

**REPORT OF
THE WORKING GROUP ON
FISHERIES
FOR
THE TENTH FIVE YEAR PLAN**



**GOVERNMENT OF INDIA
PLANNING COMMISSION
JUNE - 2001**

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GLOSSARY

BFDA	=	Brackishwater Fish Farmers Development Agencies
BOBP	=	Bay of Bengal Project
CIBA	=	Central Institute of Brackishwater Aquaculture
CICEF	=	Central Institute of Coastal Engineering for Fishery
CIFRI	=	Central Inland Capture Fisheries Research Institute
CIFA	=	Central Institute of Freshwater Aquaculture
CIFE	=	Central Institute of Fisheries Education
CIFNET	=	Central Institute of Fisheries, Nautical and Engineering Training
CIFT	=	Central Institute of Fisheries Technology
CMFRI	=	Central Marine Fisheries Research Institute
CRZ	=	Coastal Regulation Zone
DAHD	=	Department of Animal Husbandry and Dairying
DBT	=	Department of Bio-Technology
DRDA	=	District Rural Development Agencies
EEZ	=	Exclusive Economic Zone
FFDA	=	Fish Farmers Development Agencies
FISHCOPFED	=	National Federation of Fishermen Co-operatives Limited
FSI	=	Fishery Survey of India
GDP	=	Gross Domestic Product
HACCP	=	Hazard Analysis and Critical Control Points
HSD	=	High Speed Diesel
ICAR	=	Indian Council of Agricultural Research
IFP	=	Integrated Fisheries Project
IRDP	=	Integrated Rural Development Programmes
KL	=	Kilo Litre
KM	=	Kilo Meter
KVK	=	Krishi Vigyan Kendra

MATSYAFED	=	Kerala State Cooperative Federation for Fishery Development Limited
MFRA	=	Marine Fishing Regulation Act
MPEDA	=	Marine Products Export Development Authority
MT	=	Million Tonnes
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 Cooperative Development Corporation
NDP	=	Net Domestic Product
NMLRDC	=	National Marine Living Resources Data Centre
NORAD	=	Norwegian Agency for Development
NRCCWF	=	National Research Centre on Cold-Water Fisheries
OAL	=	Over All Length
SAU	=	State Agriculture University
TACT	=	Total Aquaculture Centre for Technology
TRIFED	=	Tribal Cooperative Marketing Development Federation of India
TRYSEM	=	Training of Rural Youth for Self Employment
VMS	=	Vessel Management Service

EXECUTIVE SUMMARY

The fisheries sector has been recognised as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries and is a source of cheap and nutritious food, at the same time it is an instrument of livelihood for a large section of economically backward population of the country. More than 6 million fishers in the country depend on fisheries and aquaculture for their livelihood. Indian fisheries is an important component of the global fisheries, with India being the third largest producer of fish in the world and second in inland fish production (FAO 1998). India's share in the world production of fish has increased from 3.2% in 1981 to 4.5% at present. Fishery sector occupies an important place in the socio-economic development of the country.

2.0 Globally, fish production from capture fisheries and aquaculture showed decrease from 122 million tonnes (mt) in 1997 to 117 mt in 1998. However, the production recovered in 1999, for which the preliminary estimate is about 125 million tonnes. The global patterns of fish production owe much to the activities of China, which reports production in weight that accounts for 32 percent of the world total. Other major producer countries are Japan, India, the United States, the Russian Federation and Indonesia.

3.0 Fish production in the country has been showing an increasing trend and has reached a record level of 5.65 million tonnes in 1999-2000. The estimated fish catch in the year 2000-01 will be about 5.95 million tonnes and the production is likely to reach a level of 6.26 million tonnes by the end of the Ninth Five Year plan (2001-02). However, the achievement of 6.26 million tonnes is much below the target of 7.04 million tonnes set for the Ninth plan at a growth rate of 5.64% per annum. This is because of the slow progress in the marine fish production during this period. In fact, the growth in marine fish production during 1990s has been slow (2.19% per annum) compared to Inland fisheries (6.55% per annum). The progress in the inland sector during the last decade has been commendable.

4.0 India has a coastline of 8118 km and an EEZ of 2.02 million sq km. About a million people are involved in fishing operations. With the absolute right on the EEZ, India has also acquired the responsibility to conserve, develop and optimally exploit the marine living resources within this area. Marine capture fisheries play a vital role in India's economy. The growth in marine fisheries during the 1980s and 1990s has been slow as compared to the previous two decades. During the last decade (1990s) the marine fish production has reached a plateau. A quantum jump in catch from the presently exploited grounds and in certain areas up to 200 meter depth is unlikely. Most of the major commercially exploited stocks are showing signs of over exploitation. On the contrary, demand for sea food has been growing. The present scenario suggest that the current level of marine fish production from the exploited zone has to be sustained by closely monitoring the landings and the fishing effort and by strictly implementing the scientific management measures.

5.0 Exploitation of off-shore resources in the EEZ will have to be reconsidered in terms of not only the resources available, but also in terms of infrastructure. To avoid over-capitalisation and ensure a cautious growth of the infrastructure and investments, a rationalised approach will be essential in determining the number and size of fishing vessels, their resource specific gear as well as technology to be made available either indigenously or through foreign collaborations. The development of deep sea fishery industry is of concern to the entire marine fishery sector because it would have considerable impact on the management of near-shore fisheries, shore-based infrastructure utilisation and post-harvest activities, both for domestic marketing and export.

6.0 Our marine products have shown consistently improved performance in overseas markets in view of the high quality. Exports of marine products have maintained a steady growth and provisional figures indicate that our exports have crossed US\$ 1.4 billion in the period ending March 2001. Keeping in view the global demand for Indian Seafood and also its contributions to the economy, the Tenth Plan target for export earning from fish and fishery products should be targeted at about US \$ 2.5 billion.

7.0 India has vast inland water resources in the form of rivers and canals (0.2 million km), reservoirs (3.1 m ha) and tanks and ponds (2.2 m ha) offering tremendous scope for fish production. India ranks second to China in inland capture fisheries (FAO, 2001). The extensive network of Indian rivers (45 000 km) constitutes one of the major inland fisheries resources of the country. The rivers also serves as primary habitat for original germplasm of Indian fishes. The present day riverine fishery is below subsistence level with an average yield of 0.3 tonne per km, which is only about 15% of their actual potential. Irrational fishing practices are key factors responsible for declining riverine fish production.

8.0 Fisheries in inland open waters systems have been an important source of livelihood security and nutritious protein for the growing population in the country. The inland fisheries sector registered an impressive growth rate of 6.55% in 1990s. Of the total inland fish production, about 75-80% was obtained through aquaculture. The multi-purpose nature of use pattern in inland waters has relegated fisheries to low priority in most of the riparian states and their importance relative to other production systems has not been given due recognition. Consequently, most of the inland open water resources have witnessed habitat degradation with accompanying low fish yields. This has also contributed to reduced employment opportunities in the rural areas.

9.0 The country has a large unfulfilled potential for rural aquaculture and it can contribute considerably to improve the livelihoods of poor people. In India aquaculture has emerged as an important farming activity transforming aquaculture from a traditional livelihood-support rural activity to profit oriented production system. The future development of aquaculture will depend on improvements in new and adaptive research and management, especially in relation to emerging environmental issues and their mitigation.

10.0 The important challenge for aquaculture in India in the 21st century is to ensure sustainability and profitability. Environmental sustainability has to be achieved by adopting environmentally non-degradable, technically appropriate, economically viable and socially acceptable best farming practices. For achieving sustainability it is essential

to modify our approach to not only to farm level management, but also to the larger ecosystem level management, where the total carrying capacity of the ecosystem is involved. Fish farming integrated with agriculture and livestock production along with other rural activities in some parts of Asia, which is possibly one of the keys to abundance of aquaculture production and absence of conflict in China, has amply proved this.

11.0 To support the development of fisheries and aquaculture, the country needs essential infrastructure. Harvesting activities with well-equipped fishery vessels, shore-based facilities, cold chains and transport for marketing linkages up to retail outlets. The intermediary input producing sectors such as seed, feed and equipment and the operational automation would all need the overall support from ancillary industries such as mechanical engineering, refrigeration, electronics, etc.

12.0 To sustain fisheries in the new millennium, the quality, technical skills and management of fisheries manpower in the country will have to improve in consonance with the rapidly changing needs of our society, both nationally and internationally. Human resources development (HRD) for raising a cadre of experts at various levels to support research and vindicate a sustained development of the fishery sector is critically important. To enable a balanced development of the sector, an All-India Master Plan for HRD and social security in the fisheries sector should be prepared.

13.0 Notwithstanding the existing efforts made by several agencies, the fisheries database is infirm and needs considerable strengthening. Real time data on the resource, its levels and patterns of exploitation are needed for effective planning. There is need for greater emphasis on data and information that give timely information on the economic attributes of the industry such as regular costs and earnings surveys. Increased use of the Internet facilities is highly desirable.

14.0 The growth and development of the fisheries co-operatives in the country is yet to reach the desired level. It is felt that the vertical and horizontal expansion of the co-operative base is very necessary. 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.

15.0 The fish and shellfish industry has to be made sustainable. The health of the fish-eating population of the country should be an equally important concern of the industry. Certified seed and quality feed needs to be ensured as either of these could be the carrier of a problem which may unfold itself in the farm at a later date adversely affecting both the production and produce.

16.0 Similarly, in the fast developing international scenario of trade and food security, non-tariff trade barriers are likely to play a major role. In the light of growing interest in linking environment and labour standards to international trade, these developments could be seen as an opportunity as well as a matter of concern. In fact, the greatest denial of market access for fish and fish products from developing countries in future could be under the mantle of hygiene, quality and food safety standard. Central or state fisheries authorities, together with fish worker organizations and the scientific community could develop sustainability criteria and a management mechanism, which are realistic and practical. This would ensure that such trade barriers do not impact the livelihood of the fishers.

17.0 The existing fisheries policies and programmes in most of the States and Union Territories revolve around populist welfare measures and a large part of the annual Plan budget goes towards the welfare programmes. Though welfare measures are obligatory to sustain the artisanal sector, parallel development and regulatory measures also need to be implemented. Welfare programmes have to be reoriented in a manner which provides long-term gains to the fisher.

18.0 Fishing at sea has been recognized as the most dangerous occupation in the world. The data gathered from countries that keep accurate records show that occupational fatalities in those countries fishing industries far exceed the overall national averages. Future welfare programmes should be oriented towards sea safety measures, especially for the artisanal and small-scale fishermen. In general, the fisheries sector needs a sound and implementable policy and legal framework which can enable a gradual shift in the priorities from fisher welfare measures to development of sustainable fisheries and aquaculture.

19.0 Globally, per capita fish consumption has increased from about 9 kg per annum in the early 1960s to about 16 kg in 1997. The per capita availability of fish and fishery product has therefore nearly doubled in 40 years, outpacing population growth, which also nearly doubled in the same period. However, in India no significant change in per capita consumption has taken place due to large increase in our population. Our per capita consumption, as per Ninth Plan document was 9 kg per annum based on an estimate that 56 percent Indian population is fish eater. Assuming the fish eating population to remain at 56 percent of the total population of one billion, the current per capita consumption works out to around 10 kg per annum. During the tenth plan, the per capita consumption is targetted at 11 kg per annum.

20.0 To further ensure development of sustainable and responsible fisheries and aquaculture, policies and objectives for the Tenth Five Year Plan would have to be more realistic, concentrating on both management of the resource as on its development. The involvement of the end-users would also be critical in this regard. The elements of sustainability would have to be fully engrained into the fisheries and aquaculture activities to ensure optimization of yield levels, economic viability to the producers and sustained development of the resources for posterity. A sound regulatory framework developed in consultation with the community and other stakeholders is expected to pave the way for sustainable development of fisheries and aquaculture in the country.

21.0 Credit requirements of the fishers and fish farmers are being largely met through institutional sources. Nevertheless, the critical role of the middlemen, merchants and traditional money lenders in the chain is still in vogue. However, the present liberal policies of the banking sector hold a considerable hope for improvement particularly in the fishery sector. In order to ensure remunerative returns to the fishers, it is necessary to organise marketing channels supported by adequate facilities ensuring reasonable prices. Budgetary support for research, infrastructural development, training and extension for the culture based activities need to be enhanced greatly considering the potential of the sector. Keeping in view the emerging technologies and new possibilities in different aspects of aquaculture, it is necessary that the banks and other financial institutions, in consultation with NABARD and the concerned agencies revise the levels of credit financing, to promote higher growth in the sector.

22.0 Growth rate of fish production has been about 4.12% per annum during the 90s. However, the full potential of all the water bodies have not been realized. The country has not yet been able to utilise the full potential of inland fishery resources as well as the deep-seas. In spite of sizable investment for marine fisheries in the past the growth of marine fish production in 1990s has been rather slow at an average of 2.19% as compared to the inland fish production growth rate of 6.55%. This calls for a change in our priorities to make optimum use of our inland fishery resources.

23.0 It is proposed to give thrust to the following areas during the Tenth five Year Plan:

- ***Integrated development of riverine fisheries***
- ***Habitat restoration and fisheries development of upland waters***
- ***Development of reservoir fisheries***
- ***Vertical and horizontal development of aquaculture productivity***
- ***Management of coastal fisheries***
- ***Deep-sea fisheries with equity participation***
- ***Infrastructure development and improved post-harvest management***
- ***Management and policy intervention including monitoring, control and surveillance***
- ***Implementation of the code of conduct for responsible fisheries***
- ***Gender programmes***
- ***Strengthening of database and information networking***

24.0 In the eighth plan the growth rate of fish production was 4.8%. The ninth plan fish production target was set at 7.04 million tonnes envisaging growth rate of 5.64% per annum. Keeping in view the slow growth rate achieved in marine sector in 90s and stagnation in the near shore waters, a growth rate of 2.5% has been proposed during the Tenth plan. In view of the immense potential and prospects of inland open water fisheries and aquaculture development in the fisheries a growth rate of 8% has been proposed for this sector during the Tenth Plan. Thus, the overall growth rate both for marine and inland sectors comes to 5.44% during the Tenth plan. With the proposed growth rate of 2.5% and 8% in the marine and inland sectors respectively, it is estimated that a total fish production of 8.19 million tonnes (3.36 million tonnes from marine and 4.83 million tonnes from inland sector) would be achieved at the end of the Tenth Five Year Plan.

25.0 To provide an adequate and substantial support for the development of fishery sector, it may be necessary to consider an allocation of Rs. 1 800 crores to the fisheries division of DAHD in the Ministry of Agriculture in the Tenth Five Year Plan as against the allocation of Rs. 800 crores during the Ninth Plan. Based on an annual average inflation of 7%, the present value of Rs. 800 crore is computed at Rs. 1 200 crore and an enhanced outlay of Rs. 1 800 crore is proposed for the Tenth Plan (50% over the Ninth Plan). The proposed higher outlays would ensure meeting the food and nutrition requirements of the growing population without any adverse impact on the environment as well as ecological health of the marine and freshwater resources.

26.0 The present document is an effort to suggest a thematic approach for the Tenth Plan strategy for development of fisheries and aquaculture in India under the Department of Animal Husbandry & Dairying, Ministry of Agriculture. The document is expected to serve as a guideline for finalizing the Tenth Five Year Plan strategies for fisheries and aquaculture development in India.

CHAPTER I

1.0 WORKING GROUP AND TERMS AND REFERENCES

In pursuance of the decision taken by the Planning Commission vide circular No. M-12043/2/2000-Agri dated 15.11.2001 and subsequent amendments dated 21.11.2000 5.1.2001 and 9.3.2001, a Working Group on Fisheries for the formulation of Tenth Five Year plan has been set up. The composition of the Working Group is as follows:

1. **Dr. K. Gopakumar,** - **Chairman**
*Dy. Director General (Fisheries),
ICAR, Krishi Bhawan,
New Delhi – 110001.*
2. **Ms. Nita Chowdhury,** - **Member**
*Joint Secretary (Fisheries),
DAHD, Krishi Bhawan,
New Delhi – 110001.*
3. **Dr. M. Sinha,** - **Member**
*Director,
Central Inland Capture Fisheries Res. Institute (CICFRI),
24 Paraganas,
Barrackpore – 743001 (WB).*
4. **Dr. S. Ayyappan,** - **Member**
*Director,
Central Institute of Fisheries Education (CIFE),
Jai Prakash Road,
Seven Bungalows, Versova,
Mumbai - 400061.*
5. **Dr. V.S. Somvanshi,** - **Member**
*Director General,
Fishery Survey of India (FSI),
P.B. No./ 10004, Botawala Chambers,
Sir P.M. Road,
Mumbai – 400001.*
6. **Chairman,** - **Member**
*Marine Products Export,
Development Authority (MPEDA),
Ministry of Commerce,
MPEDA House, Panampally Avenue,
Kochi – 682 015.*

7. **Joint Secretary (Ports),** - **Member**
Ministry of Shipping & Transport,
Port Wing, Parivahan Bhawan,
Sansad Marg, New Delhi – 110 001.
8. **Joint Secretary (Plan Fin.)** - **Member**
Ministry of Finance,
North Block,
New Delhi – 110 001.
9. **Managing Director,** - **Member**
National Cooperative
Development Corporation (NCDC),
4, Siri Institutional Area,
New Delhi – 110 016.
10. **Shri M.M. Tewari,** - **Member**
Managing Director,
National Federation of Fishermen's
Cooperatives Ltd. (FISHCOPED)
7, Sarita Vihar Institutional Area,
New Delhi – 110 044.
11. **Shri M.K.R. Nair,** - **Member**
Fisheries Development Commissioner,
Department of Animal Husbandry and Dairying,
Krishi Bhawan,
New Delhi 110001.
12. **Dr. S.N. Dwivedi,** - **Member**
Ex-Addl. Secretary, DOD,
(Science Adviser M.P. C S&T)
E-1/106, Arera Colony, Bhopal – 462 016.
13. **Dr. P.V. Dehadrai,** - **Member**
Ex-Dy. Director General (Fisheries),
D-3/3403, Vasant Kunj,
New Delhi – 110 070.
14. **Dr. Y.S. Yadava,** - **Member**
Ex-Fisheries Dev. Commissioner,
Coordinator,
Bay of Bengal Programme (BOBP)
91, St. Mary's Road,
Abhiramapuram,
Chennai – 600 018.

15. **Dr. D.P.S. Chauhan,** - **Member Secretary**
*Deputy Adviser (Fisheries),
Planning Commission,
New Delhi –110 001.*

Co-opted Members

- (i) **Dr. B.N. Singh,** - **Member**
*ADG, Fisheries,
ICAR,
New Delhi*
- (ii) **Dr. M. Joseph,** - **Member**
*Director,
CMFRI,
Kochi.*
- (iii) **Dr. K. Devdasan,** - **Member**
*Director,
CIFT,
Kochi.*
- (iv) **Shri K. Om Prakash,** - **Member**
*Director,
CICEF, Bangalore.*
- (v) **Dr. S.C. Pathak,** - **Member**
*Chief Gen. Manager,
NABARD, Guwahati*
- (vi) **Dr. Kuldip Kumar,** - **Member**
*Director (Fisheries),
Himachal Pradesh'
Bilaspur.*
- (vii) **Dr. Meena Kumari,** - **Member**
*Head,
Fishing Technology,
CIFT, Kochi*
- (viii) **Dr. K. Haribabu,** - **Non-Official**
*President,
A.I.F.I.,
Vishakhapatnam*
Member
- (ix) **Shri Elias Sait,** - **Non-Official**
*President,
Seafood Exporters
Association, Kochi*
Member

(x) **Dr. S.D. Tripathi,**
Ex-Director – CIFE,
Mumbai.

- **Non-Official**
Member

Commissioners/Directors Of Fisheries

Haryana, Himachal Pradesh, Madhya Pradesh, Uttar Pradesh, Assam, Tripura, Orissa, West Bengal, Andhra Pradesh, Tamil Nadu, Gujarat, Karnataka, Kerala.

1.2 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 and recommend their continuation/discontinuation/modifications/convergence.

ii) To review the performance of the fisheries sector both inland and marine in relation to the physical and financial targets fixed for the Ninth Five Year Plan for on-going programmes and the likely achievements by the end of 2000-01 and 2001-02.

iii) To identify the various problems and constraints in the implementation of the on-going development programmes in the fisheries sector especially deep-sea fishing, brackishwater, fish-seed production, training and extension, fishery cooperatives, research and development linkages, fisheries statistics etc. along with the suggestive measures.

iv) To formulate suitable proposals for the Tenth Five Year Plan inclusive of objectives, policies, strategies, targets of production and physical programmes, relevant to various subjects, keeping in view the present status of development and available potential with special emphasis on (a) exploitation of deep-sea fishery resources (formulation of deep-sea fishing policy); and (b) judicious exploitation of resources in the near shore areas; and (c) use of full potential of different category of waters.

v) To formulate programmes as an 'Aquaculture Development Plan' to double the productivity and also the programmes for development of fisheries in open waters (reservoirs, rivers, lakes etc.), saline waters, use of water-logged areas and cold water fisheries in hill areas.

vi) To develop post harvest technology to minimize wastage of raw material (fish) and ways and means to link production and processing to enhance export of fish/fish products.

3. The Working Group may co-opt or associate official/non-official experts/representatives as its members and constitutes sub-groups as may be felt necessary.

4. The expenditure of the official members on TA/DA in connection with the meetings of the Working Group will be borne by the parent Ministry/Department/Organisation. The non-official members will be paid TA/DA by the Planning Commission as per SR 190 (a) for attending meetings of the Working Group.

5. The Working Group shall submit its final report to the Planning Commission by the end of May, 2001.

1.3 The Working Group held its first meeting on the 21st December, 2000 under the chairmanship of Dr. K. Gopakumar, Dy. Director General, ICAR at New Delhi. The chairman recalled the Terms of Reference of the Working Group and sought the views of various members on the problem areas so that a proper direction and methodology for improving the fishery sector could be given. All the members of the Group gave their views in detail on the subject. After detailed discussions, the Working Group decided to co-opt nine members including two non-official members representing different disciplines of the sector. Besides 13 Commissioners/Directors of Fisheries from different states were also co-opted. The Working Group also decided to constitute five sub-groups viz. Inland Fisheries (Open Water Resources) ; (ii) Aquaculture (Fresh-water/Coldwater/Brackishwater/Mariculture) ; (iii) Marine Fisheries (Coastal/Deep-sea); (iv) Marine Products (Export/Processing/Value addition etc.) ; and (v) Financing (Banking/Fishery Cooperative /HRD etc.). The sub-groups were requested to finalise the reports by the end of March, 2001.

1.4 All the state governments were requested to furnish the details of fishery resources and its potential, productivity and production of different waters in the prescribed proforma. In addition, they were also requested to furnish the present status of fisheries in their respective states indicating the identified constraints/problems alongwith the suggestive measures to overcome these problems. The states were also requested to furnish the details on area specific felt needs.

1.5 Most of the Sub-groups held their meetings in the months of February, March and April 2001. The second meeting of the Working Group was held on 24th April, 2001 at New Delhi under the chairmanship of Dy. Director General (Fisheries), ICAR. The Commissioners/Directors of Fisheries of states co-opted as members on the Working

Group were requested to make presentations covering the above items/areas. The presentations of the states and the notes given by the states and the suggestions given by the members on the Working Group were discussed. The reports of the three sub-groups received by this time were also discussed briefly. The chairman of the other two sub-groups were requested to expedite their reports. The Working Group also constituted a sub-group consisting Dr. P.V. Dehadrai, Ex-DDG (Fisheries), Dr. S.D. Tripathi, Ex-Director, CIFE, Dr. Y.S. Yadava, Ex-Fisheries Development Commissioner, Dr. M. Sinha, Director, CIFRI, Dr. Kuldip Kumar, Director of Fisheries, Himachal Pradesh. Shri M.M. Tewari, MD, FISHCOPFED and Dr. D.P.S Chauhan, Dy. Adviser (Fisheries), Planning Commissioner/Member Secretary of the Working Group for drafting the report.

1.6 On receipt of suggestions from other members of the Working Group and chairmen of the respective sub-groups, the draft report was finalised by the above Drafting Committee of the Working Group in meetings held on 30th April, 2001 and 21st May, 2001. The report was then submitted to the Planning Commission in June, 2001.

1.7 The above report was presented by the Chairman of the Working Group in a meeting of Steering Group held on 9.7.2001. On the basis of discussions in the meeting and subsequent inputs received from the DAHD and other members, the report was revised by the Drafting Committee of the Working Group in a meeting held on 23.7.2001. Subsequently, the revised draft of the report was considered and finalised by the Working Group on Fisheries in a meeting held on 7.9.2001. The final report was then submitted to the Planning Commission in September, 2001.

CHAPTER 2

2.0 INTRODUCTION

2.1 Fisheries sector has witnessed a steady growth from the First Five Year Plan onwards with the annual fish production increasing from around 0.53 million tonnes in 1950-1951 to 5.65 (Prov.) million tonnes during 1999-2000. Starting from a purely traditional activity in the fifties, both aquaculture and fisheries have transformed to commercial enterprises opening considerable potential for employment generation and contribution to the food and nutrition security and foreign exchange earnings of the country.

2.2 Globally, fish production from capture fisheries and aquaculture showed decrease from 122 million tonnes (mt) in 1997 to 117 mt in 1998. However, production recovered in 1999, for which the preliminary estimate is about 125 million tonnes¹. The global patterns of fish production owe much to the activities of China, which reports production in weight that accounts for 32 percent of the world total. Other major producer countries are Japan, India, the United States, the Russian Federation and Indonesia.

2.3 It has been generally recognised that the oceans surrounding India have the best-developed fisheries, but coastal resources in these oceans are under stress in many areas and require effective management, even though the potential for expansion may exist offshore. In India, while inshore waters have been almost exploited to the sustainable levels, the contribution from deep sea has been insignificant. Provisionally the current (1999-2000) annual fish production has been estimated at 5.65 mt – 2.83 mt from the marine sector against a potential of 3.9 mt and 2.82 mt from the inland sector against a potential of 4.5 mt.

2.4 Increases in fish production during the first four decades (1950-1980) of planned development in the country came from the marine sector, especially the coastal waters. However, in the last decade (1990-2000), landings from marine fisheries in the

¹ FAO, 2001. The State of World Fisheries and Aquaculture. pp 142

country have levelled off at about 2.6 ± 0.2 mt. This plateauing is not unique to India, but a global phenomenon during the last decade. Over-exploitation of the coastal stocks, global warming and impacts of El Nino, pollution from various point and non-point sources are some of the reasons attributed to the present scenario in the marine sector.

2.5 In marine fisheries many fundamental changes have taken place since the creation of Exclusive Economic Zone (EEZ). The gradual shift in the law of the sea towards the enlargement of the territorial sea (a width of 12 miles in contrast to 3 miles some 35 years ago), coupled with the continual assertion of jurisdictional rights over portions of what were regarded as high seas, has reflected a basic change in the attitude of the states to the sea.²

2.6 India has a coastline of 8118 km and an EEZ of 2.02 million sq km. About a million people are involved in fishing operations. It is estimated that for every fisherman engaged in primary fishing activity about four others are getting additional employment by way of post-harvest operations, fish marketing and a host of other allied activities. However, the growth in marine fish production over the recent years has been rather slow (an average of 2.2 percent during the period 1991-1992 to 1999-2000) as compared to the inland fisheries (average of 6.5 percent during the corresponding period). Gujarat has emerged as the leading producer of marine fish during 1999-2000, followed by Kerala, Maharashtra and Tamil Nadu.

2.7 Recently, the harvestable potential of marine resources from Indian seas has been revalidated as 3.934 mt by the Working Group constituted by the Ministry of Agriculture³. The present level of exploitation of our marine fish is around 2.8 mt. The exploitation from deep sea sector is still negligible and possibility exists to enhance our

² Malcolm N. Shaw, 1997. International Law. pp. 390 – 451

³ Ministry of Agriculture, 2000. Report of the Working Group on Revalidation of the Harvestable Potential from the Indian Seas.

marine fish production to 3.5 mt provided we can exploit at least 50 percent of the estimated deep sea resources of approximately 1.0 mt. However, this increase would need investments in the deep sea fishing sector by way of man power, vessels suitable for harvesting the deep sea resources and also a strong legal support. Unless this is done it is likely that further enhancement may be difficult from the current level of exploitation from the marine sector. Simultaneously, the marine sector also needs a retrospection in terms of the prevailing management regimes. To ensure long-term sustainability of the resources, the open access has to pave way to a regulated access.

2.8 India has vast inland water resources in the form of rivers and canals (0.2 million km), reservoirs (3.1 m ha) and tanks and ponds (2.2 m ha) offering tremendous scope for fish production. India ranks second to China in inland capture fisheries (FAO, 2001). However, the reported productivity from inland capture fisheries is very low and production has declined during the last 2-3 decades. This depletion in production is due to various anthropogenic interventions and multi-user conflicts. However, the country has to develop inland water resources, especially the reservoirs and the floodplain lakes to meet the growing demand of food fish in future.

2.9 Reservoirs constitute the single largest inland fishery resource in the country, both in terms of resource size and productive potential. The reservoirs are distributed under divergent geoclimatic, morphometric and edaphic environments and fish production from different categories of reservoirs – small, medium and large has been estimated at about 50 kg/ ha/ yr, 12.30 kg/ha/yr and 11.5 kg/ha/yr respectively, the average being about 20 kg/ ha/ yr.⁴ The present low levels of production from the reservoirs is on account of many reasons such as, lack of fish seed stocking, inappropriate gear and craft, poor landing and marketing channels, absence of closed season, etc.

2.10 Notwithstanding the low levels of yield, there are few reservoirs in the country where good management practices have resulted in increased yield, comparable to the best in the world. Gobindsagar in District Bilaspur, Himachal Pradesh is one such

example where scientific development has yielded positive results (120 kg/ha/yr). To tap the inherent biological productivity of the Indian reservoirs, the success achieved in Gobindsagar needs to be replicated in other reservoirs of the country also during the Tenth Five Year Plan and beyond.

2.11 Global aquaculture production has shown an annual growth rate of 10% since 1990 (FAO, 2000). This level of growth is likely to remain sustainable in future while other land-based food production systems are reaching their limits. In 1998, China harvested 69 percent of the world aquaculture production, while our production was only 5.2 percent. While production efficiency of Indian aquaculture in the last decade has been ameliorated by the improvement of traditional techniques through application of biotechnology and domestication of species, there still exists a vast potential to expand both vertically and horizontally.

2.12 The country has a large unfulfilled potential for rural aquaculture and it can contribute considerably to improve the livelihoods of poor people. In India aquaculture has emerged as an important farming activity. Aquaculture has expanded from its traditional areas in the eastern and north-eastern parts of the country to almost all the states and union territories where resources exist. In the process, a cadre of modern fish farmers has been created in the country. This has also transformed aquaculture from a traditional livelihood-support rural activity to profit oriented production system.

2.13 The important challenge for aquaculture in India in the 21st century is to ensure sustainability and profitability. Today fish farming is chiefly finfish oriented and carp centered. Carps, both exotic and indigenous, account for nearly 80% of India's production. This is a high volume, low value production system. In India unlike China diversification in aquaculture has not taken place. India so far has culture technology of about 15 species whereas China has developed farming practices for 39 species. Diversification is the need of the hour. Any further development in aquaculture should be essentially focused on diversification as well as on regions/ areas where the development is rather slow or marginal.

⁴ Sugunan, V V, Reservoir Fisheries of India, FAO Fisheries Technical Paper, No 345.

2.14 The future development of aquaculture will depend on improvements in new and adaptive research and management, especially in relation to emerging environmental issues and their mitigation. Environmental sustainability has to be achieved by adopting environmentally non-degradable, technically appropriate, economically viable and socially acceptable best farming practices . In many parts of India, the primary objective of fish farmers is profit and they neglect the long-term viability of farming. Besides sustainable farming practices, greater emphasis is also needed on disease diagnosis and health management. The movement of live aquatic animals within the country and from across the borders needs a regulation to protect the farmers from spread of diseases and surreptitious introduction of exotics. There is also a lack of good quarantine system in India. The Tenth Plan should take into consideration the necessity of introduction and implementation of quarantine system in India.

2.15 Fish has a significant quality for processing. In 1998, only 36 percent of world fisheries production was marketed as fresh fish, while the remaining 64 percent underwent some form of processing. Improved post-harvest processing is seen as a way of developing the fishery industry without increasing harvests. In the marine sector, the available landing and berthing facilities is able to meet the requirements of about 25 percent of the available fishing fleet, leading to congestion and spoilage of fish. In the inland sector, marketing is again the weakest link. Value addition is also poor in India. Even though production in Japan is less than half of India, value realization per kg of Japan is US \$ 4.37 compared to 1.11 \$/kg of India. Reducing losses through proper handling and improved processing can increase fish production and also add value to the catch. Sanitary and phyto-sanitary measures are expected to play a major role in both domestic marketing and exports. Incorporation of HACCP and ISO 9000 into the post-harvest activities is a dire necessity and adequate attention would have to be paid in this area for providing better trade opportunities to the producer.

2.16 International trade in fishery commodities fell back from a peak of US \$ 53.5 billion dollars (f.o.b.) in 1977 to US\$ 51.3 billion in 1998. A combination of factors, including recession in some East Asian countries is responsible for this slide in the

demand. Preliminary 1999 data indicate a four percent growth in the value of world fishery trade (US \$ 53.4 billion). Developing countries registered a net fishery trade surplus of US \$ 16.8 billion, slightly down from the 1997 level of US \$ 17.3 billion.

2.17 Today, globally 40 per cent of fish production, in live weight equivalent, is traded. Export volume has increased three times towards the end of 2000 as compared to 1970s. In India the marine products export is less than 10 percent of the production. One reason is that the inland sector virtually contributes nothing to exports. To attain economically sustainable aquaculture, the Tenth Plan should lay emphasis on production of value added fish from Inland aquaculture. To achieve this, thrust is needed on culture of species like sea bass and freshwater prawn as these species command high market price in international fish trade.

2.18 Our marine products have shown consistently improved performance in overseas markets in view of the high quality. Exports of marine products have maintained a steady growth and provisional figures indicate that our exports have crossed US\$ 1.4 billion in the period ending March 2001 (Table).

