineries, quality control laboratory, etc.; (v) Promotion of brackish water aquaculture for production of prawn for export and (vi) Promotion of deep sea fishing projects through test fishing, joint venture and equity participation.

3.15 Department of Biotechnology (DBT), New Delhi

Department of Biotechnology (DBT) under the Ministry of Science and Technology gave a new impetus to the development of the field of modern biology and biotechnology in India. The department has made significant achievements in the growth and application of biotechnology in the broad areas of agriculture, health care, animal sciences, environment, and industry. The thrust areas of DBT in the field of aquaculture and marine biotechnology are: (i) Development of recombinant diagnostics and vaccines for major diseases in aquaculture; (ii) Molecular biology of Indian species, identification of useful genes and development of indigenous gene constructs for fish transgenesis work; (iii) Genomics & proteomics studies in aquaculture species; (iv) Bioactive molecules from aquatic organisms for therapeutic and industrial applications; (v) *In vitro* tissue culture, cell

culture system development in various aquaculture species; (vi) Front-line demonstrations to prove techno-economic viability of seed production and aquaculture in non-traditional species; (vii) Programmes on new feed development, nutrition, breeding, spawning agents, health and post harvest aspects etc. for enhancing aquaculture productivity; (viii) Programme support in marine biotechnology; and (ix) Training Programme in molecular biology for fisheries scientists.

Some of the relevant achievements of the DBT are: Development of diagnostics and vaccines in aquaculture; Development of suitable cell culture systems, immunostimulants, anti-bacterial and anti-cancerous agents; Isolation of novel enzymes from deep-sea fungi, molecular cloning and gene expression for alkaline protease and molecular epidemiology of white spot shrimp disease in brackish water system; Use of Immunodot-based diagnostic kit for detection of white spot syndrome virus (WSSV) in shrimp and prawn; Development of ELISA-based kit for detection of IgM of Indian major carps against *Aeromonas hydrophila* infection; Formulation of anti-WSSV as a prophylactic measure in shrimp health management; Standardization of Biosurfactants production from marine wastes employing the acinetobacter strains; New source of molecular fluorescent dyes has been attempted from sea cucumber tissues for bioactive compounds and use in biomedical applications; Bioactive properties of ink gland of cuttlefish have been studied for antibacterial, antiviral and anticancer agents; Development of culture technology in non-conventional species like seaweeds; and Development of a protocol on better aquaculture management practices.

3.16 National Institute of Oceanography (NIO), Goa

The mandate of NIO is to develop knowledge on physical, chemical, biological, geological, geophysical, engineering and pollution aspects of

the waters around India and to provide support to various industries, government and non-government organisations, through consultancy and contract research and to disseminate knowledge on the waters around India. The Institute has been undertaking researches on Oceans and Climate, Biogeochemistry and marine ecosystems, Non-Living Resources in Indian ocean, Pollution and Environmental Impact of coastal activities and modeling of impacts of environmental stresses in coastal zone, Drugs and Chemicals from the Sea, Autonomous Instrumentation for Oceanography and engineering analysis and design methodology for marine structures, Application of geological and geophysical methods in marine archaeology and underwater explorations, Seabed Surveys of exclusive economic zone of India and Development of modeling tool for acoustic seafloor classification.

3.17 Bay of Bengal Programme (BOBP-IGO), Chennai

The Bay of Bengal Programme, an Inter-Governmental Organization (BOBP-IGO) has evolved from the erstwhile Bay of Bengal Programme of the Food and Agriculture Organization of the United Nations. It is mandated to enhance cooperation among member countries, other countries and organizations and provide technical and management advisory services for sustainable coastal fisheries development and management in Bay of Bengal region. It is focusing on helping the member countries in sustaining fisheries production and ensuring livelihood security for millions of fisher folk in the region. In line with their felt needs, a range of activities are planned for implementation.

Its mission is to promote, facilitate and secure the long-term development and utilisation of coastal fisheries resources of the Bay of Bengal based on responsible fishing practices and environmentally sound management programs. To achieve this mission, the objectives of (BOBP-IGO) are to: increase awareness and knowledge of the needs, benefits and practices of coastal fisheries management; enhance skills through training and education; transfer appropriate technologies and techniques for development of small-scale fisheries;

establish a regional information networking; and promote women's participation in coastal fisheries development at all levels.

3.18 Plan budget utilisation

Fisheries is one of the fastest growing sectors in agriculture. It is also reflected in the outlay increment over successive plans. The Plan outlay has increased from Rs. 5.13 crore in the first five year plan (1951-56) to Rs. 2069.7 crores in the X plan (both Central and States/UTs). The outlay, expenditure and utilisation percentage for different Plans is mentioned in Table 3.20.

Table 3.20 Budget outlay and utilization of fisheries sector over various Five Year Plans

(Rs crores)

Plan	Central Sector		Centrally sponsored		State		Total	
	Outlay	Expenditure	Outlay	Expenditure	Outlay	Expenditure	Outlay	Expenditure
I	1.00	0.38			4.13	2.40	5.13	2.78
II	3.73	1.80			8.53	7.26	12.26	9.06
III	6.72	3.03			21.55	20.29	28.27	23.32
IV	28.00	8.11	6.00	5.17	48.68	40.83	82.68	54.11
V	51.05	39.93	17.00	4.07	83.19	71.11	151.24	115.11
VI	137.10	75.54	36.62	28.80	197.42	182.61	371.14	286.95
VII	156.58	116.93	60.75	53.26	329.19	307.40	546.52	477.59
VIII	139.00	161.01	300.00	268.02	766.39	689.43	1205.39	1118.46
IX	240.00	124.37	560.00	273.18	1269.78	1016.26	2069.78	1413.81
X	175.00	183.15	565.00	485.15	1320.54		2060.54	

Going by the trends, the expected plan budget utilisation during X Plan period would be of the order 80% (Table 3.21).

Table 3.21 Budget utilization of fisheries sector over various Five Year Plans

Plan	% Utilisation			
	Central Sector	Centrally sponsored	State	Total
I	38.00		58.11	54.19
II	48.26		85.11	73.90
III	45.09		94.15	82.49

IV	28.96	86.17	83.87	65.45
V	78.22	23.94	85.48	76.11
VI	55.10	78.65	92.50	77.32
VII	74.68	87.67	93.38	87.39
VIII	115.83	89.34	89.96	92.79
IX	51.82	48.78	80.03	68.31
X	104.66*	85.87		

* Anticipated figures

Table 3.22 Budget utilization of fisheries sector during X Five Year Plans

Items	Amount (Rs crore)
Outlay	771.00
Expenditure till 2005-06	451.30
Anticipated expenditure 2006-07	157.00
Total expenditure	608.30
Anticipated % utilisation	78.90

It is seen from the above, that the achievements as well as the fund utilisation by the DAHD&F for fisheries development programmes have been satisfactory and would further improve with adoption of some of the recommendations made in this Chapter as well as the next one, with regard to areas as well as mechanisms.

CHAPTER 4

4.0 Programmes for XI Five-Year Plan

4.1 Scenario

While presenting the programmes for the Eleventh Five Year Plan, it is relevant to look at the prevailing concerns that need to be addressed in order to design intervention points. They pertain to water availability and allocation, biodiversity loss & depletion of fish stocks, excess coastal fishing, enhancing fish productivity in all cultivable waters, oceanic and deep sea fisheries, impact of climate change on fisheries, trans-boundary fisheries issues, inland & coastal pollution, large-scale sedimentation of rivers, estuaries & lakes/wetlands, effective compliance of code of conduct of responsible fisheries, increasing input costs of water and power, high marine fishing costs & low profitability, mechanization in fisheries and aquaculture, cold chain and hygienic fish handling, quality assurance issues in exports, overseas market fluctuations, disaster management, credit and insurance, inadequate database and poor linkage in domestic marketing. The programmes in the coming plan would need to address these aspects to build in greater resilience and sustainability.

Demand projection for fish by the end of the XI plan is 9.74 million t (Fisheries Division, ICAR, 2006a) at an estimated annual consumption growth rate of 3.5%. The required annual growth rate for meeting the demand would be of the order of 5.4% and the supply projections (NCAP, 2006) are given in Table 4.1.

Further, areas with promise that need to be supported in order to achieve diversification in terms of non-food fisheries are ornamental fisheries, seaweed, pearl culture, aqua-tourism, sport fisheries and molluscan fisheries for ornamental purposes.

Table 4.1 Present and projected fish supply by the end of XI Plan

Area	Present production, (2006) million t	Projected production, (2012) million t	Approach
Marine capture fisheries	2.958	3.10	Regulated fishing and capacity reduction in mechanized sector, Conservation, sea ranching, FADs, Diversified fishing in Deep sea & Oceanic resources
Mariculture	0.007	0.05	Identification of suitable sites along the coastline, Hatcheries and grow-out systems for high value fish, crustaceans, molluscs, sea cucumber, ornamental fishes, Cage culture in open seas & island ecosystems
Enhanced Inland fisheries	0.68	1.12	Culture-based fisheries in Reservoirs with stocking of advanced fish fingerlings, Pen & Cage culture in large water bodies and Canal fishery development, Resource-specific harvesting techniques, Implementing code of conduct of responsible fisheries
Coldwater fisheries	0.0003	0.001	Seed production of trout and mahseer, Hill aquaculture, Ranching of streams, Sport fisheries
Coastal aquaculture	0.113	0.25	Increasing water area under aquaculture, from existing 13% of potential area, Diversification of species, from existing shrimp to Seabass & pearl spot, Inland saline aquaculture as an added component
Freshwater aquaculture	2.6145	5.088	Increase in the coverage of areas of ponds and tanks for fish culture, Reclamation of weed chocked waters, Diversification of species and Intensification of culture practices, Integrated fish farming and wastewater aquaculture to optimize water productivity
Total	**6.3728**	**9.609**	

(Source: Fisheries Division, ICAR, 2006a)

The strategy for realizing the potentials of the sector are:

- Ensuring adoption of responsible and sustainable fishery practices
- Enhancing fish productivity in all cultivable waters
- Establishing agro-aqua farms, aqua-shops and fishery estates from production to consumption
- Spreading fish quality literacy among fishers and aqua-farmers
- Improving facilities for fish landing and handling at harvest and post-harvest stages

- Developing social marketing techniques
- Introducing aquarian reforms, with regard to leasing and management of waters, ownership and community management
- Training in different aspects of fisheries and aquaculture

4.2 Objectives

The main Objectives of the Government of India with regard to development programmes in fisheries and aquaculture during the Eleventh Five Year Plan are as follows:

- Enhancing the production of fish from Indian waters, both marine and inland, on an environmentally sustainable and socially equitable basis;
- Address the hitherto unexplored potentials of Indian fisheries such as island fisheries and non-food fisheries;
- Conservation of aquatic resources and genetic diversity, as also preservation of health of ecosystems;
- Increasing profitability of fishers and aqua-farmers through an integrated approach from production to consumption;
- Promoting fish as health food and meeting the changing requirements of both domestic and export markets to make the sector globally competitive;
- Strengthening of Infrastructure in harvest, post-harvest, value-addition and marketing;
- Upliftment of fisher and aqua-farmer communities with gainful employment opportunities and capacity strengthening.

4.3 Thrust areas, strategies and Schemes

4.3.1 Marine

4.3.1.1 *Coastal Fisheries*

The marine fisheries sector in India has registered a phenomenal growth during the last five decades both quantitatively and qualitatively (Fig. 4.1). While the subsistence fisheries during the

early 50's produced about 0.5 million t annually, the current annual production is about 2.9 million t, forming 73.8% of the revalidated fishery potential of 3.93 million t comprising 2.02 million t of demersal, 1.67 million t of pelagic and 0.24 million t of oceanic resources.

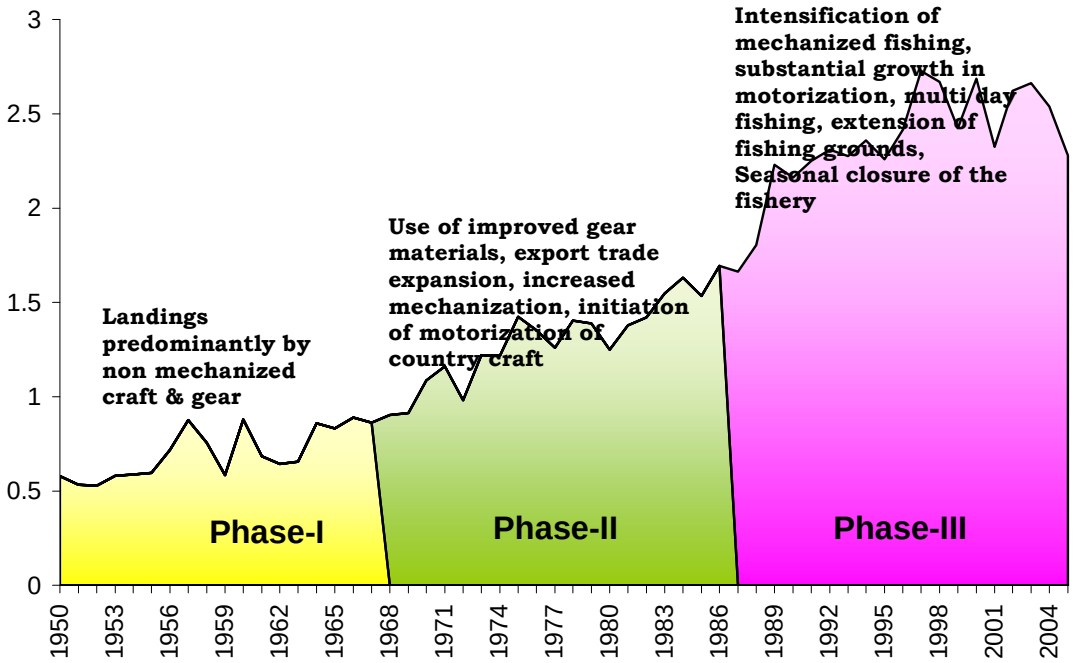

Figure 4.1 Marine fish production in India during different phases of growth (Source: DAHD&F, 2004)

The multi-species fishery comprises over 200 commercially important finfish and shellfish species. Currently 2,251 traditional landing centres, 33 minor and six major fishing harbours serve as base for 1,04,270 numbers of traditional non-motorised crafts, 75,591 small scale beach landing motorised crafts and 58,911 mechanised crafts (mainly bottom trawlers, drift gill netters and purse seiners). The sector-wise marine fish landings are presented in Fig. 4.2, also indicating the major share from the mechanised boats (Mechanised: 67.9%; Motorised: 25%; Artisanal: 7.1%, with Mechanised and motorized boats contributing 93% of the total catch).

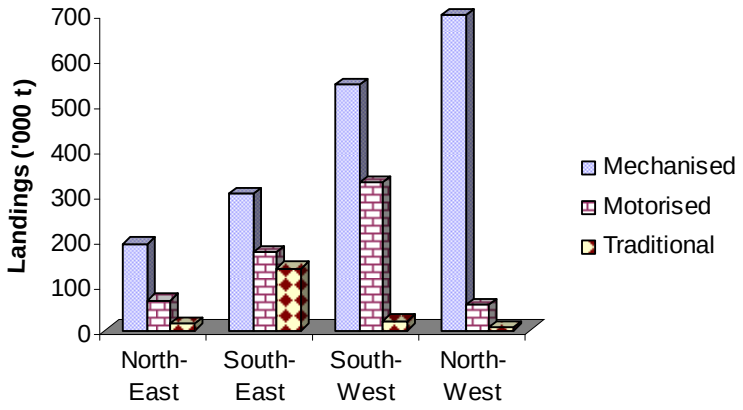

Figure 4.2 Sector wise marine landings in different regions in 2004 (Source: DAHD&F, 2005)

The Empowered Committee (DAHD&F, 2004) in their report indicated that at present there are 52 long liners, two oceanic purse seiners, 420 pole and line vessels and 17 pelagic/mid water trawlers operating in the EEZ. This is in addition to the coastal small-scale vessels upgraded/modified for fishing in the deeper waters for specific resources.

The issues in the sector are excess coastal fishing fleet capacity and overexploitation, unregulated open access fisheries, discards at capture/indiscriminate capture and downgrading of juveniles and sub adults, environmental degrading, biodiversity loss and ineffective regulatory measures, increased fishing costs and decreased profitability, poor infrastructure and linkages for domestic marking, underutilization of oceanic and deep sea resources and emerging inter and intra- sectoral conflicts. Hence a paradigm shift from increasing marine fish production to increasing profitability and sustaining the marine fishery resources through management interventions would need to be focused during the XI plan. In this context, reducing overcapacity in the mechanized sector and diversification of fishing for capture of underutilized deep sea and oceanic resources assume high significance. Post harvest handling, product diversification, value

addition and domestic marketing, Development of coastal and open sea mariculture, Conservation and stock enhancement through sea ranching, FADs, Restoration of threatened critical habitats are the other action points to ensure an annual growth rate of 5% by increased annual production of 0.5 million t marine fish.

The strategy for sustaining and augmenting marine fish production (Fig 4.3) comprises changing over from an open access to a regulated regime, employing a fishery management regime supported by a multi-dimensional information platform, upgrading technologies and capabilities in the artisanal and small mechanized sector for diversification, reducing the excess capacity of fishing fleet, freezing the entry of new coastal mechanized fishing crafts, establishing an oceanic tuna and squid fishery, promoting mariculture for finfishes, edible bivalves, sea plants, and other commercially important species and sustain fish production through the effective enforcement of MFRAs.

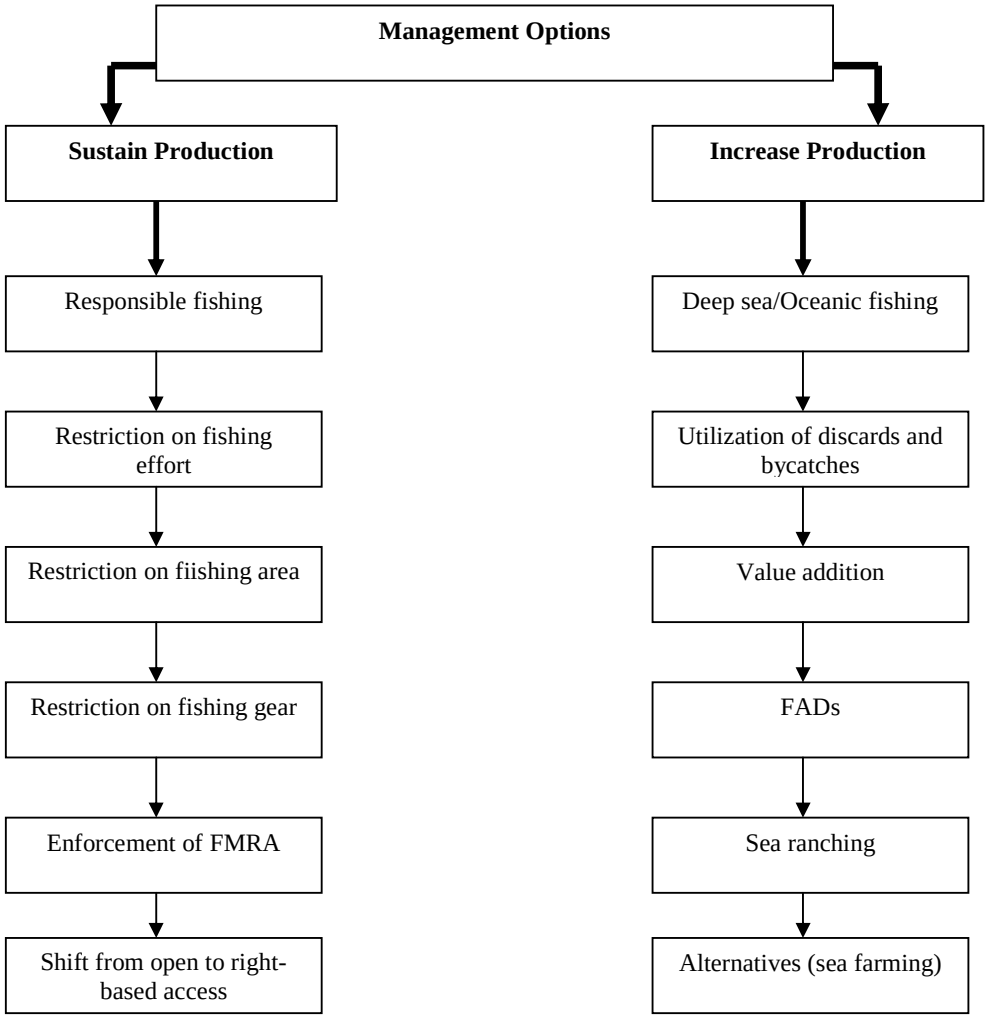

Figure 4.3 Options for Sustaining and Increasing Marine Fish Production

The process of motorisation initiated in the 1980s has largely been successful and the future course of action could be only on selective, need/area-based motorisation of traditional crafts with engines of less than 10 HP capacity. The emphasis needs to be on fuel efficiency, including the use of LPG for the purpose. Diversification from shrimping is an immediate need and the trawling fleet needs to be reduced and resource-specific deep sea fish fleet introduced for offshore fishing. Combination gear vessels with gill nets, hooks, trawls, enhanced fish hold capacities and ice storage facilities to improve the quality of the catches and reduce discards are required. Co-management needs to be encouraged for empowering fisher and

other stakeholder for the opportunities and an environment needs to be created for them to work with the Government hand in hand. Attempts are to be made to push private sector/progressive fishers in deep sea fishing.

There is a concern regarding the plateauing of catches from inshore waters and in this context, it is relevant to consider the potentials in the offshore waters, that are detailed in Table 4.2.

Table 4.2 State of exploitable fisheries resources in EEZ

(In '000 t)

Resource	Potential yield	Harvestable stock
Yellowfin tuna	115.0	57.50
Big eye tuna	12.5	6.25
Skipjack	85.2	42.60
Billfishes	5.1	2.55
Sharks	26.2	13.10
Coastal pelagics	6.8	3.40
Oceanic squids	19.9	9.90
Deep sea lobsters	2.3	1.10
Total	**273.0**	**136.40**

(Source: DAHD&F, 2004)

In order to exploit this component, the steps suggested are Introduction of vessels in the next five years as recommended by the Empowered Committee constituted by the Ministry of Agriculture, including 80 pole & line vessels, 16 purse seiners, 58 tuna long liners, 15 squid jiggers, 55 pelagic/mid water trawlers and 10 Hook & liners for deep sea lobster and other resources Table 4.3) as also developing storage and harbour facilities incorporating total quality management (TQM) and HACCP concepts.

Table 4.3 Recommended number of Resource specific vessels for introduction in the EEZ during the coming five years (up to 2009)

Resource type	Vessel type	Fishable Potential (t)	Total No. of vessels recommended	No. of vessels already in operation	Additional boats that could be permitted during the next 5 years
Oceanic tuna and billfishes	Longliners	66,300	110	52	58
Oceanic sharks	Longliners	13,000			
Skipjack	Pole & Line	42,600	500	420	80
	Purse-seiner		18	2	16
Coastal pelagics	Pelagic/ mid water trawler	3,400	72	17	55
Oceanic squid	Squid jigger	9,900	15	-	15
Deep sea lobsters	Trap/ hook & liner	1,100	10	-	10
Other bottom finfish		1,000			

(Source: DAHD&F, 2004a)

4.3.1.2 *Island Fisheries*

The coastal and offshore waters of Andamans have some of the world's richest tuna stocks as per the potential yield estimates of 1,00,000 t. In addition to this, 82,000 t of oceanic tunas are also available for exploitation and export. However, the present harvest is only about 800 t. Potential tuna resources in the seas around Lakshadweep have been estimated to be between 50,000 t and 90,000 t. About 10,000 t of tuna are caught mostly by pole & line and a little by troll lines. Pole & line-fishing boats (OAL of 25-36 feet) mostly conduct single day fishing trips and often operate two trips during the peak season. At Lakshadweep, over 85% of the total landings constitute tunas of which about 50% of the total tuna landings is used for '*Masmin*' production and the remaining 50% consumed fresh. Presently *Masmin* is prepared in the traditional way by cutting tuna in to longitudinal fillets, boiling in seawater, smoking and then sun drying for about 7-8

days. In recent years, frozen tuna export and tuna pickle preparation is being promoted by the Lakshadweep Development Corporation (LDCL). Marketing of chilled tuna from Lakhshadweep to the mainland is an economically viable proposal, but this requires facilities for icing and rapid distribution to the markets. The fishes need to be transported in chilled condition to the mainland, but proper facilities for chilled storage at the receiving end also need to be created.

The main constraints in marketing tuna are: lack of proper fish marketing chain, fishers not getting enough value for their diversified catch (yellow-fin and non-tuna species), high cost of tuna cans, poor connectivity with the mainland, lack of public awareness on environment-friendly and responsible ways for fishing practices.

By virtue of being located strategically close to the world's rich tuna stocks in the Eastern Indian and Central Pacific Oceans, India can wrest the lead from Thailand, which is currently the largest producer of canned tuna in the world. Recently, Malaysia has launched many initiatives to increase its share in the world market by establishing infrastructure facilities including a tuna harbour in Penang and announcing several trade concessions. We need to make concentious efforts to utilize the tuna resources in the Indian and Pacific Oceans.

In order to establish a standard module of fishing, processing and export of tuna, it is necessary that modern new vessels including mother/collector vessels are introduced and the existing boats are upgraded by FRP lamination of underwater hull, providing live bait tanks, insulated fish box and solar panels in the boats. Important requirements for post-harvest handling of tuna are in terms of ice plants, chilled storage, freezing facilities, cold storage, canning plant, insulated vehicles, curing facilities, waste disposal facilities, etc.

In Japan, the consumer supermarket price for *Sashimi* Tuna is as high as US $ 75/kg. Therefore the ultimate aim should be to develop tuna in the form of *Sashimi* with a brand name in international market. One of the advantages of the Andaman & Nicobar islands is their strategic location close to major world tuna markets in Singapore and Bangkok. To take advantage of this, Port Blair could be linked by air or sea to these cities, especially for transport of chilled (-60°C) *Sashimi* grade tuna. Port Blair could serve as an ideal point for export tuna linking with other ports such as Kochi, Chennai and Vishakapatnam, similar to the international tuna port of Malaysia. Facilities for production of value added products such as ready-to-eat, ready-to-serve breaded and battered products, etc. are necessary in these processing plants to realize maximum return. The international market demands are to be researched before the products are designed.

The likely benefits consist of a 70% increase in fish production, particularly in high value *sashimi* grade tuna (50,000 t) by the year 2017. In this regard, skill upgradation of fishers needs to be done, that would enable creation of more than 10,000 job opportunities. Further, since only 50% of the potential stocks are targeted for harvest, there is not likely to be any environmental consequences to the marine habitats and life. Acquisition of special vessels, both in the range of 15-30 m and over 30 m would be required, former for fishing *Sashimi* grade tuna. 'Pay & Fish' concept is being practiced in some countries including Oman, that would be practical with VMS in place. Apart from fishing, handling practices are very important for tuna exports, to retain the texture required in overseas exports in order to command the price.

4.3.1.3 *Mariculture*

While shrimp farming has been a commercial activity in the country, culture of other marine organisms such as mussels and oysters has

not reached a commercial level. In the recent past, the country has made a beginning in mariculture, mainly through bivalve farming (annual production 8,900 t consisting of mussels 7,500 t and edible oysters 1,400 t) in the State of Kerala, but is yet to pick up in other maritime states in spite of its immense potential. Potential mariculture sites for bivalve farming along the east and west coasts of India have been mapped by CMFRI. Mariculture technologies for edible oysters, mussels, marine pearl production in pearl oysters, seaweeds, and marine ornamental fishes (damsels, clown fishes and seahorses) are available. This would also enable the required diversification into non-food fisheries in terms of seaweed cultivation, pearl farming, and so on, with high export potentials.In view of the above, the following approach is suggested for marine fisheries and mariculture for the XI plan period.

Continuation of existing Schemes

Scheme	Implementation	Budget (Rs crores)
Capture Fisheries		
Need based/area wise motorization of about 10% of the traditional crafts (10,000) using <10 HP diesel engines in selected areas	Through State Governments/ Co-operatives/NGOs, etc.	20.00
Short term forecasts and resource estimation through PFZ and its efficient dissemination through radio and TV	Through State Governments/ Co-operatives/ NGOs, etc.	5.00
Increase quality of fish catch using ice boxes for traditional/ small scale sector	Through State Governments/ Co-operatives/ NGOs, etc.	10.00
Sea safety measures like GPS, VHF, life saving gadgets, etc.	Through State Governments/ Co-operatives/ NGOs, entrepreneurs, etc.	10.00
Installation of Artificial Reefs and Fish Aggregating Devises	DAH D & F, State Governments, Co-operatives, NGOs, etc.	20.00
Sub-Total		**65.00**

New schemes

Scheme	Implementation	Budget (Rs crores)
Diversification/reduction of excess capacity of costal fishing vessels of 17-19 m size of mechanized fishing fleet (intermediary vessels)	• Diversification of existing 1% shrimp trawlers per year, thereby 5% reduction at the end of the XI Plan (17-19m OAL) for deep sea fishing • Decommissioning of 1% of coastal mechanized crafts per year, thereby 5% reduction at the end of XI plan by providing alternative livelihoods (coastal aquaculture, edible oyster, mussel, seaweed, crab, ornamental fish programs, pearl oyster farming and pearl production); re-employment in deep sea fishing sector; Through State Governments/ Co-operatives/NGOs	75.00
LPG kits for outboard engines for fuel efficiency and reduce pollution	Through State Governments/ Co-operatives/NGOs, Entrepreneurs, etc.	5.00
Adoption of squid jigging technology for high unit value realization	Training, foreign collaboration, diversified or upgraded resource- specific squid jigging vessels; Through State Governments/ Co-operatives/ NGOs/ CIFNET, FSI, CIFT and entrepreneurs	10.00
Introduction of resource-specific deep sea fishing vessels	234 vessels recommended by the Empowerment Committee for the XI plan: Tuna long liners: 58 Nos Pole and line vessels: 80 Nos Purse Seiners: 16 Nos Pelagic/mid water trawlers: 55 Nos Squid jiggers: 15 Nos Traps/hook and lines vessels: 10 Nos *Through State Governments and private entrepreneurs*	234.00
MCS/VMS activities	DAHD & F, FSI, CMFRI, CIFNET, State Governments, Entrepreneurs	10.00
Massive sea ranching	Through NFDB, ICAR Institutes, SAUs, State Governments, Co-operatives, NGOs and PRIs	11.00 (NFDB)
Mariculture		
Fishfish/shellfish hatcheries (snappers, rabbit fishes, groupers and pomfrets)	Research and Development support, pilot scale demonstrations, training, extension; NFDB, DAHD & F, ICAR Institutes, etc.	25.00 (NFDB)
Mariculture development for	Research and Development support, pilot	80.00

finfish (Sea-bass, groupers, tuna fattening, etc), edible bivalves, open sea cage farming and other commercially important species	scale demonstrations, training, extension; NFDB, DAHD & F, ICAR Institutes, etc.	(NFDB)
Seaweed culture	Through ICAR Institutes, SAUs, NFDB, CMFRI, CSMCRI, Co-operatives and entrepreneurs	30.00 (NFDB)
Human Resource Development		
HRD in modern fishing, open sea mariculture	DAH D & F, NFDB, Institutes, State Government	5.00
Sub-Total		**485.00**
Total		**550.00**

4.3.2 ***Inland Fisheries and Aquaculture***

Inland fisheries resources in terms of rivers and canals (1.95 lakh km), reservoirs (3.15 m ha), floodplain wetlands (0.35 m ha), estuaries (0.26 m ha), etc offer a major opportunity for fostering fish production enabling livelihoods of lakhs of people. Majority of these are multiple use waters benefiting multiple stakeholders. The fishery operations in these waters include capture fisheries, culture-based fisheries and other forms of fisheries enhancement. Aquaculture is practised both in fresh and brackish waters with different culture systems and a number of fish/prawn candidate species. Freshwater aquaculture is primarily confined to smaller water bodies including ponds and tanks, in both private or public domains. Coldwater fisheries is a segment needing greater attention and investment during the coming plan period. A paradigm shift in inland fisheries from capture to culture is quite evident over the years (Fig. 4.4).

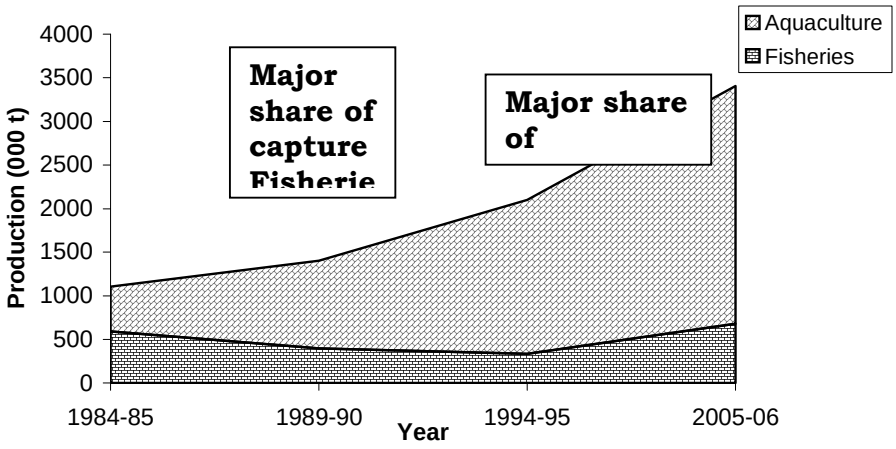

Figure 4.4 Pattern of growth of inland fish production in India
(Based on Pillai & Katiha, 2004 & DAHD&F, 2005)

Freshwater aquaculture that had a share of 46% in inland fisheries in the mid-1980s has increased to about 80% in recent years (Fig. 4.5). Freshwater aquaculture is one of the fast growing enterprises in agriculture and allied activities. In the wake of increasing pressure on water resources in the country, it has become necessary to draw up a national strategy for

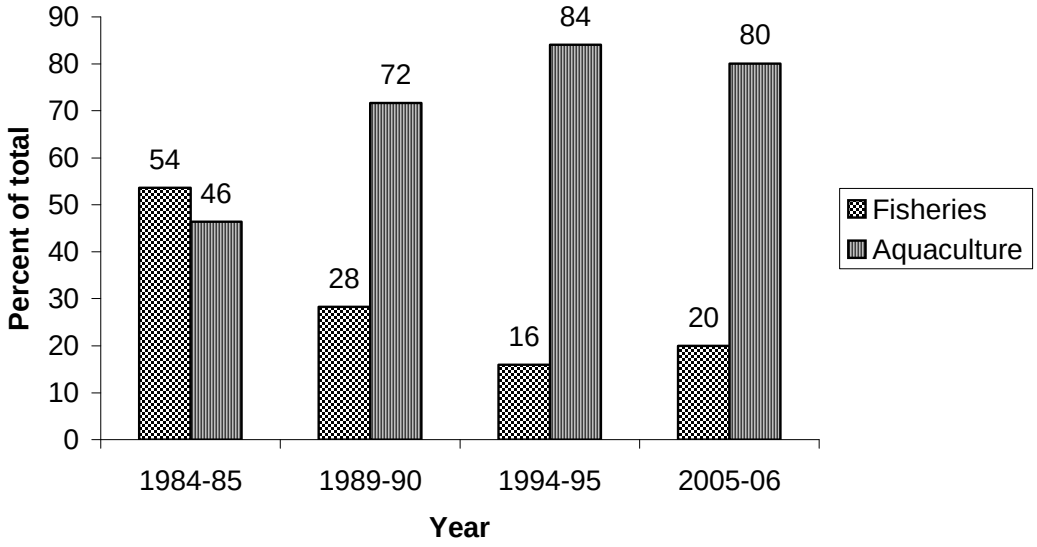

Figure 4.5 Percentage Share of inland fisheries and aquaculture during the past two decades
(Based on Pillai & Katiha, 2004 & DAHD&F, 2005)

Integrated Water Resources Management (IWRM) and factoring fisheries and aquaculture into it. Based on a suggestion from the

Box 4.1 National Consultation on *Water Management in Fisheries and Aquaculture* was held on 23-24 June 2006 at NASC, Complex, New Delhi

Following recommendations were made and action plans suggested at the Consultation

Recommendations

- **Development of predictive models for minimum water flow requirements in the major rivers for sustainable fisheries.**
- **Environmental Impact Assessment (EIA) and loss of biodiversity.**
- **Holistic approach for conservation of water and biodiversity.**
- **Integration of fisheries development with new irrigation projects.**
- Assessment of water requirements for various species suitable for culture and for maintenance of ecosystem health of rivers and reservoirs.
- Adoption of standard methods for estimation of environmental flows in our rivers.
- Development of drought and salt resistant varieties of fish.
- Conservation and utilization of rainwater and wastewater.
- **Community awareness and water productivity enhancement**.
- Development of running water culture system for Himalyan regions and designing of movement passages for migrating stocks.
- Development of innovative devices to prevent the loss of juveniles while operating water mills in the upland regions.
- Sedimentation control and rational water abstraction in rivers for germplasm conservation.