Table : Marine Products Exports

	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01*
Qty: in tonnes	296277	378199	385818	302934	343011	421072
V: in crores Rs.	3501	4121	4697	4627	5117	6309
US \$: in million	1111	1153	1296	1107	1189	1387

Source: MPEDA, Kochi (*) Provisional

2.19 Keeping in view the global demand for Indian Seafood and also its contributions to the economy, the Tenth Plan target for export earning from fish and fishery products should be targeted at about US \$ 2.5 billion. Most seafood processing industries in India have surplus capacities and they should be encouraged to diversify production line, implement value addition and explore new market outlets. They must also be directed to enter domestic markets with processed quality fish.

2.20 Globalization of economy is likely to have wider impact on fisheries in India. There is the possibility of global sourcing of fish by seafood processing companies for processing and re-export in view of their excess capacity. As the chances of large-scale import of quality fish like salmon and trout has opened to Indian market we have also to plan development of high value fish by farming to cater the demanding urban markets. In the deep sea sector, . possibility also opens for access rights and vessel leasing for distant water exploitation.

2.21 Globally, per capita fish consumption has increased from about 9 kg per annum in the early 1960s to about 16 kg in 1997. The per capita availability of fish and fishery product has therefore nearly doubled in 40 years, outpacing population growth, which also nearly doubled in the same period. However, in India no significant change in per capita consumption has taken place due to large increase in our population. Our per capita consumption, as per Ninth Plan document was 9 kg per annum based on an estimate that 56 percent Indian population as fish eater. Assuming the fish eating population to remain at 56 percent of the total population of one billion, the current per capita consumption works out to around 10 kg per annum.

2.22 The demand for fish in future will basically be determined by increase in the number of consumers and the preference for seafood. Disposable income also will play a key role in the future. Many developed nations like Japan may face a downward revision in economic growth. An unavoidable consequence will be reduction in demand for fish. As on today Indian seafood export trade has not experienced a set back. One way to address if recession takes place in future is to enlarge marketing within the country, as the demand for fish and seafood is high in India. The Tenth Plan should lay emphasis to develop internal markets for value added fishery products and implement strict quality control comparable to that of seafood exported. This is more important now in view of the globalization and relaxation of restrictions on import of fish and fishery products. Imported fish have to be rigorously assessed for quality. Unless we formulate exact standards for locally marketed fishery products it will be difficult for us to enforce regulations to imported marine products. This aspect should be given priority in the Tenth Plan.

2.23 Employment of the primary capture fisheries and aquaculture production sectors in 1998 is estimated to have been about 36 million people, comprising about 15 million full-time, 13 million part-time and 8 million occasional workers. Employment in aquaculture (inland and marine) has been increasing and is now estimated to account for about 25 percent of the total. Marine capture fisheries account for about 60 percent and inland capture fisheries for the remaining 15 percent (FAO,2000). In India, the total fishermen population as per the 1992 Census has been estimated at 6.7 million of which 0.74 million were reported as full-time fishermen (Table 22).

2.24 Fishers still remain as poorest of the poor and continue to occupy lower rungs in the social strata. Welfare programmes have to be reoriented in a manner which provides long-term gains to the fisher. Fishing at sea has been recognized as the most dangerous occupation in the world. The data gathered from countries that keep accurate records show that occupational facilities in those countries fishing industries far exceed the overall national averages. Future welfare programmes should be oriented towards sea safety measures, especially for the artisanal and small-scale fishermen.

2.25 Fisheries although recorded a higher growth rate of about 6 percent compared to that of low agricultural growth, the outlays earmarked during successive Plan Periods have not been commensurate to the growth rate achieved. Table given below gives a comparative account of outlays earmarked for fisheries sector (development and research) from the First Plan to the Ninth Plan.

Table : Plan-wise Outlays for Fisheries Development and Research

(Rs. in crores)

Plans	Total Outlay	Outlay for agri. & allied sectors	Outlay for fisheries	% of Plan outlay	Outlay for ICAR/DARE	Outlay for fisheries	% of total ICAR Outlay
	1960	294	5.13	0.26			
II	4600	529	12.26	0.27			
III	7500	1068	28.27	0.38			
IV	15902	2728	82.68	0.52	85.00	2.25	2.7
V	39322	4302	151.24	0.38	153.56	9.60	6.2
VI	97500	6609	371.14	0.38	340.00	15.75	4.6
VII	180000	10524	546.54	0.30	448.00	18.25	4.0
VIII	434100	22467	1232.82	0.28	1300.00	65.00	5.0
IX	859200	42462	2070.00	0.24	2100.00	125.00	6.0

2.26 To sustain the percent production levels from coastal fisheries and aim at a higher growth rate from the deep sea resource and aquaculture, fisheries sector would require higher outlays during the Tenth Plan Period. This would ensure meeting the food and nutrition requirements of the growing population without any adverse impact on the environment as well as ecological health of the marine and freshwater resources.

2.27 The 1982 United Nations Convention on the Law of the Sea (UNCLOS) provides that coastal states have sovereign rights over their economic zones for the purpose of exploring and exploiting, conserving and managing the fish stocks of the zones concerned. Such rights are accompanied by duties as to conservation and management measures in order to ensure that the fish stocks in the EEZs are not endangered by over exploitation and that such stocks are maintained at, or restored to levels which can produce the maximum sustainable yield. FAO intends to support Vessel Management System (VMS) which are supposed to be adopted by developing

nations to safeguard their respective EEZ from poaching and illegal fishing by neighbouring countries for better management and conservation of living resources. While these developments have resulted in significant changes in fisheries policy, planning and resource management of several Asian nations and have also had positive impacts on their economy, much more is still to be done.

2.28 Fisheries management is generally considered to be ineffective because of the common property nature of the resource coupled with free access to the fishery. However, management has proved to be effective in many a cases and improved a great deal over recent years. Various provisions of the Code of Conduct for Responsible Fisheries have been integrated into the policies and programme of the fisheries sector, both at the central and state levels.

2.29 To further ensure development of sustainable and responsible fisheries and aquaculture, policies and objectives for the Tenth Five Year Plan would have to be more realistic, concentrating on both management of the resource as on its development. The involvement of the end-users would also be critical in this regard. The elements of sustainability would have to be fully engrained into the fisheries and aquaculture activities to ensure optimization of yield levels, economic viability to the producers and sustained development of the resources for posterity.

2.30 The present document is an effort to suggest a thematic approach for the Tenth Plan strategy for development of fisheries and aquaculture in India under the Department of Animal Husbandry & Dairying, Ministry of Agriculture. The document is expected to serve as a guideline for finalizing the Tenth Plan strategies for fisheries and aquaculture development in India.

CHAPTER 3

3.0 PROGRAMMES FOR FISHERIES AND AQUACULTURE DEVELOPMENT DURING THE NINTH FIVE-YEAR PLAN

3.1 FISHERIES RESOURCES AND POTENTIAL

The country's fishery resources both marine and inland alongwith their potential is given in the following table.

1.	Length of the coastline (km)	8118
2.	Exclusive Economic Zone (million sq. km)	2.02
3.	Continental Shelf Area ('000 km)	530
4.	Length of Rivers, Canals (km)	191,024
5.	Brackishwater Area (million ha)	1.24
6.	Reservoirs Area (million ha)	3.15
7.	Tanks & Ponds (million ha)	2.25
8.	Beels, Oxbow & Derelict Waters (million ha)	0.82
9.	Marine Fish Potential (million tonnes)	3.93
10.	Inland Fish Potential (million tonnes)	4.50
11.	Fish Production (million tonnes) 1999-2000-	
	- Marine	2.83
	- Inland	2.82
	- TOTAL	5.65

The Country has a long coastline of 8118 Km and equally large area under estuaries, backwaters, lagoons etc. Highly amenable for developing capture as well as culture fisheries. After declaration of the Exclusive Economic Zone (EEZ) in 1977, the area available to India is estimated to 2.02 million sq. km. comprising 0.86 million sq. km on the west coast, 0.56 million sq. km. on the east coast and 0.60 million sq. km around the Andaman and Nicobar islands. With the absolute right on the EEZ, India has also acquired the responsibility to conserve, develop and optimally exploit the marine living resources within this area. State-wise both Marine and Inland Fishery resources are given in Tables (1 and 2).

The harvestable potential of marine fishery resources in the EEZ has been revalidated by a Group of Experts constituted by the Government of India, Ministry of Agriculture at about 3.93 million tonnes (October, 2000) consisting of 2.02 million tonnes of demersal, 1.67 million tonnes of pelagic and 0.24 million tonnes of oceanic resources (Table 5). In the Inland sector, the resources potential has been estimated at 4.5 million tonnes which takes into account the production from both capture and culture fisheries.

3.2 ONGOING FISHERIES PROGRAMMES OF DAHD

Department of Animal Husbandry and Dairying has been implementing the following plan schemes. The progress and achievements made under various schemes during the Ninth Plan are stated in the subsequent paragraphs.

(i) Development of Freshwater Aquaculture

Development of Freshwater Aquaculture has been one of the most important production oriented programmes implemented by the states as a Centrally sponsored Schemes through the Fish Farmers Development Agencies (FFDAs). 422 FFDAs had been sanctioned for establishment under this scheme covering all the potential district in the country through the earlier plans. These agencies provide a package of technical, financial and extension support to fish farmers. In order to boost inland fish production, assistance in the form of subsidy is given to fish farmers for construction of new ponds, reclamation/renovation of ponds and tanks, inputs (Fish seed, feed, fertilizers, manures etc.) for first year fish culture, running water fish culture, integrated fish farming, fish seed hatchery, fish feed mills etc. Subsidy for the above mentioned activities are given at double the rates to fishermen of Scheduled Tribes. Assistance is also given to progressive fish farmers as an incentive for purchase of aerators, who have achieved an average productivity of 3 T/ha/annum and raise to it further.

The scheme was revised during the Ninth Five Year Plan by increasing the unit costs and adding new components such as freshwater seed prawn hatcheries, laboratories (at state level), soil and water testing kits to each FFDA, integrated units including hatcheries for ornamental fishes etc. The funding pattern of the scheme was revised from 50:50 to 75:25 between the centre and the states.

Since inception of the scheme (1974-75) till 1999-2000, total water area covered under scientific culture is about 5.31 lakh ha. The total number of beneficiaries covered under the programme is 9.33 lakh and 6.34 lakh fish farmers/fishermen have been trained in improved practices during the same period. State-wise details are at Table 14. Against an allocation of Rs. 150.32 crore, an expenditure of Rs. 42.94 crore has been incurred during the first four years of the ninth plan.

(ii) *Integrated Coastal Aquaculture*

The main objective of centrally sponsored scheme is to utilize the country's vast brackishwater resources for fish/shrimp culture. Other subsidiaries objectives are to increase foreign exchange earnings through increased shrimp production, generation of employment opportunities and increase of income of fish farmers/fishermen in coastal areas. With a view providing technical, financial and extension support to shrimp farmers in the small scale sector, 39 Brackishwater Fish Farmers Development Agencies (BFDAs) had been sanctioned in all the coastal states and the UT of Andaman and Nicobar Islands. During the first four years of the Ninth plan, an area of about 5000 ha has been developed for shrimp culture in the country by the Agencies. State-wise list of BFDAs is at Table 15. Against an allocation of Rs. 15.24 crore, an expenditure of Rs. 5.84 crores has been incurred by the end of the fourth year of the Plan period.

The performance of the programme has been affected due to the Supreme Court judgement of December, 1996 prohibiting non-traditional shrimp culture within the Coastal Regulation Zone (CRZ) i.e. 500 meters from the high tide line. The matter is currently sub-judice.

(iii) Development Of Marine Fisheries

This is another centrally sponsored ongoing scheme, under which assistance is provided for the following activities:

(a) Motorisation of traditional craft

Under this programme, 50% of the cost of engine is provided as subsidy (subject to a maximum of Rs. 10,000 for Out Board Motors -OBM and Rs. 12,000 for In Board Motors – (IBM), which is equally shared by the centre and the states. Besides, a sum of Rs. 6,000 is also provided as grant to fishermen for purchase of gear. The entire cost of subsidy on engine and gear is met by the centre in the case of Union Territories. This component is being revised by increasing the subsidies and adding a new component for chemical treatment of catamarans for increasing its longevity.

Since inception of the scheme (from Seventh Five Year plan Onwards), about 34,000 traditional crafts including 5,100 in the first four years of the Ninth Plan have been motorised.

(b) Reimbursement of Central Excise duty on HSD oil

This is an on-going programme from 1991-92 onwards under which small-mechanised fishing vessels below 20 meters length are covered. The cost of Central Excise duty Rs. 351.75 per KL of the HSD is fully subsidized (Rs. 0.35 per ltr.) under this programme and is borne on 80:20 basis by the centre and the states. While in case of Union Territories and the states, which have exempted sales tax levied on HSD oil, subsidy is borne 100% by the centre. About 18,000 such fishing vessels are benefited under the programme on an average per annum for the last few years. Against an allocation of Rs. 86.55 crore, an expenditure of Rs. 45.45 crore has been incurred during the first four years of the ninth plan period.

The main objective of the programme is to provide some relief to the fishermen operating mechanised the fishing vessels of the aforesaid size towards part of the operational cost. The assistance availed by the fishermen reduce running time to fishing grounds and back thus help to reduce drudging the small scale marine fishing. It also augment fish production and export of marine products.

(iv) Fishing Harbour Facilities at Major and Minor Ports

This is also an ongoing Centrally Sponsored Scheme. Fishing harbours are being developed at both major and minor ports, in addition to fish landing centres. The objective of this scheme is to provide infrastructural facilities viz. jetty, dredging, reclamation, auction halls, slipway, workshop, and navigation facilities etc. for efficient operation of mechanised fishing vessels including deep sea fishing vessel and traditional craft at the fishing harbours.

Under this scheme, 100% grant is provided to Port Trusts for construction of fishing harbours at major ports. In case of minor fishing harbours and fish landing centres, the cost is shared on 50:50 basis by the centre and the states. Union Territories are provided 100% grant under the scheme. During the Ninth Plan, a new component on 'Repair and Renovation' has been added to the scheme for providing one time assistance to the states/UTs for improving hygienic conditions at the harbours to meet the international standards.

Since inception of the scheme, the Government of India has sanctioned 6 major fishing harbours, 48 minor fishing harbours and 171 fish landing centres. Out of this, 6 major fishing harbours, 33 minor fishing harbours and 130 fish landing centres have been completed. The remaining are at the various stages of construction. State-wise details are at Tables 13. Against an allocation of Rs. 150.17 crores, an expenditure of Rs. 49.90 crores has been incurred during the same period.

(v) Welfare Programmes for Fishermen

The Scheme has 3 components.

(a) Development of Fishermen Villages (DFV)

The objective of this component is to provide basic civic amenities such as housing, drinking water and construction of community halls for fishermen villages. In each village with 10 to 100 housing units, upto 5 tubewells and one

community hall can be constructed. One tubewell is provided where the number of houses in a village is more than 10. A community hall is provided only in those villages where the number of houses is not less than 75. The scheme was revised during the Ninth plan and the cost of houses constructed under the scheme is now Rs. 40,000, cost of tubewells is Rs. 30,000 outside the North-Eastern region and Rs. 35,000 North Eastern states and the approved cost of community hall is Rs. 1.75 lakhs. During the first four years of the Ninth plan, construction of 2250 houses have been completed.

(b) Group Accident Insurance (GAI) Scheme for active fishermen

The objective of GAI is to provide insurance cover to fishermen actively engaged in fishing. Active fishermen in the age bracket of 18-65 years only are covered under the programme. The scheme has been revised and the fishermen are now insured for Rs. 50,000 against death or permanent disability and Rs. 25,000 against partial disability. Premium amount of Rs. 14 per beneficiary per annum is shared equally on 50:50 basis by the Central Government and the State Government. In case of Union Territories 100% premium is borne by the Government of India. A single policy has been taken in respect of all those states/UTs who are participating through National Federation of Fishermen Cooperatives Limited (FISHCOPFED). During the first four years of the ninth plan, under the scheme, about 38.50 lakh fishermen have been insured at the rate of about 9.62 lakh per annum. The number is likely to increase further in the terminal year of the plan period.

(c) Saving-cum-Relief (SCR) for fishermen

The objective of SCR is to provide financial assistance to the fishermen during the lean fishing period. Till 1999-2000, this facility was available to marine fishermen only. The scope of the programme has been further extended to the inland fishermen from the current year 2000-01. The rate of contribution by the fisher folk is Rs. 75 per month for eight months for marine fishermen while it is

Rs. 50 per month for nine months for inland fishermen. This contribution is matched by a contribution shared equally between the centre and the state governments and the accumulated amount is distributed back to fishermen in four and three equal instalments for marine and inland fishermen respectively at the rate of Rs. 300 per month. About 3.25 lakh beneficiaries were covered under the scheme in 2000-01. Against an outlay of Rs. 100.36 crores, an expenditure of Rs. 69.39 crores has been incurred in the first four years of the Ninth plan.

(vi) Fisheries Training and Extension

This is an on-going central sector scheme from 1994-95 onwards. The main objective of the scheme is to provide training to fishery personnel so as to assist them in undertaking fisheries extension programmes effectively. The scheme also provides assistance to fisher-folk in upgrading their skills. To enhance training facilities, the scheme also provides assistance for setting up/upgradation of training centres. Expenditure on the scheme is shared on 80:20 basis between the Centre and the State Government. Other components of the scheme are :

- (i) to publish short, concise and useful manuals with a view providing adequate extension material to trainees and personnel associated with fish production and allied activities.
- (ii) Production of video films on the technologies developed by the Research Institutes/Organisations as well as State Fisheries Departments for the development of fisheries and its publicity through electronic media.
- (iii) To conduct meetings/workshops/seminars etc. which are of national importance and relevant to the fisheries sector.

Since starting of the scheme, about 6,600 extension officers and fishers have been trained in various activities of fish culture/farming. Besides, 18 training centres have been upgraded and 10 Awareness centres sanctioned under the scheme during the first four years of the Ninth plan. Against an allocation of Rs. 9.66 crore, an expenditure of Rs. 3.47 crore has been incurred in the first four years of the Ninth plan.

(vii) Development of Inland Fisheries Statistics

This is an ongoing central sector scheme from 1983-84 onwards, with a view to evolve standardised methodology for collection of inland fisheries statistics in the country. The scheme is now in operation in 19 states and is being extended to all the remaining states. The resource assessment survey work and catch assessment survey work have been completed in 158 and 56 district respectively (till 1998-99) under this scheme. Against an allocation of Rs. 6.84 crores, an expenditure of Rs. 3.31 crores has been incurred during the first four years of the ninth plan.

(viii) Assistance to Coastguard

The coastguard is authorized to monitor fishing by foreign vessels under the MZI Act, 1981. The scheme for affecting implementation of the Act for monitoring the foreign fishing vessels operating within the Exclusive Economic Zone (EEZ) of the country was introduced in 1990-91. The exercise under the scheme also helps the coastguard in ensuring safety of the Indian owned vessels fishing at sea and in rendering an assistance required. Against an outlay of Rs. 1.88 crores for the ninth Plan, an expenditure of Rs. 1.38 crores has been incurred during the first four years of the Plan period.

(ix) World Bank Assisted Project

A Shrimp and Fish Culture Project with World Bank assistance for developing about 3810 ha of brackishwater area and about 51000 ha of reservoirs/ox-bow lakes in the states of Andhra Pradesh, Bihar, Orissa, Uttar Pradesh and West Bengal became credit-effective in May 1992. The cost of the project was originally estimated at about Rs. 283.63 crore (equivalent to US \$ 95 million) from 1992-93 onwards for a period of seven years. About 90% of the total estimated cost of about US \$ 85 million was to be made available as IDA loan assistance.

Later, due to restructuring, the cost of the Project was revised to Rs. 172.66 crore for the development of 797.53 ha of brackishwater area and 68,700 ha of reservoirs and ox-bow lakes.

The extended period of the project is over by December, 2000. Brackishwater area of about 775 ha (97.1%), out of the targetted area of 797.53 ha in the states of Andhra Pradesh, Orissa, West Bengal have been developed. While under fish culture component reservoir area of 25490 ha (39%), out of the targetted area of 65525 ha have been taken up for fish culture in the states of Andhra Pradesh, Orissa and Uttar Pradesh. Similarly, 1740 ha (54.8%) of ox-bow lakes out of the targetted area of 3175 ha has been developed in the states of Bihar, Uttar Pradesh and West Bengal.

Under the project, expenditure as incurred by the concerned states and DAHD is Rs. 114.24 crores (66%) against the revised allocation of Rs. 172.66 crore. Expenditure incurred by the implementing states is of the order of Andhra Pradesh (67.5%), Bihar (35.5%), Orissa (45.2%), Uttar Pradesh (70.5%), West Bengal (84.0%) and DAHD (90.4%). State-wise details are at Table 16.

(x) Pilot Projects

During the terminal year (2001-02) of the Ninth Plan, the following pilot projects are being taken by the DAHD:

- (a) Development of Coldwater Fisheries and Aquaculture at a cost of Rs. 4 crores.
- (b) Development of Reservoir Fisheries at a cost of Rs. 1.00 crore.
- (c) Utilisation of Inland Saline Soil at a cost of Rs. 1.00 crore.
- (d) Development of Waterlogged Areas as Aquaculture Estates at a cost of Rs. 1.00 crore.

(xi) Institutional Support to the Fisheries Sector is provided by the following Four Institutes under DAHD:

(I) Central Institutes of Fisheries Nautical and Engineering Training (CIFNET), Kochi

The objective of the institute is to make available sufficient number of trained operatives for fishing vessels and technicians for shore establishments. In addition to the main campus at Kochi, the institute has units at Chennai and Vishakhapatnam. The institute has total intake capacity of 200 trainees for the two main courses of Mate Fishing Vessels course and Engine driver fishing vessels course, which are of 18 months duration. In addition the institute also conducts short term training programmes for sponsored/departmental candidates in fishing technology, gear technology etc. Against an allocation of Rs. 19.75 crores, an expenditure of Rs. 12.40 crores has been incurred by the end of the fourth year of the ninth plan.

(II) Integrated Fisheries Project (IFP), Kochi

The institute envisages processing, popularization and test marketing of unconventional varieties of fish. The institute has a fleet of five vessels of different sizes, a well-equipped marine workshop and a slipway to slip vessels upto 250 tonnes, an ice-cum freezing plant, and a modern processing unit. It also provides institutional training in various courses. Besides, the headquarters at Kochi, the institute also has a centre at Vishakhapatnam. Against an allocation of Rs. 24.54 crores, an expenditure of Rs. 9.50 crores has been incurred by the end of the fourth year of the ninth plan.

(III) Central Institute Of Coastal Engineering for Fishery (CICEF), Bangalore

The objective of this Institute is to conduct techno-economic feasibility studies for development of fishing harbours and brackishwater farms.

The Institute has been carrying on the following functions:

- (i) Carrying on reconnaissance survey, identify the suitability of sites for fishing harbours.
- (ii) Preparation of preliminary construction plans and detailed estimate.
- (iii) Conducting engineering and economic investigations.
- (iv) Preparation of project feasibility reports for brackishwater shrimp farms.
- (v) Designing of shrimp hatcheries and training of personnel.

The institute has investigated 13 fishery harbour sites and prepare the report for 11 sites so far during the Ninth Plan. Against an allocation of Rs. 3.00 crores, an expenditure of Rs. 1.21 crores has been incurred by the end of the fourth year of the ninth plan.

(IV) Fishery Survey of India

The Fishery Survey of India (FSI) is responsible for survey and assessment of marine fishery resources of the Indian EEZ. With its headquarters at Mumbai, the Institute has seven zonal operational bases at Porbandar, Mumbai, Mormugao and Kochi along the West Coast and Chennai and Vishakhapatnam along the east coast and Port Blair in the Andaman & Nicobar Islands. A total of 12 ocean going survey vessels are being deployed for fisheries resources survey and monitoring. Apart from collection of data for stock assessment studies, the vessels were also engaged in experimental projects and collection of sea truth data for remote sensing. Against an allocation of Rs. 130.77 crores, an expenditure of Rs. 53.87 crores has been incurred by the end of the fourth year of the Ninth plan.

List of ongoing central/centrally sponsored schemes for fisheries development during the ninth plan is at Table 17. While scheme-wise Allocation and Expenditure and Physical Targets & Achievements are given in Tables 18.

3.3 SCHEMES/PROGRAMMES BY OTHER AGENCIES

3.3.1 National Cooperative Development Corporation (NCDC)

NCDC started promoting and developing fishery cooperatives after its Act was amended in 1974 to cover fisheries within its purview. In order to discharge these functions effectively, NCDC has formulated specific schemes and pattern of assistance for enabling the fishery cooperatives to take up activities relating to production, processing, storage, marketing etc. Assistance is being provided to fishermen cooperatives on liberal terms treating the activities as weaker section programmes. Assistance to fishery cooperatives is provided by the NCDC for the following purposes:

- (i) Purchase of operational inputs such as fishing boats, nets and engines.
- (ii) Creation of infrastructure facilities for marketing (transport, cold-storages, retail outlets etc.
- (iii) Establishment of processing units including ice plants, cold storages etc.
- (iv) Development of inland fisheries , seed farms, hatcheries etc.
- (v) Preparation of feasibility reports.
- (vi) Integrated fisheries projects (marine, inland and brackishwater).

Since 1985-86, NCDC has been assisting Integrated Fisheries Development Projects (IFDPs), wherein all the activities from production to final marketing are integrated with forward and backward linkages. The main components of such projects and fishing inputs, infrastructure, marketing support, project management, extension, training, computerization etc. Under these projects, special emphasis is laid on training of employees, education of fisher members of the societies, creation of infrastructure for production, storage, processing and marketing of fish.

Till March, 2000, the NCDC has sanctioned assistance of Rs. 543.35 crores and released Rs. 335.42 crores for fishery development to cooperatives in different states and UTs. The above cost relates to 28 integrated projects. Of these total projects, 10 projects (7 in marine and 3 in inland sector) have been completed. Of the remaining 18 projects, 10 and 8 are in marine & inland sector respectively.

Against an outlay of Rs. 180 crores, an expenditure of Rs. 152.36 crores has been incurred by the end of the first three years of the Ninth plan period. In view of this, the allocation of fund in the fishery sector will not be sufficient to fulfill the demands of the beneficiaries. The routing of Department of Food Processing Industries (DFPI) grants-in-aid through the NCDC has been beneficial for the Fishery Cooperatives, since NCDC is providing single window service. However, this tie-up has been possible only in case of processing units. For inland fisheries, no such GOI funds have been available to NCDC. This has limited the environment in the development of inland fishery resources. NCDC has requested an enhanced outlay for ongoing and new programmes in the Tenth Five Year Plan.

3.3.2 National Federation of Fishermen Cooperatives Limited (FISHCOPFED)

National Federation of Fishermen Cooperatives Limited (FISHCOPFED) is the apex organisation of fishermen cooperatives in India. It came into being in 1980 and started its activities in 1982. Its goal is to facilitate the fishing industry in India through Cooperatives. During this period, FISHCOPFED entered a number of activities which can be classified in three categories viz. (i) promotional ; (ii) welfare ; and (iii) business.

Promotional activities of the agencies include organizing conferences on various aspects, supporting training initiatives, demonstration of scientific fish culture, transfer of intermediate technology, introducing marketing techniques, liaison with member organisation and various agencies, providing knowledge on health care and hygienic living etc. Federation is also involved in implementation

of Centrally Sponsored Schemes on Group Accident Insurance of active fishermen. At present, the Federation undertakes business activities on a limited scale because of its limited financial capabilities. These include inter-state and retail marketing of fish, fish seed and fishing requisites.

With the Federation at the top of the Cooperative structure, there are 17 Federations at the state level, 108 Central Societies at the district and regional levels and over 11,847 primary fishermen cooperatives societies. Membership of primary societies is about 13.78 lakhs covering about 21% of active fishermen in the country. State-wise details are given in the Table 23.

FISHCOPFED has requested an enhanced outlay as well as their participation and involvement in implementation of fisheries programmes in the Tenth Five Year Plan.

3.3.3 The Marine Products Export Development Authority (MPEDA), Ministry of Commerce

A number of ongoing subsidy assistance scheme are being implemented by the MPEDA. The schemes are :

(i) Export Production – Capture Fisheries

To increase the efficiency of large mechanised vessels, financial assistance for installation of fish finders, global positioning system, radio telephones and fish hold on board the vessels is given to the beneficiaries. Under the scheme, MPEDA subsidises 30% of the cost of the items and their installation charges subject to a maximum of Rs. 50,000 per vessel.

(ii) Export Production – Culture Fisheries

This scheme is exclusively to promote shrimp farming for augmenting export and shrimp production. Assistance in the form of subsidy is given for new farm development, small and medium size hatcheries and for effluent treatment system. Assistance given to the

beneficiaries is 25% of the capital cost with maximum ceilings of Rs. 1.5 lakhs per beneficiary for new farm, Rs. 5 lakhs for Medium scale hatchery and Rs. 1.5 lakhs for effluent treatment system whereas in case of small scale hatcheries, the assistance is Rs. 1.5 lakhs for private sector, Rs. 2.5 lakhs to cooperative sector and Rs. 5 lakhs to the government sector.

- (iii) Introduction of new technology, modernization of processing facilities and development of infrastructure facilities

Under the scheme, assistance is given to seafood processors for installation of machines for production of quality ice, generator, upgradation of cold storage, machinery and equipment for production of value added marine products, Seafood processing units and also given assistance to purchase insulated fish boxes, setting up of mini-laboratory and for establishing peeling shed with upgraded facilities. Besides, assistance is also given for setting up of water effluent treatment plants, chill room facilities and water purification system in seafood processing plants.

- (iv) Market Promotion

Under the scheme, MPEDA is assisting exporters for export of aquarium/ornamental fish, setting up chill storage, near the landing centre/airport and joint participation in international fairs to promote Indian Marine Products in new markets. grants-in-aid of a sum of Rs. 20 lakhs is also given to the companies for setting up of chilled storage at international airports. Besides, financial assistance is also given to ornamental fish breeders and to the Seafood processors/exporters for adoption of bar-coding on the packages.

3.3.4 Indian Council Of Agricultural Research (ICAR)

The Fisheries research in India is coordinated by the Fisheries Division of the Indian Council of Agricultural Research (ICAR), New Delhi. The aim of Fisheries and Aquaculture research is to conduct fundamental and applied

research in different aquatic ecosystems to generate appropriate and commercially viable technologies for sustainable evaluation/utilization, management and conservation of resources. Human resource development and product development, employment generation, development of domestic trade and exports are also added to this. Above all, the nutritional and food security of the country is the prime consideration of the fishery programmes.

The ICAR has established following 8 different resources specific fisheries research Institutes for developing technologies for exploitation of various aquatic resources from freshwater, brackishwater, coldwater, coastal and marine ecosystems for harvest and post-harvest technologies and an exclusive Fishery Institute (deemed to be University) for human resources development.

- (i) Central Marine Fisheries Research Institute (CMFRI), Cochin. The institute carries out work on Marine Fisheries resources and their exploitation besides training and extension programmes.
- (ii) Central Inland Capture Fisheries Research Institute (CICFRI) (the erstwhile CIFRI), Barrackpore. The Institute conducts research activities on open inland water systems and fishery resources in rivers, reservoirs, wetlands/lakes and estuaries besides, extension and training related to these systems.
- (iii) Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar. The institute deals with the research programmes and studies evolving technologies related to production and productivity in freshwater aquaculture and programmes as well as extension and training.
- (iv) Central Institute of Brackishwater Aquaculture (CIBA), Chennai. The institute concentrates on brackishwater aquaculture for developing technologies for shrimp and brackishwater fish culture systems and also connected extension and training programmes.
- (v) Central Institute of Fisheries Technology (CIFT), Cochin. The institute conducts R&D programmes on design of fishing crafts and gears, fishing technology, fish processing, preservation and also helps in Quality Control certification for export of fishery products.

- (vi) National Research Centre on Coldwater Fisheries (NRCCWF), Bhimtal. This NRC institute carries out research and studies on coldwater fishery resources and biology, ecology, breeding etc. of cold water fishes. It is also developing hatchery and aquaculture for indigenous and exotic coldwater fishes.
- (vii) National Bureau of Fish Genetic Resources (NBFGR), Lucknow. The institute conducts work on genetic characterization, gene-banking, biodiversity database and conservation of various fish species. The Bureau coordinates with the resources specific fisheries institutes and other national agencies in so far as fish conservation programmes are concerned.
- (viii) Central Institute of Fisheries Education (CIFE), Mumbai. The institute is a 'Deemed University' responsible for fisheries education at post graduate and doctoral level. It has developed uniform syllabus for fisheries education at post graduate level. The institute also conducts training programmes to state fisheries officials through its regional centres.

The fisheries research in ICAR is being conducted in five major areas through the above-mentioned eight fishery research institutes. The areas and the institutes concerned are as follows :

Capture Fisheries : CMFRI & CIFRI
Culture Fisheries : CIFA, CIBA, NRCCF & CMFRI
Harvest & Post-Harvest : CIFT
Fish Genetic Resources : NBFGR
Fisheries Education : CIFE

Thrust Areas – R & D

❖ CAPTURE FISHERIES

- Monitoring of exploited marine fish stocks
- Stock assessment of commercially important marine species
- Marine biodiversity, database, conservation and management
- Fisheries enhancements in inland open waters
- Catchment ecology in relation to fisheries
- Ecology and fishery potential of canals
- Riverine hydrodynamics and fish behaviour

- Hill fishery resources assessment and management
- Development of sport fishery in hill areas
- GIS based inventory of aquatic resources
- Development of predictive models

❖ CULTURE FISHERIES

- Breeding and culture of aquatic organisms
- Fish health management
- Fish nutrition and feed development
- Aquafarm engineering
- Integrated fish farming
- Environment Impact Assessment
- Cage and pen culture in large water bodies and floodplain wetlands
- Development of pearl culture technologies
- Ornamental fish culture
- Coastal zone management

❖ FISH GENETIC RESOURCES

- Cataloguing of germplasm resources and development of database
- Biodiversity repository
- DNA Fingerprinting of prioritized species
- Genetics and quarantine
- Exotics and quarantine

❖ FISHING AND FISH PROCESSING

Harvest

- Fuel efficient vessels for offshore and deep sea fishing
- Ecofriendly and responsible fishing techniques for EEZ.
- Craft and gear design improvement for marine and inland waters.

Post harvest

- Handling and transportation of fish
- Sanitation, hygiene and quality control
- Processing, value addition, packaging and marketing
- Waste utilization and by-products
- Bioactive substances from aquatic plants and animals
- Quality management and food security

Engineering

- Onboard and onshore equipments for fishing and fish processing

❖ FISHERY EDUCATION

- Education and training programmes in specialized areas of fisheries
- Fishery informatics and database
- Vocational and distance education
- Socio-economics
- Extension and Transfer of Technology
- Information Technology and production of educational materials

❖ NEW INITIATIVES

◆ All India Coordinated Research Projects

- Culture-based fisheries of small reservoirs
- Integrated management of inland saline waters
- mariculture and sea ranching

◆ Network Programmes

- Exotics and new candidates cultivable species
- Development of quarantine system
- Hill fisheries development
- Food safety risk assessment

3.3.5 Department of Biotechnology (DBT)

During the Ninth Plan the Department of Biotechnology has initiated various research projects in the area of Aquaculture and Marine Biotechnology. These projects were supported to strengthen the gap in the areas of health and diagnostics, transgenics, cell & tissue culture, intensive prawn culture, carp culture, feed and seed production, bio-active compounds and development of culture technology in non-conventional species, etc. These projects were taken up to sustain research and development needs and to help diversification in aquaculture towards production and productivity increase. The results are significant and are leading to product and process development for commercialisation. The achievements under the guidance of the Task Force show that the results are leading to transfer of technologies to industry and entrepreneurs.

The salient achievements under the programme are:

- Development of a heat killed whole cell vibrio vaccine using a virulent strain of *Vibrio harveyi*. This has shown immune response in shrimp (*Penaeus monodon*). The technology has been transferred to industry.
- New oligopeptide primers were designed for detection of white spot shrimp virus(WSSV) by PCR. This would be useful in developing a diagnostic test.
- The involvement of *Pseudomonas* and *Aeromonas* in Epizootic Ulcerative Syndrome(EUS) in fish was indicated.
- Monoclonal antibodies were developed against *Aeromonas hydrophila*. Hybridomas developed would be useful in developing diagnostic kits and vaccines against *Aeromonas hydrophilla*. Monoclonal antibodies for diagnosis, sero typing and characterisation of white spot shrimp virus(WSSV) was also developed.
- Viral DNA of Monodon Baculo Virus was studied at Madras University. Serological test developed for SEMBV in prawn could lead to a diagnostic test.
- Vaccines against infection by *Aeromonas sp* and *Pseudomonas sp*. have been developed at Bharathidasan University. These were found useful in preventing infections in cultured freshwater fishes like *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*.
- Bioreactors were developed for nitrifying water in closed system prawn hatcheries both for penaeid and non penaeid shrimp hatcheries. These reactors are found useful in handling nitrite and ammonia load in closed hatchery systems.
- Promising feeds were developed for semi-intensive prawn farming. Limited field trials were taken up. A package of shrimp feed production technology developed for semi intensive farming. An FCR of 1.6 to 2.1 has been achieved.

- An appropriate feed formulation was developed using fish viscera, poultry offal and silkworm pupae as an alternate to fish meal. Aqua-feed developed at CFTRI, Mysore employed a bio-conversion process.
- Synthetic GnRH analogues were developed for fish spawning. These analogues were found to be as effective as ovaprim and could lead to import substitute.
- A process has been developed for producing Tachypleus Amoebocyte Lysate (TAL). Its sensitivity in detecting endotoxin is high compared to available products (4ng/EU).
- Presumptive transgenic zebra fish were developed using rat growth hormone gene. Higher growth reported in Fo and F1 generation but the growth was slow in F2 generation. Experiments have been undertaken to transfer newly designed vectors to produce transgenic fish. The growth hormone of cDNA of the Indian carp and catfish were successfully cloned and sequenced.
- At JNU, genomic DNA libraries for catla and rohu have been constructed. The screening of these library using human interferon gamma cDNA insert was also attempted. Efforts are being made to produce disease resistant transgenic carp & zebra fish.
- Fresh water pearl culture technology has been developed in indigenous *Lamellidens sp.* Grafting and *in vitro* techniques have been standardised for quality pearl formation. New material for nucleus has been identified. This technology package is under transfer to entrepreneurs / industry. Marine invertebrate tissue culture laboratory has been developed. Leads have been obtained for producing tissue cultured pearls.
- *In vitro* tissue culture was attempted in seaweeds. Callus formation was observed in *Sargassum polystum* and *S.vulgare*. This protocol has been standardised.

- Development of culture technologies for black lip pearl, groupers/sea bass and seaweeds are under way through ongoing projects.
- New / non-conventional species taken up for aquaculture are seaweeds, clams, mussels, crabs, *Penaeus merquiensis*, *P.semisulcatus*, *Macrobrachium rosenbergii* etc.
- A prawn complex comprising hatchery, feed mill and farming system was set up for *Macrobrachium rosenbergii* . Prawn hatchery has an annual capacity of 10 million post larvae. A feed unit with a capacity of 250 kg. pellets per hour was established and feed production started. In a grow out system, the prawns were fed with newly evolved improved grow out diet in the pellet form produced in the feed mill. A harvest of 1.5 to 2.0t/ha has been achieved from the grow-out culture operation.

Since 1997 till 2001 period, the DBT has invested about Rs. 980.00 lakhs for supporting fisheries related research programmes in the country.

3.3.6 State Agriculture Universities (SAUs)

Fisheries education in India today is well organized. The country has a 4-year Bachelors Degree in Fisheries Science (B.F.Sc.) and a Two-year postgraduate course called M.F.Sc. These courses are run by the Agricultural Universities in India numbering 33 and one Central University and one Deemed University. The state Agricultural Universities (SAUs) are set up by the State Governments and run with the financial support (about 60%) from the ICAR. The Council plays a lead role in the management of Agricultural Universities in making policies, organizing curriculum and selection of Vice Chancellors and teaching staff.

The ICAR also gives substantial financial support by way of research grants and for building infrastructure like setting up modern laboratories, hostels, etc. 15% of the seats at B.F.Sc. level out 25% at M.F.Sc. level in all these colleges are reserved for ICAR. The ICAR conducts national tests for selection of suitable candidates for B.F.Sc. and M.F.Sc. courses. All students who opt to study outside their states are given scholarship by ICAR. The list of Fisheries Colleges offering graduate and postgraduate courses in India are given in table (26).

3.3.7 *Krishi Vigyan Kendras (KVKs)*

Despite extension being a state responsibility, the Indian Council of Agriculture Research support these efforts through a chain of KVKs. The first KVK was established by the ICAR in Pondichery during 1974. 261 KVKs have been established in the country by the end of the Eighth plan, out of which, 31 KVKs are equipped to impart training in fisheries. List is at Table (25). In these Kendras, the fish farmers are trained in available technologies according to their own needs and requirements. The philosophy is learning by doing and no formal education is required for these short term capsule courses. A KVK is attached to each of the three ICAR institute viz. Central Institute of Freshwater Aquaculture (CIFA), Bhubneshwar, Central Inland Capture Fisheries Research Institute (CIFRI), Barrackpore and Central Marine Fisheries Research Institute (CMFRI), Kochi with ascent on training in freshwater, brackishwater and mariculture respectively.

3.3.8 *Institutional Finance*

3.3.8.1 *NABARD*

The trend of disbursements of the first three years of the IX Plan indicates a growth rate of 23% during 98-99 from 97-98 and 13% increase during 99-2000 over the previous year. Actual ground level disbursements and the PLP projections in the first three years of the plan period are as follows:

(Rs. in crore)

	1997-98	1998-99	1999-2000
Ground level credit	338	443	508
PLP projections	424	479	573

The above level of achievement shows that it was 80% in the first year 93% in the second year and 89% in the third year of the plan period of the PLP projections. The average growth rate for the three years could be assumed as 15% over the previous year unless some drastic measures are initiated at the Government of India level. Based on trend of ground level credit disbursements and PLP projections the trend is given below for the remaining two years.

Ground level disbursements and PLP projections for IX plan period

(Rs. crore)

	1997-98	1998-99	1999-2000	2000-01	2001-02
Ground level credit	338	443	508	584(P)	672(P)
PLP projections	424	479	573	698	838

Based on the performance during the first three years of the IX plan period it is assumed that the remaining two years of the IX plan will continue to show a growth of 15% over the previous years thus achieving a ground level disbursement of Rs. 672 crores. Considering the same growth rate it is estimated that the ground level disbursements at the end of the tenth plan period would touch a figure of Rs. 1345 crores. The estimated share of sub sector would be 20% marine, 20% brackish, 55% inland and 5% Agro processing which will include schemes of export like shrimp farming units or processing units. The year-wise credit estimates are given below:

**Ground level disbursements estimated for the X plan period
sub sector wise**

(Rs. crore)

Sub sectors	02-03	03-04	04-05	05-06	06-07	Total
Marine	161	194	233	279	335	1202
Brackish	161	194	233	279	335	1202
Inland	444	533	640	768	921	3306
Agro-processing	41	48	57	70	84	300
TOTAL	807	969	1163	1396	1676	6010

It may be seen that the total ground level disbursements for the fisheries sector during the Tenth plan period are estimated as Rs. 6010 crores consisting of Rs. 1202 crore each for marine and brackish water, Rs. 3306 crore for inland sector and Rs. 300 crore for agro processing. This will bring prosperity in rural area since sector provides rural employment, food security and foreign exchange.

3.3.8.2 Insurance

A Group Accident Insurance Scheme for active fishermen is one of the ongoing welfare programmes being implemented by the centre government. This programme provides compensation to fishers who meet accidental death/disability. This is an ongoing programme under which the premium is equally shared by the central government and the state government concerned with no contribution from the beneficiary. An Evaluation Study of the scheme has been proposed by the FISHCOPFED during the current year. Reformulation of the scheme for the Tenth plan will be considered on the completion of the study.

Besides the above scheme, in Kerala, two insurance schemes viz. (i) The Kerala Fishermen's Welfare Fund Scheme operating under the Kerala Fishermen's Welfare Fund Act ; and (ii) Janta Personnel Insurance Scheme are in operation in the state. These scheme are implemented by the Kerala Fishermen's Welfare Board and the Kerala state Cooperative

Federation for Fishery Development Limited, respectively. The former scheme is a welfare programme and the entire premium is a responsibility of the state government whereas in the latter scheme, every fisher has to pay a premium of Rs. 15 per annum. The insured sum in the welfare scheme is Rs. 1 lakh in case of death/missing person by accident and in the latter scheme the insured sum is Rs. 1.5 lakh in the case of death/missing person by accident. Both the schemes have reported to be running to serve the interest of fishers for which these are formulated.

In the field of comprehensive insurance, although the above mentioned insurance schemes are available at present, but more components of the fishing and aquaculture activity (craft and gear, crops, household assets etc.) need to be brought under the fold of insurance. This shall save the fishers from the vagaries of climate, accident, disease and market failures. There are obvious discrepancies in the amount of insurance which should be uniform nationwide to avoid discrimination among beneficiaries.

3.4 Fish Production

Fish production in the country has been showing an increasing trend and has reached a record level of 5.65 million tonnes in 1999-2000. The estimated fish catch in the year 2000-01 will be about 5.95 million tonnes and the production is likely to reach a level of 6.26 million tonnes by the end of the Ninth Five Year plan (2001-02). However, the achievement of 6.26 million tonnes is much below the target of 7.04 million tonnes set for the Ninth plan at a growth rate of 5.64% per annum. This is because of the slow progress in the marine fish production during this period. In fact, the growth in marine fish production during 1990s has been slow (2.19% per annum) compared to Inland fisheries (6.55% per annum). The progress in the inland sector during the last decade has been commendable. Year-wise fish production during the Ninth plan is given in the following Table.

(million tonnes)

Year	Marine	Inland	Total
1996-97*	2.97	2.38	5.35
1997-98	2.95	2.44	5.39
1998-99	2.70	2.56	5.26
1999-00	2.83	2.82	5.65
2000-01	2.90	3.05	5.95**
2001-02	2.97	3.29	6.26***

* terminal year of the Eighth Plan.

** anticipated

*** target

3.5 Plan Utilisation

The fact that fishery sector has been recognised as a thrust area within the agriculture sector can be gauged from the successive plan outlays. From Rs. 5.13 crore in the first five year plan (1951-56), the total outlay has increased to Rs. 2038.58 crores in the Ninth plan (both central and states/Uts). The central outlay has increased eight times from Rs. 99.10 crore in the Seventh plan to Rs. 800 crore in the Ninth plan. Plan-wise outlay for fishery sector (both central and states/Uts) excluding research is given below:

Period	Total outlay (Rs. crores)
First Plan (1951-56)	5.13
Second Plan (1956-61)	12.26
Third Plan (1961-66)	28.27
Fourth Plan (1969-74)	82.68
Fifth Plan (1974-79)	151.24
Sixth Plan (1980-85)	371.14
Seventh Plan (1985-90)	546.52
Eighth Plan (1992-97)	1166.39
Ninth Plan (1997-2002)	2038.58

For the Ninth plan period, Rs. 800 crores (excluding Rs. 125 crores for research activities) have been earmarked for the fisheries in the central sector. Besides, an amount of Rs. 1238.58 crore has been earmarked for the states/Uts under their plan programmes. Year-wise allocation/expenditure under the central sector during the Ninth Plan period is given below:

Table : Year wise Allocation/Expenditure

(Rs. in crores)

YEAR	B.E.	EXP.
1997-98	119.15	85.06
1998-99	159.90	91.93
1999-2000	145.92	91.97
2000-01	120.70	85.98
2001-02	103.86	

As seen from the Table above, expenditure incurred during the first four years of the Ninth plan is about 44.3%, which may go up to 57.3% by the end of the plan period. The pace of utilisation of funds under various ongoing schemes has been slow for a number of reasons such as delay in approval of the Ninth plan, existing schemes could not be modified/revised, non-inclusion of new schemes/programmes etc. Besides, it is also felt that implementing mechanism both at centre and states becoming weaker and weaker presently. This requires attention of the government on priority at the appropriate level.

CHAPTER 4

4.0 REVIEW OF FISHERIES SECTOR

4.1 CAPTURE FISHERIES

The capture marine fishery resources comprise of a long coastline (8118 kms.) and EEZ (2.025 sq. kms.) while the inland , the resources comprise of rivers and canals, estuaries, floodplains wetlands, lagoons and reservoirs. Inland fishery resources hold enormous production potential to meet the inland fish requirement of the country. However, irrational norms of exploitation can endanger the delicate balance of these eco-systems leading to poor yields. Open water resources are managed on the basis of exploitation of natural stocks. Therefore, sound environmental protection norms are to be set and followed to develop the inland fishery resources in a sustainable manner.

4.1.1 Inland

The river system of the country comprises 14 major rivers (catchments >20000 km²), 44 medium rivers (catchments 2000 to 20000 km²) and innumerable small rivers and desert streams. Different river systems of the country, having a combined length of 29 000 km, provide one of the richest fish genetic resources in the world. Details of major rivers of India are at Table 3. The floodplain lakes are primarily continuum of rivers Ganga and Brahmaputra. These are in the form of oxbow-lakes (*Mauns, Chauras, Jheels, Beels* as they are called locally), especially in the states of Assam, Manipur, West Bengal, Bihar and eastern Uttar Pradesh. Reservoirs constitute the single largest inland fishery resource, both in terms of resource size and productive potential. A detailed study made by FAO in 1995 has estimated a total of 19 370 reservoirs in the country with a total area of 3.15 million ha. As per this study, the distribution of small medium and large reservoirs in India is as follows:

	Small	Medium	Large	Total
Number	19134	180	56	19370
Area (ha)	1485557	527541	1140268	3153366

4.1.1.1 Rivers and their floodplains

The extensive network of Indian rivers (45000 km) and canals (126334 km) constitutes one of the major inland fisheries resources of our country. The rivers also serves as primary habitat for original germplasm of Indian fishes. The present day riverine fishery is below subsistence level with average yield of 0.3 tonne per km, which is only about 15% of their actual potential. The catch statistics over the years indicated declining trends for riverine catch, both in quantitative and qualitative terms. The average yield of major carps in river Ganga has declined from 26.62 to 2.55 kg/ha/year during last four decades. The biologically and economically desirable fish species have started giving way to the low value species, exhibiting an alarming swing in the population structure. Recent studies at CIFRI have shown that environmental aberrations, like marked reduction in water volume due to increased sedimentation and water abstraction, accompanied with river course modifications and irrational fishing practices are key factors responsible for declining riverine fish production.

Indian floodplain lakes (0.24 million ha) are primarily continuum of rivers Ganga and Brahmaputra. These are mainly located in states of Assam, West Bengal, Bihar and Uttar Pradesh. They occupy important position in inland fisheries of India, because of their magnitude, their production potential and serving as breeding and nursing ground for riverine fish stock. These water bodies are extremely rich in nutrients. The floodplain wetlands are lying uncared for and are in the process of swampification. These are capable of yielding one tonne of fish per ha on an average, if subjected to scientific management. Therefore, a vast untapped production potential is yet to be harnessed in floodplain wetlands.

Much emphasis has been laid at various national and international scientific fora on conservation of fish germ plasm and diversity, particularly through adoption of effective conservative measures for riverine and floodplain fisheries. But it could not get place in any of the fisheries developmental schemes undertaken in earlier plans. Therefore, any effective action in this direction is still awaited. Presently, no State is willing to invest in development of fisheries of riverine resource simply because of the fact that advantage of the same would not only accrue to the State concerned. The fisheries of floodplain wetlands received attention only during ninth plan. Schemes were initiated in 1995-96 for the development of floodplain fisheries in U.P. and Bihar through a World Bank assisted project. Environmental impact studies were also conducted under the World Bank Project. Department of Fisheries, Assam and Assam Fisheries Development Corporation have recently taken up few beels for fisheries development under Assam Rural Infrastructure and Agriculture Services project, sponsored by World Bank.

The rivers and floodplains of the country may not be important from point of view of quantum jump in fish production due to "Common Property" nature of this resource and environmental reasons. But they are vital for conserving the original fish germ plasm which is essentially required even for sustained development of aquaculture.. Therefore, it is suggested to direct the plan activities towards development of riverine fisheries through in situ conservation of commercially important fish species, their ranching and habitat restoration. Culture-based-capture fisheries and habitat restoration may be the proposed actions for development of floodplain fisheries. For effective implementation of these actions, fishers' awareness programmes with their active participation are necessary.

4.1.1.2 Estuaries

The estuarine systems (2.7 million ha) are identified as important source of fish and prawn seed. These are vital for fisheries of both rivers and marine sector. The fisheries of estuaries in India are above 'subsistence level with average yield swaying between 45 to 75 kg/ha/year. Commissioning of Farakka barrage has brought definite changes in salinity and fish species composition of Hooghli-Matlah estuary. Increased water volume has a positive impact on the fishery of this estuary. The proposed impoundments in river Narmada would completely change the ecology and fisheries of its estuary in years to come. With some exceptions, this swapped physical and ecological environment is expected to offer immense potential for fishery enhancements. Neither any specific measure for development of estuarine fisheries have been undertaken in the past, nor anything is being suggested for the present, in view of present state of this fishery. Only restrictive measures to prevent over exploitation and responsible fisheries is the need of the hour.

4.1.1.3 Reservoirs

The post-independence period has witnessed commissioning of a number of small medium and large river valley projects leading to creation of a chain of impoundments in form of reservoirs. With present day magnitude of 3.15 million ha, reservoirs form the most important inland open water fishery resource of our country. State-wise distribution of reservoirs is at Table 4. The area under reservoirs is expected to reach 6.0 million ha in another two decades. The present fish production from reservoirs is estimated at 0.94 lakh tonnes, with over 79% contribution of small reservoirs, followed by large (14%) and medium (7%). At present level of management and utilisation, they yield an average of 20 kg/ha/year, which is far below the potential. Though much higher per ha fish productions are possible, even a moderate increase of 100 kg/ha for small and 50 kg/ha for medium and large reservoirs can provide an

additional increment of 1.65 lakh tonnes of fish (Valued at Rs. 49.50 lakh @ Rs. 30/- per kg). Therefore, reservoirs are one of the most potential fisheries resource for future fisheries development in our country.

Reservoir fisheries development in India has received some importance only recently when a World Bank funded Shrimp and Fish Culture Project (7 years from 1992-93 onwards) was implemented for reservoir fisheries development in the states of Andhra Pradesh, Orissa and Uttar Pradesh during ninth plan period. The three pronged strategies for reservoir fisheries, developed by CIFRI (enlargement of mesh size, balanced fishing effort and sustained stocking support), has paid rich dividends, wherever tried. Therefore, the fish production from different sized reservoirs may be increased through adoption of these practices which need include judicious stocking and suitable harvest and post harvest practices supplemented with improvement in infrastructural support in terms of facilities for raising stocking material, provision of suitable crafts and gears, HRD, and strengthening of fishers' institutions.

4.1.1.4 Upland resources

Indian upland fishery waters include rivers (8253 km), natural lakes (21900 ha) and reservoirs (29700 ha). The capture fisheries of these waters is poorly developed. It is characterized by low primary productivity of resources, slow growth rate of fish, inefficient fishing practices and inaccessibility of fishing sites. The data on resource and fish catch statistics also lacks proper documentation due to diffused nature of resources and small quantity of catch per fisher. The information gathered in recent past indicated alarming downward swing in quantity and average size of indigenous snow trouts, mahseers and exotic trouts. Upland fisheries remained less developed, primarily because of low income from this enterprise. It may be attributed to part time engagement and meager quantity of catch and absence of efficient craft and gear.

Whatever little attention has been paid in the past for development of fisheries of upland resources are restricted to promoting sport fishery with focus on brown trout. Assessment and conservation of resources, habitat restoration and development of suitable craft and gear are certain immediate measures required for development of fisheries of upland resources.

4.1.2 Marine

Marine capture fisheries play a vital role in India's economy. The sector provides employment and income to nearly two million people. The growth in marine fish production during 1950s and 1970s has been faster as compared to the inland fisheries. However, 1980s and 1990s, the trend has been reversed as the marine fish production has been slow as compared to the inland fisheries. During the last decade (1990s) the marine fish production have reached a plateau. A quantum jump in catch from the presently exploited grounds and in certain areas upto 200 meter depth is unlikely. Most of the major commercially exploited stocks are showing signs of over exploitation. But demand for sea food has been growing. The present scenario suggest that the current level of marine fish production from the exploited zone has to be sustained by closely monitoring the landings and the fishing effort and by strictly implementing the scientific management measures.

4.1.2.1 Coastal

The marine fishing fleet is estimated to be about 280491 nos. (inclusive of 810 FRP Catamarans and 135 Beach Landing Crafts) consisting of traditional craft (181284 nos.), motorised traditional craft (44578 nos.) and mechanised boats (53684 nos.). State-wise details are given in Table 6. In the total marine fish production, the share of traditional, motorised and mechanised sector is estimated at 9%, 26% and 65% respectively.

Coastal resources up to 100 m depth are subject to intensive fishing pressure and is exploited at levels close to or exceeding optimum sustainable limit. Problems of juvenile finfish mortality and bycatch discards increased with the intensification of shrimp trawling. Plateuing of catches, economic and growth over-fishing at several centres and inter sectoral conflicts in the coastal belt have highlighted the need for caution. Introduction of the principles of scientific fishery management is the need of the hour. There is increasing awareness in recent years among fishery scientists and management experts that any additional increase in fish production has to be obtained from offshore, deep sea and oceanic areas beyond the harvesting range of coastal fishing fleet.

4.1.2.2 Deep-Sea

While the inshore waters have been almost exploited to the MSY levels, the contribution from the deep sea has been insignificant. The thrust of the deep sea fishing industry has hitherto been directed at shrimps only, notwithstanding the other resources. As of today, the deep sea fishing industry is almost a 100% shrimp oriented enterprise, faced with over-exploitation of the available shrimp resources as well as the fierce competition from the smaller class of vessels.

Of the many options to harness the deep sea fishery resources, diversification of the existing deep sea fishing fleet and introduction of resource specific vessels for long-lining, purse seining and squid jigging is necessary in the present circumstances. Introduction of modern fishing vessels in the intermediate range (15-19 m OAL) is also essential to exploit areas between 70 m to about 150 m depth to harness both demersal and pelagic resources.

Lack of R&D efforts on fishing vessels best suited to the Indian conditions has also impeded the growth of this sector. The indigenous ship building yards are doing very little in improving the situation. List of Indian ship yards is at Table 24.

The development of deep sea fishery industry is of concern to the entire marine fishery sector because it would have considerable impact on the management of near-shore fisheries, shore-based infrastructure utilisation and post-harvest activities, both for domestic marketing and export. Similarly, while the upgradation of the small mechanised sector to support the entrepreneurial response in the sector will be given high priority.

4.2 Culture Fisheries

The share of inland fishery sector which was 29% in 1951 has gone up to about 49% in 1999-2000, indicating increasing contribution of inland sector to the total fish production. Further, it is significant that aquaculture production has increased tremendously during the last decade. Consequently, the percentage share of aquaculture in total inland fish production is estimated to be about 75-80%. Two specific aqua-produced, carps and prawns in freshwater aquaculture and shrimps in brackishwater aquaculture, have contributed to the bulk as well as value of the inland aquaculture sector.

4.2.1 Freshwater Aquaculture

Freshwater Aquaculture resources of the country have been estimated of the order of 13.67 million ha, of which 2.25 million ha are in the form of ponds/tanks, 8.27 million ha beels/jheels/derelict water bodies and 3.15 million ha reservoirs. The Present contribution of 2.8 million tonnes from these resources hardly commensurate with their vastness and offer the scope for more production with the available technologies in the country.

There has been a very impressive growth in fish production during 1990s in the country. A total production of 5.65 million tonnes was achieved during the year 1999-2000. Of the total, 2.83 million tonnes was from marine resources and 2.82 million tonnes from inland resources. The inland fisheries sector registered an impressive growth rate of 6.55% in 1990s. Of the total inland fish production, about 75-80% was obtained through aquaculture.

The main thrust in freshwater aquaculture in the country has been attributed to the Fish Farmers Development Agencies (FFDAs), set up in mid 70s. Of the total 422 FFDAs sanctioned to the states about 400 FFDAs are operational mostly at district level and some at regional/state level. These agencies provide technical, financial and extension support to the fishermen/fish farmers. The fact that these agencies have played a pioneer role in the promotion of freshwater aquaculture and have brought about 5.31 lakh ha water area under scientific fish culture and imparted training to over 6.34 lakh fishers in improved practices. The most significant achievement of the Agencies has been that a cadre of well trained fishers and entrepreneurs have been created in the country.

With the available resources, potential and technology, certain states in the country have shown better response and faster development when compared with others. It may be prudent to divide the states in the country in categories and provide the developmental thrust accordingly. Rural sector in all the states in the country deserve support for low cost rural aquaculture without discrimination for income generation, employment and judicious utilisation of aquatic resources available. In coordination with rural aquaculture, the entrepreneurial response to the sector needs to be organised for operational protocol, use of feed, chemicals and drugs, growth monitoring, disease control, harvesting, storage, marketing, transport etc.

4.2.2 Coldwater Aquaculture

Coldwater fishery resources encompass high and mid altitude lakes, rivers, streams and man-made reservoirs. According to conservative estimates, the riverine stream length holding coldwater fisheries in the two mountainous zones trained by the Indus and its tributaries, Jhelum, Chenab, Ravi, Beas, Satluj, Bhagirathi and Alaknanda are about 7,000 kms. The approximate fishable stream length of hill stream on North West and eastern Himalayas has been estimated as 3,200 kms. Further, there are large number of natural lakes located in the uplands of Jammu & Kashmir, Himachal Pradesh, Uttaranchal, Arunachal Pradesh and Sikkim. These natural eco-tops are virtually dotted all over the hilly terrain of these states and hold rich ichthyofauna of both commercial and sport fishes.

While there exist vast and varied scope for development of coldwater fisheries both on grounds of logistics and economics, these resources have largely remain untapped mainly due to lack of development and scientific efforts. The current fishing activities in the hills are limited to fishing/angling by individual fisherman in the rivers and streams, hardly of any commercial importance.

The successful evolvement of technology on commercial “Rainbow Trout Farming” through foreign-aided projects in J & K and Himachal Pradesh has opened tremendous potential in exploiting various hilly rivers and streams flowing in the foothills of Himalayas. Similarly, successful “Running Water Fish Culture Programme” being carried out by monoculture of mirror carp in the hill States has given a new impetus to the Aquaculture promotion programme in the uplands. The expansion of both these programme could go a long way not only in boosting fish production in the Himalayan states but also generation of large scale employment for hill inhabitants.

4.2.3 Brackishwater/Coastal Aquaculture

Coastal Aquaculture production in the country largely on account of shrimp farming is estimated that out of about 1.23 million ha identified as potential areas for brackishwater fish farming in the country, Of the total area, about 10% area is being farmed at present. Of this area, about 80% is under traditional farming systems and the remaining is under extensive and semi-extensive shrimp farming. The activities of shrimp farming on commercial scale are taken up in the states of Andhra Pradesh and Tamil Nadu. The traditional farming systems are located in West Bengal and Kerala.

Commercial shrimp farming is more than a decade old in India and both shrimp seed production and farming practices are based on technology imported mainly from South-east Asian countries. The rapid expansion in shrimp farming did bring its own problems and necessitated corrective measures. Guidelines have been issued by the Government to ensure that coastal aquaculture is planned, developed and managed with adequate checks and controls. In respect of the brackishwater-farming sector, there has been a major set back owing to a

number of reasons. These include the set back due to legal intervention (Supreme Court Judgement in December, 1996) affecting the production activities, incidence of diseases, social conflicts etc.

The Aquaculture Authority has been set up under the directives of the Supreme Court's judgement, which issues approvals for setting up of shrimp farms, the process is slow, which may take some time to pick up momentum. The Shrimp culture activities, however, continue within the frameworks of the Supreme Court's judgement and the guidelines provided by the Aquaculture Authority.

There has been lull in coastal aquaculture activities on account of above court judgement. A Review Petition has been filed in the Supreme Court against this judgement which is still pending. The Government had been considering to bring an enactment of legislation after a decision on the Review Petition. All these issues are to be sorted out by the authorities concerned. Brackishwater farming sector provides employment to several thousands of persons and contributes to export.

Current aquaculture development efforts will be strengthened to further improve the management and operation of aqua-farms to ensure their durability and environmental compatibility. Aquaculture sustainability and its implication on environment protection has been studied in the country recently. For the purpose a survey was undertaken including 966 shrimps farmers in Andhra Pradesh, Kerala, Tamil Nadu and Orissa. The study indicated that shrimp farming is profitable and can be sustainable but attention is required to environment management concerns. The recommendations are (i) improvement of farm management; (ii) use of water resources and sedimentation ponds; (iii) drying of pool bottom between crops; (iv) addressing conflict timely through application of EIA; (v) intensified monitoring of the coastal zone through appropriate agencies with power to punish the polluters; and (vi) development of local balanced feeds to reduce cost and risks. Further guidelines are to ensure that agriculture lands

are not converted to aquaculture, mangroves are not destroyed, buffer zones are created between agriculture farm and lands used for other purposes, and between villages and township with access zones, groundwater is not drawn for aquaculture, standards for effluents are formulated etc.

4.2.4 Mariculture

Mariculture is expected to be a major activity in the coastal areas in the years to come. Given the wide spectrum of cultivable species and technologies available, the long coastline and the favourable climate, mariculture is likely to generate considerable interest amongst the coastal population. At a time when we speak of over-exploitation in the near-shore waters, limited access to capture fisheries and the need for diversification, mariculture can be one of the most appropriate alternatives. Technologies for a couple of species are presently available in the country and there is an urgent need for developing package of practices for many more commercially important species (e.g. sea bass, sea bream). Work has been started for production of Seabass, for a hatchery and grow out system by ICAR with French Technical assistance at CIBA in Chennai.

However, with a possible scenario of large-scale mariculture activities taking place in the near future, it is likely that a situation akin to shrimp farming can be created where unplanned and a fast growth resulted in social conflicts and challenges to the sustainability of the coastal environment. To avoid repeating the shrimp history, a systematic investigation of the entire coastline would be necessary, to prepare a comprehensive status on the area-wise suitability of the available mariculture technologies, carrying capacity of the ecosystem, social, legal and environmental implications, research and policy support, credit availability and other forward and backward linkages. A status report of this nature would essentially be a SWOT analysis and keep us in preparedness if mariculture activities were to be adopted on a larger-scale during the Tenth Plan. It may also be worthwhile to develop an All India Coordinated Research Project on Mariculture for transferring the technologies developed so far. Pilot-scale programmes are essential for standardization and also to enable

the end-users to familiarize with the technology. The successful and country-wide adoption of composite fish culture is largely due to the AICRP on Composite Fish Farming implemented in representative states of the country.

4.2.5 Ornamental Fisheries

Ornamental fishes are no longer an entertainment for the hobbyist alone, they are now a craze the world over in the form of a big business. The world trade in ornamental fishes has touched a record figure of over US \$ 1 billion that is growing at about 10% per year with Asia sharing almost 70% of the total export trade. In Asia, the players are Singapore, Hongkong, Thailand, Indonesia, Philippines, Malaysia, Japan, Sri Lanka, and to a much lesser degree, India. Despite a vast potential, India has woken up rather late and had been missing the opportunity to join the bandwagon. About 50% of India's exports are to the USA followed by Japan (25%) and other countries and valued at about Rs 250 million.

A large number of freshwater ornamental fishes from India that belong to the family Cyprinidae are already known to the world. The family includes the colourful barbs and loaches which are abundant in almost all rivers and hill streams. *Puntius*, *Brachydanio*, *Danio*, *Barilius*, *Rasbora*, *Esomus*, *Trichogaster*, *Garra*, *Nemacheilus*, *Botia* and *Lepidocephalus* are well-known genera from the family Cyprinidae. These besides, there are certain catfishes which are equally popular.

Global trade in marine ornamental fish is fast picking up and its present contribution is about US \$ 39 million. India has some of the finest ornamental fishes in the seas around Lakshadweep and Andaman and Nicobar Islands besides Kerala, Gulf of Mannar, Palk Bay and Gujarat. Notable amongst these are a number of species of damsel fishes, parrot fishes, surgeon fishes, wrasses and butterfly fishes. Attempts to breed a few of these species, especially *Amphiprion chrysogaster*, in confinement have been quite successful opening up a new avenue for export.