Action Plans

- Revitalizing/reorientation of policies for addressing reservoir productivity, integrated farming, gaps in technology transfer.
- Effective implementation of scientific decisions/recommendations.
- Ensuring adequate functional coordination among fisheries and other related departments in different states.
- Proper policy formulation and water budgeting for sustainable production.
- Fisheries should be considered at par with agriculture.
- Strengthening inter-ministerial linkages at centre.

Source: AoA, IFSI, CIFRI & CIFA, 2006

National Committee on implementation of Code of Conduct for Responsible Fisheries, a national consultation on water management was held during June, 2006. The recommendations of the Consultation are given in Box 4.1 Along with water budgeting, plans are afoot for prescribing specific models of integrated farming and water reuse in fish farming.

4.3.2.1 *Inland Fisheries*

4.3.2.1.1 *Riverine fisheries*

The riverine systems in the country comprise 14 major and 44 minor rivers with innumerable tributaries and streams, harnessing significant fish biodiversity. However, through the years of anthropogenic stresses, they have come under serious threat of loss in ecosystem properties and fish stocks causing considerable economic loss to the country. Therefore, a major initiative is needed during the XI plan to restore river ecology and fisheries, with programmes such as Generation of database on resources, Yields and production estimates on GIS format, Habitat restoration and pollution abatement for protection of breeding grounds, River ranching, Fish passes for migratory fish species, and Regulated fishing practices with closed seasons and mesh regulations in accordance with the Code of Conduct for Responsible Fisheries. The National Committee on implementation of Code of Conduct for Responsible Fisheries has made number of recommendations for conservation of fisheries in these natural waters. These include: (i) Central Government should provide necessary support to the States to enable them to implement the Fisheries Act, especially with respect to the conservation aspect; (ii) R&D institutes should fabricate environmentally safe fishing gear suitable for the inland waters; (iii) The Central Government should encourage a uniform closed season policy for the rivers across the States; and (iv) For sustainable management of fisheries in the rivers and their estuaries, the community-based fisheries management should be introduced, which has been very effectively demonstrated by Bay of Bengal Programme (BoBP) in coastal marine fisheries.

With increasing emphasis on irrigation, canal network is becoming a resource for fish cultivation, even to serve as a supplementary resource to riverine fisheries. Fish culture in enclosures within the canals as also in the submerged areas along the canals is a possibility

that deserves attention and investments. Issues to be addressed are ownership and harvesting rights, leasing, duration of water retention and suitable practices.

Estuaries being important breeding grounds for a variety of commercially important fish and shellfishes, require special attention in terms of regulated discharge of freshwater, reduced fishing efforts, particularly with regard to mechanised fishing, controlled collection of natural fish/shellfish seed and mangrove conservation.

4.3.2.1.2 *Reservoir fisheries*

Indian reservoirs are diversified and located under different geo-climatic situations classified as large, medium and small. The fish yields from these reservoirs have remained in the range of 12-15 kg/ha in case of large and medium ones while it is 50 kg/ha in small reservoirs (Sugunan, 1995 & 2001). But some reservoirs in the country, which were subjected to scientific management recorded significantly higher yields, indicating their higher fish production potential. This production potential can be harnessed by providing enabling policy and technology support to improve the overall productivity of reservoirs in the country and enhance the production by more than 160% (Table 4.4).

Table 4.4 Potential for fish production enhancement in reservoirs

Category	Production (in '000 t)			% Increase
	Existing	Potential	Gap	
Small	74.2	148.6	74.4	100.4
Medium	6.5	39.6	33.1	510.0
Large	13.0	57.0	44.0	337.4
Total	**93.7**	**245.2**	**151.5**	**161.8**

(Source: CIFRI, 2005)

Special efforts are required to be made to reach the reservoir productivity levels of other countries in Asia especially China where yields more than 800 kg/ha have been achieved from reservoirs. This

is a major open-water fishery resource, which can significantly contribute to the inland fish production basket of our country and provide livelihoods to a large number of fishers who are ousted from riverine stretches due to different water diversion projects in the country. Ownership and leasing of reservoirs on long term are issues to be dealt with, for enabling complete fishery rights and interventions for achieving higher productivity. The programmes to be pursued are Stocking with fingerlings of carps and other relevant species (requirement being 9 billion), Provision of adequate rearing space (on/off site) for fingerling production, Cage and pen culture, Appropriate/improved fish harvesting gear & crafts, Post-harvest (Storage, transportation, hygienic marketing, etc.) and Manpower development for reservoir fisheries managers and skill development among fishers. The National Committee on implementation of Code of Conduct for Responsible Fisheries also recommended for standardization of management norms for different categories of reservoirs (small, medium and large). It further suggested to organize a National consultation to promote culture based fisheries in Indian open waters.

4.3.2.1.3 *Fisheries of floodplain wetlands and lakes*

The resources of floodplains and associated wetlands are significant in the States of Assam, Bihar, West Bengal and Uttar Pradesh while the lakes resources are restricted in Northern states and southern uplands. Both wetlands and lakes have significant fish biodiversity, indigenous and exotics, and are sustaining livelihoods of large number of people and providing nutritional security to local population. These unique ecosystems are rich in nutrients and biodiversity, having significant potential to raise fish productivity (Table 4.5).

Table 4.5 Potential for fish production enhancement in floodplain wetlands

State	Area ('000 ha)	Production ('000 t)			% increase
		Existing	Potential	Gap	
West Bengal	42.5	9.56	53.15	43.59	455.96
Bihar	40.0	4.80	30.00	25.20	525.00
Assam	100.0	12.00	95.00	83.00	691.67
Uttar Pradesh	152.0	22.80	114.00	91.20	400.00
Other NE states	19.2.0	1.49	15.78	14.29	959.06
Total	353.7.0	50.65	307.93	257.28	507.96

(Source: CIFRI, 2005)

Apart from food fish, these ecosystems have large varieties of potential ornamental fish species. These ecosystems especially in Himalayan regions also offer opportunities for developing sport fishing and eco-tourism. Some of these water bodies are ecologically sensitive and are declared as Ramsar sites but can be harnessed as sustainable fish production systems without altering their ecological functions. Therefore, during XI plan, these ecosystems need specific approaches for integrated fishery development, conservation, sport fishing and eco-tourism promotion. There are also other indirect benefits to the community such as water recharging of aquifers, ensuring water for crops and other uses, etc. Specific approaches for integrated fishery development, conservation, sport fishing and eco-tourism promotion are suggested to bring significant direct and indirect benefit to all stakeholders. The proposed strategy/programme for these wetlands are stocking of fish seed of right species and size requirement (seed requirement being about 1.4 billion), Provision of adequate rearing space (on/off site) Fingerling raising, Restoration of habitat through desilting, dyke construction & removal of aquatic weeds, Integrating fisheries with agriculture and animal husbandry, and pen and cage culture. Community-based fisheries management is the suitable approach, for which necessary incentives in terms of lease for the fisher community, seed supply and market linkage has to be provided.

4.3.2.1.4 *Inland environment and fish stock health*

The status of environment in the inland water bodies is deteriorating, which will impair the production systems. Therefore, we have to develop suitable technologies to mitigate the levels of pollution in waters, reuse the limited good quality water to raise fish, identify hardy species that can withstand the stressed water quality. Based on the time-scale data collection on aquatic environment and fisheries, capabilities to forecast the anticipated changes in fish stocks, potential harvest zones and ecosystem changes need to be developed in order to take timely and appropriate action and equip the machinery at district level to meet the challenge.

The declining fish catch from natural waters both in quantity and quality over past four decades raised emergent concerns for conservation of fish biodiversity and our original fish germplasm. Further, human/natural introduction of exotic fish species and rising trend for fish diseases in natural and cultured waters also need special monitoring. In this context, the thrust areas suggested are National surveillance, Documentation & reporting mechanism for fish and shellfish Diseases, Establishment of quarantine centre for import of live Aquatic Exotics and Propagation-assisted rehabilitation of threatened species.

Introduction of exotic species for aquaculture, both for food and ornamental purposes, in cases of finfish and shellfish, is a matter to be considered on a continuous basis, based on needs, relative merits, market demands and impacts on local biodiversity. In view of the concerns on biosecurity, a strong quarantine mechanism, that was initiated during the XI plan, needs to be put in place, to address these concerns.

4.3.2.2 *Freshwater Aquaculture*

Production from aquaculture has gone up from 0.37 million t in 1980 to 2.4 million t at present, with carps alone contributing over 85 per cent. A host of technologies developed over the years have largely contributed to such a growth in the sector. Carps, catfishes and prawns are the important components of culture practices in the country. The three Indian major carps – catla, rohu and mrigal, together contribute a lion's share of over two million t with exotic silver carp, grass carp and common carp forming the next important group. Culture of giant freshwater prawn and catfishes like *magur* and *singhi* has also received increased attention in the recent past due to high market prices.

With the available resources in terms of ponds and tanks and the fish species, doubling of fish production through freshwater aquaculture is being seen as a clear possibility. However, with water availability going to be restricted in the coming years, strategies of multiple use, reuse and integration of aquaculture with other farming systems need to be developed. At the same time, resources of wastewater and degraded waters such as ground saline water provide new opportunities for aquaculture practices. Water productivity would be the key issue in farming practices. Therefore, developmental strategies proposed are: extending the coverage of freshwater aquaculture area; optimising productivity of existing waters; diversification of species and intensification of culture practices and fish health management and disease diagnostics. There should be greater reliance on air-breathing fish and backyard fisheries. The annual fish seed requirements over the plan period for aquaculture and culture-based fisheries are given in Table 4.6.

Table 4.6 Annual fish seed (Fry) requirement during XI Five Year Plan

Water resource/fish	Area (million ha)	Stocking rate (Fry/ha)	Requirement (million fry or PL)
Ponds & tanks (Carps)	2.00	12,000	24,000
Reservoirs (Carps)	3.00	3,000	9,000
Wetlands (Carps)	0.35	4,000	1,400
Seabass	-	10,000	2
Scampi farming	2.00	4,000	8,000
Brackishwater (Shrimp)	2.50	40,000	10,000

The feed requirements for freshwater aquaculture by the end of next plan is estimated at 3.15million t, while for brackishwater aquaculture it is 0.23 million t (Table 4.7).

Table 4.7 Annual fish feed requirement during XI Five Year Plan

Freshwater Aquaculture	(million t)	
	Grow-out systems	Seed production
Total feed requirement**	3.05	0.1
Rice bran/wheat bran requirement @ 70% of the total	2.14	
Oil cake requirement @ 30% of the total	0.91	0.1
Brackishwater Aquaculture	0.23	

** Considering 20% of fish to be produced @ 6 t/ha with FCR 2.5 and 20% of fish to be produced @ 4 t/ha with FCR of 1.5, and rest from fertilizer-based systems

The provision to meet these input requirements is made by continuation of ongoing scheme on freshwater aquaculture. The suggested new programmes/schemes are: breeding, hatchery establishment and seed production of *Magur* and freshwater prawn; advanced & upgraded Protocols for Carp breeding, seed certification, certified brood banks, etc.

4.3.2.3 *Coldwater Fisheries/Culture*

The country has significant coldwater/hill fishery resources extending from north-western to north-eastern Himalayan region and some parts of Western Ghats, encompassing about ten states. The coldwater fish utility is in-terms of gene pool and food, sport and ornamental

fishes value This diverse natural resource-base, wide climatic diversity *vis-à-vis* altitude are conducive to conserve and rear different fish species, developing domestic market for high value fish and growing interest of people in eco-tourism including angling within and outside the country. The contribution of coldwater fish to the national fish basket is about 1.5%, which however is of high-value, low-volume category, and the projected volume at the end of the XI plan is of the order of 6%. The main issues and programmes conceptualized for the plan period are: Establishment of small hatchery units for seed production of mahseers and snow-trouts; The mid-altitude exotic carp farming; Integrated fish farming with agriculture, horticulture and livestock and Development of sport fishery in streams & high altitude lake. The success in trout farming of fast growing variety of rainbow trout in Kashmir and Himachal Pradesh needs to be extended to other Central Himalayan, northeastern and southern states.

4.3.2.4 *Brackishwater Aquaculture*

Brackishwater aquaculture has emerged as an important food production sector playing a vital role in export of marine products. The area under shrimp production has expanded from about 50,000 ha (including traditional farming system) in 1989-90 to 1,84,115 ha during 2005-06. Shrimp production increased from about 30,000 t in 1989-90 to 1,85,990 t by 2005-06. Cultured shrimps contributed 45% of the total shrimp exported and accounted for 60% of the foreign exchange earnings. Concomitant to the above growth in the commodity, all round development was witnessed in establishment of hatcheries for shrimp seed production, shrimp feed mills, ancillary industries in aquaculture engineering, drugs and chemicals, marketing, processing and export activities. The sector has given employment to more than three lakh people.

The major bottlenecks limiting the growth of aquaculture are the non-availability of disease free seed and the dependence on a single

species (*Penaeus monodon*). There are about 320 shrimp hatcheries in the country with an annual installed production capacity of 12 billion post larvae (PL). There was however a drop in the requirement for shrimp seed due to the recurring diseases like White Spot Syndrome Virus (WSSV), loose shell syndrome and Monodon Baculo Virus (MBV) disease. The imminent need is to domesticate the shrimp and produce Specific Pathogen Free (SPF) seed to overcome the problems. While there are R&D efforts in place in the country, establishment of biosecure facility and dedicated seed centres is an important requirement. Further, the mechanism of quarantine to screen the imported seed, that was initiated during the Tenth plan period needs to be strengthened with centres at major port cities like Chennai, Kolkata and Mumbai.

It is expected that the area of shrimp farming will expand to 2,26,000 ha by the end of XI plan and the expected production will be of the order of 2,30,000 t. The shrimp seed requirement at the end of XI plan period will be around 9 billion and this can be met with the existing hatcheries (12 billion annual production capacities). Considering the sustainability issues in shrimp aquaculture, National Committee on implementation of Code of Conduct for Responsible Fisheries suggested that the voluntary code of practices for hatchery operators framed in past should be revised and made binding. Establishment of aqua-estate along the coastal areas on the pattern of industrial estate, with proper effluent treatment plants may be promoted.

There are about 35 feed mills with an annual installed production capacity of 1,50,000 t. However, the feed requirement will go up to 2,25,000 t accounting for an additional requirement of 75,000 t of feed, that needs to be met by expanding the present capacity or installing new feed mills.

It is necessary to remove this single species dependence in brackishwater aquaculture, with other shrimps as well as brackishwater finfishes. Both seed production on one end and processing and export of new species at the other would need to be addressed to achieve the desired diversification in the culture practices. Finfish aquaculture is expected to be taken up in about 2,000 ha during the XI plan period, mostly focusing on culture of the seabass (*Lates calcarifer)*, with an expected production of around 8000 million t. At a stocking density of 10,000 seabass seed per hectare, the seed requirement will be 2 million. In order to meet this seed requirement, about 20 seabass hatcheries with a production capacity of 10 lakh seed per annum are to be established. Inland saline aquaculture would assume greater importance in the coming years, with increasing salinisation in different parts of the country.