Presently, the Indian export is almost entirely dependent on the freshwater species of ornamental fishes, the major exporting centres being Kolkata, Chennai and Mumbai. Development of marine ornamental fish export may soon bring Cochin and Goa also on the map. With the financial support provided by MPEDA by way of reimbursing 10% of the FOB value of exports, subject to a maximum of

Rs 2.00 lakhs per exporter, it appears that a breakthrough in the export of marine species is not far behind once the Government of India permits the removal of parent stocks from these areas. It is, however, necessary to note that they inhabit a very fragile system which is to be protected and conserved at all costs. Unregulated exploitation of these species would be highly dangerous. Moreover, export trade of ornamental fishes should not be based on exploitation of naturally occurring stock but a well planned breeding system will have to be established to envisage a sustainable trade.

Ornamental fisheries should not be seen as forex earner alone. These could be kept in the garden pools or glass bowls or tanks in houses, offices or public places as one of the most delightful and harmless pets which attract the children and old alike. These are highly educative when kept in public aquaria which are, unfortunately, almost non-existent or maintained in a very shabby condition. The pride of the nation, Taraporewala Aquarium, in Mumbai is now 50 years old and dying, if not dead. It is being pulled down to instal a third generation aquarium in its place.

The breeding and culture of freshwater ornamental fishes could generate great employment in almost all parts of India and develop into a local trade. Besides the fish, their food - live or artificial - aerators, thermostats, aquatic plants, sand and pebbles, chemicals and medicines for disease control, dead shells/corals and such other items that are placed inside the aquarium to make it look beautiful would create additional channels of trade and employment. This is an area for employment of women and school drop-outs who would find it

convenient to indulge in these exercises in their spare time. Some of the ICAR institutes, agricultural universities, and other organisations are already engaged in training the women.

With increasing supply of ornamental fishes, the demand for aquaria would also go up and production of aquarium tanks could be developed as a small scale entrepreneurship or cottage industry which will be an additional source of employment.

While the development of ornamental fish culture would be highly beneficial to the people in the neighbourhood of urban areas, it would also be desirable to establish large farms where new breeds and varieties could be developed by geneticists and disease investigations conducted. It is necessary to bear in mind that inbreeding in ornamental fishes would soon show its impact leading to heavy losses. Such farms would be the breeding grounds of fish geneticists and disease experts in the country. Florida (USA) boasts of the largest ornamental fish farm in the whole world while Madurai (Tamil Nadu) with its 4-ha farm in the private sector claims to have the largest and perhaps the only one in India.

4.3 *Post Harvest*

To support the development of fisheries and aquaculture, the country needs essential infrastructure. Harvesting activities with well-equipped fishery vessels, shore based facilities, cold chains and transport for marketing linkages upto retail outlets. The intermediary input producing sectors such as seed, feed and equipment and the operational automation would all need the overall support from ancillary industries such as mechanical engineering, refrigeration, electronics etc.

4.3.1 *Infrastructure*

Adequate infrastructure is the basic requirement for the development of any sector and fisheries is no exception. Strengthening of infrastructure development at the culture phase and also post-harvest infrastructure such as

storage facilities, iceplants, cold chains, roads and transportation etc., as well as affective marketing system in identified aquaculture areas are the key requirements for the development of this sector. This would ensure high profit margins to the producers enabling faster fisheries and aquaculture development.

4.3.2 Processing/Value Addition

The Indian seafood industry has a very humble beginning. It started in the early part of the century with the export of dried fish to Sri Lanka, Burma, Singapore, Hongkong etc., mostly South East Asian countries. In the 1950's the country started export of canned shrimp and fish. In India, approximately 67 per cent of the total fish production is consumed in fresh form as per the available data. Nearly 6 per cent is used for reduction into fishmeal. Altogether 23 per cent is consumed in processed and preserved form that includes 16 per cent used for drying, 7 per cent for freezing and less than one-half per cent for canning- almost all of these under medium and small- scale sectors.

Currently India exports over 55 commodities to world markets. A number of conventional value-added and non-conventional products like icing glass, chitosan etc. are also now exported from India. Existing infrastructure for the seafood processing industry is at Table 27.

In regard to innovative marketing mechanism, the traditional sale of whole fish to the consumer directly from the production centres has been the main cause of low remuneration to the producer and his dependence on middlemen. Organised sale of processed/filleted fish in consumer packs through a chain of retail outlets would help in enhancing income and generate large scale employment. Aquaculture produce has high potential for export to Gulf countries and even to USA.

Success of aqua-business in rural sector would largely depend on encouragement of entrepreneurship. Existing channels of input support could be utilised to establish production centres. These centres would need to be linked up with organised marketing, mechanisms on cooperative or consortium patterns. To begin with a few 'purple patches' could be created in the states.

4.3.3 Domestic Marketing

In spite of the emphasis on the overall development of fisheries for employment, income generation and export earnings, the sector suffers from weakness in the most essential component of organised marketing, both domestic and to some extent for export. The fishermen as primary producer needs to be paid remunerative prices on one hand and make fish products available to the consumer at reasonable rates on the one other. Wholesale fish markets are very few and retailing disorganized. Apart from six wholesale fish markets in Calcutta and one in Delhi, fish wholesale takes place at wholesale-cum-retail markets in all the consumption centres. Retail markets are usually unorganized and managed by private entrepreneurs, though owned by local administration. Overcrowding and unhygienic handling of fish is a common sight at these markets.

Due to lack of storage and preservation facilities, a bulk of inland catch is marketed in fresh condition. Although, reservoir/ floodplain/ culture-based fisheries has the advantage of influencing the supply to suit market conditions and alleviating price fluctuations, but the decision making process becomes more difficult and critical, particularly, due to uncertainty of marketing service support.

4.3.4 Export

Fishery sector has been one of the major contributors foreign exchange earnings through export. There has been phenomenal increase in the export of marine products both in quantity and in value terms during the last decade. The share of marine products in the total export earnings of India is around 3.4%. The quantity of marine products from the level of 139419 tonnes in 1990-91 has increased to 421071 tonnes in 2000-01. While the value of the export quantity has increased from Rs. 893.37 crores to Rs. 6,308.80 crores during this period. In the nineties, the export has increased with an annual growth rate of 10.41% and 20.23% in quantity and value respectively. Trend in export of marine products from 1961-62 to 2000-01 is at Table 20.

In recent years, there has been a diversification in export of items like frozen squid, cuttle-fish and variety of other fishes. Japan continued to be our major market, importing around 45% of the sea food from India followed by European Union in the recent past. Other major markets are USA, Belgium, Italy, Thailand, Republic of Korea, China, Taiwan, Hongkong, Singapore, Malaysia. Export to the Middle-East has shown an increasing trend in the recent past. A notable feature currently seen in the entry of low-value finfish as major export commodity.

Prospects of export lie in diversified fishing, products and markets. Tuna and Cephalopods have been identified as potential export candidates. The trade in frozen fish, fish fillets and Surimi is promising and the industry is to be adequately geared and equipped to handle and export them in value added packages. Freshwater species, such as major carps too have a potential market, specially in West Asia. Modernisation of the processing facilities to meet international standards is of primary importance for the industry in the coming years.

4.3.5 Quality Control

The hygiene and sanitation conditions in most of the harbours and fish landing centres are below the normal specifications. This is partly due to inadequacies in the design and construction of the facilities and partly due to poor maintenance. The user groups are largely responsible for the poor state of hygiene and sanitation. Accepted standards of hygiene and handling of fish demand that these facilities be maintained properly and contamination of fish be kept down to a minimum. The fishing harbours need to be modernised to meet minimum international standards for fish quality assurance. Special design approaches should be adopted to meet the requirements of standards laid down by Hazard Analysis and Critical Control Points (HACCP) and ISO 9000. If these requirements are not met in the immediate future, the marine products exports may face trade restrictions, since most of the importing countries have stringent hygiene and sanitary conditions. Further, a greater awareness is necessary for

the fisherfolk on the importance of hygienic handling and preservation of fish as also personnel hygiene in improving the quality of landed fish and prevention of loss and wastages.

4.4 Fishery Cooperatives

In Fisheries Sector there are 11,847 number of Primary Cooperative Societies in India with a total membership of about 13.78 lakh. The total business operation in these primary societies revolves around Rs. 149.49 crore.

The Fisheries Cooperatives in the country have developed into a 3-tier structure operating at the village, district and state levels. Out of 11,847 primary cooperatives, 1860 are in the marine sector. Some of the fisheries cooperatives still have organisational, managerial, and operational weaknesses making them unsuccessful, inactive or moribund in spite of Government support in terms of technical, financial, and infrastructural facilities. Most of the fisheries cooperatives have yet to reach their objectives. This can be attributed to the weak linkages with different organisations and also between the primary, district and state level cooperative societies, Federation, Apex bodies etc.

FISHCOPFED organised 4th National Cooperative Congress at Patna in March, 1997. A conference at Directors of Fisheries of State Governments was organised in Shimla during May, 2000. Concerted efforts were made to transfer intermediate technology to fishermen on net making and fish culture. Leadership training to office bearers, members and fish farmers and paid staff of fisheries cooperatives were organised. Imparted training to start 200 fishers in Bihar and Maharashtra during Ninth Plan period. Development of inter-state marketing suffered due to lack of funds. Even after acquiring the Import-Export Code, the required infrastructure could not be organised. Presently, the FISHCOPFED is procuring fish from Orissa for the requirement of Delhi. The Federation established demonstration cum fish production units in Maharashtra, Punjab and Delhi for the benefit of fishermen cooperatives. It also arranged supply of dry fish to North Eastern Region. The Federation participated in selecting the best three fishery cooperatives for the National Productivity Awards since 1992.

As a well known fact, the cooperatives are the only answer for creating a forum through which the technology for self sufficiency and income generation could be transferred to the fishers. But the saga of the fisheries cooperatives in the country is rather tragic.

The success stories are several though and they are the source of inspiration to us. The cooperatives movement must be made successful as there are no alternatives.

Out of several constraints, which have been understood to be blocking the performance of the cooperative societies, certain critical ones have been identified as poor management, unorganized skill enhancement mechanism, discouraging production and productivity trends, lack of infrastructure facilities, problematic financing and finance management, poor linkages with relevant organisations and indiscriminate gender bias etc.

During the Tenth Five Year Plan, the FISHCOPFED has proposed their participation in a number of schemes. The schemes are : (i) Human Resource Development ; (ii) Development of Freshwater Aquaculture; (iii) Development of Fish Marketing Infrastructure ; (iv) Social Security to Fishers; and (v) Development of Model Fisher Village to achieve its mandated goals. The total amount need by them for the schemes is estimated at Rs. 229.4 crore.

The country has vast fishery resources with great potential, however, fishery cooperatives represent one of the weaker sections of the society. There is a need to revitalize and strengthen fishery cooperatives in the country besides developing linkages among different tiers of fishery cooperatives. On the pattern of NAFED and TRIFED, procurement and marketing of fish is the need of hour to be undertaken in a large scale by the FISHCOPFED. To take up such activity for the benefit of fishers who are members of the cooperatives, there is a need to strengthen resource base of the Federation. FISHCOPFED has been requesting Government of India for making a provision of Rs. 25 crores to them towards share capital/seed money for the purpose. During the Tenth plan, the request of the Federation needs consideration on Priority for the benefit of large number of fishers in the country.

4.5 Credit and Insurance

Credit requirements of the fishers and fish farmers are being largely met through institutional sources. Nevertheless, the critical role of the middlemen, merchants and traditional money lenders in the chain is still in vogue. However, the present liberal policies of the banking sector hold a considerable hope for improvement particularly in the fishery sector.

As per the estimates by NABARD, total ground level disbursement for the fisheries during the Tenth Plan are estimated at Rs. 6010 crore against Rs. 2545 crore (provisional) in the Ninth Plan. The total estimates for the Tenth Plan of Rs. 6010 crore consists Rs. 1202 crore each for marine and brackish sector. Rs. 3306 crore for Agro-processing. Details are given under Para 3.3.8.1.

Assistance is also extended by the National Cooperative Development Corporation (NCDC) after its Act was amended in 1974 to cover fisheries. As a weaker section programme, the NCDC provides liberal assistance to fisher cooperatives for purchase of operational equipment, creation of infrastructure, preparation of feasibility reports and integrated fisheries projects.

An outlay of Rs. 250 crores is proposed for the ongoing schemes namely the corporation sponsored scheme for developed states/UTs (Rs. 120 crores) and corporation sponsored scheme for integrated Fisheries Development (Rs. 130 crores). In addition, during Tenth Five Year Plan, the NCDC has proposed new schemes viz. (i) Beel Fishery Development ; (ii) Reservoir Fishery Development ; (iii) Motorisation of Traditional Craft ; (iv) Intermediate Fishing Craft ; (v) Fisheries Training/Extention; (vi) Fish-finder/positioning Equipment ; and (vii) Introduction of new Technology at a total cost of Rs. 530 crores.

FISHCOPFED is implementing the centrally sponsored Group Accident Insurance scheme for the active fishers, under which more than 5000 fisher families have benefited upto December, 2000. The insurance coverage has been increased from Rs. 35,000/- to Rs. 50,000/- with the nominal increase in the premium from Rs. 12/- to Rs. 14/- during the ninth plan.

The comprehensive insurance has been serving the community though but more components of the fishing and aquaculture activities need to be brought under the fold of the insurance. Protection from the vagaries of nature, accidental loss of assets, disease outbreaks and market failures is as much necessary.

4.6 Human Resource Development

Investment in Human Resource development (HRD) could be the key for laying the foundation of a sustained developmental process in the fishery sector. The fishery sector needs skilled manpower at various levels, from research scientists to supervisory and operational staff at the field level. Certain higher categories of training is available through ICAR Institutes, State Agricultural Universities of Fisheries colleges. But the need is to provide in service training to the state level supervisory staff and to those farmers and fishers who need to be upgraded in their operation skill. There is a need to organize training programmes at the central, regional and local levels. There is also a need for college of Fisheries to establish linkage with other national laboratories and institutions of the conventional universities.

Fisheries and aquaculture play a critical role in the rural society and their economic activities. The proposed training programmes could be effectively linked with the parallel programmes of the Ministry of Rural Development such as TRISEM, IRDP and DRDA etc. for tapping the available additional fund resources for mutual benefits.

The mandate of the FISHCOPFED includes transfer of technology to fishers through training under the existing cooperative system in coordination with the networking of ICAR institutes located in proximity. FISHCOPFED proposes to create 20 fisheries cooperatives training centres and linking them with the existing training infrastructure under state governments/cooperatives. The growth and development of the fisheries co-operatives in the country is yet to reach the desired level. It is felt that the vertical and horizontal expansion of the cooperative base is very necessary. Emphasis also need to be laid on fisherwomen cooperatives 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.

To sustain Indian fisheries in the third millennium, the quality, technical skills and management of fisheries manpower will have to improve in consonance with the rapidly changing needs of our society, both nationally and internationally. Human resources development for raising a cadre of exports at various levels to support research and vindicate a sustained development of the fishery sector is critically important to India. Moreover, to maintain the pace of growth witnessed by the fisheries sector in the recent past, the efforts may have to be probably larger and faster by several times more than made earlier. For such an effort adequate funding to strengthen and streamline organisations, infrastructure and manpower would be the basic requirement.

Sectors like fisheries are expanding in multi-dimensional base hence manpower requirement especially at middle level opens up avenues for new employment opportunities. Therefore, education has to be re-oriented to meet the qualitative and quantitative needs of manpower, which should be able to manage the multi-disciplinary aspects of fisheries industry. In addition, the following programmes are envisaged during the Tenth Five Year Plan:

- Revival of training courses for state middle level officials by ICAR Fisheries Institutes namely CIFE and CIFRI.
- Establishment of Total Aquaculture Technology (TACT) centres for demonstration and training preferably under FFDA/FISHCOPFED.
- Publication of extension material in different languages for various categories of operatives and end-users.
- Establishment of Fishermen Cooperative Training Centres linking those with the existing ICAR/SAUs establishments in regard to fisheries and aquaculture.
- Encouraging/reorganizing private industry's efforts to raise the field level managerial and supervisory cadre for fisheries and aquaculture.
- Existing training mechanism available in states/UTs are required to be further strengthened to facilitate the skill enhancement mechanism for farmers/fishers at field operational level.

4.7 Welfare of Fishers-gender bias

Welfare of the under privileged, resource poor fisher class of the society should receive un-interrupted attention. What is that development when the concerned fisher is not at the centre stage of considerations? During seventh Five Year Plan through Ninth Five Year Plan. Programmes on Group Insurance Coverage, constructing model fisher colonies/housing, water supply and sanitation, saving-cum-relief for marine fishers during lean period were some of the highlights under welfare schemes. In addition, during Ninth Plan, insurance cover to fishers for loss of craft and gear was suggested. Similarly insurance of Fish Pond and pond fish were also suggested. However, these programmes could not be implemented during the Ninth plan. FISHCOPFED conducted the programme on Health Care, family welfare and awareness against AIDs through fishery cooperatives. Programmes on leadership development were organised. With a view to enhance productivity and income of the cooperative members and opportunity for their employment, net making machines were provided with technology transfer back-up facilities.

To provide increased opportunity to fisherwomen through cooperatives studies on gender integration was conducted. Cooperative management education was extended to the women folk. Skills for net making, fish marketing, small savings were directed towards the women folk of the community. Absence of organised marketing for fish and fish products at any level in fishery cooperatives is of serious concern.

Due to ignorance among the fisher community the significance of the housing and village development has failed to percolate down to the fishers. It is envisaged during Tenth Plan to continue housing programme along with other facilities such as drinking water, recreation, etc. However, the housing scheme is dominating the activities of certain states with obvious subjectivity. The activities need to be made more rational and the state governments need to be made more production oriented with emphasis on post harvest and marketing development.

Efforts are to be made to register all women fisheries cooperatives wherever possible.

There is a need to conduct a survey based study on the impact of development efforts on the techno-socio-economic status of the fishers to generate bench mark data for future development strategies.

4.8 Linkages

4.8.1 National

Several Ministries /Departments in the Union Government have fisheries included in their respective Rules of Business. Particularly in regard to marine fisheries development, the sharing of responsibilities between the Ministries of Agriculture, Commerce and Surface Transport, needs a well organised coordinating mechanism. Cooperative linkages with the Ministries of Surface Transport and Industry for coordinating the association of ancillary industries such as mechanical engineering, refrigeration, electronics, etc., with the marine fisheries is an important aspect and should be strengthened.

In support of export oriented fisheries and aquaculture, the responsibilities for production functions are being presently shared by the Ministries of Agriculture and Commerce in addition to the cardinal role played by the coastal States and Union Territories. These responsibilities need to be defined in detail. The post-harvest technology development, quality control standards, development and production of new and value added fish products as well as utilisation of by-catch through planned diversification necessitates a coordinated and organised thrust. Sustainable exploitation of the EEZ would also need close coordination between the Ministries and the Departments at the Centre and with the coastal State Governments and Union Territories. In this regard special mention may be made of the Coast Guards.

Breakthrough in research and development of new technologies have to find a place in the national stream of developmental activities. A sound system of technical backstopping and coordination between the Indian Council of Agricultural Research (ICAR) research institutes and the field-level

developmental agencies would help in speedy implementation and transfer of appropriate technologies to keep the fisheries sector ever modern. The catalytic roles of the Department of Ocean Development and Department of Biotechnology in promoting specific fisheries programmes would require larger participation by the resource specific research institutes and developmental agencies concerned.

Aquaculture for the benefit of farmers, rural educated unemployed youth, entrepreneurs as well as corporate houses is already being supported through the Central and State Government programmes, welfare agencies, NGOs as well as several bilateral and International funding sources through subsidies, loans and equity participation. The Government of India in coordination with the State Governments is promoting freshwater aquaculture in the country through district level Fish Farmers Development Agencies (FFDA), one each in 422 districts. For brackishwater aquaculture, a similar mechanism exists and 39 Brackishwater Farmers' Development Agencies have been set up to cover all the coastal districts in the country. The ICAR has established a large number of Krishi Vigyan Kendras (KVK) and many of them undertake training and demonstration on aquaculture. The Ministry of Rural Development has several programmes such as DRDA, IRDP, TRYSEM which are implemented in collaboration with Block Level Administration in the districts and these have funds available to support aquaculture activities through subsidies, employment and training. The Panchayats have the facilities to promote aquaculture for employment under Jawahar Rozgar Yojana. The funds available with the District Collector under Special Component Plan Funds could also be utilised for infrastructure development to promote aquaculture, particularly in the tribal sector. In addition to subsidies, technical support and coordination available from the above agencies, organizations such as National Cooperative Development Corporation (NCDC), as well as lead banks through NABARD refinancing programme have been supporting enterprises on a large- scale.

Several development programmes under agriculture sector such as mini-watershed in dry land farming and irrigation canals could have added components of aquaculture for additional productivity and remuneration to the rural folks, individually or to groups/ community. Aquaculture is highly suitable to integration with several components of crop and animal husbandry such as rice-fish farming, recycling of organic waste from cattle shed, pig sties, poultry sheds as well as highly profitable part of a multi-carp farming system. For technical support, linkages with agencies concerned at district/ block levels will be necessary, besides coordination with the Ministry of Rural Development and Employment. The Panchayati Raj institutions would have to be involved in a big way in the development of aquaculture and capture fisheries. The fisheries sector is lacking in dedicated NGOs and this needs to be strengthened, especially with regard to technology transfer programmes. Similarly, common extension programmes can be developed in association with the other production departments such as Agriculture, Animal Husbandry, etc.

4.8.2 Regional and International

With the rapid pace of globalisation, removal of quantitative restrictions and a regime of free trade, increasing movement of live aquatic animals, threats of non-tariff trade barriers, imposition of sanitary and phyto-sanitary measures, etc, the importance of regional and international cooperation has assumed much more significance than what it was in the past.

The 1990s have witnessed important international agreements and accords relating to the intentions of the international community to achieve sustainable fisheries and to which India has been a party. These agreements represent milestones in international efforts over many years and include Chapter 17 of Agenda 21 of the UN Programme of action which includes programme areas relating to coastal areas and the oceans; the 1992 International Conference on Responsible Fishing (held in Cancun, Mexico) and the 1993 Agreement to promote compliance with International Conservation and Management Measures by fishing vessels on the high seas.

All these contemporary global initiatives to which India has been a signatory call for concurrence and compliance and a greater interaction with the countries in the sub-region, region and at the international level. These developments also call for a more prominent role to be played by India, especially in the existing sub-regional, (e.g SAARC) and regional mechanisms (e.g BOBP, IOTC, BIMST-EC).

4.9 Policy Issues and Legislation

Entry 57 of List 1 of Seventh Schedule of the Constitution specifies *Fishing and Fisheries beyond Territorial Waters* as Union Subject, whereas Entry 21 of List II speaks of *Fisheries* as a State Subject. Reading both the Entries together, it follows that control and regulation of fishing and fisheries within territorial waters is the exclusive province of the State, whereas beyond the territorial waters, it is the exclusive domain of the Union. The Ministry of Agriculture as per its allocated business, helps the coastal States and Union Territories in development of the fisheries within the territorial waters, besides attending to the requirements of the sector in the EEZ. Therefore, management of fishery resource in the country, including exploitation in the EEZ requires a retrospection in terms of the present policy and legal framework supporting fisheries sector and also a close coordination between the Centre and the States. The following account details the requirements necessary for the sustainable development of the fisheries sectors.

Inland Fisheries

Fisheries in inland open waters systems have been an important source of livelihood security and nutritious protein for the growing population in the country. The multi-purpose nature of use pattern in inland waters has relegated fisheries to low priority in most of the riparian states and their importance relative to other production systems has not been given due recognition. Consequently, most of the inland open water resources have witnessed habitat degradation with accompanying low fish yields. This has also contributed to reduced employment opportunities in the rural areas.

The varied nature of inland open waters including rivers, reservoirs, estuaries and floodplain lakes require different regimes for their management. The ownership or revenue rights of most of them are vested with government or public institutions, e.g. State Departments, panchayats, etc., while some are under private property regime. Being state property, these resources have multiple uses, including fisheries. Therefore, these are either in open access or managed as common property resources and lack a well-defined fisheries management regime. Further, the diffused nature of the resource and open access for fishing impedes proper assessment of fish production and sustainable development and management of fisheries.

The Indian reservoirs being largely in the tropical to sub-tropical regime are highly productive from the biological point of view. This productivity can be optimally utilised by stocking a right mix of Indian major carps. Otherwise, the productivity goes sheer waste. To tap the inherent biological productivity of the reservoirs, the success achieved in Gobindsagar, Himachal Pradesh needs to be replicated in the other reservoirs of the country also.

Aquaculture

The three Indian major carps contribute to about 84.0% of India's aquaculture production, which is mostly rural based. Increasing the unit area production of these three carps as well as the exotic carps, and expanding the culture area possibly through integrated fish farming as a package can lead to substantial increase in freshwater fish production. Similar thrust is also required to give a boost to aquaculture in the north-eastern states and the upland areas of the country.

All over the world, increase in aquaculture production has been possible through diversification of aquaculture at different levels. However, diversification of Indian aquaculture is still at initial stages, in spite of the fact that India, producing 2.03 million tonnes (in 1998 according to FAO) is second only to China (producing 69 % of the world total). The disparity to a large extent is owing to the high level of diversification of Chinese aquaculture, which utilises several diversified aquaculture systems, all the

seven major bio-categories (commodities) and a total 29 species. Comparatively, India uses only two bio-categories (freshwater fishes accounting for 97 % of production, and shrimps) and about 15 species.

While species number utilised is not directly linking with aquaculture production, this in combination with bio-categories utilised does link up with production. India would benefit by utilising promising species from all the major categories of aquatic organisms in its efforts in boosting aquaculture, subject to appropriate species selection, siting and marketing criteria. While smaller countries and their geography would have limitations in increasing production, India with her vast resources such and a long coastline of > 8000 km of can certainly increase its aquaculture production several times the present.

Integration of fish culture in the rural farming scenario is yet to be effective. However, successful large and efficient carp culture has established well in some parts of the country (Andhra Pradesh, Haryana, Punjab, West Bengal), cutting costs of fish production considerably. It would be very appropriate to integrate the low cost carp culture (composite or polyculture) with other rural production systems in an overall scheme for rural development. To achieve this objective in a shorter time span, perhaps there is a need for revival of the ICAR's All- India Coordinated Research Projects on aquaculture or any other variant to them, responsible for additional research and technology transfer in representative parts of the country.

Adopting a holistic approach to integrated aquaculture systems, both in inland and coastal areas would lead to sustainability. For achieving sustainability it is essential to modify our approach to not only to farm level management, but also to the larger ecosystem level management, where the total carrying capacity of the ecosystem is involved. Fish farming integrated with agriculture and livestock production along with other rural activities in some parts of Asia, which is possibly one of the keys to abundance of aquaculture production and absence of conflict in China, has amply proved this.

Coastal Marine Fisheries

The Indian subcontinent covers a vast region with long coastlines and different ecosystems, both on land and in the sea. The fishery resources are diverse, as are the fishery technologies and systems. Artisanal and small-scale fishermen operate from thousands of landing places dispersed along the coast and live within socially and culturally disparate communities. Responsibilities and programmes for fisheries management and development are split between the Union Government and State/ Union Territory governments, which differ in their policies, programmes and approaches.

The fish production from near-shore waters (0-50 meter) has reached its optimum yield levels and has been stagnant for some years. To sustain this production and to ensure that the major fisheries do not suffer any irreparable damage, improved management measures, based on community participatory approach have to be put in place without further loss of time.

The open access nature of marine fisheries is one of the major reasons for depletion, economic waste and conflict among user groups. Without adequate control over access, these consequences will become increasingly severe and further impede the sustainable management of fishery and the resource. With an open access, no catch limits have been set on effort or the catch. However, to optimise the fishing fleet size, a National-Level Review Committee was constituted in 1997 to study the size of the marine fishing fleet in India *vis-à-vis* the harvestable potential and give recommendations on the fishing effort that need to be deployed. The Committee concluded, after discussions with experts and with coastal States and the Union Territories, that the mechanized fishing fleet, in the size range of 8.0 to 15.0 m over-all length (OAL), has attained optimum strength and no fresh entry should be allowed. However, 700 new-generation resource-specific vessels of about 18m over all length (OAL), including trawlers and gillnetters-cum-longliners, could be added to the fleet to tap resources in the EEZ beyond the 50 m depth zone. This step also vindicates the recommendation of the Committee on Deep Sea Fishing set up by the Union Government in mid-nineties.

Recent trends in both artisanal and small-scale fisheries in the country have been disturbing and indicate the need for implementation of sound management programmes. In fact, such management for the coastal marine fisheries is long overdue. The catches and earnings of fisherfolk have been declining. Resource scarcity and the dearth of new income opportunities have combined to make life difficult for small-scale fisherfolk. In the trawl fishery, on the other hand, average sizes of species have been falling and the species composition is changing, indicating the need for a pragmatic approach and good management.

On a fair estimate, 70% of the operational cost of a mechanized fishing vessel is accounted for by fuel cost alone. Therefore, one of the prime requirements of the fishing industry is development, demonstration and popularisation of fuel saving designs of fishing craft, fishing gear and methods. Studies on the energy efficient hull designs for fishing vessels for reduced power requirements and their effect on vessel motions and maneuverability at sea, are required on a continuous basis. Development of hull designs in FRP and aluminium for deep sea fishing vessels is also essential keeping in view the scarcity of timber.

At present, the mechanized fishing vessels alone are licensed. The system of licensing need to be extended to motorized and non-motorized craft as well. Licensing will be helpful to maintain an inventory of all categories of fishing vessels. New vessel may be permitted to be acquired only as a replacement of a vessel of equal size and capacity. The priority of licensing should be shifted from a means of mere revenue earning to a system of regulating the number and type of fishing vessels. Presently, the fishers, including those involved in mechanized fishing, are not accountable for the catch and the revenue. The fishers need not disclose their catch and income to any agency. Disclosure of catch and income to the fisheries departments of State Governments should be mandatory for issue of license.

Another management option that has been considered for this area is to encourage small trawlers to diversify into fishing activities that can be practised further offshore, in order to reduce overcrowding in coastal waters and reduce the pressure on

the fish stocks. However, few fishermen are equipped for such ventures, and there is a need to provide support to this category as also technical information on the availability of resources or the best fishing methods with which to target them.

The economic disparity between the fishers involved in mechanised fishing and traditional fishing is one of the major causes for concern. The fundamental problem of the artisanal fisheries is their persisting poverty. Clearly, they have not been able to afford to adopt advanced fishing technologies.

Gear employed for exploitation of demersal resources, particularly the bottom trawl operated from mechanized and motorized craft, are being excessively used. The trawlable biomass appears to be over-exploited and a reduction in the trawl effort is necessary to sustain the trawl fisheries. On the other hand, the gear employed for exploitation of pelagic and mesopelagic resources are either underutilized or unutilized. Considering the biomass abundance of the plankton, pelagic and midwater trawling, which have not been practiced along the larger part of the Indian coast, should be introduced.

Lack of R&D efforts on fishing vessels best suited to the Indian conditions has also impeded the growth of this sector. The indigenous ship building yards are doing very little in improving the situation. Mechanised vessels below 20m OAL necessitate major inputs in their design to not only increase their voyage but also facilitate bringing back the catch in as good condition as possible. Adoption of new hull material such as fibre reinforced plastic (FRP) and ferro-cement boats (FCB) have not caught the imagination of the industry, in spite of the subsidy offered through the centrally sponsored scheme. This aspect needs promotion to reduce the dependence on wood. Similarly, artificial reefs and fish aggregating devices which provide a tool for enhancing fisheries and also help in protecting the coastal ecosystem for sustainable fishery development need to be taken up in right earnest.

Exploitation of off-shore resources in the EEZ will have to be reconsidered in terms of not only the resources available, but also in terms of infrastructure. To avoid

over-capitalisation and ensure a cautious growth of the infrastructure and investments, a rationalised approach will be essential in determining the number and size of fishing vessels, their resource specific gear as well as technology to be made available either indigenously or through foreign collaborations. The development of deep sea fishery industry is of concern to the entire marine fishery sector because it would have considerable impact on the management of near-shore fisheries, shore-based infrastructure utilisation and post-harvest activities, both for domestic marketing and export. Similarly, up-gradation of the small mechanised sector should be given high priority to facilitate their entry into the deep sea sector.

We are already in the new millennium and at a very crucial juncture of marine fisheries development. Many landmark decisions have been taken in the near past (e.g. closed season during monsoon months, optimization of the fishing fleet) and their implementation is likely to bring radical changes. Restricted access to marine fisheries is being talked about more loudly than in the past. With all these major events happening, it may be worthwhile to conduct a census of craft, gear and other attributes of economic significance for the entire coastline (including the two groups of Islands). This exercise would also be seen as a benchmark for the millennium and would be valuable for planning and development of the marine fisheries sector in the country. A sizeable percentage of the fishing vessels operates in near-shore waters (*i.e.* within 12 nautical miles), leading to pressure on the coastal fin and shell fish resources and regular conflicts between traditional and mechanised sectors. Although, the Marine Fishing Regulation Act (MFRA) promulgated by the states (except Gujarat) and the union territory of Lakshdweep provides zonation for different categories and sizes of fishing vessels to operate in demarcated areas, this seldom takes place due to inherent weaknesses in the Act. State-wise details of MFRA is at Table 7.

The existing regulatory policies also restrict fishing season, fishing areas and the mesh size of gear. However, there is no monitoring and surveillance system available with the concerned implementing organizations. Voluntary compliance by the fishermen to operate in the areas allotted to them, is totally absent and encroachment by the larger mechanized vessels in the areas demarcated for the artisanal craft continues. The

Central Government has now proposed to introduce a vessel monitoring system, which is expected to resolve the problem. Similarly, the Central Government should also consider providing a fresh model bill to the States/Union Territories to enable them to revive their MFRA on the basis of their present requirements and also global initiatives to which India is a signatory.

The existing fisheries policies and programmes in most of the States and Union Territories revolve around populist welfare measures and a large part of the annual Plan budget goes towards the welfare programmes (e.g. housing, saving-cum-relief) . Though welfare measures are obligatory to sustain the artisanal sector, parallel development and regulatory measures also need to be implemented. In general, the fisheries sector needs a sound and implementable policy and legal framework which can enable a gradual shift in the priorities from fisher welfare measures to development of sustainable fisheries and aquaculture. This will bring in long-term gains to the sector.