Continuation of existing schemes

Scheme	Implementation	Budget (Rs crores)
Development of Inland Fisheries & Aquaculture		
Capture fisheries • Development of inland fisheries capture resources • Programme for augmenting productivity of reservoirs **Aquaculture** • Development of Freshwater Aquaculture (FFDA) • Development of Aquaculture in hill regions • Development of coldwater fish culture • Development of water logged areas for aquaculture • Development of inland saline soils for aquaculture • Development of integrated coastal aquaculture	State Fisheries Departments	432.00

New schemes

Scheme	Implementation	Budget (Rs crores)
Capture Fisheries		
Survey, assessment and evaluation of inland aquatic resources using remote sensing and GIS tools for inland fisheries and aquaculture	State Fisheries Departments with technical guidance from CIFRI, Barrackpore	60.00
Improving productivity of inland open-water fishery through pens, cages and ranching.	State Fisheries Departments	35.00
Improving Fish Productivity in Reservoirs and canals	State Fisheries Departments	305.00
Aquaculture		
Freshwater		
Magur breeding, hatchery establishment and seed production	State Fisheries Departments	6.00*
Advanced & Up-graded Protocols for Carp Breeding	State Fisheries Departments with technical guidance from CIFA, Bhubaneswar	10.00
Seed certification (for both food fish and ornamental fishes)	State Fisheries Departments with technical guidance from CIFA, Bhubaneswar and NBFGR, Lucknow	10.00
Certified Brood banks for food fish and ornamental fish	State Fisheries Departments with technical guidance from CIFA, Bhubaneswar	30.00
Brackishwater		
Hatchery establishment, Seed production of Seabass and Pearl spot (*Etroplus*), including grow-out units	To be executed through BFDAs in coastal states	50.00*
Coldwater		
Establishment of Mahseer Seed production facility (Hatchery, rearing & brood-stock tanks and other support)	State Fisheries Departments	5.00*
Construction of Community Raceways for Trout Farming in Hilly Regions	State Fisheries Departments	2.00
Conservation of fish stocks and fish diversity		
Establishment of Centres/Facilities in States for surveillance, monitoring and reporting of fish diseases	State Fisheries Departments through established channel of DAHD&F with technical inputs from NBFGR, Lucknow	10.00
Establishment of Fish quarantine centers at strategic airports and	State Fisheries Departments with	30.00

international boarders	technical assistance from ICAR institutes	
General		
Establishment of Aqua- shops at district level in states	State Department of Fisheries	25.00
State level soil-water testing and disease diagnostics laboratories	State Department of Fisheries	15.00
Aqua-Tech-Park	State Department of Fisheries	10.00
Sub-total		**583.00**
Total		**1,035.00**

* Subsidy component only

4.3.3 ***Infrastructure***

4.3.3.1 ***Harvest and post harvest infrastructure***

The projected annual growth rate of fisheries sector during XI plan is of the order of 5%, with 2.5% in marine fisheries and 8% in inland aquaculture, with a projected annual fish production to the tune of 9.6 million t. In order to ensure this, fisheries sector would need to strengthen the infrastructure for both harvesting and post-harvest handling and processing in a big way. This includes modern deep sea fishing vessels, fisheries harbours both major and minor, other fish landing centres, etc. As the existing facilities at the harbours and landing centres (Table 4.8) are inadequate and the conditions unhygienic, they need to be modernized by providing additional facilities for storage, icing and handling, packaging and transportation. The additional requirement for harbours and landing centers by 2012 is estimated at two major fishing harbours, 13 minor fishing harbours and 46 landing centers.

Continuous potable water availability has to be ensured for washing and cleaning. Suitable waste disposal mechanisms, raised platforms for hygienic handling and packaging of fish and availability of sufficient quantity of quality ice, etc. are to be ensured. Installation of efficient effluent treatment plants to ensure economical use of potable water and minimize environmental pollution is an imminent need. The

steps needed to improve harvest and post harvest activities are: information on Market price at landing centres, communication towers for deep sea, solving law and order problems, involvement of private sector at harbours and landing centre for recording of catch statistics, etc.

Table 4.8 Fishing harbours and boat landing centres in India

State	Major fishing harbours	Minor fishing harbours	Landing centres
Andhra Pradesh	1	4	2
Goa			2
Gujarat		5	21
Karnataka		8	14
Kerala	1	10	28
Maharashtra	1	2	36
Orissa	1	4	26
Tamil Nadu	1	7	11
West Bengal	1	3	12
Andaman & Nicobar		1	
Daman & Diu			2
Lakshadweep			3
Pondicherry		1	1
Total in operation	6	45	158
Sanctioned Total	6	50	184

Major harbours: Harbours where 600 boats can be operated on a daily basis
Minor harbours: Harbours where 300 boats can be operated on a daily basis

The state-wise distribution of existing post harvest infrastructure is given in Table 4.9.

Table 4.9 Present post harvest infrastructure in India, 2005

(Capacity in t)

State	Freezing Plant		Canning Plant		Ice Plant		Fish meal plants		Cold Storage	
	No	Cap/day	No	Cap/day	No	Cap/day	No	Cap/day	No	Cap/day
Kerala	105	2,042	2	1.5	58	147			167	30,697.1
Tamil Nadu	44	812			30	511	4	73	93	11,735
Karnataka	12	308.4			26	549.5	3	259	28	5,080
Andhra Pradesh	56	1,159.4			9	91			56	14,050
Goa	5	269.5	2	13	7	278.5			6	2,300

Gujarat	59	2,981.6	2	4	49	1,628.3	2	23	63	38,075
Orissa	19	359			16	406.5			19	4,195
Maha-rashtra	34	1,940			11	423	4	73	39	26,263
West Bengal	32	488.1			4	81.5			31	7,014
Delhi									1	15
Total	**366**	**10,359.8**	**6**	**18.5**	**210**	**4,116.3**	**13**	**428**	**503**	**1,39,424**

State	**Other Storage**		**Peeling Shed**		**AFD Plant**	
	No	Cap/day	No	Cap/day	No	Cap/day
Kerala	3	27.0	185	2,379.1	2	3.1
Tamil Nadu	165	5,830.0	44	67.5		
Karnataka	9	972.0	16	160.7	1	0.4
Andhra Pradesh	3	16.0	64	339.9		
Goa			6	72.0		
Gujarat	23	2,295.0	65	693.7		
Orissa	9	202.0	18	120.4		
Maharashtra	22	1,695.0	49	696.6		
West Bengal	2	14.5	30	116.6		
Total	**236**	**11,051.5**	**477**	**4,646.7**	**3**	**3.5**

The new programmes in next plan may be directed towards creation of new harbours, modernization of existing harbours, cold chain facilities and factory vessels to develop island fisheries.

4.3.3.2 *Marketing*

About 75% of fish produced in the country is marketed domestically through wholesale, major and minor retail (including roadside) markets. This however is highly unorganised, with some planned development only in the export sector. Majority of domestic markets are unhygienic and the fish storing and handling facilities are extremely poor. There is lack of proper transportation system including roads, refrigerated vehicles, etc. Availability of potable water, good quality ice, electricity and waste disposal system is inadequate. There is considerable time lag during the transportation of fish from the landing centre to the interior markets which results in poor quality of the material leading to high nutritional and post-harvest losses. A study in the Ernakulam District of Kerala and West Godavari

District of Andhra Pradesh indicated the post-harvest losses in fish to the extent of 15%, amounting to over Rs 2,700 crores annually on a national basis.

The marketing system is rather complex that from the producers' level, the product changes hands to the wholesaler, retailer and vendor levels. Consequently, the primary producer gets a very small share of the consumer's rupee. There should be a mechanism for eliminating middlemen and fixing floor prices by government agencies, cooperative societies, etc. so that fair revenue is ensured to the fishermen. A mechanism to monitor and document food fish borne diseases is also needed to effectively prevent outbreaks of any diseases, as is done is developed nations. This is lacking at present and many cases go unnoticed. The railway vans, air transport, containers, and cold chain are the essential components for efficient fish marketing system.

The National Committee on implementation of Code of Conduct for Responsible Fisheries suggested the following measures to promote and monitor exports and domestic marketing: Collection of complete details of cases coming before the Appellate Panel of WTO, Setting up of a National data centre, Necessary support to trade to fight antidumping, Setting up a network of cold storages, refrigerated outlets and small-scale training units, Exploring domestic market for a variety of value added products and related aspects.

During the XI Plan, model markets are to be set up in major landing centres. Fishermen can have good solar driers near to the landing centres to utilize all catches, thereby reducing post harvest losses.

4.3.3.3 Processing

India exported 5,12,164 t of seafood during 2005-06 valued at Rs 7245.3 crore. During the current year, the export has registered a

growth rate of 11% in quantity and 9% in value. With the proposed additional infrastructure provided during XI Plan, an annual growth rate of 12% in export can be visualized and accordingly the export by 2012 has to go up to 1.13 million t to fetch foreign exchange of around Rs 15,000 crores. For obtaining this, the existing infrastructure has to be upgraded. Presently the utilization of the installed capacity in the fish processing factories is only 25% (based on annual working days of 300 days in 2 shifts). If the existing utilized capacity can be increased to 40% by way of import of raw material for re-export, we may still require an additional annual installed capacity of 7.68 lakh t by the end of XI Plan. However, the development of fish processing infrastructure is almost completely handled by the private sector. Import, processing and re-export of fish will also ensure better capacity utilization. Diversification of the presently shrimp oriented industry and introduction of new lucrative products like sashimi tuna, oceanic squids and other similar items is needed.

The National Committee on implementation of Code of Conduct for Responsible Fisheries also suggested measures to promote fish processing in the country, such as Upgradation of preprocessing and processing units in a time bound manner, Evolving a suitable mechanism for monitoring the quality of ice produced by ice plants not attached to processing plants, and Monitoring samples of fish, shrimp etc. from farms and from water bodies susceptible to be contaminated with effluents, etc.

4.3.3.4 *Value addition*

The value addition is one of the major components in increasing the exports both in quantity and value terms. Value addition in fish and fisheries products has great scope for improvement in our country. To facilitate increased value addition, National Committee on implementation of Code of Conduct for Responsible Fisheries

suggested measures such as Improving fish handling and preservation facilities on board fishing vessels, Encouraging fishing boats to have insulated and refrigerated fish holds, Ensuring quality of the ice, Imparting training to workers of pre-processing and processing plants on various aspects connected with hygiene, Sanitary drills, Handling of raw material and production of value added products, Changes in the EXIM Policy so as to grant preference to value added products over commercial products, Market promotion steps through benefits under schemes like Brand Equity Fund, Market Access Initiative, Joint ventures for production and marketing of value added products, Adequate facility for catch handling at fisheries harbours and landing jetties and facility for catch preservation such as chilled/cold storage, Setting up small scale projects for production of semi processed ready-to-cook fish products from low valued fishes, fish pickles, quality dried products, fish curry etc. by coastal population, promoted by families, unemployed youth, etc.

Continuation of existing schemes and New schemes

Scheme	Number	Total budget (Rs crore)	Suggested Share of Govt. of India (Rs crore)
Harvest			
New fishing harbours	2	100.00	50.00*
New minor fishing harbours	13	325.00	162.50*
Upgradation of major fishing harbours	6	150.00	150.00
Upgradation of minor fishing harbours	45	450.00	225.00
New fish landing centres	46	92.00	46.00*
Upgradation of landing centres	184	184.00	150.00
Sub total		**1,301.00**	**783.50**
Post Harvest			
Processing plants	(Private sector)		
New model retail fish markets	50	500.00	100.00
Modernisation of 10 wholesale markets	10	725.00	145.00
Transport & Insulated containers to societies		50.00	50.00

Women's SHGs for marketing (Kiosk)		50.00	50.00
Value addition @ 50% to SHGs		50.00	50.00
Sub total		**1,375.00**	**395.00**
Culture			
Domestication of *Penaeus monodon* and Establishment of SPF- seed multiplication centre		50.00	50.00
Holding centres, PCR labs, sales counters for brood stock	4	4.00	4.00
Testing facilities for feed, seed & fish	20	10.00	10.00
Sub total		**109.00**	**64.00**
Grand total		**2785.00**	**1242.50**

* 50% of the total requirement. Total requirement to be shared by the Central and State Governments on a 50:50 basis.

4.3.4 *Welfare Programmes, Governance, Transfer of Technology and Capacity Building*

Fishers belong to one of the most poor and under privileged community of the society. Welfare programmes become the core objective of the plan for fisheries and fisher community development. In earlier plans, emphasis was on subsidized production inputs, model fisher villages, premium-free insurance and saving-cum relief. Some of the welfare schemes have not percolated down to the target fishers due to their poor literacy level, awareness and implementation lacunae. Therefore, urgent need is felt to address these issues. The first step towards the welfare of the fishers and aqua-farming community is to organize them and bring under co-operatives or self help groups. A complete registration of the fishers and aqua farmer population followed by steps to literate them and train them in latest fishing and aquaculture practices along with necessary provision for subsidized necessary inputs would pave the way for their welfare. The basic amenities of education, primary health, credit and drinking water also need strengthening along with necessary infrastructure.

4.3.4.1 *Welfare programmes*

Holistic people-centered developmental approach would need to be kept in mind while devising the welfare programmes. To empower fishing/small and marginal farming communities, schemes must address the issues of primary target groups such as education and health, housing, drinking water, communication and access to information, and welfare and support services. Sharing the cost and responsibilities while complementing efforts with other development departments of the States like rural development, agriculture, animal husbandry, rural electrification, PHED, PRIs, etc. shall be the basic approach. Besides the line departments, the implementation of the welfare schemes could be given to NGOs, private sector, KVKs, SIRDs, etc. with proper monitoring mechanisms. The National Committee on implementation of Code of Conduct for Responsible Fisheries suggested that the Government together with fish worker organisations should develop realistic and practical sustainability criteria and a management mechanism. This would ensure that trade barriers do not impact the livelihood of the fishers. Based on the discussions and inputs from various quarters, following welfare schemes are suggested to implement in the Eleventh Plan.

4.3.4.1.1 *Housing*

The Development of Model Fishers Village scheme needs to be continued in this Plan with enhancements in view of the cost escalation from the present level of Rs 40,000 to Rs 1,00,000. The provision of drinking water, sanitary latrine and community hall needs to be made which shall function as Village Resource Centres (VRC).

4.3.4.1.2 *Insurance*

The General Insurance companies should consider a package for insuring freshwater aquaculture on a priority basis. Some other schemes suggested are:

4.3.4.1.2.1 *Modification of Group Accident Scheme for active fishers*

The existing group accident scheme be modified to include Rs one lakh for death or permanent disability and Rs 50,000 for partial permanent disability against the annual premium of not more than Rs 30/head. The premium shall be subsidized by Centre and State on 50:50 basis. The scheme be implemented by FISHCOPFED, which may be paid a service charge @ Re 1/client per annum for implementing the scheme

4.3.4.1.2.2 *Hut insurance scheme*

A new scheme of hut insurance with a cover of Rs 5,000 for total loss and Rs 1000 for partial loss of all registered huts of fishers against the annual premium of not exceeding Rs 20 deserves introduction.

4.3.4.1.2.3 *Group insurance for fishing craft and gear in the event of natural disasters*

A new scheme of group insurance for fishing craft and gear in the event of natural disasters needs to be initiated.

4.3.4.1.2.4 *Mediclaim policy*

Jan Arogya policy for a sum insured of Rs 5,000/family with GIC implementing agency may be initiated to cover the medical expenditure of the fishers.

4.3.4.1.3 *Saving-cum-relief*

The present relief for closed season to marine and inland fishers is not sufficient. It is proposed to remove the distinction between the sectors and uniformly increase the relief by increasing the savings of fishers @

Rs 120/month during the fishing season of eight months. With the matching contribution from State and Central Governments individually, the relief of Rs 120/month may be provided to the fishers for four months.

4.3.4.1.4 *Safety at sea*

To ensure safety at sea, the Life saving equipment such as jackets, floats and bouys may be provided at subsidized rates, with Centre-State share for subsidy being 50:50.

4.3.4.1.5 *Gender issues*

Special incentives are suggested to be given to women groups (SHGs) to encourage alternative income generating/livelihood development activities. Women SHGs to be supported @ Rs.10,000/SHG. Most of the fish marketing and post harvest activities are performed by women folk. Therefore, it is suggested that ladies' toilets and night shelters are constructed at these sites. The involvement of women in the suitable areas may be enhanced in indoor activities, like propagation and seed raising of ornamental fish, seed raising and farming of trout, etc. Fish marketing, particularly retailing, is being carreid out by women for long. To increase their efficiency in marketing, their skills in fish marketing may be upgraded with regard to upkeep and maintain fish texture and quality. The programmes ensuring supply of insulated fish boxes, low cost drying rakes have shown good results to remunerate their returns. The fisher women may be involved in awareness, saving credit and alternate income generating schemes.

4.3.4.2 ***Policy issues***

The Public-private–community participation shall be the approach at this juncture to propel the overall development in fisheries sector. An overarching National Fisheries Development Policy framework is needed to guide the State Governments to formulate their own policies suiting to the local needs, aspirations and the environment. Such a national level policy needs to encompass the capture fishing

regulations in the marine and freshwater bodies and aquaculture management practices in the marine, coastal and brackishwater bodies as well as the freshwater sector, including the effective strategies to address international issues such as WTO matters on fisheries, Illegal Unregulated and Unreported fishing, Quality control of fisheries products, Sea safety measures with the inclusion of Code of Conduct for Responsible Fisheries, Land leasing, Seed availability, insurance, Interstate water bodies, Exotics, Treating fisheries and Aquaculture at par with agriculture in tariff rates for electricity and water, Freight rates for fish and shrimp seed transport, Regular monitoring of pattern of subsidy, the rates, the costs and the prices thereon is a pre-requisite. Also, the measures to deal the problems of human right issues in fisheries like poor wages, long working hours, illiteracy, exposure to high risk without protection, etc, to be incorporated in the national level policy.

The draft National Fisheries Development Policy formulation requires a series of consultations at various levels to incorporate the views aspirations and concerns of all the stakeholders. The outcome will be the development of a comprehensive overarching National Fisheries Developmental Policy and the formulation of state level policies reflecting the basic framework of national level policy.

4.3.4.3 *Management and governance*

Pilot schemes for capacity building and protection of aquatic resources through the principle of co-management need to be initiated. A pilot scheme to create awareness on CCRF at the National and State level is also suggested.

Certification of boatyards manufacturing FRP boats and training of boat surveyors and incorporation of FAO/IMO/ILO voluntary guidelines for the design, construction and equipment of small fishing

vessels is required. Fish, shrimp and prawn hatchery certification may also be put in place.

Uniform and long term leasing policy particularly for reservoirs required if the reservoir have to be developed with proper management practices to be enforced. A major constraint in aquaculture is that it is treated as an industry on several counts such as provision of water and electricity, taxation, etc. It is strongly opined that steps should be taken to treat Aquaculture at par with agriculture, as it is basically a farming activity.

4.3.4.4 *Aquarian reforms*

The comprehensive aquarian reforms in inland and coastal waters for sustainable and equitable use are overdue. To help the fishers and aqua farmers, these should be based on gender and social equity and eco-system sustainability. The reforms include: leasing policy for major inland waters and coastal waters for aquaculture, concessional water and power tariffs at par with agriculture, enforcement of closed season in large waters, easy credit support for production of feed for aquaculture species, etc.

4.3.4.5 *Human resource development*

Institutional strengthening, reorientation/reorganization to face the emerging challenges are the focus of HRD programmes for the Eleventh Five Year Plan. The State/UTs should encourage formation of Fish Farmers' Associations to promote the idea of collective farming

<u>Capacity building at the State level</u>

- Establishment of Training Centres at State and District level
- Training of in-service State Department Officers and Staff (one year Diploma programme as a Centrally Sponsored Scheme with stipend)
- Central Government support for the participation of State

officials in seminar, workshops, and cross-country visits

Capacity building of Fisheries Co-operative Associations, NGOs and CBOs

- Hands-on Training
- Pilot-scale demonstrations
- On-site interventions

4.3.4.6 *Service delivery system*

A review and evaluation of the functioning of the FFDAs and BFDAs are suggested, in order to equip them to meet the emerging challenges. These two programmes need to be strengthened and revitalized by giving adequate thrust on the delivery of technical services and assistance to farmers and fishing communities.

4.3.4.7 *Fisheries cooperatives*

The country has one national level fish co-operative federation namely, National Federation of Fishermen Co-operatives Limited (FISHCOPFED). The number of state level co-operatives is 17, central societies - 108 and primary co-operative societies - 11,847. The number of fishermen members of co-operative societies is 19,17,305, which are over 32% of the fisher population. The fisheries co-operatives in the country are considered as very weak, which needs to be organized and strengthened.

4.3.4.7.1 *Revitalization*

As mentioned earlier, a need was felt to revive the fisheries co-operatives. To start with, about 500 cooperatives that have the potential to grow may be taken up and an amount of Rs 10 lakh per cooperative society may be provided on merit basis. Further, exclusive women societies and societies having a higher participation of women may be given preference & liberal financial assistance/benefits.

4.3.4.7.2 *Capacity building*

Cooperative training institutes in every state will train 1,000 personnel (2 each from 500 societies), which have a turnover of less than Rs 25 lakh per year. Later in a phased manner, it will also train the other society personnel. In this manner, 1,000 persons of the cooperative societies will be trained by State level Cooperative Training Institutes.

For other societies having a turn over or more than Rs 25 lakh, orientation and refresher courses be organised. Two representatives per society from other 1000 societies will be trained. The training will be organized by NCCT/ State Level Cooperative Training Institutes/ District Level Cooperative Training Institutes of the remaining societies, 2,000 personnel shall be provided training through the State / District Level Cooperative Institutes.

4.3.4.8 ***Public Private Partnerships***

4.3.4.8.1 *Accreditation of Shrimp Hatcheries*

Quality seed is one of the critical inputs in development of shrimp culture in the country. Therefore, accreditation of hatcheries and their regular monitoring is essential steps, already initiated by the Coastal Aquaculture Authority. By the end of the plan period, hatcheries without accreditation may not be allowed to operate to ensure supply of disease free shrimp seed to the shrimp grow out farms.

4.3.4.8.2 *Demand generation and Value addition*

With an expected growth of 5 per cent during the Eleventh plan, the fish production is expected to increase to over 9 million t. In order to ensure remunerative prices for the producers, both fishers and aqua-farmers, it is essential to undertake publicity campaigns about fish as health food and enhance fish consumption in the country. Further, value addition is important considering the higher production and as

well as to cater to the needs of domestic high income consumers & markets and exports. The current capacity utilisation of the processing plants needs to be upgraded. Thus it requires a special attention from the Ministry of Food Processing Industries to introduce a value chain project. Potential associates could be from the following segments: Existing feed suppliers, FMCG companies, New entities in the retail business, Consumer cooperatives, NGO/agro-clinics and agribusiness, Export houses/agencies and Existing Cooperative with good record of performance.

4.3.4.8.3 *Research*

Depending upon the success of different schemes, demand-driven research may be carried out in public-private partnerships like alternate culture species - culture practices, marketability and export, etc.

4.3.4.8.4 *Deep Sea Fishing*

To operate in deep seas segment, it is a necessity to involve big companies because of the need for large investments and the necessary know-how to market the produce in the world market. Deep Sea fishing issue needs modification in the existing policy. This activity will require participation of foreign companies covering world markets, without harming the interests of existing fisherman.

4.3.4.8.5 *New enterprises*

Canal fish culture is a new aspect needing attention, with high public-private partnership, in view of the ownership of the resource. The country has an extensive canal network of about 1.5 lakh km spread over different river systems with vast unrealized fishery potential. Although a good part of this canal network is small channels with little scope for fish culture, a substantial canal area in the country can effectively be used for fish culture, depending on the water availability. Fish can be cultured in canals in various ways, viz., open

stocking in canals, placing screens to create sheltered areas, cage culture and culture in deep pools in the channel (where fish can stay alive even when the main canal is dry). Apart from appropriate culture techniques, there are several issues that need to be resolved such as: ownership of fish stocks, right to access and ensuring water availability during the crucial time of culture operation and sharing of benefits among stakeholders. Necessary technological interventions coupled with policy support in canal fish culture can lead to substantial increase in inland fish production.

Similarly, Ornamental fish culture, both marine and freshwater, requires greater investments. Ornamental fishes support a global export trade worth US$ 250 million, with the Asian share of US$120 million. Singapore exports ornamental fishes worth US$ 50 million just from 70 farms covering 156 ha Considering the farm facilities and species richness of the country India can easily become the leader in this sector. However, the key to success lies in the packaging technology. Quick and mortality-free transportation is the main factor that determines the success. They include repacking starvation, lowering of temperature of packing water and use of chemical additives, etc. These packing practices can reduce the effective mortality up to 2-3% against the accepted industry standard of 5%.

New enterprises comprising larval and nursery rearing, grow-out farms and packaging transport need to be encouraged.

Singapore collects ornamental fish from all over grow them and supply to global buyers and thus has become virtually a supermarket on ornamental fish. While India has made inroads into ornamental fish trade during the last decade (Tables 4.10 & 4.11), the present levels are a fraction of the potentials. It is also a concern that fish species are often exploited from the natural environs, that might lead to erosion of the diversity. With development of infrastructure supported

by suitable government policies, India can successfully adopt the Singapore model of importing ornamental fishes for re-export. There also exists immense possibility for indigenous ornamental trade, both freshwater and marine, the prerequisite being development of breeding practices for a number of these, towards which R&D efforts need to be strengthened. Documentation of ongoing efforts at breeding, culture and trade (as for example, Kolathur area in Chennai and markets in Kolkata), establishment of ornamental fish hubs with brood stock and certification facilities, connectivity to overseas markets are strongly emphasized in this approach.

Table 4.10 Exports of ornamental fishes from different ports in the country

(Rs lakhs)

Port	Value
Mumbai	544.8
Kochi	32.3
Trivandrum	61.0
Chennai	1,282.6
Calcutta	2,388.6
Mangalore	123.6
Calicut	5.6
Total	**4,438.4**

(Source: Fisheries Division, ICAR, 2006d)

Table 4.11 Major ornamental fish export markets for India

(Rs lakhs)

Country	Value
Japan	493.9
USA	715.5
European Union	794.6
China	83.6
South-east Asia	2,239.3
Middle East	5.5
Others	106.0
Total	**4,438.4**

(Source: Fisheries Division, ICAR, 2006d)

4.3.4.9 *Transfer of Technology*

Transfer of technology (ToT) takes place when extension activities; their approaches, strategies, methods, outputs, outcome and impacts are designed by professionals through participatory mode and further are blended with appropriate technologies, welfare programmes, services, and field experiences through a two way channels between the technology generating institutions and the field services on one hand and the interest of clienteles' or the stake holders' on the other.

4.3.4.9.1 *Capacity building and awareness creation*

Following steps are needed to build the capacity at different levels and create awareness

- The awareness activities related to fisheries development programmes of the central/state governments should be strengthened.
- There is a necessity to strengthen the field level staff of State Departments of Fisheries (DoF) in order to carry out unified fisheries extension activities.
- Need based training programmes for fishers in fisheries and aquaculture in marine and inland sector on value-addition, post-harvest, hygiene and safety issues are to be organized. These programmes would have focus on fisher women also.
- Preparation of extension literature in local languages with pictorial presentation and production of CDs need to be taken up.
- Training of trainers of KVKs, field extension staff of DoFs and NGOs in subject matter, communication and management to upgrade their knowledge and skill need to be arranged
- Training and supporting unemployed graduates in fisheries to establish aqua-clinics and aqua-shops on the lines of agri-clinics and agribusiness centers with funding from SFAC and NABARD through MANAGE is required.

- Extensive use of information technology (IT) for dissemination of information on new technology and market information need to be encouraged.
- Exclusive channel for fisheries on EDUSAT requires to be provided.
- Vocational educational and training facilities should be strengthened in fisheries schools for students.
- In the districts with high potential for fisheries, the KVKs should have the Training Organizer from fisheries discipline besides, one fisheries subject matter specialist.
- The programmes of ToT should result in empowerment of clientele through widening their knowledge base, favourable attitude towards new technologies and skill up gradation and not just meeting the targets.
- Efforts to be made to promote organic pisciculture.

4.3.4.9.2 ***Demonstration and exhibitions***

- Conducting location specific field trials for technology refinement and commercial viability of technologies, establishment of demonstration units and exhibitions at Fisheries Research Institutes and Colleges to attract persons for aquaculture, aqua-tourism and augment mass awareness.
- Large numbers of quality demonstrations are to be organized following trickle down extension approach on the farms of 2-3 innovative farmers per block to demonstrate the new technology to other farmers. These demonstrations exert indirect influence on farmers of the area. Community based fisheries management approach to be promoted in capture fisheries.
- Involving reputed and pro-active NGOs in ToT work and reviewing their performance periodically.

4.3.4.9.3 *Co-ordination and linkages*

- Fisheries Technology Dissemination Centres (FTDC) need to be established with the objectives of refinement of extension literature, conduct of mass awareness programmes through exhibitions and the mass media, on production and consumption of fish and fish products as well as monitor and co-ordinate ToT activities in the state
- ToT units need to be established at all Fisheries Institute and Colleges of Fisheries (CoF).
- A system/procedure have to be evolved to certify the hatcheries as in the case of crops, where certification of seed produced by farmers is done.
- Encouraging public-private partnership involving self-help-groups (SHGs), entrepreneurs and co-operatives in establishing hatcheries, feed mills and marketing of fish.

Following transfer of technology model (Fig 4.6) is suggested to transfer the research outcomes to the clientele group:

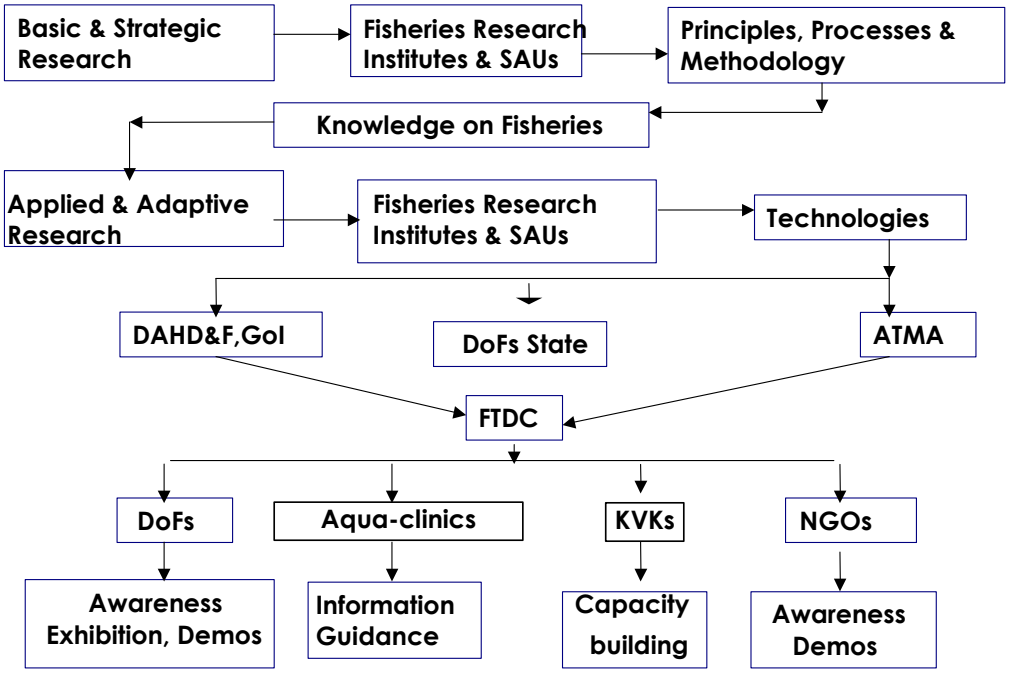

Figure 4.6 Transfer of technology model for Fisheries during XI Plan

Continuation of existing schemes

Scheme	Implementation	Budget (Rs Crores)	Central Share (Rs Crores)
Welfare Programmes			
Development of Model Fishers Villages	State Fisheries Departments, NGOs, Private sector, KVKs, SIRDs	96.00	96.00
Group Accident Scheme for active fishers	FISHCOPFED	30.00	15.00
Saving-cum-Relief	State Fisheries Departments, FISHCOPFED, NGOs	96.00	96.00
Sub total		**222.00**	**207.00**
Capacity building and Awareness creation			
Establishment of Awareness Centers	State Fisheries Departments	5.00	4.00
Training programmes for fishers	State Fisheries Departments	9.00*	7.20
Extension literature &Video films	State Fisheries Departments	2.00	1.60

Trainer's training & Refresher course	Fisheries Institutes, SAUs	10.00*	10.00
Sub total		**26.00**	**22.80**
Total		**248.00**	**229.80**

New schemes

Scheme	Implementation	Budget (Rs Crores)	Central Share (Rs Crores)
Welfare Programmes			
Hut insurance scheme	FISHCOPFED	10.00	5.00
Group insurance of fishers and farmers	FISHCOPFED	30.00	15.00
Mediclaim policy	FISHCOPFED	20.00	10.00
Incentives to Fisherwomen groups (SHG)	FISHCOPFED, State Fisheries Departments	2.00	2.00
Safety at sea	State Fisheries Departments	10.00	5.00
Assistance to FISHCOPFED	FISHCOPFED	10.00	10.00
Policy Issues			
Draft National Fisheries Development Policy formulation	ICAR Institutes, DAHD&F, NCAP, State Fisheries Departments	5.00	5.00
Management and governance			
Co-management, CCRF and certification of boatyards and hatcheries	Fisheries Institutes, State Fisheries Departments	12.00	9.60
Human Resource Development			
Capacity building at the State level	DAHD&F Fisheries Institutes, SAUs	10.00	10.00
Use of IT in ToT	State Fisheries Departments, Fisheries Institutes, SAUs	2.00	2.00
Programmes for EDUSAT	DAHD&F, Fisheries, Institutes, SAUs	1.00	1.00
Vocational education in fisheries schools	State Fisheries Departments	0.50	0.25
Capacity building of fisheries co-operative Associations, NGOs, SHGs	FISHCOPFED, State Fisheries Departments	10.00	9.60
Strengthening of Service delivery system	Fisheries Institutes, State Fisheries Departments, SAUs, KVKs	10.00	8.00
Co-operatives and Public-Private partnerships			
Revitalization of Co-operatives	Cooperatives, Federation & State Fisheries Departments	50.00	50.00

Capacity building/training	Cooperatives, Federation & State Fisheries Departments	7.50	7.50
Demand generation for fish	Government of India	50.00	50.00
Demonstration and Exhibitions			
Location specific field trials and Demonstration units	Fisheries Institutes, SAUs	5.00*	5.00
Trickle down extension	State Fisheries Departments, Fisheries Institutes, SAUs	10.00	10.00
Involving NGOs in ToT	NGOs, PRIs	2.00	2.00
Co-ordination and Linkages			
FTDC	Fisheries Institutes, SAUs	30.00	30.00
ToT units at Fisheries institutes/SAUs	Fisheries Institutes, SAUs	27.00	20.25
Total		**314.00**	**267.20**
Total for ongoing and new schemes		**562.00**	**497.00**

4.3.5 Strengthening of Database and Information Networking

Reliable, accurate and timely statistics on fishery resources and production is an essential pre-requisite for formulation of policies and programmes. The present status of database with regard to fishery sector, is not comprehensive. To minimize the data gaps, especially in inland fisheries, 'Development of Inland Fisheries Statistics' was introduced in the VI plan. This was the first step towards development of uniform concepts, definitions and methodology for estimation of inland fish production. The scheme on Inland Fisheries statistics continued till the end of IX plan.