According to the Food and Agriculture Organization of the United Nations, the value of world fishery product exports in 1998 stood at US \$49 billion. The developing countries contributed to 48 per cent of the total. The export of fish and fish products thus is very important for many maritime developing countries. When about 40 per cent of global fish production enters international trade, only about 6 to 8 per cent of forest products enter international trade (FAO 2000). The net foreign exchange earnings of developing countries in 1977 from fish and fish products stood at about US\$16 billion, which, according to FAO is more significant than the combined net export earnings from coffee, tea, rice and rubber.

However, in the fast developing international scenario of trade and food security, non-tariff trade barriers are likely to play a major role. In this context, two recent initiatives can be cited which may have vital bearings on the marine fish exports from India. First, the Marine Stewardship Council (MSC), a joint initiative of the World Wide Fund for Nature (WWF) and the multinational giant, Unilever, and the Fairly Traded Fish and Fish Products initiative of a German organization called the Fair Trade. The former

focuses on sustainable fishing and the latter on living and working conditions of fish workers in developing countries.

In the light of growing interest in linking environment and labour standards to international trade, these developments could be seen as an opportunity as well as a matter of concern. While it is still unclear or too early to say how the market will respond to eco-labelled and fairly traded fish, there is a strong likelihood in this direction in future. Environmental and labour standards could complement the standards for food safety, which are strictly adhered to in the US, EU and the Japanese markets. In fact, the greatest denial of market access for fish and fish products from developing countries in future could be under the mantle of hygiene, quality and food safety standard.

However, fisheries in many developing countries, including India could benefit from these developments. Fishers using environmentally accepted fishing practices and those belonging to genuine fish worker cooperatives or associations could expect to be more benefited. While making all efforts to profit from such developments, fish worker organizations and national governments should exercise sufficient caution to prevent such standards from acting as an external barrier to trade. Central or State fisheries authorities, together with fish worker organizations and the scientific community could develop sustainability criteria and a management mechanism, which are realistic and practical.

Human Resource Development and Welfare Measures

To sustain fisheries in the new millennium, the quality, technical skills and management of fisheries manpower in the country will have to improve in consonance with the rapidly changing needs of our society, both nationally and internationally. Human resources development (HRD) for raising a cadre of experts at various levels to support research and vindicate a sustained development of the fishery sector is critically important. Moreover, to maintain the pace of growth witnessed by the fisheries sector in the recent past, the efforts may have to be probably larger and faster by several times more than made earlier. For such an effort adequate funding to strengthen and streamline organisations, infrastructure and manpower would be the basic requirement.

To enable a balanced development of the sector, an All-India Master Plan for HRD and social security in the fisheries sector should be prepared. In the HRD at the organised level where formal education is given, there is need for more sector-oriented education and greater linkage between the formally educated and the industry. There is need for greater emphasis on the role of women in the sector and great care and attention to the health and welfare of the children in the communities. The importance of understanding all aspects of human population dynamics in fishing communities needs to be stressed. There is great importance for providing coastal non-fishing employment opportunities for youth in the fishing communities. Measures for ensuring the safety of those fishing at sea needs to be given greater priority both during the normal operations and during times of unpredictable weather.

The growth and development of the fisheries co-operatives in the country is yet to reach the desired level. It is felt that the vertical and horizontal expansion of the co-operative base is very necessary. 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.

Fisheries Laws and Regulations

For sustainable development of marine resources, the constitution was amended in 1976, and the Parliament enacted the Territorial Sea, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act in 1976, establishing a 200 nautical-mile EEZ from January 15, 1997. Besides, the Government has also enacted the following legislation for the judicious exploration, exploitation, conservation and management of marine living resources.

1. *Marine Products Export Development Authority Act, 1972.*
2. *The Wild life Protection Act, 1973 and various central legislation on environmental protection*
3. *Indian Coast Guard Act, 1978*
4. *The Maritime Zones of India (Regulation of Fishing by Foreign Fishing Vessels) Act, 1981.*

Under the enabling provisions of the Indian Fisheries Act, 1897, various States

and Union Territories have introduced their fishery regulations. For regulation of fisheries in the territorial waters, all the coastal States and the Union Territory of Lakshdweep (except Gujarat and the remaining Union Territories) have enacted their Marine Fishing Regulation Act (MFRA). These Acts are based on a model bill provided by the Union Government in 1979.

The MFRA by the maritime provincial governments and the deep sea fishing schemes as provided under the Maritime Zone of India (Regulation of Foreign Fishing Vessels) Act, 1981 of the Government of India provide for prohibition of fishing by foreign vessels in the areas earmarked for the traditional and small motorised crafts.

For monitoring the fishing activities to be carried out in different assigned fishing zones by respective fleets, patrol boats are provided to the fisheries department of the maritime States. The resources monitoring surveys conducted by the Fishery Survey of India (FSI) are being linked with the management measures to be evolved and applied for sustainable development of fisheries. However, at present there is no law to regulate Indian owned deep sea fishing vessels.

Besides effective and implementable legislation to regulate fishing by the Indian owned fishing vessels in the EEZ and compliance of international agreements (e.g. Straddling Stock, Compliance agreement), legal support is also necessary to regulate various production functions (e.g. fin and shell fish seed); domestic and international trade (e.g. standards for hygiene and product specifications); movement of live aquatic animals within the country and from across the borders (e.g. Quarantine) and conservation of resources and germplasm (e.g. revision of MFRA). A sound regulatory framework developed in consultation with the community and other stakeholders is expected to pave the way for sustainable development of fisheries and aquaculture in the country.

4.10 Database and Information Networking

Fisheries Information and Databases

The Ministry of Agriculture is the nodal agency, which collects, collates and compiles data on fish catches and fishing fleets through the provincial governments, fisheries departments and the central institutions like Central Marine Fisheries Research Institute (CMFRI) and FSI. The stratified random sampling involving the clusters of the landing centers and days for enumeration developed by the CMFRI is followed for collecting catch and effort data and relevant information. The information on the fishing crafts and gear is collected through census by the central and state agencies which are updated from time to time.

The Central Inland Capture Fisheries Research Institute, Barrackpore based on various studies pointing towards infirmities and lacunae in the data collection and estimation procedures took up work for standardising the methodology under the auspices of a Central Sector Scheme for development of inland fisheries statistics. The scheme has enabled preparation of a uniform and sound data collection methodology on the basis of sample surveys conducted in various states. Estimation procedures have also been formulated for different ecological environments in inland fisheries.

However, as the Inland fisheries resources are vast and varied and scattered across the country, enumeration of these resources through conventional methods for developing reliable baseline data is rather impossible unless huge resources (human and financial) are committed. Moreover, these methods are slow, costly, arduous and suffer from the hazards of subjectivity. Remote sensing techniques are quick, reliable and cost effective in mapping of areas for identification, classification and assessment of resources and can be efficiently used in mapping and assessment of the total water spread area of the country.

India is one of the coastal nations which witnessed rapid development of marine fisheries in the post-EEZ era. As attendant responsibilities of a coastal state. India has been conducting exploratory surveys in the EEZ for knowing the types of fish resources and their potential.

Notwithstanding the existing efforts made by several agencies, the fisheries database is infirm and needs considerable strengthening. Real time data on the resource, its levels and patterns of exploitation are needed for effective planning. There is need for greater emphasis on data and information that give timely information on the economic attributes of the industry such as regular costs and earnings surveys. Increased use of the Internet facilities is highly desirable. Research priorities of all research institutes need to be set in keeping with the needs of the sector. To achieve this, more constructive interaction between research institutions involved in data and information generation and the stakeholders in the sector is warranted.

4.11 Fish Disease and Health Management

Diseases did not pose a serious threat to traditional fish culture that was so far typically extensive. With intensification of aquaculture involving high stocking densities coupled with external inputs of feed and fertiliser, sometimes of doubtful quality, the fish farmer is now face to face with diseases of various kinds from protozoan to helminth parasites to fungal, bacterial and viral diseases and syndromes. Diseases, especially 'ich', have always been quite common in the carp nurseries in the Hooghly and 24 Paraganas district of West Bengal inflicting in some cases even serious economic losses. Argulus, the most menacing of all parasites, adversely affects the growth of rohu and the overall production from sewage bheris around Kolkata. Ichthyophthieriasis, argulosis, gyrodactylosis and dactylogyrosis are now known from various parts of the country. In recent years, some of these diseases have assumed serious proportions in the newly developed aquaculture estate in India, viz. Andhra Pradesh, where intensive aquaculture is being practiced increasingly. The farmers have been suffering heavy losses both on account of mortality as well as morbidity. This has resulted in increased use of chemicals and antibiotics that are anyway not a welcome addition to the human food through this important food chain.

India suffered the worst disaster regularly for consecutive years beginning mid-eighties when certain species of food fishes suffered heavy mortality in ponds, tanks, rivers and reservoirs. Taken unawares by this mysterious disease known as the Epizootic Ulcerative Syndrome (EUS), a panic situation was created leading to a scare

regarding the effects of consuming the dead or diseased fish. The syndrome, which had already devastated the fisheries and aquaculture in other countries in the South-east Asian region, had arrived in India through the North-eastern States, Assam and West Bengal, where severe losses were reported. It was for the first time that the country woke up to the importance of diseases in fish and investigations taken up locally and in collaboration with disease experts in UK and USA. Some environmental factors such as low alkalinity were found to help in its spread, hence liming was suggested both as a prophylactic and a curative treatment. Research investigations to identify the causative organism(s) continued and various opinions expressed from the involvement of *Aeromonas* to *Rhabdovirus*. The latest, though still debated, is that the fungus, *Aphanomyces* sp., is the causative organism while all others are associates. The Central Institute of Freshwater Aquaculture, Bhubneshwar, developed a chemical called CIFAX that proved quite an effective drug in controlling the disease and even in preventing its occurrence.

The country suffered a further set-back that was far more serious than the EUS and involved the brackishwater sector when the highly valuable shrimp crops meant for export were lost in almost all maritime states and especially in Andhra Pradesh. This was a world phenomenon which was afflicted by shellfish diseases, especially the white spot syndrome (WSS). A large number of farms were closed and farmers gave up shrimp farming which led to a decline in foreign exchange earnings through this sector. Scientific basis of aquaculture takes into account the quality of the seed and feed. The import of diseased seed and infected feed from neighbouring countries helped in its spread at a fast pace. The greed to profiteering through intensification that did not take into account the importance of water quality parameters was the main culprit. It appears that diseases are now a part of the Indian aquaculture scene and it would need a farmer to be on his toes not only with respect to water quality but to the entire gamut of operations.

Fish and shellfish management have to be given their dues if the industry has to be sustainable and the farmers and entrepreneurs have to be making profits. The health of the fish-eating population of India should be an equally important concern of the industry. Certified seed and quality feed needs to be ensured as either of these could be

the carrier of a problem which may unfold itself in the farm at a later date adversely affecting both the production and produce.

Disease expertise is extremely limited in the country. While all the fisheries research institutions need to develop this expertise with at least half-a-dozen scientists in each institution working on different problems, it is equally necessary that such expertise is also developed in the States where aquaculture has been in practice for long or has been recently introduced. Depending on the size of the State and the water area, each state should have some officers trained in disease management. Disease laboratories should be established in each state and properly equipped too where the trained officers would be able to conduct necessary preliminary investigations. If need be, the diseased specimens/ material could be sent to the research institutions and the experts contacted. Routine monitoring of diseases is necessary and farmers need to be made aware of the problem of disease infestation and losses owing mortality and morbidity. Methods of control for common diseases should be made known to every farmer so that he may take immediate steps to save his crop. A serious country-wide drive to create an awareness in respect of fish diseases and health management is urgently necessary.

Quarantine is unknown to Indian fisheries and aquaculture and introduction of exotic fishes goes unchallenged. A strict watch needs to be kept on such illegal introductions and the legal ones allowed only through quarantine regulations. The application of these regulations in itself would considerably reduce the severity of the disease problems. The research institutions should enlarge the scope of their studies and initiate work on disease-resistant varieties and develop protocols for quarantine and seed certification.

CHAPTER 5

5.0 PROGRAMMES FOR TENTH FIVE-YEAR PLAN

5.1 Objectives

The main objectives of the fisheries and aquaculture development programmes of the Government of India during the Tenth Five Year Plan are as follows:

- ◆ Enhancing the production of fish and the productivity of fishermen, fisherwomen, fish farmers and the fishing community;
- ◆ Generating employment and higher income in fisheries sector;
- ◆ Improving the socio-economic conditions of traditional fishers and ensuring their welfare;
- ◆ Augmenting the export of marine, brackish and freshwater fin and shell-fishes and other aquatic species;
- ◆ Increasing the per capita availability and consumption of fish to about 11 kg per annum;
- ◆ Adopting an integrated approach to marine and inland fisheries and aquaculture taking into account the needs for responsible and sustainable fisheries and aquaculture;
- ◆ Conservation of aquatic resources and genetic diversity; and
- ◆ Strengthening of Post-harvest Infrastructure and Marketing.

5.2 Programmes and Strategies

The strategies necessary for optimum utilisation and sustainable development of the fisheries sector in general and inland fisheries in particular and the constraints being faced by them necessitate that all major issues be addressed through a programmatic approach. Increase in fish production and productivity would be one of the continuing

programmes during the Tenth plan. Some of the main programmes suggested to be taken up for the development of Fisheries and Aquaculture both in Inland and Marine sector are as follows:

(i) *Integrated River Management*

The rivers of the country are not only important on the fisheries perspectives but they also play a vital role by conserving the precious bio-diversity. The objectives of the riverine fishery development is to give emphasis on conservation on bio-logical and particularly fishery resources while attempting to optimise the productivity and sustain the livelihood of millions of fishers and their families.

(ii) *Development of Reservoir Fisheries*

Reservoir fisheries in India can play a vital role in augmentation of fish production for human consumption and mitigating the protein deficiency. Development of reservoir fisheries is labour intensive, and thus has the potential to provide gainful employment to weaker sections, rural unemployed youths etc. Cooperatives would play a major role in implementation of developmental activities in reservoir fisheries.

(iii) *Implementation of the Code of conduct for responsible fisheries*

At various international fora concern had been expressed over exploitation of important stocks, damage to eco-systems, economic losses and issues affecting fish trade. The proposed project will be implemented in consonance with the broader objectives of the Code for establishing principles for responsible fishing, national policies for fishing and fisheries, provide guidance for international agreements, facilitate technical, financial and other cooperation, promote contribution of fisheries to food security and food quality etc.

(iv) Strengthening of database and information networking in Inland fisheries sector

The objective of information integration is to organise data and knowledge in a cohesive unit and provide a single window access for the end users. It is anticipated that this system will enhance the availability of information on resource size, market arrivals, wholesale price indices of important fish species and products, productivity data, management of fish health etc. on a real-time basis. The broad objectives of the project are – inventorying and mapping of inland fisheries resource using remote sensing and GIS techniques, catch assessment and production estimation through sampling techniques and information networking and making available on time data on various aspect of inland fisheries.

(v) Programmes for higher production and productivity in Freshwater through aquaculture (demonstration for production levels from 2.0 – 12.0 tonnes/ha/annum):

- ◆ **Modified extensive carp culture (2 – 3 t/ha)** : Assam, Bihar, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Tamil Nadu.
- ◆ **Semi intensive carp culture (5 – 8 t/ha)** : Andhra Pradesh, Haryana, Punjab, Sikkim and West Bengal.
- ◆ **Intensive carp culture (8 – 12 t/ha)** : Andhra Pradesh, Punjab and West Bengal.
- ◆ **Carp polyculture with Freshwater Prawn** (3 – 4 t carp + 300 – 500 kg prawn) : Andhra Pradesh, Haryana, Punjab, Orissa, Tripura and West Bengal.
- ◆ **Minor carp culture (bata, reba, javanicus etc.) in seasonal ponds (5 – 6 months)** : Assam, Madhya Pradesh, Orissa, Tripura and West Bengal.
- ◆ **Integrated fish farming : poultry** (Andhra Pradesh, Haryana, Punjab and Tamil Nadu) : **duckery** (Andhra Pradesh, Assam, Tamil Nadu and West Bengal) : **Piggery** (North-Eastern states) : **Paddy** (Andhra Pradesh, Kerala, Orissa, Tamil Nadu and West Bengal).

- (vi) **Culture of air-breathing fish** (magur and singhi) in seasonal ponds -1 t/ha (6 months) : Andhra Pradesh, Assam, Madhya Pradesh, Tripura and West Bengal.
- (vii) **Seed production and culture of freshwater prawn** (Andhra Pradesh, Goa, Gujarat, Kerala, Karnataka, Maharashtra, Orissa, Tamil Nadu and West Bengal.
- (viii) **Utilisation and re-cycling of sewage through aquaculture** (Andhra Pradesh, Bihar, Haryana, Punjab, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal)
- (ix) **Culture of spirulina** – is a blue green algae and known for its protein and betacarotne contents apart from most of vitamins, minerals and pigments in its make-up. It stands out among the algal forms with a protein content of 62.5 to 71% on dry weigh basis as compared to maximum of 50% in others. Its protein yield per unit area is the highest among protein yielding crops. Spirulina culture can be undertaken as a cottage industry involving rural women.
- (x) **Culture of Azolla** – The regular use of inorganic fertilizers may cause long-term environmental problems. Therefore, the use of organic Azolla needs to be promoted for sustainable maintenance of aquaculture resources. It contains approximately 4% nitrogen and 41.5 – 45.3% carbon which make it suitable as a nitrogenous fertilizer in fish ponds eco-system. Azolla alone, 40 t/ha/year providing 100 kg of nitrogen, 15 kg of phosphorous, 90 kg of potash in addition to 1500 kg of organic matter, has shown that the nutrient requirement of composite carp culture could be met. In view of the above increasing cost of chemical fertilizers and associated energy inputs, it would be worthwhile to undertake eco-friendly Azolla culture for use as bio-fertilizer in aquaculture practices.
- (xi) **Establishment of hatchery for shrimps in coastal states**
 - ◆ **P. monodon**: Kerala, Andhra Pradesh, Tamil Nadu, Orissa, West Bengal
 - ◆ **P. Indicus**: Kerala, Tamil Nadu, Andhra Pradesh and Orissa
 - ◆ **P. merguensis** : Gujarat and Maharashtra
- (xii) **Culture of prawn and fish in Inland saline soils-region specific programmes/projects** (demonstration on identified sites before activities undertaken on commercial basis).
- (xiii) **Culture of tiger shrimp in saline soils** (demonstration on identified sites before activities undertaken on commercial basis).

- (xiv) **Running water fish culture in raceways in hilly areas.** In hill districts where flowing water is abundantly available after the monsoons and also in the areas where possibility of diverting canal water/artesian well water exists.
- (xv) **Culture of identified combination of fish species at mid-altitude and higher altitude areas.**
- (xvi) **Strengthening of infrastructure for fish/shrimp seed production at identified places where the agro-climatic conditions are conducive for prolong breeding possibilities.** Required nursery and rearing space are to be earmarked at district/block levels to ensure proper rearing of the seeds to stockable size. Establishment of hatcheries for seeds wherever necessary needs to be promoted for ensuring timely supply of seeds of stockable size for large waters.
- (xvii) **Women employment, employment generation, rural transformation and poverty alleviation through programmes on post harvest activities** (construction of drying racks/fish smoking/fish marketing through retail outlets and providing credit and security etc.).
- (xviii) **Culture of**
- **edible oyster*** : (Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Orissa and Tamil Nadu).
 - **pearl oyster*** : (Andhra Pradesh, Gujarat, Tamil Nadu and Andaman and Nicobar Islands).
 - **Mussel*** : (Andhra Pradesh, Karnataka, Kerala, Maharashtra, Orissa, Tamil Nadu).
 - **Clam*** : (Andhra Pradesh, Goa, Karnataka, Kerala and Maharashtra) etc.
- *in identified sites on pilot basis
- Need to develop technology for the proper utilisation of seaweeds.
- (xix) **Upgradation of technologies and capabilities in the artisanal and small mechanised sector** aimed at increasing productivity through diversification.
- (xx) **To establish an oceanic tuna fishery and other deep sea resources** such as shrimp and lobster.
- (xxi) **Introduction of deep-sea fishing fleet of resource specific fishing vessels** such as tuna long-liners, purse-seiners, squid-jiggers etc. is necessary in the present circumstances. These vessels would operate strictly on off-shore zones

in EEZ as well as beyond in the international waters. There would be no scope of conflict with the traditional sector. Such deep-sea fishing fleet would be capital intensive and need to be encouraged through foreign equity participation as well through technology transfer.

5.3 Thrust Areas

A number of programmes/activities have been suggested to be taken up during the Tenth Plan. Of these, some of the areas identified as thrust areas needs adequate attention for the development of fishery sector are given below:

5.3.1 Inland

Although potential of 4.5 million tonnes of fish has been estimated from the inland sector, but in true sense this has little meaning. Other than natural resources, such as rivers, estuaries and the floodplain and natural lakes, area under man-made water bodies such as reservoirs, ponds and tanks etc. is fast increasing and as such the potential would also increase.

5.3.1.1 Riverine Fisheries

Indian inland open water resources are much noted for their variety, rich ecological heritage, bio-diversity and production potential. The fish production from these resources is much below their potential, simply due to low priority given to this sector, especially the inland open waters. The share of riverine fisheries in total inland fish production may not be significant, but being the prime source of original fish germ plasm, their role becomes crucial for conservation of fish bio-diversity. The riverine fishery is already showing a declining trend. Millions of fishers and their families depend on rivers for their livelihood. These factors prompt an accent on development of riverine fisheries, which has rarely got the deserved emphasis of the planners. Therefore, it is the time, to take emergent steps to conserve our riverine fish biomass, to restore their habitat and initiate awareness programmes among fishers on benefits expected from these steps.

The concerns of property regime, overexploitation of natural fish stock, ecosystem degradation, economic losses, etc., are some of the issues, which threatens the sustainability and overall existence of inland open water fisheries. Therefore, now it is high time to introduce the concept of responsible fisheries through implementation of code of conduct. It will include establishment of principles for responsible fisheries, which may serve as legal and institutional reference for responsible fisheries.

5.3.1.2 Reservoir Fisheries

The manmade open waters, the reservoirs offer great potential for fisheries development in our country. These form one of the most important untapped fisheries resources. Their area is bound to increase with commissioning of new projects over time. The present fish yield from these waters is frustratingly low. A production of 50-100 kg/ha/year can easily be realised from large and medium reservoir by adoption of scientific management practices. The small reservoirs have the potential to yield 200 – 300 kg/ha/year. The fisheries development of reservoirs requires proper documentation of area under reservoirs, assessment of their production potential, introduction of improved technology and strengthening the infra-structural, institutional support and HRD programmes. This may lead to improvement in the socio-economic status of the poor reservoir fisher folk.

5.3.1.3 Aquaculture Productivity

National average productivity from the FFDA supported ponds/tanks has been increased to about 2.2 tonnes per ha/per year at present. This is no doubt a good achievement, however, we cannot rest at this level of accomplishment, as much more can be done which is possible. There are advanced technologies developed to raise the production level. Programmes for augmenting freshwater production to

integrated farming, running water or flow through system etc. have to be taken up with varied fish species. By the year 2030, aquaculture is expected to dominate fish supplies accounting nearly over 50 per cent of total fish production (FAO, 2000).

The fish yield levels from ponds and tanks in different states in recent years should be taken as a bench-mark for making further projections, as also attributing possible levels of production to varied percentage of water sheets. With a view, enhancing the freshwater aquaculture production achieving double production from the present level is to be undertaken as a scientific exercise based on the technologies available in the country. To achieve the desired results a large number of demonstrations in the potential areas may be organised by the concerned agencies (ICAR institutes, DAHD, State Fisheries Departments, FFDA's, NGOs/Voluntary Organisations as TACT centres).

Intensive freshwater aquaculture on a factory-farm basis at strategic places, particularly with private investments have immense possibilities in certain states such as Andhra Pradesh, Haryana, Punjab, West Bengal, Orissa etc. for high production of fish. ICAR institutes (Central Institute of Freshwater Aquaculture (CIFA), Bhubneshwar) could provide necessary technology support. Developed states may require advanced management approach whereas the developing states may require more encouraging support.

In respect of brackishwater sector, the Aquaculture Authority of India in the Ministry of Agriculture may play an active role and promote the sector by enacting the legislation to regulate the brackishwater aquaculture and to overcome the legal intervention (Supreme Court Judgement of December, 1996) affecting the production activity. They may also promote the production activities particularly in wasteland adjoining the coast.

The potential for fish culture in brackishwater system/salt affected areas has not been exploited so far. There is a need for diversification for production of fishes, crabs, seaweeds etc. besides taking up a large number of species of shrimp.

Rainbow trout farming technology established in the states of J & K and Himachal Pradesh through Externally Aided Projects should be extended among the private farmers of all the hill states of the country by formulation of suitable incentive oriented programmes/ schemes.

Trout and Mahseer fish to be given due importance for development of sport fisheries. While for brown trout, new quick growing strain needs to be evolved indigenously or imported. There is urgent need to evolve new 'culture models' on the lines of 'composite fish culture' involving in stream fishes.

Pilot projects on culture and seed production of clam, mussel, edible oyster and pearl oyster may be taken up in the identified coastal states and UTs. Culture of sea-bass and other commercially important fish species need to be adopted on commercial scale by entrepreneurs.

5.3.1.4 Habitat Restoration and Productivity of Upland Waters

During the past few years, in view of engineering interplay and heavy silting the high latitude rivers and protected waters harbouring original wild stock of precious fish species viz. trout, mahseer, snow trout, minor carps, etc. have greatly shrunk in view of recurrent floods and consequent ecological degradation. The deep pools which used to provide suitable shelter to native, pristine stock have become shallower and no longer offer hiding and breeding grounds to the resident fish stock. As such, each year during the rainy season a large number of fish stock get washed away with the current of water.

It is, therefore, imperative to provide proper protection work, deepen the juvenile growing pockets, provide deep pools so that the nurseries and sanctuaries of riverine ecosystem could regain the lost habitat.

Survival and completion of life history of fishes are directly related to intact longitudinal pathways, including the possibility of migration into tributaries that are highly important for reproduction and to server as rearing areas for larvae and young fish. Further each barrier has an affect on the species composition of communities upstream of the barrier, most importantly on the population structure of resident fish population.

Fish sanctuaries are repository of country's precious fish fauna. As per available information there are about 200 fish sanctuaries located in different parts of the country. They are instrumental in preserving the original germ-pool, boosting tourism and imparting awareness to the new generation about the precious fish wealth of the country. Further fishes do have religious sanctity in our country and as such attract large number of naturists/environmentalists both from sport and religious angles. There is a need to develop these sanctuaries as 'Ecological Parks'.

The restoration of habitat and productivity of upland aquatic resources would entail a broad integrated approach taking into account requirement of fisheries with other users. It would necessitate regulation of fishing efforts, strict enforcement of fisheries rules, rejuvenation of endangered fish species through stocking programmes, protection of natural breeding grounds and setting up sanctuaries for restoration of depleted gene-pool.

While sport fishing constitute a small part of total economy, its importance in the larger context of the environmental quality of river systems hardly needs to be stressed. For plentiful stocks of mahseer and

trouts efforts require to be made to arrest further erosion of the rivers and their tributaries, especially in the high altitude areas and contribute in improving the economy of such regions.

5.3.2 Marine

The estimated marine fish production will be around 2.9 million tonnes in 2000-01 which is a marginal increase on 2.83 million tonnes in 1999-2000. This is against an estimated potential of 3.93 million tonnes. During 1950s – 90s, the marine fish production have increased with a growth rate of 3.43%, which is slow as compared to 5.27% in the Inland fisheries during this period. Moreover, the growth in marine fish production over the recent years has been rather slow (an average of 2.19% in 1990s) as compared to the Inland Fisheries (average of 6.55% during the corresponding period). Gujarat has emerged as a leading producer of marine fish during 1999-2000 followed by Kerala Maharashtra and Tamil Nadu.

Exploitation of territorial waters upto 12 nautical miles is a state subject whereas the rest of EEZ is with central government. The fisheries resources exploitation by the artisanal as well as the small mechanised sector has already extended beyond the territorial waters on the one hand and on the other the activities of the larger mechanised vessels and those under foreign collaboration exploiting the off-shore fishery have indulged in fishing activities this regarding demarcation of fishing zones. The over-lapping interest of various fishing sectors on near-shore resource areas are resulting in social and political conflicts. The management of fishery exploitation in the EEZ, therefore, requires close coordination between the centre and the state with identified agencies to be entrusted with specific responsibilities.

5.3.2.1 Management of Coastal Fisheries

A positive and purposeful check on over exploitation of resources in the near shore areas through appropriate regulations on the number of fishing vessels, their operational areas, ban on monsoon fishing, mesh size, use of the right type of fishing gear and other such restrictions to prevent economic and over size fishing.

The present ageing intermediary mechanised fishing vessels need to be replaced with 15-19 meter Over All Length (OAL) vessels capable of fishing 70-200 meters depth zones. Standard designs best suited to the Indian conditions with necessary financial support needs promotion.

5.3.2.2 Deep-Sea Fisheries

Introduction of deep sea fishing fleet of resource specific fishing vessels such as tuna long-liners, purse-seiners, squid-jiggers etc. is necessary in the present circumstances. These vessels would operate strictly in off-shore zones in Exclusive Economic Zone (EEZ) as well as beyond in the international waters. There would be no scope of conflict with the traditional sector. However, such deep sea fishing fleet would be capital intensive and need to be encouraged through foreign equity participation as well through technology transfer.

Formulation and introduction of a new deep-sea fishing policy consistent with national interest should be given a top priority. The present vacuum is having several repercussions, more important of which is leaving the EEZ open to other neighbouring countries and owners of foreign fishing vessels who may take advantage of the situation for their benefit. Even land locked neighbouring states may stake their claims on under exploited marine resources in Indian EEZ.

Deep sea fishing industry requires an efficient onshore infrastructure support at the fishing harbour. Management of the fishing harbours may be entrusted to an identified central authority.

At present, the Coast Guard is authorized to monitor fishing by foreign vessels under the Maritime Zones of India (MZI) Act, 1981 (Vessels operating under Joint Venture are not covered under MZI Act, 1981 since they fly the Indian flag). This seems to be inadequate and it is felt that a programme for satellite-assisted Vessel Monitoring System (VMS) may be introduced in the EEZ for both Indian owned and foreign vessels. This would ensure the safety of fishermen and vessels, and in rendering any assistance required. This would also help in collection of fishery technical data as well as to determine the number of vessels required in particular area for exploiting the available resources.

5.4 Infrastructure and Post-Harvest

As spoilage of fish starts right from the time it is caught, the proper storage, preservation and prompt disposal or transport services are essential. Therefore, strengthening of post-harvest infrastructure such as storage facilities, ice plants, cold chains, roads and transportation, etc., as well as effective marketing system in identified areas are the key requirements for the development of this sector. This would ensure higher profit margins to the producers enabling faster fisheries development.

In the marine fisheries sector, the Central Government has been implementing a central sector scheme and a centrally sponsored scheme since 1964 to provide infrastructure facilities for landing and berthing of mechanised fishing vessels (MFVs), traditional and motorised fishing craft and deep sea fishing vessels. During the Second, Third and Fourth Five-Year Plans, emphasis was laid mainly on the construction of minor fishing harbours and fish landing centres. During the Fifth Plan (1974-1979), the construction of major fishing harbours at Sassoan Dock, Cochin, Chennai, Visakhapatnam and Roychowk was sanctioned. The development of fishing harbours and landing centres continued subsequently in the Sixth, Seventh, Eighth and Ninth Five-Year Plans.

At the end of the First Five-Year Plan, there were 863 mechanised fishing vessels operating along the Indian coast. Presently, there are about 54 000 MFVs and 44 578 motorised fishing crafts. The landing and berthing facilities commissioned so far can only meet the needs of a quarter of the total fishing fleet, resulting in overcrowding and a host of other accompanying problems. Therefore, there is an imperative need to develop more fishing harbours and landing centres to meet the requirements of the existing fishing fleet.

Most fishing harbours in the country are not properly maintained, due to lack of management and inadequate revenue collections. After the harbours are commissioned, the responsibility of maintenance and management is vested with the user agencies. However, adequate revenue is being collected regularly in only a few fishing harbours. In some, the revenue collected is too meagre for proper management and maintenance. Adequate funds are essential to maintain the facilities, especially dredging. In the absence of regular maintenance dredging, the basins of many harbours can be utilised only during the high tide, resulting in congestion and partial utilisation of the facilities.

Sea food processing industry is one which consumes large quantities of potable water. The demand for water will be still more in view of implementation of EU requirements and HACCP programmes. Therefore, it is essential that copious supply of potable water is ensured to the industry. Other inputs such as ice, insulated containers, insulated and refrigerated trucks, etc. are also needed to ensure quality of the finished product. Better infrastructure for human resource development in all fields related to fishing and fish processing should be developed. This should cover the manpower requirement for the emerging class of new design of fishing vessels, fish processing plants operating on the HACCP/EU principles, marketing experts, etc.

Fish is a highly perishable commodity; the processes responsible for its decomposition are autolysis, bacterial spoilage and oxidative rancidity. These processes can be retarded effectively by chilling with ice. Radurization is an irradiation process for extension of shelf life of fresh fish/ fishery products in ice or under refrigeration by reducing the number of spoilage bacteria. The major benefit of the application of radiation in fish/ fishery products is in the reduction of post-harvest losses

and improving the hygienic quality. Recognizing the techno-economic advantages, 40 countries including India have permitted such radiation treatment and this practice should be popularised in the country.

Market intelligence is of utmost importance in product promotion and formulating appropriate marketing strategies depending upon the needs of the international markets. The tremendous advances made in the field of information technology should be profitably made use of in deciding upon product makeup, marketing strategy and exploitation of the market potential in full.

The other important issues that need to be addressed in the post-harvest activities is as to how can exploitation of the producers by the traders be avoided? To what extent can fish markets (at first-sale point and the wholesale-end nearer the consumer) be regulated? Is there a need to raise the generic demand for fish? Can a national initiative to enhance fish production and marketing, along the lines of the National Dairy Development Board (NDDB) be conceived? National Quality Standards for fish and fishery products should be formulated.