As the statistics is required for entire fishery related activities and for overall development of fishery, the working group on Fisheries for formulation of X plan recommended a scheme on "Strengthening of Database and Information Networking for Fisheries Sector" with components: Remote Sensing, Information Technology, GIS, Inland and Marine Fisheries Census and Catch assessment of marine

fisheries, besides, Inland fisheries statistics. The scheme is recommended for continuation during XI Plan with the following components:

4.3.5.1 *Sample survey for estimation of inland fishery resources, their potential and fish production*

This component is proposed to prepare benchmark estimates of inland fish production along with the potential of inland fish production. The survey is to be conducted one time during the initial year of X Plan with suitable sampling design so that the required estimates with standard error can be computed for States/UTs and the pooled estimate at All India level. The task may be assigned to CIFRI. The scope of the coverage of survey would be confined to Inland fisheries resources.

4.3.5.2 *Census on marine fisheries*

The component on conduct of census on marine fisheries may be entrusted to Central Marine Fisheries Research Institute (CMFRI) in eleven States/ UTs. In respect of Andaman & Nicobar and Lakshadweep Islands, the census would be conducted using services of Fishery Survey of India, Mumbai. It is necessary that a provision for engaging manpower in two UTs is made and 10% of the schedules filled during the conduct of catch assessment surveys should be checked by CMFRI and 2% of the same by State Governments and reports of the inspection should be submitted to the DAHD&F.

4.3.5.3 *Catch assessment survey for inland and marine fisheries*

4.3.5.3.1 *Catch assessment survey for inland fisheries*

The survey for Catch Assessment Survey of Inland Fisheries will be done as per the methodology developed by the CIFRI. The four posts under the scheme in X plan would be continued in XI plan also. In addition, for the ongoing survey, existing schedule may be revised to

incorporate the fish production exclusively from aquaculture ponds, in order to have a separate estimate of fish production from aquaculture ponds.

4.3.5.3.2 *Marine catch assessment surveys*

The marine catch assessment survey would be conducted on the methodology developed by the CMFRI. Besides, Catch assessment surveys by adopting the CMFRI methodology, collection of data from deep sea/oceanic sectors including LOP vessels, converted vessels etc. may be included for coverage with appropriate log book system/observer programme/enumerators.

A point has been raised by various State Governments time and again that they do not have manpower to go to field for data collection and they would require contractual persons in this regard. In view of the constraints being faced by all the organizations, it is recommended that contractual data enumerators are hired for collection of data on Catch Assessment Survey of Inland and Marine Fisheries.

4.3.5.4 ***Development of GIS***

4.3.5.4.1 *Inland Fisheries*

The Development of GIS is one of the components of the Central Sector Scheme on "Strengthening of Database and Information networking for the Fisheries Sector" for inland fisheries. During the X plan, water bodies of area more than 0.5 ha have been mapped and located using satellite images of LISS III in all the states and LISS IV in five states only. During XI Plan, LISS IV images will be used for all the states and the coverage of water body smaller than 0.5 ha would be taken up. Further, the GIS developed during X Plan would be improved upon for making more interactive and user-friendly equipped with more information. The task could be assigned to the CIFRI, Barrackpore.

4.3.5.4.2 *Marine Fisheries*

GIS development for marine sector with information from marine census and subsequent landings data for all maritime districts/Islands to be initiated during XI plan. The task could be assigned to the CMFRI, Kochi/FSI, Mumbai.

4.3.5.5 *Assessment of fish production potential in coastal areas*

The National Committee on implementation of Code of Conduct for Responsible Fisheries (CCRF) recommended for assessment and revalidation of fisheries resource potential for coastal areas. It is essential that the data on different species harvested from the aquaculture farms should be included to arrive at the correct production data. A proper sample survey methodology will be evolved for collecting this information through the farmers / collection centres / processing plants.

The CIBA has developed the methodology for the potential sites identification for the future development of brackishwater aquaculture using satellite data from LISS III, LISS I, Thematic mapper sensors and GIS. This methodology needs to be adapted and a national level study involving all the maritime states is required to be undertaken to assess actual area presently under culture and the potential area that are available for the brackish water aquaculture. During the XI plan, a comprehensive quantified data on total brackish water land resources of the nine coastal states, creek based master plans and site-specific designing of the existing and future aquaculture farms with the critical coastal habitat, soil and water information system would be developed. Suitable cultivable species of shrimp and fishes will be identified for the different geographical areas in GIS platform.

The pattern of assistance would be 100% grant-in-aid by the Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India.

Continuation of existing schemes and new schemes

Scheme	Implementation	Budget (Rs crores)
Sample Survey for estimation of inland fishery resources, their potential and fish production	DAHD&F with CIFRI, Barrackpore	5.55
Census on marine fisheries	DAHD&F with CMFRI, Kochi	2.00
Catch assessment survey for inland and marine fisheries	DAHD&F with CIFRI, Barrackpore, CMFRI, Kochi	45.00
Development of GIS for inland and marine fisheries	DAHD&F with CIFRI, Barrackpore & CMFRI, Kochi	22.45
Delineation of Brackishwater areas, assessment of productivity & production	CIBA, Chennai	3.00
Total		**78.00**

4.3.6 Fisheries Institutes

The four Institutes under the Ministry of Agriculture, Department of Animal Husbandry, Dairying & Fisheries are Fishery Survey of India (FSI), Mumbai, Central Institute of Fisheries Nautical and Engineering Training (CIFNET), Kochi, Integrated Fisheries Project (IFP), Kochi and Central Institute of Coastal Engineering for Fishery (CICEF), Bangalore.

Some suggestions for improvement of functioning and efficiency of these institutions are as follows:

- Need for appraisal of mandate of these institutes to suit to present requirements and also change in the nomenclature of CICEF as Central Institute of Coastal Fisheries Engineering (CICFE).
- Upgradation of the posts of the Directors.
- Better collaboration between FSI and Remote sensing institutes to work on forecasting models and the models should be more user friendly and get more knowledge about marine fisheries (>30 m).

- Coordination between programmes of FSI and CMFRI for joint publications on fisheries resources of Indian seas, as also higher levels of coordination between IFP and CIFT.
- Reorientation of programmes of CIFNET in line with changing needs of the industry.

4.3.6.1 *Fishery Survey of India*

4.3.6.1.1 *Resources survey / monitoring in the Indian EEZ*

The survey coverage in some of the areas has not been adequate and the resources, which are under different levels of exploitation, need to be monitored on a continuous basis, the on-going resources survey projects together with experimental fishing by eco-friendly and diversified methods using traps, hand-lines and jigs is proposed to continue during the XI Plan.

4.3.6.1.2 *Development of fishery forecasting models including application of remote sensing technology*

FSI is involved in developing a fishery forecasting model in collaboration with Space Application Centre, Ahmedabad and National Remote Sensing Agency, Hyderabad, by integrating the Sea Surface Temperature and Chlorophyll data obtained from NOAA-AVHRR and the dedicated Indian satellite OCEAN SAT-4.

4.3.6.1.3 *Training of deep sea fishing operatives*

FSI provides practical onboard training to the deep sea fishing operatives and fishermen of maritime states in different fishing methods and also to the CIFNET trainees, for acquiring sea service to appear for desired certificate of competency examinations. This activity will now have a greater focus on diversified capture techniques.

4.3.6.1.4 *Creation of infrastructure facilities: facility centre at Mumbai and laboratories at Base offices*

The construction of the buildings at HQ's facility centre of the FSI at Mumbai and the Fish Genetics Laboratory at the Visakhapatnam Base Office will continue in the XI Plan. Inter-disciplinary research with provision of multi-purpose facilities will be initiated at the Base Centre.

4.3.6.1.5 *Exploration of oceanic tunas and allied resources in theinternational waters between the EEZ*

Exploratory surveys by tuna long lining have provided a comprehensive picture of the oceanic tunas and allied resources in the Indian EEZ. However, the areas in the international waters between the EEZ along the east coast and around Andaman and Nicobar Islands are yet to be surveyed. As oceanic tunas are of highly migratory nature, survey of this high sea segment is of crucial importance in understanding their distribution and seasonality in the region.

4.3.6.1.6 *Special drive for survey and assessment of oceanic tunas and allied resources*

The exploitation of oceanic tuna resources around Lakshadweep is presently by pole and line fishing and is mainly targeted at the skipjack tuna. The FSI has, at different times, conducted surveys of large deep swimming tunas in the region. It is proposed to conduct a special drive to survey and assess the oceanic tunas and allied resources around the Lakshadweep Group of Islands and consolidate the findings. In view of the economic importance stocks of high value species, viz., bigeye tuna and albacore tuna, exploration of equatorial waters is envisaged during the XI Plan.

4.3.6.1.7 *Application of diversified longlining technologies*

Apart from the yellowfin and bigeye tuna, bill fishes, sharks and perches form the other major components of the long line catches. Each of these components requires diversification of the long line

technique with suitable adjustments and modifications in the gear. During the XI Plan, long line technique will be diversified with due regard to the ecological preferences of the species concerned.

4.3.6.1.8 *Survey of surface swimming larger pelagic resources by purse-seining*

No attempt has so far been made to survey the surface swimming tunas due to the non-availability of suitable vessels, expertise and infrastructure for tuna purse-seining. This fishing method is the most important industrial capture technique in the Indian Ocean and accounts for harvesting about 35% of the oceanic tunas. It is therefore proposed to take up the survey of surface swimming larger pelagic resources by purse-seining.

The following new projects would need new vessels and training of the personnel involved

- Preliminary survey of skipjack and yellow-fin tuna by pole and line fishing in Lakshadweep and Andaman & Nicobar Waters
- Preliminary survey of the squid resources by jigging in the EEZ

4.3.6.1.9 *Acquisition of new vessels on replacement basis*

The FSI is operating a fleet of thirteen vessels at present which includes nine vessels that are more than twenty years old. As the FSI does not have suitable vessels for effective survey of the smaller pelagics, two vessels with state-of-the art acoustic systems may be acquired to replace the two existing vessels, which are more than 25 years old. Another four vessels may be replaced during the Plan for undertaking diversified survey activities. On acquisition of the new vessels, an equal number of old vessels will be decommissioned and disposed off so that the same fleet strength is maintained and no additional manpower or operating costs involved.

The induction of these vessels to the survey fleet is expected to yield a strong data base on demersal, coastal, pelagic and oceanic fishery resources in the Indian waters and adjoining areas for rational development, optimum utilisation and effective management of the stocks.

4.3.6.1.10 *Re-commissioning of marine workshop, dredgers and slip-way*

An Expert Committee has been constituted to examine the requirements for re-commissioning the facilities transferred from the Integrated Fisheries Project for optimization of their use. It is proposed to re-commission the Slipway. Once the Slipway complex is re-commissioned, as many as seven vessels can be slipped at a time for under-water repairs. On an average 20 vessels can be repaired in a year and approximately Rs. 20-25 lakh can be realized as revenue.

The existing Jetty is 40m in length and is having a draught of less than 1m. It is proposed to dredge the waterfront area to a draught of 5m. Once the dredging is carried out, the vessels of FSI and CIFNET can be berthed at this Jetty, and also the private vessels which are coming for Slipway repairs can be berthed. An amount of Rs. 2-3 lakh per annum can be realized by renting the Jetty to the sister organizations and the private vessels. Further, the Marine Engineering Workshop transferred from the Integrated Fisheries Project, Kochi, to Fishery Survey of India, can be fully utilized in repairing the departmental as well as the private vessels.

It is proposed to construct a mini-dry dock at the Marine Engineering Division of FSI to accommodate vessels up to 500 GRT. At present the vessels of FSI and other sister organisations are fully depending on the Public Sector Shipyards for their dry-dock repairs and have been experiencing difficulties in getting slots for docking the vessels. As per

the proposed period of dry-docking, it may become still more difficult to get the docking facilities at the shipyards in the years to come. This would not only amount to loss of survey time of our vessels but also result in huge expenditure. Therefore, it is essential to have devoted facility to dry-dock the vessels of FSI and sister organizations like CIFNET, IFP, CMFRI, CIFE & CIFT. A mini dry-dock of approximately 70m x 20m x 10m can be constructed in the space available near the present Slipway. It can accommodate all the survey vessels and other medium size vessels. The average cost of dry-docking and other service charges per vessel at the Public Sector Shipyards is approximately Rs. 30-40 lakhs. It may also be possible to undertake dry-docking of some of the vessels belonging to the Fishing Industry.

4.3.6.1.11 *Research Investigations*

FSI propose to undertake research investigations on: fish stock identification and biodiversity studies using fish genetics, resources monitoring in the inshore waters**,** medium and long term fisheries modeling and forecasting and coral reef ecosystem.

4.3.6.1.12 *Training of Scientific and Technical personnel*

In order to upgrade the quality of the work and achieve high international standards under each of the above projects, there is a need to train the Scientific and Technical personnel at internationally-reputed institutes. The following areas have been identified for training of the personnel during the XI Plan.

- Fish stock assessment by acoustic techniques
- Stock identification by genetic tools
- Age determination in fishes by using hard parts (including Otolith studies) with modeling
- GIS applications in marine fisheries management including Remote Sensing Technology
- Use of advanced electronics equipment on board the fishery survey vessels

- Modern fish handling and preservation technologies onboard fishery survey vessels.

Depending on the qualifications and experience of the scientific and technical personnel, two types of training programmes are envisaged such as: (i) Training for six months to one year for Masters and Ph.D. degree holders with 5-10 years experience; and (ii) Advanced training in specialized areas including doctoral and post-doctoral studies for young scientists. The countries identified for the training programmes are: USA, Canada, Norway, Denmark, Japan and France.

4.3.6.2 *Central Institute of Fisheries, Nautical and Engineering Training, Kochi*

The Training Programmes of the Institute are targeting the development of manpower in skills to operate the vessels and to carry out different types of fishing.

At present the institute is having three training vessels stationed at Kochi, Chennai and Vishakhapatnam excluding one old vessel transferred from Integrated Fisheries Project in October 2005 for imparting practical training to the candidates. All the three vessels are more than 25 years old and require frequent repairs. The dry-docking expenses have also increased considerably. It is therefore proposed to replace the two old vessels with new training vessels equipped with modern machinery and sufficient accommodation during the XI Plan.

The Institute needs to upgrade the skills of its personnel. The training areas identified are: (i) Fishing gear design and fabrication; (ii) Safety at sea with IMO regulations; (iii) Marine Pollution & Marine Environment; and (iv) Marine Refrigeration. The countries where the proposed training programmes can be arranged are Japan, France, Norway, South Korea and Italy.

4.3.6.3 *Integrated Fisheries Project, Kochi*

The revised mandate and objectives of the institute have focused its activities on: Development and diversification of value added products and processing of sea food, Augmenting the market reach of IFP to cover more consumer segments, Empowerment of fishermen community to local participatory co-management, Human resource development and fishery science and technology in the post harvest sector, Design and dissemination of appropriate traditional technologies.

There is an unstated demand for fish and fishery products especially among the urban consumers all over India with special reference to metros like, Delhi, Mumbai, Kolkata and Chennai. Structured and targeted marketing efforts have been lacking so far. Hence it is proposed that marketing efforts will be made in the metros in collaboration with local administration.

A center with low cost processing techniques suitable to micro-enterprise is proposed to be established at IFP. This will cater to the needs of the Self Help Groups (SHGs) of fisherwomen. This will also act as a community processing center extending facilities to SHGs in their micro-entrepreneurial ventures.

IFP had been very receptive and positive in addressing training needs of the students of fisheries science and technology at different levels. To systematize and augment the above, the physical infrastructural requirements have to be addressed to accommodate the constantly increasing training demands.

To support and catalyze the proposals and programmes, communication and information technology infrastructure has to be strengthened manifold. Development of IFP's own technology and

information database, speedy access to international technology database, redesigning of websites of IFP are imperative.

The project needs upgradation of skills of the personnel working with it. The training areas identified are: (i) Recent advances in value added product processing technology for all varieties of sea food; (ii) Diversified processing methodology; (iii) Refrigeration Technology; and (iv) Quality assurance concepts like Laboratory techniques, Risk assessment and Traceability. The countries where the training can be arranged are Poland, Japan, France, Norway, South Korea and Italy.

4.3.6.4 *Central Institute of Coastal Engineering for Fishery*

During the XI Five Year Plan, the Institute proposes to undertake:

- Engineering and Economic Investigations
- Preparation of Techno-Economic Feasibility Reports
- Updating of Master Plan for the development of fishery harbours/fish landing centres
- Monitoring of ongoing projects
- Post Investment Evaluation Studies

For effective implementation of the activities proposed during the XI plan, it proposes to purchase additional computers and peripherals and organize advanced training for concerned personnel in the designing of the fishery harbours and jetties and infrastructure development for hygienic fish handling and model testing.

Continuation of existing schemes and new schemes

Schemes	Budget (Rs crores)
Fishery Survey of India	
Ongoing	
Survey of coastal pelagic resources by acquiring two mid-water trawlers	60.95
On going activities excluding construction of buildings	210.63
Creation of infrastructure facilities	16.20

New	
Strengthening of Extension Division at HQ	1.10
Acquisition of new vessels	185.00
Re-commissioning of marine workshop, dredgers slip-way and Mini Dry-dock at Kochi (including cost of dredging)	10.82
Studies on population genetics of fish populations in collaboration with relevant Institutions	2.00
Resources monitoring in inshore waters	12.00
Development of fisheries forecast models	2.00
Coral Reef Ecosystem: Surveys and Investigations	2.30
Training of Scientific and Technical personnel	2.00
Sub Total	**505.00**
Central Institute of Fisheries Nautical Engineering & Training	
Ongoing schemes	10.00
Fishery Training Vessels	40.00
Buildings	8.30
Equipments related to marine engineering, fishing gear, navigation	5.00
Minor works	18.00
Salaries	2.00
Sub Total	**83.30**
Integrated Fisheries Project	
Induction of new generation technologies and processing in post-harvest sector	3.72
Extending marketing efforts to cover large segments of consumers	0.51
Establishing rural appropriate technology design and dissemination center	1.85
HRD Activities in the fisheries sector	0.26
Scheme to strengthen communication and information technology of the project	0.15
Capacity building in new technologies among the staff	0.40
Support to on-going and above new activities (Salaries, Supplies & Materials, Office Expenditure, etc.)	5.35
Sub total	**12.24**
Central Institute of Coastal Engineering For Fishery	
Engineering and Economic Investigations	10.00
Preparation of Techno-Economic Feasibility Reports	
Updating of Master Plan for the development of fishery harbours/fish landing centres	
Monitoring of ongoing projects	
Post Investment Evaluation Studies	
Sub total	**10.00**
Grand Total	**610.54**

The total budgetary requirements for Fisheries during the XI Plan period are given in Table 4.12. In view of the newly created National Fisheries Development Board with an allocation of Rs 2,100 crores (with a fund availability of Rs 2,069 crores during the XI Plan), the projected requirement of funds for the Department's activities would

be Rs 1,944.04 crores. As could be seen from the above account, much of the marine fisheries programmes would be continued under the existing and new schemes proposed in the subsector, as also the programmes of the FFDAs with regard to inland fisheries and aquaculture. Further, new activities like Database and informationa networking, certified brood banks, efforts on conservation, seed certification, policy setting and welfare programmes would need to be addressed by the Department. As the NFDB would has been mandated to address eleven activities in partnerships with the Governmental as well as private agencies, it would bring a commercial angle to the sector and address specific areas with a stress on marketing.

Table 4.12 Projected Budgetary requirements for Fisheries in the XI Plan

Sl. No.	Schemes	Budget (Rs crores)
1	Marine Fisheries and Mariculture	550.00
2	Inland Fisheries and Aquaculture	1035.00
3	Infrastructure	1242.50
4	Welfare programmes, Governance, Transfer of technology and Capacity building	497.00
5	Strengthening of Database and Information networking	78.00
6	Central Institutes	610.54
	Total	**4013.04**

Provision of Rs 2,069 crores made for NFDB during the XI Plan

Annexures

Table A. Marine Fisheries Resources of India

	State / Union Territory	Length of coast line (Km)	Continental shelf ('000 sq km)	No. of landing centres
1	Andhra Pradesh	974	33	314
2	Goa	104	10	34
3	Gujarat	1,600	184	123
4	Karnataka	300	27	88
5	Kerala (P)	590	40	178
6	Maharashtra	720	112	152
7	Orissa	480	26	57
8	Tamil Nadu	1,076	41	352
9	West Bengal	158	17	44
10	A & N Islands (P)	1,912	35	57
11	Daman and Diu (P)	27	NA	7
12	Lakshadweep (P)	132	4	11
13	Pondicherry	45	1	26
	Total	**8,118**	**530**	**1,443**

Table B. Marine Fishing Villages and Population

	State / Union Territory	No. of fishing villages	No. of fishermen families	Fisherfolk population
1	Andhra Pradesh	498	1,29,246	5,09,991
2	Goa	39	1,963	10,668
3	Gujarat	263	59,889	3,23,215
4	Karnataka	156	30,176	1,70,914
5	Kerala (P)	222	1,20,486	6,02,234
6	Maharashtra	406	65,313	3,19,397
7	Orissa	641	86,352	4,50,391
8	Tamil Nadu	581	1,92,152	7,90,408
9	West Bengal	346	53,816	2,69,565
10	A & N Islands (P)	45	NA	NA
11	Daman and Diu (P)	22	5,278	29,305
12	Lakshadweep (P)	10	NA	NA
13	Pondicherry	28	11,541	43,028
	Total	**3,257**	**7,56,212**	**35,19,116**

P - Provisional

Source: Fisheries Census, Part-1, 2005 & Handbook of Fisheries Statistics, 2005

Table C. Inland Fishery Resources of India

Sl. No.	States/UTs	Rivers & canals (km)	Reservoirs (million ha)	Ponds & Tanks (million ha)	Beels, Oxbow lakes & Derelict water bodies (million ha)	Brackish water (million ha)
1	Andhra Pradesh	11,514	0.23	0.52	-	0.06
2	Assam	4,820	0.002	0.023	0.11	-
3	Bihar	3,200	0.06	0.10	0.01	-
4	Goa	250	0.003	0.003	-	Neg
5	Gujarat	3,865	0.24	0.07	0.01	0.1
6	Haryana	5,000	Neg	0.01	0.01	-
7	Himachal Pradesh	3,000	0.04	0.001.	-	-
8	Jammu & Kashmir	27,781	0.01	0.02	0.01	-
9	Karnataka	9,000	0.44	0.29	-	0.01
10	Kerala	3092	0.03	0.03.	0.24	0.24
11	Madhya Pradesh	17,088	0.23	0.06	-	-
12	Maharashtra	16,000	0.28	0.06	-	0.01
13	Manipur	3,360	0.001	0.01	0.004	-
14	Meghalaya	5,600	0.01	0.002	Neg	-
15	Nagaland	1,600	0.02	0.05	Neg	-
16	Orissa	4,500	0.26	0.11	0.18	0.43
17	Punjab	15,270	Neg	0.01	-	-
18	Rajasthan	* 5290	0.12	0.18	-	-
19	Sikkim	900	-	-	0.003	-
20	Tamil Nadu	7,420	0.57	0.06	0.01	0.06
21	Tripura	1,200	0.005	0.013	-	-
22	Uttar Pradesh	28,500	0.14	0.16	0.13	-
23	West Bengal	2,526	0.02	0.28	0.04	0.21
24	Arunachal Pradesh	2,000	-	0.28	0.04	-
25	Mizoram	1,395	-	0.002	-	-
26	A & N Islands	115	0.001	0.003	-	0.12
27	Chandigarh	2	-	Neg	Neg.	-
28	Delhi	150	0.004	-	-	-
29	Lakshadweep	-	-	-	-	-
30	Pondicherry	247		Neg	0.001.	Neg
31	Dadra & Nagar Haveli	54	0.01	-	-	-
32	Daman & Diu	12	-	Neg	-	Neg
33	Chhattisgarh	3,573	0.08	0.06	-	-
34	Uttaranchal	2,686	0.02	0.001	-	-
35	Jharkhand	4,200	0.09	0.03	-	-
	Total	**1,95,210**	**2.916**	**2.407**	**0.797**	**1.24**

* Provisional

Source: Hand Book on Fisheries Statistics, 2005; Report of Working Group on Fisheries for X Five Year Plan, MoA, 2001

Table D. Length of Major Rivers of India

	River	Total Length (km)	States	Length (km)
1	Ganga	2,525	a) Uttar Pradesh	1,450
			b) Bihar	445
			c) West Bengal	520
			d) Boundary of Bihar and U.P.	110
2	Brahmaputra	916	a) Arunachal Pradesh	218
			b) Assam	698
3	Indus	1,114	a) Jammu & Kashmir	1,114
4	Brahmani	799	a) Orissa	541
			b) Bihar	258
5	Krishna	1 ,401	a) Maharashtra	640
			b) Andhra Pradesh	386
			c) Karnataka	375
6	Mahanadi	851	a) Madhya Pradesh	357
			b) Orissa	494
7	Sabarmati	371	a) Rajasthan	48
8	Narmada	1,312	a) Madhya Pradesh (M. P.)	1,079
			b) Gujarat	159
			c) Boundary of M.P. and Gujarat	39
			d) Boundary of M.P. and Maharashtra	35
9	Mahi	583	a) Madhya Pradesh	167
			b) Rajasthan	174
			c) Gujarat	242
10	Tapti	724	a) Madhya Pradesh	228
			b) Maharashtra	228
			c) Gujarat	214
			d) Boundary of M.P. and Maharashtra	54
11	Godavari	1,465	a) Andhra Pradesh	771
			b) Maharashtra	694
12	Pennar	597	a) Karnataka	61
			b) Andhra Pradesh	536
13	Cauveri	800	a) Karnataka	320
			b) Tamil Nadu	416
			c) Boundary of Karnataka and Tamil Nadu	64
14	Subarnarekha	395	a) Bihar	269
			b) West Bengal	64
			c) Orissa	62

Source: Report of Working Group on Fisheries for X Five Year Plan, MoA, 2001

Table E. Distribution of Small, Medium and Large Reservoirs in India

SI. No.	States	Small		Medium		Large		Total	
		Number	Area (ha)	Number	Area (ha)	Number	Area (ha)	Number	Area (ha)
1	Tamil Nadu	8,895	3,15,941	9	19,577	2	23,222	8,906	3,58,740
2	Karnataka	4,651	2,28,657	16	29,078	12	1,79,556	4,679	4,37,291
3	Madhya Pradesh	6	1,72,575	21	1,69,502	5	1,18,307	32	4,60,384
4	Andhra Pradesh	2,898	2,01,927	32	66,429	7	1,90,151	2,937	4,58,507
5	Maharashtra	-	1,19,515	0	39,181	0	1,15,054	0	2,73,750
6	Gujarat	676	84,124	28	57,748	7	1,44,358	711	2,86,230
7	Bihar	112	12,461	5	12,523	8	71,711	125	96,695
8	Orissa	1,433	66,047	6	12,748	3	1,19,403	1,442	98,198
9	Kerala	21	7,975	8	15,500	1	6,160	30	29,635
10	Uttar Pradesh	40	2,18,651	22	44,993	4	71,196	66	3,34,840
11	Rajasthan	389	54,231	30	49,827	4	49,386	423	1,53,444
12	Himachal Pradesh	1	200	0	0	2	41,364	3	41,564
13	North East	4	2,239	2	5,835	0	0	6	8,074
14	Haryana	4	282	0	0	0	0	4	282
15	West Bengal	4	732	1	4600	1	10,400	6	15,732
	Total	**19,134**	**14,85,557**	**180**	**5,27,541**	**56**	**11,40,268**	**19,370**	**31,53,366**

Source: Sugunan, V. V., 1995. Reservoir Fisheries in India. FAO Fisheries Technical Paper No. 345, Food and Agriculture Organisation, Rome

Table F. Fishing Crafts - Coastal States and Union Territories

Sl. No	State/Union Territory	Mechanised boats	Motorised	Non motorised	Total
1	Andhra Pradesh	2,541	14,112	24386	41,039
2	Goa	1,087	932	532	2,551
3	Gujarat	13,047	7,376	3,729	24,152
4	Karnataka	4,373	3,705	7,577	15,655
5	Kerala	5,504	14,151	9,522	29,177
6	Maharashtra	13,053	3,382	7,073	23,508
7	Orissa	3,577	4,719	15,444	23,740
8	Tamil Nadu	7,711	22,478	24,231	54,420
9	West Bengal	6,829	1,776	10,041	18,646
10	A & N Islands*	230	160	1,180	1,570
11	Daman and Diu	562	654	211	1,427
12	Lakshadweep*	478	306	594	1,378
13	Pondicherry	627	2,306	1,524	4,457
	Total	**59,619**	**76,057**	**106,044**	**241,720**

Source: Marine Fisheries Census, Part-1, 2005, Report of Working Group on Fisheries for X Five Year Plan, MoA, 2001

Table G. Fish Production Over the Plan Periods

Plan Period	Fish Production at the end of the period ('000 t)			Growth (Per cent) during the plan period			Average Annual Growth rate
	Marine	Inland	Total	Marine	Inland	Total	
Pre-Plan Period (1950-51)	534	218	752		-	-	-
1st Plan (1951-56)	596	243	839	11.61	11.47	11.57	2.31
2nd Plan (1956-61)	880	280	1,160	47.65	15.23	38.26	7.65
3rd Plan (1961-66)	824	507	1,331	6.36	81.07	14.74	2.95
Annual Plans (1966-69)	904	622	1,526	9.71	22.68	14.65	4.88
4th Plan (1969-74)	1,210	748	1,958	33.85	20.26	28.31	5.66
5th Plan (1974-79)	1,490	816	2,306	23.14	9.09	17.77	3.55
Annual Plan (1979-80	1,492	848	2,340	0.13	3.92	1.47	1.47
6th Plan (1980-85)	1,698	1,103	2,801	13.81	30.07	19.70	3.94
7th Plan (1985·90)	2,275	1,402	3,677	33.98	27.11	31.27	6.25
Annual Plan (1990-91	2,300	1,536	3,836	1.10	9.56	4.32	4.32
Annual Plan (1991-92	2,447	1,710	4,157	6.39	11.33	8.37	8.37
8th Plan (1992-97)	2,967	2,381	5,348	30.42	69.83	45.44	6.49
9th Plan (1997-02)	2,830	3,126	5,956	4.62	31.29	11.37	2.27
10th Plan (2002-03)	2,990	3,210	6,200	5.65	2.69	4.10	4.10
10th Plan (2003-04)	2,941	3,458	6,399	1.64	7.73	3.21	3.21
10th Plan (2004-05)	2,780	3,520	6,300				

Source: Central Marine Fisheries Research Institute, Kochi for the period up to 1970-71, State Governments/ Union Territory Administrations since 1970-71; Hand Book on Fisheries Statistics, 2005

Table H. Fish Seed Production

Year	Production (million fry)
1973-74 (End of IV Plan)	409
1978-79 (End ofV Plan)	912
1984-85 (End of Vl Plan)	9,639
Vll Plan	
1985-86	6,322
1986-87	7,601
1987-88	8,608
1988-89	9,325
1989-90	9,691
Annual Plans	
1990-91	10,332
1991-92	12,203
VIII Plan	
1992-93	12,500
1993-94	14,239
1994-95	14,544
1995-96	15,007
1996-97	15,852
IX Plan	
1997-98	15,904
1998-99	15,156
1999-2000	16,589
2000-01	15,608
2001-02	15,758
X Plan	
2002-03	16,333
2003-04	19,231
2004-05	20,811

Source: Hand Book on Fisheries Statistics, 2005

Table I. Fishing Harbours and Fish Landing Centres Commissioned/ under Construction By State/ Union Territory

A. Maior Fishing Harbours

Port	Cost (Rs lakhs)	Year of sanction	Status	Designed Capacity			
				DSV (No)	MFV (No.)	Draft (m)	TL
1. Vishakhapatnam							
Stage I	955.50	1975	C	90	300	4.5	1,938
Stage II	1099.20	1978	C				
Staqe III	454.30	1998	C				
Staqe IV	354.00	2001	C				
2. Madras							
Stage I	1,334	1973	C	50	500	3.0	1,220
Stage II	850	1994	UC	No change in capacity. Stage II for additional facilities			
3. Cochin							
Stage I	494	1971	C	57	450	6.0	560
Stage II	77 (100)	1993	UC	No change in capacity. Stage II for additional facilities			
4. Calcutta (Roychowk)	370	1971	C	15	-	6.0	120
5. Paradip	2,834(3,807)	1990	C	50	500	6.0	2335
6. Mumbai (Sassoon Dock)	825 (1,099)	1977	UC	-	700	3	1153

B. Minor Fishing Harbours and Fish Landing Centres

Sl. No	State/ Union territory	Minor Fishing Harbour		Fish Landing Centres	
		Commissioned	Under construction	Commissioned	Under construction
1	Andhra Pradesh	3	1	2	15
2	Goa	-	-	2	2
3	Gujarat	4	2	20	2
4	Karnataka	6	3	10	3
5	Kerala	8	5	23	5
6	Maharashtra	1	1	35	1
7	Orissa	3	2	21	7
8	Tamil Nadu	7		11	10
9	West Bengal	4	1	12	
10	A & N Islands	1	-	-	- 1
11	Daman and Diu	-	-	2	-
12	Lakshadweep	-	-	3	-
13	Pondicherry	1		1	-
	Total	**38**	**15**	**142**	**46**

* Data as on 1996-97, ** Data as on 1997-98
Figures in brackets indicate the revised cost
C - Completed/ Commissioned; UC- Under construction DSV Deep Sea Vessels; MFV- Motorised Fishing Vessels; TL- Total length of landing + berthing + outfitting + repair quay/wharf (in meters)
Source: Ministry of Agriculture, DAHD & F & Hand Book on Fisheries Statistics, 2005

Table J. Details of Fish Farmers Development Agencies (FFDAs)

(Achievements till 2003-04)

Sl. No.	State/UTs	No. of FFDAs	Water area covered (ha)	Fish farmers trained (nos.)	No. of Beneficia-ries	Average Productivity (kg/ha/yr)
1	Andhra Pradesh*	22	4,120	11,927	5,805	3,500**
2	Arunachal Pradesh	2	824	3,500	4,907	1,100
3	Assam	23	4,522	22,882	13,190	1,750
4	Bihar	33	25,290	30,459	33,773	2,180
5	Goa	1	-	-	-	
6	Gujarat	21	61,322	25,886	17,583	1,040
7	Haryana	18	13,948	16,055	17,547	3,730
8	Himachal Pradesh	2	573	5,560	2,523	2,800
9	Jammu & Kashmir	2	9,162	4,443	4,614	3,000
10	Karnataka	18	54,564	15,875	11,161	3,417
11	Kerala	14	28,177	25,058	83,458	1,465
12	Madhya Pradesh	38	81,773	40,461	91,984	1,360
13	Maharashtra	29	27,487	17,076	61,618	1,135
14	Manipur	8	2,909	4,853	8,773	2,400
15	Meghalaya	2	798	2,067	2,067	1,500
16	Mizoram	5	1,310	7,326	5,327	3,000
17	Nagaland	8	2,998	3,915	16,931	1,800
18	Orissa	30	37,326	48,552	134,721	2,390
19	Punjab	17	17,515	22,982	14,493	6,094
20	Rajasthan**	15	7,637	11,604	7537	1,447
21	Sikkim	1	181	1,345	1,634	3,,500
22	Tamil Nadu	17	23,255	7,792	13,,690	1,000
23	Tripura	4	10,023	1,02,678	48,951	2,200
24	Uttar Pradesh	53	1,11,265	11,3986	107,751	2,550
25	West Bengal	18	1,16,483	20,5225	383,640	2,685
26	Pondicherry	2	242	701	,994	1,410
27	Uttaranchal	3	134	1,050	1,394	2,240
28	Jharkhand	16	537	5,759	19,895	1,200
29	Chattisgarh	7	5,083	2,767	9,405	2,373
	Total	**429**	**6,49,458**	**7,61,778**	**11,25,366**	**2,216**