The Uruguay Round of the General Agreement on Tariffs and Trade (GATT) was marked by a comprehensive exercise to lower the trade barriers and liberalise the trade regime. Even on rough estimate, the new trade opportunities that are expected to be generated are fairly large. The process of globalisation, rapid growth of trade in services and the inclusion of intellectual property rights in the policy making of the world trade system have drawn attention to market access impediments inside many countries, both developed and developing. Issues emerging out of such global developments need to be discussed and policies outlined for the advantage of the fisheries sector.

5.5 Management and Policy Intervention

The Ninth Plan has focused on an integrated approach to sustainable development and aimed to optimise production and productivity, augment export of marine products, generate employment, improve socio-economic conditions of the fishermen and fish farmers, conserve aquatic resources and genetic diversity and

increase per capita availability and consumption of fish. This focus shows that so far there has been emphasis on development, in other words more and more exploitation of the resources. However, the management which is often perceived as a response to development has not received the desired attention. The Code of Conduct for Responsible Fisheries provides an excellent opportunity to integrate management with development.

The Code of Conduct for Responsible Fisheries and other Global Initiatives at various international fora, concern had been expressed about the over-exploitation of important stocks, damage to ecosystems, economic losses, and issues affecting fish trade. All these threatened the sustainability of fisheries. The 19th Session of the FAO Committee on Fisheries, held in March 1991, recommended that FAO should develop the concept of responsible fisheries and elaborate a Code of Conduct toward this end. The Code of Conduct for Responsible Fisheries (Code) finally came into being on 31 October 1995 at the 28th session of the FAO Conference in Rome. The Code is voluntary, but certain parts of the Code reflect and include major articles and provisions from a number of global UN conventions and agreements.

The Code of Conduct for Responsible Fisheries (CCRF) or simply the Code, as it is popularly known, defines in the General principles that “*The right to fish carries with it the obligation to do so in a responsible manner.*” It sets out principles and standards of behaviour for such practices and aims at effective conservation, management and development of living aquatic resources. The Code covers not merely capture of fish and fishing operations, but the processing and trade of fish and fishery products, aquaculture, fisheries research, and the integration of fisheries into coastal area management. The Code reflects and includes major articles and provisions from a number of global UN conventions and agreements such as:

- The U N Convention on the Law of the Sea, of 10 December 1982
- The 1992 Declaration of Cancun
- The 1992 Rio Declaration on Environment and Development
- Agenda 21 adopted by the UN Conference on Environment and Development, in particular Chapter 17 of Agenda 21.

The Code is global in scope. It is directed toward members and non-members of FAO, fishing entities, organizations of all kinds, fishers, people engaged in the processing and marketing of fish and fishery products – in short everyone concerned with conservation of fishery resources and management and development of fisheries.

The Code contains 12 articles plus two annexes. The Code calls on all members and non-members of FAO and everyone concerned with the conservation, management and utilization of fisheries resources to collaborate in implementing the Code's objectives and principles. It says that FAO will monitor the application and implementation of the Code. It calls upon all states and organizations, government or non-government, to co-operate actively with the FAO in this work. The Code also notes the special needs of developing countries and urges financial and technical assistance, technology transfer, training and scientific co-operation to address these needs. The ability of developing countries to develop their own fisheries should be enhanced. Their access to high-seas fisheries should be improved.

On fisheries management the Code urges conservation and management measures based on the best scientific evidence available. Coastal states should co-operate in the management of transboundary, straddling or highly migratory fish stocks. Mechanisms should be set up for fishing monitoring, surveillance, control and enforcement. Excess fishing capacity should be prevented; fishing effort should be commensurate with sustainability. The precautionary approach should be a guiding principle for fishery management; the absence of scientific information should not be reason for inaction on conservation and management measures. States should regulate fishing in such a way as to avoid the risk of conflict among fishers. States should take measures to minimize waste, discards, catch by lost or abandoned gear, catch of non-target species. The Code also suggests integration of fisheries into coastal area management. It urges an institutional framework, policy measures and regional co-operation to facilitate sustainable use of coastal resources.

Largely arising out of global initiatives, there is now also a pronounced trend towards adoption of preventive approaches to management of renewable resources

and such approaches are being increasingly used for fisheries. The wide adoption of such approaches will bring in the desired changes in the state of affairs in marine living resources conservation and could also offer opportunities to improve fisheries management and ensure sustainable fisheries development. However, care must be exercised to avoid indiscriminate application and ensure that any change does not lead to social or economic chaos.

The 1990s have witnessed many other international agreements and accords relating to the intentions of the international community to achieve sustainable fisheries and to which India has been a party. These agreements represent milestones in international efforts over many years and include Chapter 17 of Agenda 21 of the UN Programme of action which includes programme areas relating to coastal areas and the oceans; the 1992 International Conference on Responsible Fishing (held in Cancun, Mexico) and the 1993 Agreement to promote compliance with International Conservation and Management Measures by fishing vessels on the high seas.

India needs to adopt all international fishery and related conventions and agreements. (e.g. Straddling Stocks Agreement, Compliance Agreement) to which it has been a signatory. In fact, being the largest maritime country in the region we need to set the example. It is also in our strategic interest to do so first. Because of the large marine fisheries resource available to the country, the straddling and migratory nature of many valuable stocks like tuna and emerging issues in sustainable management of the resources it is important to take the lead to set up regional fisheries bodies which will help to widen the use of our national research and technical expertise in the region. Our fishery policies have thus far kept us as an insular nation. This may have had good reason in earlier times, but it can be counter-productive in the future globalising scenario.

A sound policy makes a good beginning in our efforts to sustainably and equitably manage our fisheries resources. The renewable fishery resources, if properly managed, can produce long-term sustainable yields and thus support continuous economic activities and employment. The most effective implementation of the National

Policy (good interface) can only be through a viable partnership between the government, industry and the civil society.

Monitoring, Control and Surveillance

MCS problems in the country include the vast size of the EEZ (2.02 million km), the long coastline (8118 km), multiple fleets, participation of foreign-flagged vessels and regional jurisdictional demarcations. VMS to be adapted for effective surveillance of Indian EEZ. Control of domestic vessels operating largely within the territorial waters is undertaken by coastal State and Union Territory Governments. Central Government is responsible for issuing licences to deep-sea vessels and to foreign-flag vessels. Licences carried restrictions on fishing methods, types of gear, area, depth and cod end mesh size. Other regulatory measures included closed seasons and marine parks.

The first legislation for fisheries management was enacted in 1976, which extended maritime jurisdiction up to 200 nautical miles. The control of foreign vessels was based on the Maritime Zones of India Act of 1981, and the rules framed there under in 1982.

Surveillance in coastal waters is undertaken by the coastal State/ Union Territory Governments. The Central Government had also sponsored a Scheme which met 100% of the capital costs of 30 patrol boats to be deployed in territorial waters. Surveillance beyond the territorial waters is undertaken by the Coastguard.

The fishers are generally independent group of individuals and to enhance their income and profit, they try to ignore the prevailing restrictions under the Acts/ Government Orders. Hence, for a management system to be effective, monitoring, control and surveillance programme is necessary to enforce the regulations. Inadequate

implementation of existing policies is one of the major constraints towards sustainable development. The administrative objectives, therefore, call for (i) adequate implementation of regulatory measures and (ii) promotion of participatory co-management of the fisheries.

5.5.1 Aquaculture at par with Agriculture

Traditionally in India, fisheries had been associated with the poor, illiterate and under nourished population, who belonged to economically weaker sections of the society and deserve support of the Government. Fisheries sector in India has come a long way since independence, contributing immensely to the country's protein requirements as also export earnings. Freshwater aquaculture has made notable strides in the recent years with the component contributing about 3/4th of the total fish production in the country. With an annual growth rate of about 6.55% in 1990s. It has also been identified as an farming activity that would ensure domestic food security and rural development by organisations all over the world, particularly in the Asian continents.

Like the crops and pulses produced by Agriculture, fish produced from ponds by practicing aquaculture is a daily food for a large section of the society all over the country. Aquaculture should, therefore, receive all the incentives/concessions so far given to agriculture. Basically, aquaculture also required all the inputs and practices which are needed and have been provided for the development of agriculture sector, during the successive Five Year Plans.

Fish Farmers Development Agencies (FFDAs – 422 Nos. in the country) provide a package of technical, financial and extension support to the fish farmers as in the case of Small Farmers Development Agencies (SFDAs) in the agriculture sector. For the development of fish/prawn farming in the country about 39 Brackishwater Fish Farmers Development Agencies (BFDAs) are in operation

in the coastal states. However, assistance/incentives, available to the farmers in the agriculture sector, are not available to the fishers. Assistance on the following now given to agriculture should be extended suitably to aquaculture also:

- a) Income Tax relief.
- b) Power supply at concessional rates.
- c) Supply of water at concessional rates.
- d) Loan facility for tubewells.
- e) Loan facility on differential rate of interest.
- f) Insurance cover for aquaculture.
- g) Draught and flood relief for aquaculture.
- h) Subsidy on Seed/Feed, Fertilizer, Machinery/Equipments, Transport, Land Development and Soil Conservation, Demonstration and Training etc.
- i) Priority booking facility by rail and air.

Fishers are the poorest of the poor. They deserve interest free loan or loan at concessional rate of interest and other concessions mentioned above and available to the farmers in the agriculture sector at present.

5.6 Gender Programmes

Traditionally, women have played an important role in the fisheries sector, and in the emerging scenario of fisheries and aquaculture development, they have a much larger role to play. So far, women's activities have been paid special attention by the Bay of Bengal Programme (BOBP), a regional small-scale fisheries project of the FAO, based in Chennai and active in seven countries around the Bay of Bengal. Now more than two decades old, the BOBP has rich experience in planning and implementing strategies to improve the role and status of women. Besides technology generation, BOBP has played a prominent role in improving the status of fisherwomen, focussing

on training, awareness-raising, savings and credit schemes, and promotion of alternative income generating activities and making them take a more active part in their own development.

During the second phase of BOBP (1986-93), several post-harvest activities were carried out through a sister project executed and funded by the UK. Insulated fish boxes to improve quality and prices were promoted in Andhra Pradesh; a permanent on-shore ice box was demonstrated in Kanniyakumari; low-cost drying racks for anchovies were introduced in Kanniyakumari. A new prototype fish container, more hygienic, cost-effective and comfortable than traditional fish baskets, was designed, tested and introduced in Tamil Nadu.

Based on the experience of BOBP in carrying out gender programme, activities can be largely classified into three types:

- ◆ Income-generation
- ◆ Training and facilitation, to improve the participation of women in their own socio-economic, cultural and technological development
- ◆ Credit

The success of income-generating activities for women depends on the local economy and local circumstances. There are special income-generating challenges and opportunities in specific locations. These need to be identified and tapped. The surest way to improve the status of fisherwomen in a community is to train them to improve their participation in their own development. In sum: training for empowerment. Training for production skills to improve incomes is of little use, unless the access to markets is also improved. Credit schemes for fisherwomen – through group formation and liaison with banks – have also enjoyed great success in improving their condition and need to be implemented.

5.7 *Strengthening of Database and Information Networking*

Sustainable development of inland fisheries resources necessitates inventorying, monitoring and management of surface water resources, which harbour the fish and aquatic bio-diversity. Therefore, basic data on various aspects of inland fisheries such

as surface water spread, fish stocks, fishers engaged and their socio-economic status, production, marketing and distribution, etc. is a pre-requisite for formulating sound development plans.

Considering the dynamic trend and advancements in information technology in recent times, free flow of information is of crucial importance for fisheries development, sustenance and rational programme planning . Real time transfer of information has now become a basic requisite for activities of economic nature.

The creation of information highways has now made it possible to synergise the combined capabilities of cyberspace technologies along with optimizing informatics on the use of land and water resources for taking a quantum leap in agriculture research and production. The end users can now have access to a strong knowledge base which can be a boon in developing strategies and technologies for productive utilization and sustainable development of the resources.

The objective of information networking is to organize data and knowledge in a cohesive unit and provide a single window access for the end users. It is anticipated that this system will enhance the availability of information on resource size, market arrivals, wholesale price indices of important fish species and products, productivity data, management of fish health, etc. on a real-time basis. Thus, keeping in view the advantages of remote sensing technology and information networking, a project needs to be implemented during the Tenth Five- Year Plan with the following broad objectives and components:

Objectives:

- inventorying and mapping of inland fisheries resources using remote sensing and GIS techniques.
- catch assessment and production estimations through sampling techniques.
- information networking and making available on-time data on various aspects of inland fisheries .

Components:

- National inventorying and mapping of inland fisheries resources
- Catch assessment through sampling techniques
- Information networking

Besides the above, the information networking component of the project would also provide market intelligence on various products and services and also serve as a buyer-seller meeting point.

5.8 State-wise Prioritization of Thrust Areas

Fisheries is a state subject and as such the primary responsibility for development rest with the state governments. However, supplementing the efforts of the state governments, the central government has been promoting various production oriented, input supply and infrastructure development programmes for increasing the fish production and productivity. On the basis of fishery resources potential in the states and detailed discussions with the state representatives in the Working Group meeting while formulating the Tenth plan, an attempt has been made to identify the areas suggested for adoption on priority basis by the respective state governments. State-wise identified priority areas to be undertaken in the Tenth plan by the state governments have been Annexed I.

CHAPTER 6

6.0 RECOMMENDATIONS ON PROGRAMMES, TARGETS AND OUTLAYS FOR TENTH PLAN

6.1 Programmes

The Fisheries Division of the Department of Animal Husbandry & Dairying (DAHD) implemented 17 central sector/ centrally sponsored schemes during the Ninth Five Year Plan. These schemes covered institutional support to the fisheries sector, programmes on fresh and brackishwater aquaculture, training and extension, infrastructure with emphasis on providing landing and berthing facilities to the marine fishing fleet, motorisation of traditional fishing craft, relief on central excise duty on high speed diesel for mechanised fishing fleet below 20 meter overall length, welfare programmes, etc. The ongoing schemes of DAHD during the Ninth Five Year Plan have been discussed in detail under chapter 3 and their list is given at Table 17.

Based on the discussions of the Working Group and between Planning Commission and the DAHD, it has been felt necessary to bring in convergence/ merger of some of the on-going schemes having common objectives and overlapping programmes. Keeping in view the changes those the fisheries sector has gone through in the recent times, it is also felt necessary to phase out some of the on-going schemes/ programmes and revise the others to meet the requirements of the sector during the Tenth Plan and beyond.

Accordingly, the Tenth Plan programmes/ schemes are proposed to be implemented under the following six broad heads:

- 1. Central Assistance to Fisheries Institutes**
- 2. Development of Inland Aquaculture and Capture Fisheries**
- 3. Development of Marine Fisheries**
- 4. Infrastructure and Post-harvest Programmes**
- 5. Strengthening of Database and Information Networking**
- 6. Welfare Programmes, Policy Issues and Human Resource Development**

The following paragraphs detail the schemes/ programmes proposed for implementation under the above six heads during the Tenth Five Year Plan and a summary of the schemes/ programmes is given in the Annexure to this chapter:

1. Central Assistance to Fisheries Institutes

Presently, the following four Institutes implement various programmes to meet the requirements of the marine fisheries sector in the country. These Institutes have different objectives, mandates, functions and activities which have little overlap with each other.

- **Fishery Survey of India**
- **Central Institute of Fisheries, Nautical and Engineering Training**
- **Central Institute of Coastal Engineering for Fishery**
- **Integrated Fisheries Project**

It is proposed that these Institutes would continue to function as separate components under a single central sector scheme. However, all the four Institutes need re-organisation in terms of their mandate and programmes to meet the changing requirements of the fisheries sector during the Tenth Plan. The following is proposed in this regard:

(i) Fishery Survey of India (FSI)

The present focus of the Fishery Survey of India (FSI) is on survey and catch estimation of fisheries in the territorial waters and the exclusive economic zone (EEZ). While continuing to provide adequate coverage to the entire marine resources of the country, the Institute during the Tenth Plan should aim at commercial application of the data collected and compiled at regular intervals. The Institute would also serve as the focal point for vessel monitoring system which is proposed to be introduced during the Tenth Five Year Plan. For adequate coverage of the EEZ for survey and monitoring of the resources, it may be necessary to provide the required number of survey vessels, technical/ scientific manpower and strengthening of the existing bases of the Institute set up in the different coastal states and the union territory of A& N Islands.

In view of the above, it is mentioned that Government of India should issue requisite notification under Part XVA on fishing boats, section 435W of Merchant Shipping Act, making it mandatory to all the fishing vessels above 20 m OAL operating in the Indian EEZ to furnish their fishery data to FSI. Working Group for revalidating the potential of fishery resources in the EEZ in its Report submitted to the Ministry of Agriculture, DAHD has also recommended as follows:

“ It should be made mandatory for all fishing vessels above 20 m OAL to report their operational details and species-wise catch to the FSI as per the prescribed format. Similarly the state machinery collecting catch data from the fishery harbours and other landing centres should also furnish such data to the FSI. The FSI in turn should furnish one set of all data to the NMLRDC at CMFRI.”

(ii) *Central Institute of Fisheries, Nautical and Engineering Training*

The Central Institute of Fisheries, Nautical and Engineering Training (CIFNET) with its centres at Chennai and Visakhapatnam undertakes two long-term courses of 18 months duration for training mate and engine drivers for fishing vessels. The total intake capacity for these two courses is 200 trainees. However, with the prevailing impasse in the deep sea fisheries and little need for such trained hands in other categories of fishing vessels, the intake of candidates in the two courses has sharply declined in recent years.

In view of the above, it is proposed that CIFNET should reduce the intake of candidate for the two courses to about 25 each and develop short-term training modules on use of communication and navigation equipments; sea safety; engine repairs and maintenance; operation of resource-specific gear, their fabrication and maintenance; on-board preservation and value addition; etc. with a focus on the artisanal and small- scale fishers. For training programmes on post-harvest activities, the Institute may also build-up linkages with the Integrated Fisheries Project, Industry and the concerned ICAR fisheries institutes who have already established facilities.

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

The Central Institute of Coastal Engineering for Fishery (CICEF) has a mandate of conducting pre-feasibility studies for selection of sites for fishing harbours and fish landing centres, assisting the states and union territories in preparation of detailed project reports and cost estimates for construction and subsequent monitoring of the sanctioned projects. The Institute also has a limited mandate to provide engineering support to states/ UTs for development of brackishwater aquaculture. However, the engineering support to the states/ UTs for construction of shrimp farms has undergone a change in the light of the Supreme Court's judgement on shrimp aquaculture.

Keeping in view the expertise available with the Institute in the field of harbour engineering, and also the greater demand placed on the Institute from various agencies such as the Central Water and Power Research Station, Engineers India Limited, etc with regard to harbour designing and construction, it is proposed that the mandate of CICEF may be modified to enable them to take consultancy assignments individually or in collaboration with other agencies.

(iv) Integrated Fisheries Project

During the Tenth Five Year Plan, the Integrated Fisheries Project (IFP) should concentrate on commercialisation of techniques on value addition and marketing of unconventional fish varieties and development of low cost technologies for utilisation of by-catch, etc. The Institute's work programme should focus on providing training programmes in post-harvest activities, especially with regard to the incorporation of HACCP and other sanitary requirements of the fisheries sector. The Institute should take up programmes to develop village level technologies and provide training, especially to the women folk in value addition of small and non-commercial fish species. The Institute should also work on areas such as improved packaging and processing and domestic marketing of preserved and processed fish. Rationalization of manpower and physical facilities may have to be considered along with the changed mandate of the Institute.

2. Development of Inland Capture Fisheries and Aquaculture

(i) Inland Aquaculture

This is an on-going scheme with the broad objectives of providing a package of financial, technical and extension support to the fresh and brackishwater fin and shell fish farmers. The support to the freshwater fish farmers is provided through the 422 FFDA's and to the shrimp farmers through the 39 BFDA's set up in all the potential freshwater and brackishwater districts of the country.

Besides fresh and brackishwater ecosystems, the scheme during the Tenth Plan would also provide coverage to the coldwater and the inland areas which are saline and waterlogged. To make the standardised farming practices broad-based, more sustainable and environment friendly and also to meet the changing requirements of the fish/ shrimp farmers in the country, the following additions/ changes are proposed in the existing programmes:

- (a) *Construction of raceways for coldwater aquaculture in addition to ponds and tanks.*
- (b) *Inputs (seed, feed, fertilizers, manures, etc.) for the first two years (separate cost for inputs under different activities, wherever necessary).*
- (c) *Second dose of subsidy to the existing ponds after a period of 5-7 years.*
- (d) *Popularisation of integrated fish farming, and running water fish culture, especially in the North-eastern Region and other hilly areas.*
- (e) *Setting up of fish/ freshwater prawn seed hatchery in government/ private sector. The assistance would be made available for setting up of such hatcheries for all the commercial species of fish and prawns.*
- (f) *Setting up of common effluent treatment plants, especially for small shrimp farms established in clusters.*
- (g) *In the brackishwater sector, a second dose of input subsidy would be allowed in the event of floods, tidal waves, earthquakes and other natural calamities since the coastal farms are worst hit by such natural calamities.*
- (h) *Strengthening of the disease diagnostic capabilities through a chain of laboratories at the district, regional and national levels.*
- (i) *Assistance to the government/ private sector for setting up of fish/ prawn feed units.*

- (j) *Productive utilization of inland waterlogged and saline areas for aquaculture.*
- (k) *Popularisation of ornamental fish culture, breeding and trade through government/ private sector initiatives.*
- (l) *Extension of stipendiary assistance to trainers and trainees along with fishers.*
- (m) *Separate package/ unit costs for North- eastern States and other hilly areas as well as for utilisation of inland saline area.*

In view of the popularization of aquaculture in the country and also the fact that major increments in fish production during the Tenth Five Year Plan would come from farming, it is proposed that the central assistance to the states/ beneficiaries should be increased from the present level of 75 per cent to 90 per cent. The balance 10 per cent would come from the state/ beneficiary. It is also proposed to provide the central assistance directly to the Department of Fisheries in the states/ union territories as opposed to the present system of channeling the funds through the state/ union territory governments.

To enable optimum utilization of the subsidy provided to the state/ beneficiary, it is also proposed to allow flexibility in the selection of components within the list of total approved components and their unit costs under the scheme. Further, it may also be essential for the central government in conjunction with the state/ union territory governments to facilitate loan availability to the beneficiary through simplification of procedures for bank/ institutional finance.

(ii) *Inland Capture Fisheries*

During the previous Plans, no major programmes were undertaken for the improvement of inland capture fisheries resources, which have shown progressive deterioration. Coupled with decline in the ecology of the resources, there has been a sharp decline in the fish production also from almost all the inland fisheries resources. However, during the terminal year of the Ninth Five Year Plan, a pilot-scale scheme on fish yield optimization from the reservoirs has been initiated. Based on the response of the states/ union territories and the genuine requirements of the inland capture fisheries sub-sector, it is proposed to implement a scheme with the following major programmes/ activities:

- (a) *Conservation of commercially important fish species in riverine/ floodplain stretches through ranching and habitat restoration.*
- (b) *Fish yield optimization from different categories of reservoirs through stocking of seed and provision of harvest (craft and gear for beneficiaries) and post-harvest infrastructure necessitating construction of ponds /rearing sites/ cages and pens for raising stocking material and construction/ strengthening of landing centres with essential and basic needs (platforms, sheds, sanitation, water facilities, ice, packaging, toilets) and cluster approach based value addition centres.*
- (c) *Organisation of cooperatives and facilitating their involvement in production and marketing activities.*
- (d) *Training of fisheries officials, cooperative members/ group of fishers in various activities related to development of inland capture fisheries.*
- (e) *Involvement of local population and awareness programmes*

Inland open water fisheries cut across the geographical boundaries of different states in the country. Conservation and sustainable exploitation measures taken in one state need to be complemented by the neighbouring states, up/down stream of the rivers following mutually agreed principles of responsible fishing. To initiate the awareness for conservation of bio-diversity, revival of commercially viable bio-mass productivity and protection of the habitat, harmonized programmes need to be taken up in identified stretches. This may also necessitate uniform legislation in the inland states for which the central government may consider formulation of a model Bill and its circulation to the states/ union territories. This would facilitate the states/UTs in formulation and enacting fisheries acts in respective states.

Since the inland capture fisheries programmes would be implemented for the first time and would be of a catalytic nature, it is proposed to implement the above activities with a funding pattern of 75:25 between the center and the states/ beneficiary during the Tenth Five Year Plan.

3. *Development of Marine Fisheries*

The on-going programmes in the marine fisheries sub-sector have largely aimed at the motorisation of the traditional fishing craft and providing relief to the mechanised fishery sector to enhance their economic viability. In view of depleting fish resources in the near-

shore waters, and the need to exploit the off-shore waters for fish production, the following major programmes are proposed for implementation during the ensuing Tenth Five Year Plan Period:

(i) *Modernisation of Artisanal and Small-scale Fishing Vessels*

This programme would be aimed at modernization of the existing artisanal and small-scale fishing vessels to enable them to go far and deeper in to the sea and reduce the pressure on the inshore waters. The programme is proposed to include the following components:

- (a) *Replacement of old-wooden boats (catamarans, etc.) by fishing craft made of fibre-reinforced plastic (FRP)/ ferro-cement boats (FCB) with improved facilities.*
- (b) *Provision of suitable nets and gear.*
- (c) *Assistance to fishers towards the cost of OBMs and kerosene.*
- (d) *Provision of GPS, fish finders, life floats and other mandatory equipment on board the fishing vessels.*
- (e) Introduction of FED and BRD's in fishing operation for prevention capture juveniles and protection of endangered species.

It is proposed to dovetail most of the components listed above with the credit facilities offered by the National Cooperative Development Corporation (NCDC) under its programmes on marine fisheries. Besides the central subsidy, the beneficiary may receive a subsidy from state government as fixed by them.

With the increased number of motorisation of traditional crafts, requirement of fuel (kerosene) has also shown a steady increase. The total excise component in the cost of operation of the motorised boats amounts to Rs. 2 per litre of kerosene. To offset the burden on the small-scale fishermen and make the fishing operations economically more viable, it is proposed to be subsidise the fuel used by the OBMs. The subsidy would be equally shared by the centre and the states.

With the growing concern on depletion of the valuable forest resources, it is highly essential to promote alternate material such as fibre-reinforced plastic, ferro-cement, steel, etc to meet the requirements of the boat building industry. As the cost of such material is generally high, a portion of the cost is proposed to be subsidised, as a promotional measure as well as to lessen the burden on the fishers. This component is proposed to be implemented through NCDC with participation of state governments and beneficiaries. The Government may also consider removal or reduction excise/ custom duties on building material like FRP etc.

(ii) Introduction of Intermediate range of fishing Craft with Improved Design

This programme is aimed at introduction of modern, fuel efficient and multi-purpose mechanised fishing vessels of size range 15 – 19 meter OAL and with longer endurance to fish in depths of about 90-200 meter. The programme is proposed to have the following two major components:

- (a) *Replacement of aging existing mechanised fishing vessels by resource specific improved design vessels suitable to Indian conditions.*
- (b) *Financial package to support group of fishers/ cooperatives for acquiring intermediate range of fishing vessels.*

This programme would again be considered for dovetailing with a similar programme of NCDC to ease the availability of the loan component to the beneficiary. The central subsidy may amount to 10-15 per cent of the total cost of the fishing vessel, to be shared on 75:25 basis between the center and the states.

(iii) Introduction of Resource-specific Deep sea Fishing Vessels

This programme is aimed at suitable interventions to exploit the deep-sea fishery resources in the EEZ and beyond through introduction of resource-specific deep sea fishing fleet such as tuna long-liners, purse-seiners, squid jiggers, etc. The exact composition of this programme would be determined by the comprehensive policy on marine fisheries, which is presently under finalisation. However, it is felt that any successful introduction of a larger fleet fishing in the deeper waters would have to be complemented with an effective

mechanism of monitoring, control and surveillance, including the coverage through Vessel Monitoring System (VMS) in the Indian EEZ.

(iv) Mariculture (Pilot Projects)

At a time when there is over- exploitation of fishery resources in the near shore waters, limited access to capture fisheries and the need for diversification, mariculture could be one of the most appropriate alternatives. Presently, there are no programmes on introduction of mariculture in the coastal waters of the country. It may be worthwhile to develop an All India Coordinated Research Project on Mariculture for transferring the technologies developed so far, especially with regard to oysters, mussels, sea bass, groupers etc. However, pilot- scale programmes with 100 per cent central assistance would be essential for standardization and also to enable the end users to familiarize with the technology. The pilot-projects should be taken up for implementation through ICAR fisheries institutes.

4. Infrastructure and Post-harvest Programmes

Infrastructure development programmes implemented by the Ministry of Agriculture during the Ninth Five Year Plan mainly concentrated on construction of fishing harbours and fish landing centres. While these programming have met with some success, there have been certain limitations on achieving the desired progress. Keeping in view the future requirements of the marine sector, it is proposed to take up the following infrastructure development and post-harvest programmes during the Tenth Five Year Plan.

- *Strengthening of the post-harvest infrastructure through construction of fishing harbours (including one each at west coast (Maharashtra) and Andaman & Nicobar Islands) and fish landing centers. However, the emphasis would be on the fish landing centers, which would enable construction of large number of facilities with low cost.*
- *Upgradation of Fishing Harbours/ Landing centres with basic and essential requirements (platforms, sheds, storage facilities, sanitation, water facilities, etc).*
- *Need to develop resources – product – market linked fishery harbours with facilities of global standards.*

(i) Maintenance Dredging of Fishing Harbours/ Fish Landing Centres

Every harbour/ landing centres is subjected to siltation due to natural phenomenon. The rate of siltation varies depending on site conditions and other hydraulic parameter prevailing at the site. Periodic maintenance dredging is inevitable to keep the harbour/ landing centre basins fit for safe navigation. The DAHD has acquired a dredger, TSD Sindhuraj under Japanese-grant-in aid programme. The beneficiary states have expressed their inability to fund the periodical maintenance dredging since the revenue collected by way of user charges is meager and is barely sufficient for upkeep and running maintenance. Under the circumstances it is proposed that the maintenance dredging identified in harbours/ fish landing centres should be subsidised and the facilities should be made fully operational to meet the growing requirements of landing and berthing facilities by the fishing fleet.

(ii) Upgradation of hygienic condition in existing harbours

The sanitary and hygiene requirements in the existing fishing harbours and fish landing centres constructed earlier with central assistance have become essential, especially with regard to HACCP and ISO 9000. Non-compliance of universally agreed requirements of sanitary and hygiene conditions, both domestic and export markets are likely to be adversely effected in the near future. To enable incorporation of HACCP and ISO 9000 requirements in the infrastructure facilities, it is proposed to take up suitable programmes during the Tenth Plan. This assistance may be shared by the center and the states on 50:50 basis. Established institute/ organisation like CIFT, MPEDA may be involved for effective implementation of the programmes.

(iii) Programmes for Augmenting Post- harvest & Marketing Infrastructure

The target of 11 kg per capita consumption of fish can be achieved largely by minimizing post-harvest losses and creating a marketing infrastructure. A large group of fisherwomen and unemployed youth is proposed to be targetted under this programme. The scheme would include:

- *Training in low cost techniques of fish products development to be implemented through IFP*

- *Supply of input subsidy to self help groups of fisherwomen for setting up processing units (through State Fisheries Departments or women development Departments)*
- *Assistance for setting up of fish vending kiosks and mobile retail marketing units through three wheelers with refrigerated/ice hold. This would generate considerable employment opportunities and provide fresh fish to consumers in hygienic conditions.*
- *Setting up of model fish markets and establishment of cold chain at identified sites.*

5. Strengthening of Data Base and Information Networking

Notwithstanding the existing efforts made by several agencies, the fisheries database is in firm and needs considerable strengthening. In the inland sector, the priorities are towards standardisation of methodologies for estimation of catch from the diverse aquatic resources and establishing mechanisms for regular collection and dissemination of data by the states and union territories. In the marine sector, the existing methodologies need a revision and also a subsequent re-orientation of the Department of Fisheries on collection and estimation of methodologies. To strengthen the efforts in this direction, the use of remote sensing and Geographical Information System in estimation of resource size and productivity also needs to be integrated in the existing programmes of fisheries catch statistics.

Considering the dynamic trend and advancements in information technology in recent times, free flow of information is of crucial importance for fisheries development, sustenance and rational programme planning. Real time transfer of information has now become a basic requisite for activities of economic nature.

The objective of information networking is to organize data and knowledge in a cohesive unit and provide a single window access for the end users. It is anticipated that this system will enhance the availability of information on resource size, market arrivals, wholesale price indices of important fish species and products, productivity data, management of fish health, etc. on a real-time basis.

The following components are proposed with regard to the strengthening of data base and information networking during the Tenth Plan:

- ***Inland Fisheries Statistics***
- ***Remote Sensing***
- ***Information Networking***
- ***Making Marine Fisheries Statistics more informative and accurate.***
- ***National census on Important Attributes of Marine and Inland Fisheries***

The above components would be implemented under a central sector scheme with 100 per cent assistance from the center. The implementation of the programmes would also involve a larger participation from the concerned ICAR Fisheries Institutes and the fishery Survey of India.

6. *Welfare Programmes/ Policy Issues/ Human Resource Development*

Given the continued poverty of the fishing communities and the extreme risk in the occupation, more promotional and social security measures at the national level need to be implemented. Presently, the following welfare programmes are being implemented in the country :

- (i) *Development of Model Fisher Villages.*
- (ii) *Group Accident Insurance Scheme for active Fishers.*
- (iii) *Saving-cum-Relief Scheme for Fishers.*

The scheme is proposed to be continued in the Tenth Five Year Plan in the same pattern as was implemented during Ninth Plan mainly owing to the fact that this was thoroughly revised only very recently. However, the following minor modifications are proposed to be carried out during Tenth Five Year Plan.

- *To allow additional subsidy on housing scheme to beneficiaries in hilly areas on account of high cost of materials and transportation.*
- *To cover seasonal fishers also under savings-cum-relief scheme*
- *To include a component for renovation of existing houses*
- *To include platforms for fish drying/ fish trading in fisher villages as a community facility.*

Safety at Sea

Safety at sea has been a neglected aspect in the maritime states, thereby causing loss of many lives at sea every year. Besides human misery, the cost of search and rescue is also an additional burden on the government agencies, which can be largely reduced, if the fishing boats adopt the use of simple communication and navigation equipments and sea safety measures. It is therefore essential that the safety of those fishing at sea needs to be given greater priority both during the normal operation and during times of un-predicable weather.

The components proposed under a centrally sponsored programme would include the following:

- (i) *subsidy to fishermen on safety equipments to be procured and kept on boat,*
- (ii) *subsidy to State Governments are on upkeep of patrol boats supplied under earlier scheme;*
- (iii) *training of fishermen and conducting awareness campaign.*

Responsible Movement of Live Aquatic Species and Setting up of Quarantine Infrastructure at major ports)Mumbai/ Goa/ Cochin/ Chennai/ Visakhapatnam/ Kolkata etc.).

There are several areas where immediate policy intervention is necessary to meet the requirements of the fisheries sector in the new millennium. One of the foremost requirement where major investments have to be made by the center relate to the setting up of quarantine infrastructure in the country.

With the increased movement of live aquatic animals the risks of introducing exotic species and pathogens have greatly increased. The risks are equally grave for movements from across the border and also within one zoo-geographic region and the country to the other. Similarly, to meet the pre-movement quarantine requirements, facilities would have to be created at all the ports of entry. This would also necessitate a sound regulatory framework for setting up of quarantine units and regulation for movement of live aquatic animals within the country. These units are proposed to be set up at parts of the

country so as to address to the quarantine needs of exotic / aquatic living organisms and products being imported into the country. Only this programme would have a staff component details of which would be worked out. The setting up of quarantine facilities in the country would be through central sector programme with 100 percent funding by the Ministry of Agriculture.

In this regard, the Ministry of Agriculture has already set up a National Level Committee on Introduction of Exotic Aquatic species in Indian Waters and the Committee has prepared the draft National Strategic Plan for Aquatic Exotics and Quarantine in the country. The National Strategic Plan on adoption would form the basis of the quarantine framework to be set up and also the legislation to provide necessary backup support to the quarantine infrastructure in the country.

Training and Extension

There is a need for human resource development of the labouring sections who are responsible for the giving value to the resource by catching, processing and marketing it. It is proposed to adopt a holistic approach to the training and extension activities in the country by channelising training efforts in various sectors after taking an inventory of trained personnel in each sector, additional requirements, etc. The scheme also would identify the potential training centres and resource persons besides preparing a master plan for setting up of infrastructure for training. The programme is proposed for implementation with 75 per cent central assistance in association with ICAR, state governments and NGOs. The training and extension programmes would also have a focus on empowerment of fisherwomen.

Code of Conduct for Responsible Fisheries

A positive and purposeful check on over-exploitation of resources in the near shore areas through appropriate regulation on the number of fishing boats/ vessels, their operational areas, ban on monsoon fishing, mesh size, use of the right type of fishing gear, and safety equipment etc. seems essential to regulate fishing in the coastal waters to meet the requirements of the Code of Conduct on Responsible Fisheries.

This interventions in this regard would include translation of Code of Conduct for Responsible Fisheries in to vernacular languages, financing workshops for stake holders for popularizing the Code, etc. The implementation of this programme would be with the active involvement/ participation of NGOs and would implemented with 100 per cent assistance from the center government.

While formulating the developmental schemes in fisheries and aquaculture, particularly in the small scale sectors both for harvest and post-harvest related aspects should be linked with the ongoing activities of the Ministry of Rural Development. The pool of funds available under the various schemes of the Ministry of Rural Development such as DRDA, IRDP, TRYSEM, etc. may be utilised through appropriate linkages inbuilt in the proposed programmes during the Tenth Five Year Plan.

In addition to the aforesaid proposed programmes, the Working Group recommends the following to initiate action on priority:

Aquaculture at par with Agriculture

Like the crops and pulses produced by Agriculture, fish produced from ponds by practicing aquaculture is a daily food for a large section of the society all over the country. Basically, aquaculture also required all the inputs and practices which are needed and have been provided for the development of agriculture sector, during the successive Five Year Plans. The resource base for aquaculture is also land and water although the water used is not consumptive in aquaculture. However, assistance/ incentives such as income tax relief, power and water supply, loan facilities, insurance cover (for crops), drought and flood relief (for crops), subsidy on seed/ feed, fertilizer, machinery/ equipments, transport, land development and soil conservation, demonstration and training etc. as available to the farmers in the agriculture sector may also be made available to the aquaculture sector. Aquaculture should, therefore, receive all the incentives/ concessions so far given to agriculture.

Revival of Mahseer

The mahseers are the coldwater fishes of great national significance. They are highly acclaimed sport and food fish of the hilly regions. Despite their abundance at one time, mahseers are declining very rapidly in their numbers and sizes in different parts of India which is also a global concern. Keeping in view the importance of mahseer fisheries, there is an urgent need for more concerted efforts in research and development by all concerned in the government organisations, universities, NGOs etc. and to provide necessary infrastructure for undertaking conservation and propagation of the fish.

Strengthening of Fisheries Division

Animal Husbandry and Fisheries are two separate wings of the department (DAHD) under the Ministry of Agriculture. Considering the potential and the pace of development of the fishery sector and its overall contribution to the GDP and foreign exchange earnings in the recent past, the Ministry of Agriculture, may review the structure and technical manpower of Fisheries Division to cope with enlarged responsibilities/ activities envisaged in the tenth five year plan proposals. On the same lines, the state governments may also consider strengthening their fisheries departments.

Strengthening of Fishery Cooperatives

The fishery cooperatives represent one of the weaker sections of the society. There is need to revitalize and strengthen fishery cooperatives in the country besides

development linkages among different tiers of fishery cooperatives. On the pattern of NAFED and TRIFED, there is need to strengthen resource base of FISHCOPFED (National level Federation) for taking up fisheries activities for the benefit of fishers who are members of the cooperatives. Since Cooperation Division is with the Department of Agriculture & Cooperation (DAC) in the Ministry of Agriculture, Working Group was of the view that the issue may be referred to DAC. Accordingly, the issue has been referred to them for consideration during the tenth five year plan.

Establishment of Marine Parks

While discussing the draft report on Fisheries for the Tenth Plan, Steering Committee under the chairmanship of Dr. M.S. Swaminathan on 9th July, 2001 suggested that establishment of four marine parks, two each along the east and west coasts may be considered during the Tenth Five Year Plan by the Government.

The Working Group on Fisheries accepting the suggestion, proposed that such marine parks may be provided with basic infrastructure such as hatcheries and grow-out facilities for endangered species of animals, fish, medicinal plants etc. and an implementation agency for ensuring conservation and responsible fishing to preserve our biodiversity. A museum/aquarium for preservation of valuable specimen should be included.

A micro-survey of the coastal regions would be essential to identify suitable locations for such marine parks. It may, however, be ensured that the traditional rights of coastal fisher-folks to fish for subsistence and livelihood is not obstructed.

The Working Group on Fisheries was aware of the fact that establishment of marine parks is under the purview of Ministry of Environment and Forests (MOEF) as per the Rules of Business. Therefore, the issue may be referred to the MOEF for consideration during the Tenth Five Year Plan development programmes in coordination with the Ministry of Agriculture, DAHD and the states concerned.

6.2 *Targets*

6.2.1 *Fish Production*

Fisheries has made a significant progress over the successive five year plans. Fish production levels have increased from 0.75 million tonnes of fish and shell-fish in 1950-51 to 5.65 million tonnes in 1999-2000. During 1950s-1990s, the marine and inland fish production levels have increased with a growth rate of 3.43% and 5.27% per annum respectively with an overall annual growth rate of 4.14% during this period. The inland and marine fish production levels during the corresponding period have risen from 0.22 million tonnes and 0.53 million tonnes to 2.82 million tonnes and 2.83

million tonnes respectively. The share of inland fishery sector, which was 29% in 1950-51, has gone up to about 50% in 1999-2000. The production levels of both inland and marine are almost equal at present (Tables 8, 9 and 10).

Growth Rate of fish production has been a robust 4.12% per annum during the nineties. During the Eighth Plan the growth rate of the fish production was 4.8%. The ninth plan fish production target was set at 7.04 million tonnes envisaging growth rate of 5.64% per annum. However, from the present production trend and the achievement made so far, it is expected that the fish production may reach to a level of 6.26 million tonnes in the terminal year of the Ninth plan (2001-02).

In marine sector, whereas the inshore waters have been almost exploited to the Maximum Sustainable Yield (MSY) levels, the contribution from the Deep-sea has been insignificant. In spite of sizeable investment for marine fisheries in the past, the growth in marine fish production in 1990's has been rather slow at an average of 2.19% as compared to the inland fish production growth rate of 6.55%. Considering the present pace of development and the other requirements of the sector, the growth rate for the marine fisheries for the Tenth plan has been fixed at 2.5% per annum while the same for the inland fisheries is kept at 8%.

With this growth rate it is expected to reach a fish production target of about 8.19 million tonnes by the end of the Tenth Five Year plan i.e. 2006-07. Year-wise projections both for inland and marine with the envisaged growth rate is given in the Table 30.

6.2.2 Fish Seed Production

During the Sixth and Seventh Plan period, the government laid adequate emphasis on production of fish seed (major carps) to meet the growing requirement of fish farmers in the country. In the process, a number of commercial fish seed farms and hatcheries were established in the government sector. These farms and hatcheries alongwith the private enterprise (mainly restricted to West Bengal and Assam) did bring the desired results and around late eighties the country seemed to be self sufficient in meeting the seed (major carps) requirement of farmers.

From Eighth plan onwards, the government has been encouraging fish seed production in the private sector. In the process, fish seed production has increased from 9691 million fry in 1989-90 to 16589 million fry in 1999-2000 with a growth rate of 4.60% per annum. During Eighth Plan the growth rate for seed production was 5.44% per annum. However, the growth rate during the first three years of the Ninth Plan has been 2.1% per annum. This is likely to be increased by the end of the ninth plan (Tables 11 and 12).

India is reckoned to be self sufficient in carp seed production to support aquaculture. However, much still requires to be done in the area of fish seed production and besides production of quality fish and shrimp seed, the deficit areas needs promotion. The carp seed production infrastructure in the country is inadequate and inefficient particularly in public sector and is localized in certain states only. Diseases free and diseases resistant carp seed is to be ensured with strict quarantine measures. Brood stock maintenance is to be encouraged on the seed farms. Further technologies for raising seed of minor carps, cat fishes and cold water fish species, particularly of game fish, indigenous ornamental fishes and species for mariculture programmes are required to fill the gaps and for further promoting aquaculture through diversification. Genetic upgradation of candidate species for aquaculture through genetic selection process is an immediate necessity so that better performing fish seed stock is made available to the aquaculturists. Application of bio-technology should be given emphasis in fisheries sector, particularly in aquaculture.

Seed being the basic input into culture system, its production has been accorded priority in terms of brood stock management, establishment of hatcheries, refinement of induced breeding techniques, rearing and production of quality seeds across the country. It is estimated that a total of 17,000 million fry (Indian major carps and exotic carps) shall be produced by the end of the Ninth plan. The target set for fish seed production for the Tenth plan for the Indian major carps and exotic carps are based on an annual (of 8%) growth rate and it is expected that about 25,000 million fry will be produced by the end of the Tenth plan (2006-07). Year-wise projections for fish seed production for the Tenth plan is given in the Table 31. Besides, adequate

infrastructure and efforts on priority are required to produce seed of shrimp (about 20,000 million PL) and Finfish (about 150 million fry) such as Sea bass, Grey mullet, Grouper, Snapper, Chanos sp. etc.) for diversifying fisheries activities during the Tenth plan.

6.2.3 Fish Feed

Lack of feed support to Freshwater and Brackishwater Aquaculture has been a major constraint for taking up intensive farming practices. After more than two decades of successful carp farming, the farmer has still to rely on a crude mixture of rice bran and oil cakes (mustard and groundnut oil cakes are mostly used). The efforts need to be directed at production of good quality feed for carps and other commercially important fish species with an equally good marketing network to ensure supplies in the hinterland.

The total fish production from inland sector, as projected, will be about 4.8 million tonnes by the end of the Tenth Plan. The aquaculture contribution would be about 3.3 million tonnes at 70% of the total inland fish production. With an average conversion ratio at a moderate efficiency level of 2:1, at least 6.6 million tonnes of feed would be required. For intensive/semi-intensive aquaculture, the feed may have at least 40% of animal protein thus posing a demand of 2.6 million tonnes of fish-meal. The currently produced meal remains totally booked for poultry industry. The way out would be either to increase the fish meal production or to import the commodity. Alternatively, technologies to be developed to utilize plant protein sources from soyabean etc. which would force a compromise on fish production quantum per unit area. Even without fish meal added, feed for rural and semi-intensive aquaculture with limited productivity, the envisaged fish production target would require about 3 million tonnes each of oil cake and bran alongwith organic manure and fertilizers. Import of fish feed needs to be urgently reviewed and steps taken to indianise the fish feed industry not only to make the country self sufficient and independent but also to ensure safety of the stocks against possible incursion of unknown diseases.

6.3 Outlays

Growth rate of fish production has been about 4.12% per annum during the 90s. However, the full potential of all the water bodies have not been realized. The country has not yet been able to utilise the full potential of inland fishery resources as well as the deep-seas. In spite of sizable investment for marine fisheries in the past the growth of marine fish production in 1990s has been rather slow as compared to the inland fish production growth rate. This cause for a change in our priorities to make optimum use in our inland fishery resources.

Some of the major constraints being faced in the development of fishery sector in the past are : inadequate infrastructure for fish seed production and rearing space, lack of feed support to aquaculture, inadequate trained manpower, post-harvest infrastructure and marketing, lack of research inputs to enhance productivity and to control fish disease etc. Further, technologies for raising seed of minor carps, cat fish, coldwater fish species etc. are also required to fill the gaps through diversification of aquaculture.

As stated above, the Ninth plan outlay for fisheries in the DAHD was Rs. 800 crores. Based on an annual average inflation of 7%, the present value of Rs. 800 crore is computed at Rs. 1200 crore and an enhanced outlay of Rs. 1800 crore is proposed for the Tenth plan (50% over the Ninth plan). This appears to be the trend in the overall enhancement of the plan outlay from previous plans from First to Ninth (refer table under chapter 2). The list of proposed programmes/schemes for implementation during the Tenth plan alongwith the tentative allocation is given at Table 32.

Table 1 : Marine Fishery Resources Of India

State/ Union Territory	Approximate length of coast line (Kms.)	Continental shelf ('000 sq. km.)	No. of landing centres	No, of fishing villages
1. Andhra Pradesh	974	33	508	508
2. Goa	104	10	88	72
3. Gujarat	1,600	184	286	851
4. Karnataka	300	27	29	221
5. Kerala (P)	590	40	226	222
6. Maharashtra	720	112	184	395
7. Orissa	480	26	63	329
8. Tamil Nadu	1,076	41	362	556
9. West Bengal	158	17	47	652
10. Andaman & Nicobar Islands (P)	1,912	35	57	45
11. Daman and Diu (P)	27	-	7	31
12. Lakshadweep (P)	132	4	11	10
13. Pondicherry	45	1	28	45
Total	8,118	530	1,896	3,937

P - Provisional

Source: State Governments/ Union Territory Administrations

Table 2 : Inland Fishery Resources of India

S.No.	STATES/UTs	Rivers & Canals	Reservoirs	Ponds & Tanks	Beels, Oxbow lakes & Derelict Water bodies	Brackish-water
		(kms)	(million ha)	(million ha)	(million ha)	(million ha)
1	ANDHRA PRADESH	11514	0.46	0.52	-	0.06
2	ASSAM	4820		0.02	0.11	-
3	BIHAR	3200	0.09	0.10	0.01	-
4	GOA	250	-	neg.	-	-
5	GUJARAT	3865	0.29	0.07	0.01	0.1
6	HARYANA	5000	-	0.01	0.01	-
7	HIMACHAL PRADESH	3000	0.04	neg.	-	-
8	JAMMU & KASHMIR	27781	-	0.02	0.01	-
9	KARNATAKA	9000	0.44	0.36	-	0.01
10	KERALA	3092	0.03	neg.	0.24	0.24
11	MADHYA PRADESH	20661	0.46	0.12	-	-
12	MAHARASHTRA	16000	0.27	0.03	-	0.01
13	MANIPUR	3360	-	neg.	0.04	-
14	MEGHALAYA	5600		neg.	-	-
15	NAGALAND	1600	-	0.05	-	-
16	ORISSA	4500	0.20	0.06	0.18	0.43
17	PUNJAB	15270	-	0.01	-	-
18	RAJASTHAN	* 5290	0.15	0.18	-	-
19	SIKKIM	900	-	-	neg.	-
20	TAMIL NADU	7420	0.36	0.22	NA	0.06
21	TRIPURA	1200		0.01	-	-
22	UTTAR PRADESH	31200	0.34	0.16	0.13	-
23	WEST BENGAL	2526	0.02	0.28	0.04	0.21
24	ARUNACHAL PRADESH	2000	-	neg.	0.04	-
25	MIZORAM	1395	-	neg.	-	-
26	ANDAMAN & NICOBAR	115	-	0.03	-	0.12
27	CHANDIGARH	2	-	Neg	Neg	-
28	DELHI	150	-	-	-	-
29	LAKSHADWEEP	-	-	-	-	-
30	PONDICHERY	247	-	Neg	neg.	neg.
31	DADRA & NAGAR HEVELI	54	-	-	-	-
32	DAMAN & DIU	12	-	-	-	-
	<u>TOTAL</u>	191024	3.15	2.25	0.82	1.24

Source : Hand Book on Fisheries Statistics, MOA, DAHD.

Report of Working Group on Fisheries for Ninth Five Year Plan, MOA. ; * = Provisional

Table 3 : Length of Major Rivers of India

River	Total length (Km)	State	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
		b) Gujarat	323
8. Narmada	1,312	a) Madhya Pradesh	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: Central Water Commission

Table 4: Distribution of Small, Medium and Large Reservoirs in India

Sl. No.	States	Small		Medium		Large		Total	
		Number	Area (ha)	Number	Area (ha)	Number	Area (ha)	Number	Area (ha)
1	Tamil Nadu	8895	315941	9	19,577	2	23,222	8906	358,740
2	Karnataka	4651	228657	16	29078	12	179556	4679	437291
3	Madhya Pradesh	6	172575	21	169502	5	118307	32	460384
4	Andhra Pradesh	2898	201927	32	66429	7	190151	2937	458507
5	Maharashtra	-	119515	0	39181	0	115054	0	273750
6	Gujarat	676	84124	28	57748	7	144358	711	286230
7	Bihar	112	12461	5	12523	8	71711	125	96695
8	Orissa	1433	66047	6	12748	3	119403	1442	98198
9	Kerala	21	7975	8	15500	1	6160	30	29635
10	Uttar Pradesh	40	218651	22	44993	4	71196	66	334840
11	Rajasthan	389	54231	30	49827	4	49386	423	153444
12	Himachal Pradesh	1	200	0	0	2	41364	3	41564
13	North East	4	2239	2	5835	0	0	6	8074
14	Haryana	4	282	0	0	0	0	4	282
15	West Bengal	4	732	1	4600	1	10400	6	15732
TOTAL		19134	1485557	180	527541	56	1140268	19370	3153366

Table 5 : Potential of Fishery Resources in the Indian EEZ

(Million tonnes)

Resource	Demersal	Pelagic	Oceanic	Total
Potential	2017071	1673545	243800	3934416
Present Yield (Average of 1993-98)	1229888	1221896	Negligible	2451784*
Additional Harvestable Yield	787183	451649	243800	1482632

* Excluding molluscs and other cephalopods

Source : Working Group Report revalidating potential of fishery resources in the Indian EEZ , DAHD, Ministry of Agriculture.

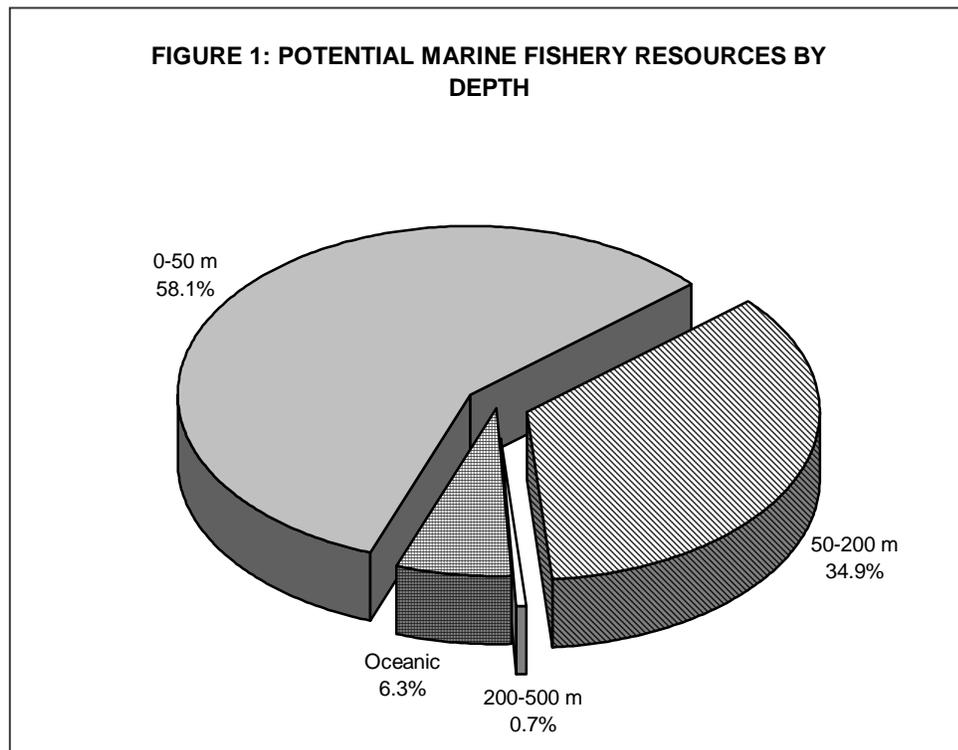


Table 6 : Fishing Crafts - Coastal States and Union Territories

State/Union Territory	Non motorized traditional crafts	Motorised traditional crafts	Mechanised boats	Total
1. Andhra Pradesh	53,853	4,164	8,642	66,659
2. Goa	1,094	1,100	1,092	3,286
3. Gujarat	9,222	5,391	11,372	25,985
4. Karnataka	19,292	3,452	2,866	25,610
5. Kerala	28,456	17,362	4,206	50,024
6. Maharashtra	10,256	286	8,899	19,441
7. Orissa	10,993	2,640	1,276	15,854*
8. Tamil Nadu	33,945	8,592	9,896	52,433
9. West Bengal	4,850	270	3,362	8,482
10. Andaman & Nicobar Islands	1,180	160	230	1,570
11. Daman and Diu	252	350	805	1,407
12. Lakshadweep	594	306	478	1,378
13. Pondicherry	7,297	505	560	8,362
Total	181,284	44,578	53,684	280,491*

* Total includes 810 FRP Catamarans and 135 Beach Landing Crafts.

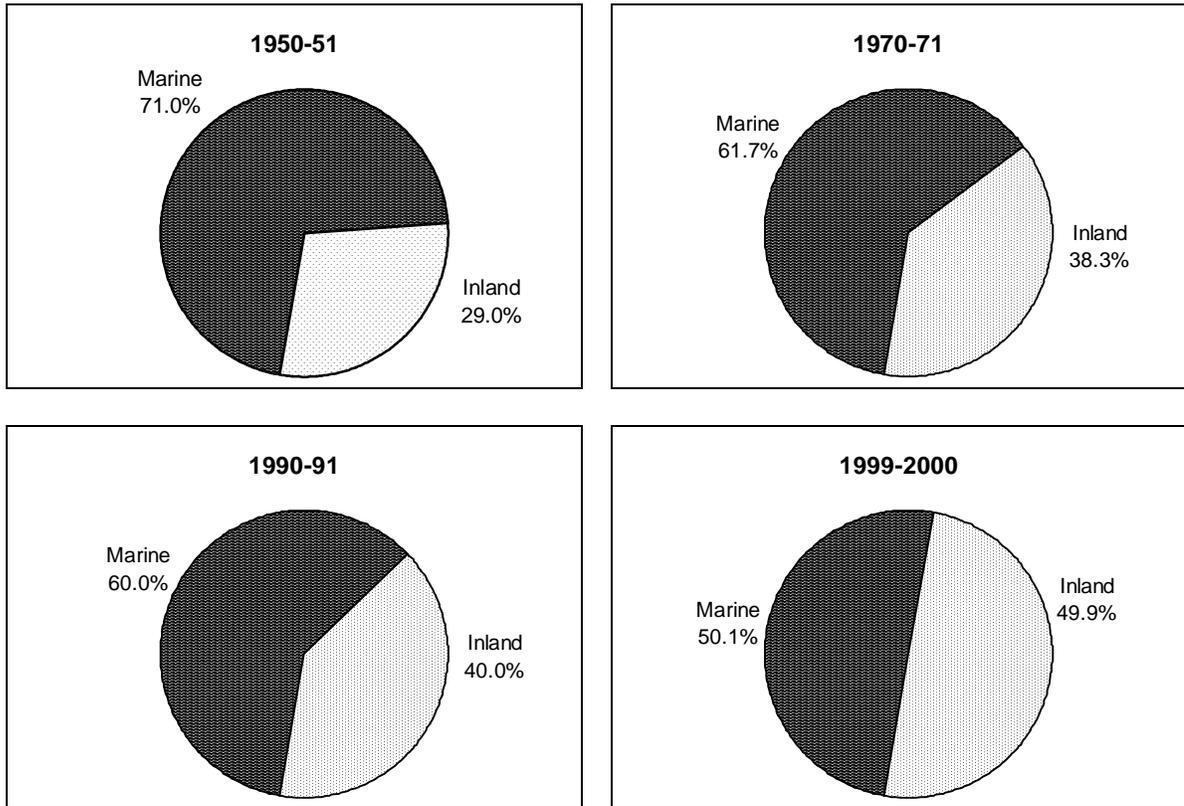
Table 7 : State-wise details of Marine Fishing Regulation Acts

S.No.	State/Act	Area exclusively for Traditional Craft*	Area for mechnised Vessel
1	Gujarat	Marine Fishing Regulation Act under consideration	
2	Maharashtra – MFRA ** 1981	5 – 10 fathom depth (9-18 m depth)	
3	Goa – MFRA 1980	5 km	Beyond 5 km
4	Karnataka – MFRA 1980	6 km	Beyond 6 km
5	Kerala – MFRA 1980	10 km	Beyond 10 km
6	Tamil Nadu – MFRA 1983	3 nautical miles (5.4 km)	Beyond 3 nautical miles
7	Andhra Pradesh – MFRA 1993	10 km	Beyond 10 km
8	Orissa - MFRA 1982	5 km	(i) upto 15 meter OAL beyond 5 km
9	West Bengal – MFRA 1993		(ii) above 15 meter OAL beyond 10 km
10	UT of Lakshadweep – MFRA 2000		

* Traditional craft can fish any where in the sea. The reservation mentioned implies only that other category of vessels may not fish in the area reserved for traditional craft.

** Marine Fishing Regulation Act.

Figure 2: FISH PRODUCTION BY SOURCE – SELECTED YEARS



**Table 8 : Fish Production and Average Annual Growth Rate, India
(1950-51 To 1999-2000)**

Year	Fish Production (‘000 tonnes)			Average Annual Growth Rate (Per cent)		
	Marine	Inland	Total	Marine	Inland	Total
1950-51	534	218	752	--	--	--
1955-56	596	243	839	2.32	2.29	2.31
1960-61	880	280	1,160	9.53	3.05	7.65
1965-66	824	507	1,331	-1.27	16.21	2.95
1970-71	1,086	670	1,756	6.36	6.43	6.39
1973-74	1,210	748	1,958	3.81	3.88	3.83
1978-79	1,490	816	2,306	4.25	1.76	3.33
1979-80	1,492	848	2,340	0.13	3.92	1.47
1980-81	1,555	887	2,442	4.32	3.24	3.91
1981-82	1,445	999	2,444	-7.07	12.63	0.08
1982-83	1,427	940	2,367	-1.25	-5.91	-3.15
1983-84	1,519	987	2,506	6.45	5.00	5.87
1984-85	1,698	1,103	2,801	11.78	11.75	11.77
1985-86	1,716	1,160	2,876	1.06	5.17	2.68
1986-87	1,713	1,229	2,942	-0.17	5.95	2.29
1987-88	1,658	1,301	2,959	-3.21	5.86	0.58
1988-89	1,817	1,335	3,152	9.59	2.61	6.52
1989-90	2,275	1,402	3,677	25.21	5.02	16.66
1990-91	2,300	1,536	3,836	1.10	9.56	4.32
1991-92	2,447	1,710	4,157	6.39	11.33	8.37
1992-93	2,576	1,789	4,365	5.27	4.62	5.00
1993-94	2,649	1,995	4,644	2.83	11.51	6.39
1994-95	2,692	2,097	4,789	1.62	5.11	3.12
1995-96	2,707	2,242	4,949	0.56	6.91	3.34
1996-97	2,967	2,381	5,348	9.60	6.20	8.06
1997-98	2,950	2,438	5,388	-0.57	2.39	0.75
1998-99	2,696	2,566	5,262	-9.40	5.25	-2.34
1999-2000*	2,834	2,823	5,657	5.12	10.01	7.48

* Provisional

Note: The growth rates presented for the periods prior to 1979 are the average annual compound growth rates

Source:

- I. Central Marine Fisheries Research Institute, Kochi for the period up to 1970-71.
- II. State Governments / Union Territory Administrations since 1970-71.

Table 9 : Fish Production over the Plan Periods - India

Plan Period	Fish Production at end of the period ('000 tonnes)			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	16.76	33.51	23.65	5.17

Source: i. Central Marine Fisheries Research Institute, Kochi for the period up to 1970-71.
 ii. State Governments / Union Territory Administrations since 1970-71.

TABLE 10: FISH PRODUCTION DURING THE NINTH PLAN (1997-98 TO 1999-2000)

(in tonnes)

S.No.	STATES/UTs	1997-98			1998-99			1999-2000		
		MARINE	INLAND	TOTAL	MARINE	INLAND	TOTAL	MARINE	INLAND	TOTAL
1	ANDHRA PRAD.	146545	226314	372859	150000	260829	410829	166482	380580	547062
2	ARUNA. PRAD.	0	2130	2130	0	2301	2301	0	2395	2395
3	ASSAM	0	155132	155132	0	155714	155714	0	159768	159768
4	BIHAR	0	208540	208540	0	202290	202290	0	254740	254740
5	GOA	88809	3240	92049	65841	3175	69016	61460	3509	64969
6	GUJARAT	745706	70798	816504	550000	80000	630000	670951	70328	741279
7	HARYANA	0	32050	32050	0	32520	32520	0	30000	30000
8	H.P.	0	6685	6685	0	6786	6786	0	6995	6995
9	J & K	0	18530	18530	0	18850	18850	0	18850	18850
10	KARNATAKA	189859	95275	285134	160612	95000	255612	165653	126646	292299
11	KERALA	526342	57514	583856	583364	65855	649219	575500	73900	649400
12	M.P.	0	115161	115161	0	119592	119592	0	127429	127429
13	MAHARASHTRA	453000	127000	580000	394883	125496	520379	397901	135390	533291
14	MANIPUR	0	13700	13700	0	15309	15309	0	15506	15506
15	MEGHALAYA	0	3085	3085	0	4525	4525	0	4676	4676
16	MIZORAM	0	2700	2700	0	2775	2775	0	2890	2890
17	MAGALAND	0	3700	3700	0	4500	4500	0	5000	5000
18	ORISSA	156081	153428	309509	124329	159904	284233	125935	135303	261238
19	PUNJAB	0	36000	36000	0	44500	44500	0	47177	47177
20	RAJASTHAN	0	15100	15100	0	12000	12000	0	12968	12968
21	SIKKIM	0	140	140	0	140	140	0	140	140
22	TAMIL NADU	355100	109500	464600	359545	110200	469745	363000	112000	475000
23	TRIPURA	0	27906	27906	0	28410	28410	0	29340	29340
24	U.P.	0	160017	160017	0	183030	183030	0	192714	192714
25	WEST BENGAL	164000	786020	950020	171500	823500	995000	180000	865700	1045700

Table 10 Contd..

26	A & NICOBAR	27225	40	27265	27400	42	27442	28147	56	28203
27	CHANDIGARH	0	4	4	0	2	2	0	2	2
28	D & N HEVELI	0	15	15	0	17	17	0	29	29
29	DAMAN & DIU	18807	0	18807	26850	0	26850	15946	4400	20346
30	DELHI	0	4200	4200	0	4420	4420	0	0	0
31	LAKSHADWEEP	10550	0	10550	13540	0	13540	13600	4210	17810
32	PONDICHERRY	38420	4104	42524	38595	4108	42703	38620	0	38620
33	DEEP SEA	30000		30000	30000	0	30000	30000	0	30000
	TOTAL	2950444	2438028	5388472	2696459	2565790	5262249	2833195	2822641	5655836

Table 11 : Fish Seed Production

Year	Production (million fry)
1973-74 (End of IV th Plan)	409
1978-79 (End of V th Plan)	912
1984-85 (End of VI th Plan)	9,639
<u>VIIth Plan</u>	
1985-86	6,322
1986-87	7,601
1987-88	8,608
1988-89	9,325
1989-90	9,691
<u>Annual Plan</u>	
1990-91	10,332
1991-92	12,203
<u>VIIIth Plan</u>	
1992-93	12,500
1993-94	14,239
1994-95	14,544
1995-96	15,007
1996-97	15,852
<u>IXth Plan</u>	
1997-98	15,904
1998-99	15,156
1999-2000	16,579

Source: State Governments/Union Territory Administrations

**Table 12 : State-wise Fish Seed Production during the Ninth plan
(1997-98 To 1999-2000)**

(In million fry)

S.No	State	1997-98	1998-99	1999-2000
1	ANDHRA PRADESH	700.00	752.40	899.00
2	ARUNACHAL PRADESH	24.00	24.50	24.50
3	ASSAM	2245.57	1703.06	2114.14
4	BIHAR	405.49	451.39	449.11
5	GOA	-	0.45	0.40
6	GUJARAT	670.00	469.50	469.07
7	HARYANA	151.69	168.00	177.00
8	HIMACHAL PRADESH	23.35	23.21	23.63
9	JAMMU & KASHMIR	13.07	10.65	0.00
10	KARNATAKA	202.12	232.80	183.91
11	KERALA	5.18	9.50	19.02
12	MADHYA PRADESH	584.94	495.10	610.61
13	MAHARASHTRA	242.00	241.00	208.00
14	MANIPUR	110.05	98.20	115.10
15	MEGHALAYA	0.98	0.78	1.13
16	MIZORAM	2.70	5.80	14.00
17	NAGALAND	50.00	50.00	50.00
18	ORISSA	234.20	261.71	346.00
19	PUNJAB	60.05	71.97	71.00
20	RAJASTHAN	220.00	167.31	238.51
21	SIKKIM	2.50	3.60	2.50
22	TAMIL NADU	561.05	542.44	814.36
23	TRIPURA	210.03	211.12	209.90
24	UTTAR PRADESH	680.10	730.54	806.52
25	WEST BENGAL	8500.00	8610.00	8725.00
26	ANDAMAN & NICOBAR	0.47	0.14	0.48
27	CHANDIGARH	-	6.60	0.30
28	DADRA & NAGAR HEVELI	-	-	-
29	DAMAN & DIU	-	-	-
30	DELHI	4.10	4.25	3.20
31	LAKSHADWEEP	-	-	2.40
32	PONDICHERRY	-	-	-
	TOTAL	15903.64	15346.02	16578.79

**Table 13 : List of Fishing Harbours and Fish Landing Centres
Commissioned/ under Construction By State / Union Territory**

Major Fishing Harbours

Port	Cost (Rs. Lakhs)*	Year of sanction	Status	Designed Capacity			
				DSV (No)	MFV (No)	Draft (m)	TL
1. Visakhapatnam Stage I Stage II Stage III	2,138	1975 1978 1988	C C C	90	300	4.5	1,938
2. Madras Stage I Stage II	1,334 850	1973 1994	C UC	50	500	3.0	1,220
3. Cochin Stage I Stage II	494 77 (100)	1971 1993	C UC	57	450	6.0	560
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	3.0	1153

* 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)

Table 13 (contd.)