* Data as on 1996-97; ** Figures of 2002-03

Source: Ministry of Agriculture, DAHD & F, Hand Book on Fisheries Statistics, 2005

Table K. Details of Brackishwater Fish Farmers Development Agencies (BFDAs)

Sl. No.	State	No. of BFDAs	Districts
1	Andhra Pradesh	6	Krishna Mellore Srikakulam East Godavari Prakasam West Godavari
2	Gujarat	3	Valsad Surat
3	Karnataka	2	Bhroach Uttar Kannada Oakshin Kannada
4	Kerala	7	Ernakunam Quilon Cannanore Thrissur Allappuzha Kozhikode Kasargod
5	Maharashtra	4	Thane Ratnagiri Raigad Sindhudurg
6	Orissa	7	Kendrapada Gangam Khurda Puri Jagatsinghpur Balasore Bhadrak
7	West Bengal	3	North 24 Parganas South 24 Parganas Modnapore
8	Tamil Nadu	5	South Arcot Thanjavur Chindambranar Chengai Anna and Ramnad
9	Goa	1	South and North Goa
10	A & N Islands	1	Port Blair
	Total	**39**	

Source: Hand Book on Fisheries Statistics, 2005

Table L. Fishers Population of India

(Hundreds)

Sl. No	State/Union Territory	Total No. of members				Number of family members engaged in fishing operations	
		Males	Females	Children	Total	Full time	Part time
1	Andhra Pradesh	2,494	2,509	3,931	8,934	1,175	1,507
2	Arunachal Pradesh	16	14	14	44	-	19
3	Assam	1,313	980	1,611	3,904	1,057	664
4	Bihar	13,912	12,667	23,014	49,595	371	583
5	Chhatisgarh	6,216	5,297	7,601	19,114	76	466
6	Goa	55	49	36	140	22	17
7	Gujarat	1,345	1,299	2,289	4,933	837	370
8	Haryana	59	33	73	165	27	14
9	Himachal Pradesh	15	14	27	56	6	6
10	Jammu & Kashmir	96	76	132	305	33	20
11	Jharkhand	5,779	5,716	7,814	19,309	52	214
12	Karnataka	558	529	502	1,590	144	99
13	Kerala	2,240	3,178	2,061	7,478	1,148	327
14	Madhya Pradesh	2,139	2,006	3,025	7,170	54	179
15	Maharashtra	634	466	619	1,718	196	497
16	Manipur	250	241	214	705	30	41
17	Meghalaya	5	5	14	24	-	5
18	Mizoram	55	53	71	179	1	14
19	Nagaland	58	55	36	149	-	-
20	Orissa	710	483	607	1,800	353	388
21	Punjab	22	19	51	91	16	13
22	Rajasthan	26	17	30	73	7	10
23	Sikkim	99	83	86	268	11	3
24	Tamil Nadu	1,720	1,561	1,485	4,766	693	431
25	Tripura	160	132	176	467	35	56
26	Uttar Pradesh	704	489	598	1,791	145	158
27	Uttaranchal	.32	.23	.35	1	.52	2
28	West Bengal	5,872	2,052	1,192	9116	2,679	4,465
29	A & N Islands	99	77	0	176	26	72
30	Chandigarh	2	1	2	5	2	1
31	D & N Haveli	-	-	-	-	-	-
32	Daman & Diu	76	78	101	255	41	
33	Delhi	5	5	15	25	2	3
34	Lakshadweep	104	26	0	130	42	38
35	Pondicherry	124	128	128	380	47	26
	India	**46,962**	**40,340**			**9,331**	**10,721**

(Data of the year 2002-03)

Table L. (contd.)

(Hundreds)

	State/Union Territory	Family members engaged fishing related activities other than actual fishing			
		Marketing of fish	Repair of fishing nets	Processing of fish	Other activities
1	Andhra Pradesh	1,121	504	219	260
2	Arunachal Pradesh	420	-	-	-
3	Assam	132	113	26	-
4	Bihar	331	167	56	167
5	Goa	20	6	3	7
6	Gujarat	147	116	34	637
7	Haryana	-	-	-	38
8	Himachal Pradesh	2	1	-	-
9	Jammu & Kashmir	39	11	1	-
10	Karnataka	114	47	16	26
11	Kerala	254	135	81	426
12	Madhya Pradesh	152	103	23	15
13	Maharashtra	650	272	184	45
14	Manipur	-	-	-	-
15	Meghalaya	-	-	-	-
16	Mizoram	1	-	-	-
17	Nagaland	-	-	-	-
18	Orissa	132	113	4	9
19	Punjab	-	-	-	-
20	Raiasthan	-	1	-	-
21	Sikkim	-	-	-	-
22	Tamil Nadu	221	237	48	69
23	Tripura	13	4	-	1
24	Uttar Pradesh	246	89	50	376
25	West Bengal	613	320	95	394
26	A and N Islands	5	5	5	1
27	Chandigarh	3	-	-	-
28	Dadra & Nagar Haveli	-	-	-	-
29	Daman & Diu	-	-	-	-
30	Delhi	-	-	-	-
31	Lakshadweep	-	-	6	2
32	Pondicherry	31	13	24	89
	India	**4,647**	**2,257**	**875**	**2,562**

Source: Indian Livestock Census-1992. Summary Table Volume-I; Hand Book on Fisheries Statistics 2005

Table M. Structure of Fisheries Cooperatives

Sl. No.	State	State Federation (17)	Central Societies (108)	Primary Societies (11,440)	Membership	Total Fishermen
1	Andhra Pradesh	1	10	3,646	3,59,021	4,96,731
2	Arunachal Pradesh	-	-	4	,300	5,716
3	Assam	1	-	456	3,909	4,75,000
4	Bihar	1	5	532	40,000	11,13,018
5	Delhi	-	-	2	,239	16,430
6	Goa	1	-	10	1,000	18,836
7	Gujarat	1	4	385	80,000	1,40,208
8	Haryana	-	-	59	1,,005	16,034
9	Himachal Pradesh	-	1	28	7,096	8,455
10	Jammu &Kashmir	-	-	-		13,000
11	Karnataka	1	3	296	76,136	8,10,468
12	Kerala	1	16	292	2,00,000	7,10,502
13	Madhya Pradesh	1	7	1,001	62,570	1,30,982
14	Maharashtra	1	21	2,024	2,08,273	4,25,652
15	Manipur	1	-	181	9,182	32,350
16	Meghalaya	-	-	58	2,569	11,,097
17	Mizoram	-	-	36	808	,600
18	Nagaland	-	-	168	4,285	1,85,350
19	Orissa	1	4	482	1,20,000	2,02,112
20	Punjab	-	-	4	60	4,200
21	Rajasthan	1	-	107	4,624	13,557
22	Sikkim	-	-	-	-	,550
23	Tamil Nadu	1	10	675	4,44,866	2,67,309
24	Tripura	1	-	129	14,225	50,955
25	Uttar Pradesh	1	5	110	41,000	1,60,823
26	West Bengal	1	20	1,072	1,60,000	5,97,180
27	A & N islands	-	-	45	3,812	3,678
28	Chandigarh	-	-	1		,250
29	D & N Heveli	-	-	-	-	130
30	Daman & Diu	-	-	6	2,993	31000
31	Lakshadweep	-	-	2		6000
32	Pondicherry	1	2	36	28,754	10971
33	Chhattisgarh				31,427	
34	Jharkhand				9150	
	Total	**17**	**108**	**11,847**	**19,17,305**	**59,59,144**

Source: Hand Book on Fisheries Statistics 2005

Table N. Infrastructure for the Seafood Processing Industry

Category	Registered as on 31.3.1990	Capacity	Registered as on 31.3.2000	Capacity
Exporters	864	-	1,549	-
Fishing vessels	12,083	-	14,266	-
Freezing Plant	231	2,296	394	8,439
Canning Plant	24	84	13	51
Ice Plant	132	1,854	157	2,970
Fish Meal Plant	26	463	12	229
Peeling sheds	924	-	576	3,387
Conveyance	481	-	511	-
Cold Storage	304	42,458	479	105,991
Agar agar Plant	-	-	4	0.145
Isinglass	-	-	1	10
AFD Plant	-	-	3	3
Surimi Plant	-	-	5	112

Source: Report of Working Group on Fisheries for X Five Year Plan, MoA, 2001

Table O. Contribution of India to World Fish Production

(000' t)

Year	World Production			Contribution of India		
	Total	Marine	Inland	Total	Marine	Inland
1950	19,755	17,521	2,234	730	520	210
1955	28,642	24,968	3,673	839	596	243
1960	36,691	32,665	4,026	1.161	880	282
1965	51,229	46,141	5,088	1,331	824	507
1970	67.279	61,277	6,003	1,759	1,086	673
1975	68,341	61,481	6,860	2,267	1,482	785
1980	75,585	67,953	7,633	2,445	1,555	891
1985	91,553	80,888	10,665	2,839	1,747	1,092
1990	1,03,590	88,997	14,593	3,875	2,300	1,575
1995	1,24,152	1,02,801	21,351	4,998	2,786	2,212
1996	1,28,648	1,05,252	23,396	5,353	3,016	2,337
1997	1,30,882	1,05,770	25,112	5,477	3,024	2,453
1998	1,17,790	92,593	25,197	5,275	2763	2,512
1999	1,26,651	99,468	27,183	5,592	2848	2,744
2000	1,30,433	1,01,831	28,602	5,689	2852	2,837

Source: Hand Book on Fisheries Statistics, 2005

Table P. Fish Production Projections by the enf of XI Plan

(million t)

Area	Present Production (2006)	Proejcted Production (2012)
Marine capture	2.958	3.1
Mariculture	0.007	0.05
Inland capture	0.68	1.12
Coldwater fisheries	0.0003	0.001
Coastal aquaculture	0.113	0.25
Freshwater aquaculture	2.6145	5.088
Total	6.3728	9.609
Exports (Quantity)	0.46	1.06
Exports (Value in Rs crores)	7245	15,000

Source: Fisheries Division. ICAR, 2006

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BUDGETARY PROJECTIONS OF SCHEMES IN FISHERIES DURING THE XI PLAN

Schemes	Components	Budget (Rs crores)
Marine Fisheries		
Capture Fisheries		
Ongoing Schemes	Motorization of traditional crafts	20.00
	Forecasting, resource estimation and dissemination	5.00
	Ice boxes for traditional/ small scale sector	10.00
	Sea safety measures	10.00
	Installation of Artificial Reefs and FADs	20.00
New Schemes	Diversification/reduction of excess capacity of costal fishing vessels	75.00
	LPG kits for outboard engines	5.00
	Squid jigging technology	10.00
	Introduction of resource- specific deep sea fishing vessels	234.00
	MCS/VMS activities	10.00
	Sea ranching	11.00
Mariculture		
New schemes	Fishfish/shellfish hatcheries	25.00
	Mariculture development for finfish	80.00
	Seaweed culture	30.00
HRD in marine fisheries and mariculture	HRD in modern fishing, open sea mariculture	5.00
Sub total		**550.00**
Inland Fisheries and Aquaculture		
Ongoing Schemes	Capture fisheries Development of inland fisheries capture resources Programme for augmenting productivity of reservoirs Aquaculture Development of Freshwater Aquaculture (FFDA) Development of Aquaculture in hill regions Development of coldwater fish culture Development of water logged areas for aquaculture Development of inland saline soils for aquaculture Development of integrated coastal	432.00

	aquaculture	
New schemes		
Capture fisheries	Survey, assessment and evaluation of inland aquatic resources	60.00
	Improving productivity of inland open-water fisheries	35.00
	Improving Fish Productivity in Reservoirs	305.00
Aquaculture		
Freshwater	*Magur* breeding, hatchery establishment and seed production	6.00
	Advanced & Upgraded protocols for Carp breeding	10.00
	Seed certification (for both food fish and ornamental fishes)	10.00
	Certified Brood banks	30.00
Brackishwater	Hatchery establishment, Seed production of Seabass and Pearl spot (*Etroplus)*	50.00
Coldwater	Establishment of Mahseer seed production facility	5.00
	Construction of Community Raceways for Trout Farming in Hilly Regions	2.00
Conservation of fish stocks and fish diversity	Establishment of Centres/Facilities in States for surveillance, monitoring and reporting of fish diseases	10.00
	Establishment of Fish quarantine centers at strategic airports and international boarders	30.00
General	Establishment of Aqua- shops at district level in states	25.00
	State level soil-water testing and disease diagnostics laboratories	15.00
	Establishment of Aqua-Tech-Parks	10.00
Sub total		**1,035.00**
Infrastructure		
New Schemes		
Harvest	New fishing harbours	50.00
	New minor fishing harbours	162.50
	Upgradation of major fishing harbours	150.00
	Upgradation of minor fishing harbours	225.00
	New fish landing centres	46.00
	Upgradation of landing centres	150.00
Post-harvest	New model retail fish markets	100.00
	Modernisation of wholesale markets	145.00
	Transport & Insulated containers to societies	50.00
	Women's SHGs for marketing (Kiosks)	50.00

	Value addition @ 50% to SHGs	50.00
Culture	Domestication	50.00
	Holding centres, PCR labs, sales counters for brood stock	4.00
	Testing facilities for feed, seed & fish	10.00
Sub total		**1,242.50**
Welfare programmes, Governance, Transfer of technology and Capacity building		
Ongoing Schemes		
Welfare Programmes	Development of Model Fishers Villages	96.00
	Group Accident Scheme for active fishers	15.00
	Saving-cum-Relief	96.00
Capacity building and Awareness creation	Establishment of Awareness Centers	4.00
	Training programmes for fishers	7.20
	Extension literature &Video films	1.60
	Trainers' training & Refresher courses	10.00
New schemes		
Welfare Programmes	Hut insurance scheme	5.00
	Group insurance of fishers and farmers	15.00
	Mediclaim policy	10.00
	Incentives to Fisherwomen groups (SHG)	2.00
	Safety at sea	5.00
	Assistance to FISHCOPFED	10.00
Policy issues	National Fisheries Development Policy formulation and related aspects	5.00
Mangement and governance	Co-management, CCRF and certification of boatyards and hatcheries	9.60
Human resource development	Capacity building at the State level	10.00
	Use of IT in ToT	2.00
	Programmes for EDUSAT	1.00
	Vocational education in fisheries schools	0.25
	Capacity building of fisheries co-operative Associations, NGOs, SHGs	9.60
	Strengthening of Service delivery system	8.00
Co-operatives and Public-Private partnerships	Revitalization of Co-operatives	50.00
	Capacity building/training	7.50
	Demand generation for fish	50.00
Demonstration and Exhibitions	Location specific field trials and Demonstration units	5.00

	Trickle down extension	10.00
	Involving NGOs in ToT	2.00
Co-ordination and Linkages	FTDC	30.00
	ToT units at Fisheries institutes/SAUs	20.25
Sub total		**497.00**
Strengthening of Database and Information Networking		
	Sample Survey for estimation of inland fishery resources, their potential and fish production	5.55
	Census on marine fisheries	2.00
	Catch assessment survey for inland and marine fisheries	45.00
	Development of GIS for inland and marine fisheries	22.45
	Delineation of Brackishwater areas, assessment of productivity & production	3.00
Sub total		**78.00**
Fisheries Institutes		
Fishery Survey of India, Mumbai		
Ongoing Schemes	Survey of coastal pelagic resources	60.95
	On going activities excluding construction of buildings	210.63
	Creation of infrastructure facilities	16.20
New Schemes	Strengthening of Extension Division	1.10
	Acquisition of new vessels	185.00
	Re-commissioning of marine workshop, dredgers slip-way and Mini Dry-dock at Kochi	10.82
	Studies on population genetics of fish populations	2.00
	Resources monitoring in inshore waters	12.00
	Development of fisheries forecast models	2.00
	Coral Reef Ecosystem: Surveys and vestigations	2.30
	Training of Scientific and Technical personnel	2.00
Central Institute of Fisheries Nautical Engineering & Training, Kochi		
Ongoing schemes		10.00
New Schemes	Fishery Training Vessels	40.00
	Buildings	8.30
	Equipments related to marine engineering, fishing gear, navigation, etc.	5.00
	Minor works	18.00

	Salaries	2.00
Integrated Fisheries Project, Kochi		
	Induction of new generation technologies and processing in post-harvest sector	3.72
	Extending marketing efforts to cover large segments of consumers	0.51
	Establishing rural appropriate technology design and dissemination center	1.85
	HRD Activities in the fisheries sector	0.26
	Scheme to strengthen communication and information technology	0.15
	Capacity building in new technologies among the staff	0.40
	Support to on-going and above new activities	5.35
Central Institute of Coastal Engineering For Fisheries, Bangalore		
Ongoing Schemes		10.00
Sub total		**610.54**
Grand Total		**4013.04**

Summary of Projected Budgetary requirements for Fisheries in the XI Plan

Sl. No.	**Schemes**	**Budget (Rs crores)**
1	Marine Fisheries and Mariculture	550.00
2	Inland Fisheries and Aquaculture	1035.00
3	Infrastructure	1242.50
4	Welfare programmes, Governance, Transfer of technology and Capacity building	497.00
5	Strengthening of Database and Information networking	78.00
6	Central Institutes	610.54
	Total	**4013.04**

Provision of Rs 2,069 crores made for NFDB during the XI Plan