State/ Union territory	Minor Fishing Harbour		Fish Landing Centres	
	Commis-sioned	Under constru-ction	Commis-sioned	Under constru-ction
1. Andhra Pradesh	3	1	1	1
2. Goa	--	--	1	1
3. Gujarat	4	1	20	1
4. Karnataka	5	3	9	5
5. Kerala	5	5	22	6
6. Maharashtra	1	1	29	7
7. Orissa	3	1	21	5
8. Tamil Nadu	6	1	11	
9. West Bengal	2	1	12	
10. Andaman & Nicobar Islands	1	--	--	--
11. Daman and Diu	--	--	--	2
12. Lakshadweep	--	--	3	--
13. Pondicherry	--	1	1	--
Total	30	15	130	28

**Table 14 : Details of Fish Farmers Development Agencies (FFDAs)
(Achievements till 1999-2000)**

S.No.	STATES/UTs	No. of FFDAs	Water area covered (ha)	Fish farmers trained (nos.)	No. of Beneficiaries	Average Productivity (kg/ha/year)
1	ANDHRA PRADESH*	22	4120	11927	5805	3500
2	ARUNACHAL PRADESH	2	661	3100	4003	1200
3	ASSAM	23	3694	20118	11433	1870
4	BIHAR	49	24729	24769	26574	2175
5	GOA	1	-	-	-	0 (not operative)
6	GUJARAT	17	49270	17970	15341	1245
7	HARYANA	16	9668	12221	12594	2050
8	HIMACHAL PRADESH	2	373	3564	1662	2200
9	JAMMU & KASHMIR	2	5673	3034	2878	2530
10	KARNATAKA	18	38846	11988	8493	1430
11	KERALA	14	17267	23347	59278	2500
12	MADHYA PRADESH	45	76180	35162	79374	1740
13	MAHARASHTRA	29	22547	13383	60030	1750
14	MANIPUR	8	2275	3874	7292	2400
15	MEGHALAYA	2	513	1308	1308	1500
16	MIZORAM	5	444	1516	1530	2000
17	NAGALAND	8	2398	3671	14606	1800
18	ORISSA	30	33215	46654	122162	2060
19	PUNJAB	17	14110	17130	13745	4735
20	RAJASTHAN**	15	3164	9405	2710	2055
21	SIKKIM	1	21	1031	1322	3000
22	TAMIL NADU	17	16080	7620	13511	1770
23	TRIPURA	4	4369	70175	20936	2300
24	UTTAR PRADESH	56	93683	93640	91719	2350
25	WEST BENGAL	18	107712	196820	354695	2950
26	PONDICHERRY	1	217	681	926	1475
	<u>TOTAL</u>	422	531229	634108	933927	2226

* Data as on 1996-97

** Data as on 1997-98

Source : Ministry of Agriculture, DAHD.

Table 15 : Details of Brackishwater Fish Farmers Development Agencies (BFDAS)

Sl. No.	State	No. of BFDAs	District
1	Andhra Pradesh	6	Krishna Mellore Srikakulam East Godavari Prakasam West Godavari
2	Gujarat	3	Valsad Surat Bhroach
3	Karnataka	2	Uttar Kannada Dakshin 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	

Table 16 : World Bank Assisted Shrimp & Fish Culture Project (2329 – IN)

State-wise Financial Details

(Rs. in lakhs)

S.No.	States	SAR Allocation	Revised Allocation	Expenditure for total period (Dec. 2000)
1.	Andhra Pradesh	8812.78	1187.69	801.88
2	Bihar	556.83	523.83	185.94
3	Orissa	7013.30	6945.35	3141.18
4	Uttar Pradesh	701.39	366.94	258.94
5	West Bengal	10296.40	6515.24	5474.60
6	Central Government	983.10	1726.83	1561.50
	TOTAL	28363.80	17265.88	11421.04

Table 17 : List of Central/Centrally Sponsored Schemes in the Ninth Plan (1997-2002)

(Rs. in crores)

Sl. No.	Name	Allocation Ninth Plan	Expd. Upto 2000-01	2001-02 B.E.
1.	Fishery Survey of India	130.77	53.87	30.20
2.	Cent. Inst. of Fisheries Nautical	19.75	12.40	1.68
3.	Cent. Fish. Coast Engg. Inst.	3.00	1.21	1.18
4.	Integrated Fisheries Project	24.54	9.50	2.70
5.	Dev. of Freshwater Aquaculture	150.32	42.94	14.00
6.	Inland Capture Fisheries	40.50	-	1.00
7.	Dev. of Fisheries in Hilly Region	15.60	-	1.00
8.	Establishment of Fishing Harbours	150.17	49.90	14.00
9.	Acquisition of Dredging Equipment	31.67	44.50	0.40
10.	Development of Marine Fisheries	86.55	45.45	11.00
11.	National Welfare of Fishermen	100.36	69.39	22.00
12.	Training & Extension	9.66	3.47	1.32
13.	Inland Fisheries Statistics	6.84	3.31	1.10
14.	Asst. to Coast Guard	1.88	1.43	0.10
15.	Integrated Coastal Aquaculture	15.24	5.84	2.00
16.	World Bank Project on Shrimp	8.67	8.38	0.14
17.	Inland Fish Marketing	4.48	3.35	0.04
	<u>TOTAL</u>	800.00	354.94	103.86

Table 18 : Plan Allocation & Expenditure for Fisheries Development Schemes

(Rs. in
crores

Sl. No.	Particulars	9th Plan Alloc.	1997-98			1998-99			1999-2000			2000-01			BE 2001-02
			BE	RE	Expd.	BE	RE	Expd.	BE	RE	Expd.	BE	RE	Expd.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	FISHERIES SECTOR														
	Action Plan Schemes														
1	Establishment of Fishing Harbours	150.17	30.00	20.00	18.13	20.00	11.00	10.69	25.00	12.52	9.84	21.00	14.00	11.24	14.00
2	Development of Freshwater Aquaculture	150.32	15.05	15.00	14.94	18.50	8.00	7.98	21.00	8.00	8.68	20.00	14.00	11.34	14.00
3	Development of Marine Fisheries	86.55	13.00	12.00	13.08	12.00	11.00	10.56	16.00	12.00	9.81	11.00	11.00	12.00	11.00
4	National Welfare of Fishermen	100.36	14.30	15.29	15.49	15.25	11.00	10.85	20.00	20.00	20.55	23.70	22.00	22.50	22.00
5	Fishery Survey of India	130.77	15.50	13.42	10.38	27.00	12.00	10.60	38.00	17.11	17.57	22.03	18.96	15.32	30.20
	Sub - total	618.17	87.85	75.71	72.02	92.75	53.00	50.68	120.00	69.63	66.45	97.73	79.96	72.40	91.20
	Other Schemes														
6	Central Institute of Fisheries Nautical	19.75	4.50	4.10	3.91	6.00	4.50	2.99	3.50	3.00	1.94	3.42	3.42	3.56	1.68
7	Central Fish. Coast Engg. Inst.	3.00	0.14	0.12	0.13	0.65	0.35	0.28	0.70	0.36	0.34	1.15	0.56	0.46	1.18
8	Integrated Fisheries Project	24.54	6.64	4.94	3.39	6.00	4.10	2.48	7.00	4.00	1.80	5.00	3.10	1.83	2.70
9	Training & Extension	9.66	0.50	0.50	0.68	0.70	0.40	0.40	0.75	1.25	1.09	1.30	1.30	1.30	1.32
10	Inland Fisheries Statistics	6.84	0.80	0.80	0.69	0.90	0.60	0.60	1.00	0.90	1.00	1.00	1.00	1.02	1.10
11	Inland Capture Fisheries	40.50	1.00	0.00	0.00	0.50	0.00	0.00	0.50	0.00	0.00	0.50	0.10	0.00	1.00
12	Development of Fisheries in Hilly Region	15.60	0.06	0.00	0.00	0.50	0.00	0.00	0.60	0.00	0.00	0.50	0.10	0.00	1.00
13	Assistance to Coast Guard	1.88	0.40	0.38	0.38	0.40	0.40	0.00	0.50	0.50	0.50	0.50	0.50	0.55	0.10
14	Inland Fish marketing	4.48	5.00	3.00	2.08	2.50	1.00	0.00	1.50	1.50	1.27	1.00	0.25	0.00	0.04
15	Integrated Coastal Aquaculture	15.24	4.00	4.00	0.81	3.00	1.00	1.00	4.00	2.00	2.53	1.50	1.50	1.50	2.00
16	Acquisition / Maintenance of Dredg. Equip.	31.67	0.01	0.01	0.00	40.00	40.00	31.65	0.02	12.24	11.64	3.00	1.91	1.21	0.40
17	World Bank Project on Shrimp Culture	8.67	8.25	2.24	0.97	6.00	2.05	1.85	5.85	3.70	3.41	4.10	2.93	2.15	0.14
	Sub - total	181.83	31.30	20.09	13.04	67.15	54.40	41.25	25.92	29.45	25.52	22.97	16.67	13.58	12.66
	Total (Fisheries Sector)	800.00	119.15	95.80	85.06	159.90	107.40	91.93	145.92	99.08	91.97	120.70	96.63	85.98	103.86

Table 19 : Physical Targets and Achievements during Ninth Plan

Sl. No.	Scheme / Component	9TH PLAN Target	1997-98		1998-99		1999-2000		2000-01		2001-02	Total Achievement during first four year of Ninth Plan (1997-2001)	% Achievement to IX Plan Target
			Target	Ach.	Target	Ach.	Target	Ach.	Target	Ach.	Target		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Fisheries Sector												
1	Cent.Fish.Naut. Inst.												
	i. Training of Fishermen (Nos.)	1300	300	359	300	414	300	400	300	318	300	1491	114.69
2	Cent.Inst.of Coastal Engg. Fisheries												
	i. Investigation of Fishery Harbour sites (Nos.)	15	3	3	3	3	4	4	3	3	3	13	86.67
	ii. Preparation of Fishery Harbour Report (Nos.)	15	3	3	3	2	4	4	4	2	3	11	73.33
3	Integrated Fisheries Project												
	i. Fish Processing (Tonnes)	1806	416	174	325	167	345	181	350	290	452	812	44.96
	ii. Marketing of Fish (Tonnes)	1051	268	126	181	80	184	101	175	180	218	487	46.34
4	Estt.of Fishing Harbours at Major & Minor Ports												
	i. Development of facilities at (a) Major Ports (Nos.)	3	-	-	-	-	1	0	1	0	1	0	0
	(b) Minor Ports (Nos.)	10	2	4	-	0	3	3	3	1	2	8	80
	(c) Landing Centres (Nos.)	30	9	10	5	5	5	14	5	0	2	29	96.67
5	Dev. of Freshwater Aquaculture												
	i. Area brought under Fish cult.(Lac.Hec)	1.5	0.3	0.34	0.3	0.41	0.3	0.3	0.3	0.3	0.3	1.39	92.67
	ii. Training of Fish Farmers(Lac.Nos.)	1	0.2	0.38	0.2	0.29	0.2	0.3	0.2	0.2	0.2	1.14	114
6	Dev.of Marine Fisheries												
	i. Motorisation of Traditional Craft(Hund.Nos.)	120	30	15	30	7.4	30	15	30	30	33	67.4	56.17
	ii. Reimb.of Central Excise duty	About 18,000 fishing vessels below 20 metre length have been benefited per year on an average and hence no shortfall.											
7	National Welfare of Fishermen												
	i. Insurance of Fishermen (No. in Lac.)	12.5	11.5	11.62	11.75	10.13	12	12	12.25	12.3	12.25	46.04	368.32
	ii. Construction of Houses (Hund.Nos.)	240	25	45.6	30	33.33	60	87	60	130	65	296.01	123.34
	iii. Assistance to Fishermen (Lac.Nos.)	3.75	2.5	2.17	2.75	2.68	2.75	3.1	3	2.16	3	10.06	268.27
8	Training & Extension												
	i. Estt. of Training Centres (Nos.)	44	1	6	2	2	12	12	14	6	26	26	59.09
	ii. Estt. of Awareness Centres (Nos.)	25	1	0	1	0	6	6	5	4	4	10	40
	iii. Development of Human Resources (Hund.Nos.)	150	4.7	20.09	9.4	21.27	23.45	9.7	46.9	11.8	58.96	62.89	41.93
	iv. Handbooks Extension Manual		18	15	18	5	38	38	57	15	68	73	
	v. Workshop/ Seminar etc.		5	6	22	6	39	39	52	5	50	56	
	vi. Documentary Films		1	0	1	1	4	4	5	1	4	6	
9	Dev. of Integrated Coastal Aquaculture												
	i. Coverage of water area (Th.Hec.)	10	2	0.8	2	0.84	2	3	2	0.16	2	4.8	48
10	Fishery Survey of India												
	i. Bottom Trawl Survey (Sampling Hours)	32000	7180	4823	6592	2664	6165	###	6000	2354	6570	12927	40.4
	ii. Mid-water Trawl Survey (Sampling Hours)	1750	405	45	540	0	270	75	270		450	120	6.86
	iii. Oceanic Long Line Survey (Th.hooks operated)	1265	232.25	152	276.8	142.1	255.5	128	250	130	257	552	43.62

Table 20 : Trend in Exports of Marine Products (1961-62 To 2000-01)

Year	Quantity (Tonnes)	Value (Rs. crores)	Unit value (Rs./tonnes)	Unit value index	Annual growth rate(%)	
					Quantity	Value
1961-62	15,732	3.92	2,491.74	100.00	--	--
1962-63	11,161	4.20	3,763.10	151.02	-29.1	7.1
1963-64	19,057	6.09	3,195.68	128.25	70.7	45.0
1964-65	21,122	7.14	3,380.36	135.66	10.8	17.2
1965-66	15,295	7.06	4,615.89	185.25	-27.6	- 1.1
1966-67	21,116	17.37	8,225.99	330.13	38.1	146.0
1967-68	21,907	19.72	9,001.69	361.26	3.7	13.5
1968-69	26,811	24.70	9,212.64	369.73	22.4	25.3
1969-70	31,695	33.46	10,556.87	423.68	18.2	35.5
1970-71	35,883	35.07	9,773.43	392.23	13.2	4.8
1971-72	35,523	44.55	12,541.17	503.31	- 1.0	27.0
1972-73	38,903	59.72	15,351.00	616.08	9.5	34.1
1973-74	52,279	89.51	17,121.60	687.14	34.4	49.9
1974-75	45,099	68.41	15,168.85	608.77	-13.7	-23.6
1975-76	54,463	124.53	22,865.06	917.64	20.8	82.0
1976-77	66,750	189.12	28,332.58	1,137.06	22.6	51.9
1977-78	65,967	180.12	27,304.56	1,095.80	- 1.2	- 4.8
1978-79	86,894	234.62	27,000.71	1,083.61	31.7	30.3
1979-80	86,401	248.82	28,798.28	1,155.75	- 0.6	6.1
1980-81	75,583	234.84	31,070.48	1,246.94	-12.5	- 5.6
1981-82	70,105	286.01	40,797.38	1,637.31	- 7.2	21.8
1982-83	78,175	361.36	46,224.50	1,855.11	11.5	26.3
1983-84	92,691	373.02	40,243.39	1,615.07	18.6	3.2
1984-85	86,187	384.29	44,587.93	1,789.43	- 7.0	3.0
1985-86	83,651	398.00	47,578.63	1,909.46	- 2.9	3.6
1986-87	85,843	460.67	53,664.25	2,153.69	2.6	15.7
1987-88	97,179	531.20	54,662.02	2,193.73	13.2	15.3
1988-89	99,777	597.85	59,918.62	2,404.69	2.7	12.5
1989-90	110,243	634.99	57,599.12	2,311.61	10.5	6.2
1990-91	139,419	893.37	64,078.07	2,571.62	26.5	40.7
1991-92	171,820	1,375.89	80,077.41	3,213.72	23.2	54.0
1992-93	208,602	1,767.43	84,727.38	3,400.33	21.4	28.5
1993-94	243,960	2,503.62	102,624.20	4,118.58	16.9	41.7
1994-95	307,337	3,575.27	116,330.61	4,668.66	26.0	42.8
1995-96	296,277	3,501.11	118,170.16	4,742.48	- 3.6	- 2.1
1996-97	378,199	4,121.36	108,973.32	4,373.39	27.7	17.7
1997-98	385,818	4,697.48	121,753.78	4,886.30	2.0	14.0
1998-99	302,934	4,626.87	152,735.24	6,129.66	-21.5	-1.50
1999-2000	343,030	5,116.67	149,161.20	5,986.23	13.2	10.6
2000-01	421,071	6,308.80	149,827.30	6,012.96	22.8	22.1

Source: Marine Products Export Development Authority, Kochi

Table 21 : Contribution of Fisheries Sector to Gross Domestic Product (Current Prices)

(Rs. Crores)

Year	Total GDP	GDP from		GDP from fisheries as % of	
		Agriculture	Fisheries	Total GDP	GDP from Agriculture
1970-71	39,708	16,821	245	0.62	1.46
1971-72	42,248	17,105	263	0.62	1.54
1972-73	46,473	18,772	305	0.66	1.62
1973-74	56,954	24,836	393	0.69	1.58
1974-75	67,039	27,057	454	0.68	1.68
1975-76	71,201	26,651	567	0.80	2.13
1976-77	76,536	27,105	601	0.79	2.22
1977-78	87,351	32,238	618	0.71	1.92
1978-79	93,880	32,815	738	0.79	2.25
1979-80	102,442	33,586	768	0.75	2.29
1980-81	122,427	42,466	921	0.75	2.17
1981-82	143,216	47,736	1,008	0.70	2.11
1982-83	159,395	50,527	1,174	0.74	2.32
1983-84	186,723	61,318	1,448	0.78	2.36
1984-85	208,533	65,181	1,716	0.82	2.63
1985-86	233,799	69,964	1,974	0.84	2.82
1986-87	260,030	74,405	2,250	0.87	3.02
1987-88	294,851	83,515	2,686	0.91	3.22
1988-89	352,703	104,103	3,142	0.89	3.02
1989-90	408,661	115,447	3,781	0.93	3.28
1990-91	475,604	135,162	4,556	0.96	3.37
1991-92	551,552	162,317	5,300	0.96	3.27
1992-93	627,913	184,536	6,649	1.06	3.60
1993-94	799,077	242,438	9,074	1.14	3.74
1994-95	943,408	284,042	11,099	1.18	3.91
1995-96	1,103,238	312,791	12,729	1.15	4.07
1996-97	1,285,259	376,091	15,055	1.17	4.00
1997-98	1,384,446	387,445	19,555	1.41	5.04
1998-99*	1,612,383	469,340	22,223	1.38	4.73

* Quick estimates

Source: Central Statistical Organisation

Table 22 : Fishers Population

State/Union Territory	Total No. of members				Number of family members engaged in fishing operations	
	Males	Females	Child- ren	Total	Full time	Part time
1. Andhra Pradesh	2,768	2,602	3,348	8,718	1,428	1,321
2. Arunachal Pradesh	4	1	--	5	--	--
3. Assam	1,538	807	795	3,140	254	201
4. Bihar	1,800	1,322	1,589	4,711	255	754
5. Goa	53	49	47	149	24	14
6. Gujarat	889	882	1,844	3,615	557	236
7. Haryana	49	8	13	70	4	--
8. Himachal Pradesh	13	8	15	36	2	3
9. Jammu & Kashmir	120	129	124	373	19	22
10. Karnataka	434	411	615	1,460	134	74
11. Kerala	1,978	1,970	2,381	6,329	1,099	275
12. Madhya Pradesh	890	671	1,050	2,611	112	566
13. Maharashtra	1,277	1,670	1,022	3,969	761	387
14. Manipur	305	186	66	557	318	239
15. Meghalaya	--	--	--	--	--	--
16. Mizoram	1	1	--	2	--	--
17. Nagaland	--	--	--	--	--	--
18. Orissa	1,065	977	1,400	3,442	225	128
19. Punjab	--	--	--	--	--	--
20. Rajasthan	26	24	37	87	5	9
21. Sikkim	--	--	--	--	--	--
22. Tamil Nadu	1,460	1,325	2,379	5,164	890	145
23. Tripura	27	17	21	65	8	31
24. Uttar Pradesh	5,951	5,196	5,146	16,293	301	750
25. West Bengal	2,829	1,181	1,343	5,353	884	1,927
26. Andaman & Nicobar Islands	80	64	97	241	9	22
27. Chandigarh	3	--	--	3	3	1
28. D & N Haveli	--	--	--	--	--	--
29. Daman & Diu	--	--	--	--	--	--
30. Delhi	--	--	--	--	--	--
31. Lakshadweep	174	175	175	524	9	21
32. Pondicherry	127	124	135	386	83	11
INDIA	23,861	19,800	23,642	67,303	7,384	7,137

Source: Indian Livestock Census-1992, Summary Tables Volume-I
 Directorate of Economics and Statistics, Ministry of Agriculture

Table 22 (contd.)

(Numbers in hundreds)

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

Table 23 : Structure of Fisheries Cooperatives

NATIONAL LEVEL COOPERATIVE FEDERATION:
(NATIONAL FEDERATION OF FISHERMEN'S COOPERATIVES LTD.)

STATE-WISE POSITION

Sl. No.	State	State Federation (17)	Central Societies (108)	Primary Societies (11,440)	Membership	Total Fishermen
1	ANDHRA PRAD.	1	10	3646	359021	496731
2	ARUNA. PRAD.	-	-	4	300	5716
3	ASSAM	1	-	456	-	475000
4	BIHAR	1	5	532	66835	1113018
5.	DELHI	-	-	2	239	16430
6	GOA	1	-	10	971	18836
7	GUJARAT	1	4	385	43631	140208
8	HARYANA	-	-	59	1005	16034
9	H.P.	-	1	28	3369	8455
10	J & K	-	-	-	-	13000
11	KARNATAKA	1	3	296	76136	810468
12	KERALA	1	16	292	122089	710502
13	M.P.	1	7	1001	44100	130982
14	MAHARASHTRA	1	21	2024	208273	425652
15	MANIPUR	1	-	181	9182	32350
16	MEGHALAYA	-	-	58	2569	11097
17	MIZORAM	-	-	36	808	600
18	MAGALAND	-	-	168	4285	185350
19	ORISSA	1	4	482	73852	202112
20	PUNJAB	-	-	4	60	4200
21	RAJASTHAN	1	-	107	4624	13557
22	SIKKIM	-	-	-	-	550
23	TAMIL NADU	1	10	675	231224	267309
24	TRIPURA	1	-	129	14225	50955
25	U.P.	1	5	110	5000	160823
26	WEST BENGAL	1	20	1072	85895	597180
27	A & NICOBAR	-	-	45	1443	3678
28	CHANDIGARH	-	-	1	11	250
29	D & N HEVELI	-	-	-	-	130
30	DAMAN & DIU	-	-	6	1993	31000
31	LAKSHADWEEP	-	-	2	349	6000
32	PONDICHERRY	1	2	36	16449	10971
	<u>TOTAL</u>	17	108	11847	1377938	5959144

TABLE 24 : LIST OF INDIAN SHIPYARDS

A. PUBLIC SECTOR

1. Cochin Shipyards Ltd.,
Cochin 682015
2. Hindustan Shipyard Ltd.,
Gandigram,
Visakhapatnam-530003.
3. Mazagon Dock Ltd.,
Dockyard Road,
Bombay – 400010.
4. Garden Reach Shipbuilders and
Engineers Ltd.,
43/46, Garden Reach Road,
Calcutta 700024.
5. Goa Shipyard Ltd.,
Vaddem House, Vasco-da-Gama,
Goa-403802.
- 6, Hooghly Dock & Port Engineers Ltd.,
Martin Burn House, R.N. Mukharjee Road,
Calcutta – 700 001.
7. Rajabagan Dockyard of central Inland
Water Transport Corporation,
4, Fiarlie Place,
Calcutta – 700 001.

B. STATE GOVERNMENT SECTOR

8. Alcock Ashdown (Gujrat) Ltd.,
Post Box No. 28, Old Port, Ramsar Works,
Bhavnagar – 364001 (Gujarat).
9. Shalimar Works (1980) Ltd.,
Calcutta – 700 023.

C. PRIVATE SECTOR

10. Bharati Shipyard Pvt. Ltd.,
19, Bombay Mutual Building,
Sir P.M. Road,
Bombay – 400 001.

PRIVATE SECTOR (Contd..)

12. Modern Mechanical and Marine Works,
Marine House, Dongri Bridge,
93, Dr. Maheshwari Road,
Bombay-400 009.
13. West Coast Lighterage Co-Pvt. Ltd.,
91/92, Bajaj Bhavan, Nariman Point,
Bombay – 400 021.
14. Uran Shipyard Pvt. Ltd.,
32A, Pais Street,
Off Byculla Station Road,
Bombay – 400 011.
15. A.C. Roy & Co.
6/1, Sudder Street,
Calcutta – 700 016.
16. Chowgule & Co.
6/1, Sudder Street,
Calcutta – 700 016.
17. Samant Shipyard Pvt. Ltd.,
Swatantra Path, Opp. Canara Bank,
Vasco-da-Gama, Goa.
18. Shivam Engineers,
Shanta Alto Porvorim bandez,
Goa.
19. Empreteries Garais Pvt. Ltd.,
Post Box. No. 107, Station Road,
Mormugao, Goa.
20. Salgaonkar & Bros. Pvt. Ltd.,
P.B. No. 14, Vasco-da-Gama, Goa.
21. Dampo Engineering Works Pvt. Ltd.,
Chmpal, Panjim,
Goa 403 001.
22. Sasa Goa Ltd.,
Altinho, Panjim,
Goa 403 001.
23. Alang Marine Works,
Gogha Yard,
Bhavnagar (Gujarat)

11. N.N. Shipbuilders & Engineers (Pvt.) Ltd., 602-B, Poonam Chambers, 6th Floor, Shivasagar-Estate, Worli, Bombay – 400018.
24. Vipul Shipyard, Surat (Gujarat)

2

Table 24 (contd..)

25. ABG Shipyard, Megdala, Surat.
26. Elite Shipyard, Verawal, Gujarat.
27. East Coast Boat Builders & Engineers Ltd., New Beach Road, Kakinada (A.P.)
30. Karnataka Engineering & Marine Co., Gonsalves Road, Kadri, Mangalore-575 002.
31. Vadyar Boats, 50 (N.P.), Industrial Estates, Guindy, Madras-600 097.
32. Bristol Boat, Cochin.

Table 25 : LIST OF KRISHI VIGYAN KENDRAS

S. No.	Name & Address of KVK	S. No.	Name & Address of KVK
1.	Training Organiser, N.G. RangaKrishi Vigyan Kendra, Vinayasharam, Kavur, Guntur (AP)	12.	Training Organiser, Krishi Vigyan Kendra, CMFRI Res. Stn., Narakkal, Ernakulam – 682 505 (Kerala)
2.	Training Organiser, Krishi Vigyan Kendra, Opp. Rama Krishnan Temple UMDI, Rayalam Bhimavaram, West Godavari – 534208 (AP)	13.	Training Organiser, Krishi Vigyan Kendra, Peruvannamuzhi, Calicut-673012, Kozhikode (Kerala)
3.	Training Organiser, Krishi Vigyan Kendra, VPO Basaith, Chandpura, Madhubani – 847102 (Bihar)	14.	Training Organiser, Krishi Vigyan Kendra, Cilton Island (Lakshadweep)
4.	Training Organiser, Krishi Vigyan Kendra, ICAR Complex, Ela, Old Goa 403202.	15.	Training Organiser, Krishi Vigyan Kendra, Shirgaon, Ratnagiri (MS)
5.	Training Organiser, Krishi Vigyan Kendra, NDRI, Karnal – 132 001 (Haryana)	16.	Training Organiser, Krishi Vigyan Kendra, Poip Adarsh Krishi, Sindhudurg 416 622 (MS)
6.	Training Organiser, Krishi Vigyan Kendra, Agril. Research Station, Bajaura, Kullu – 175125 (HP)	17.	Training Organiser, Krishi Vigyan Kendra, C/o Gokhle Education Society, Kosbad Hill, Thane – 401703 (MS)
7.	Training Organiser, Krishi Vigyan Kendra, P.O. Sultanpur, Baloo, Chamba – 176314 (HP)	18.	Training Organiser, Krishi Vigyan Kendra, ICAR Complex for NEH, Region, Sansan Girri, Bobasipara, Tura, West Garro Hills - 794005
8.	Training Organiser, Krishi Vigyan Kendra, Kalibari, Kathua	19.	Training Organiser, Krishi Vigyan Kendra, Angul (Orissa).
9.	Training Organiser, Krishi Vigyan Kendra, Reg. Res. Stn. Pattambi – 679 306 (Kerala)	20.	Training Organiser, Krishi Vigyan Kendra, Cuttack 763 006 (Orissa)
10.	Training Organiser, Krishi Vigyan Kendra, Kasargod – 671 124 (Kerala)	21.	Training Organiser, Krishi Vigyan Kendra, Kausalyaganga, Dhauli, Bhubneswar – 751 002 (Orissa)
11.	Training Organiser, Krishi Vigyan Kendra, Mitraniketan, Velland, Tiruvananthapuram (Kerala)	22.	Training Organiser, Krishi Vigyan Kendra, P.B. No. 22, Village : Rauni, Patiala – 147 001 (Punjab)

Table 25 (contd...)

23.	Training Organiser, Krishi Vigyan Kendra, Sultanpur Road, Near New Grain Market, Kapurthala 144 601	28.	Training Organiser, Krishi Vigyan Kendra, Sohna, Sidharthnagar – 272193 (UP).
24.	Training Organiser, Krishi Vigyan Kendra, Bachat Bhavan, Collectorate Compound, Shahjanpur (UP)	29.	Training Organiser, Krishi Vigyan Kendra, C/o Sri Ramkrishnan Ashram, P.O. Nimpith, Ashram South 24 – Parganas (WB).
25.	Training Organiser, Krishi Vigyan Kendra, ICAR Complex for NEH, Birchandra Manu, South Tripura	30.	Training Organiser, Krishi Vigyan Kendra, Kapgri, Midnapore - 721212
26.	Training Organiser, Krishi Vigyan Kendra, Banjaria Farm, P.O. Karya, Basti (UP)	31.	Training Organiser, Krishi Vigyan Kendra, Brackish water, Experimental Fish Farm, P.O. Kaddweep South, Parganas – 24 (WB).
27.	Training Organiser, Krishi Vigyan Kendra, Jai-Prabha, Gram-Gopalgram, Khargu Chandpur, Gandhi Park, Gonda – 271001(UP)		

Table 26 : List of Fisheries Colleges

Name and address of Fisheries Institute/College	Course offered*
College of Fisheries (University of Agricultural Sciences) Mangalore, Karnataka	1, 2 and 3
Fisheries College (Tamilnadu University of Veterinary and Animal Sciences) Tuticorin, Tamil nadu	1,2 and 3
College of Fisheries (Orissa University of Agriculture and Technology) Berhampur, Orissa	1,2 and 3
College of Fisheries (Kerala Agricultural University) Panangad, Kochi, Kerala	1 and 2
College of Fisheries (Gujarat Agricultural University) Rajendra Bhavan Road Veraval, Gujarat	1 and 2
College of Fisheries (G.B. Pant University of Agriculture and Technology) Pantnagar, U.P.	1 and 2
Fisheries College (Konkan Krishi Vidyapeeth) Ratnagiri, Maharashtra	1 and 2
College of Fisheries (Rajendra Agriculture University Muzaffarpur, Bihar.	1
College of Fisheries Science (Acharya N.G. Ranga Agricultural University) Nellore, Andhra Pradesh	1
College of Fisheries (Assam Agriculture University Raha, Assam	1
College of Fisheries (West Bengal Veterinary and Animal Sciences University) Calcutta, West Bengal	1
College of Fisheries (Central University of Agricultural Sciences) Lembuchera, Tripura	1

*1=B.F.Sc., 2=M.F.Sc., 3=Ph.D.

Table 27 : Infrastructure for the Seafood Processing Industry

Category	Registered as on 31.3.1990	Capacity	Registered as on 31.3.2000	Capacity
Exporters	864	-	1549	-
Fishing vessels	12083	-	14266	-
Freezing Plant	231	2296	394	8439
Canning Plant	24	84	13	51
Ice Plant	132	1854	157	2970
Fish Meal Plant	26	463	12	229
Peeling sheds	924	-	576	3387
Conveyance	481	-	511	-
Cold Storage	304	42458	479	105991
Agar agar Plant	-	-	4	0.145
Isinglass	-	-	1	10
AFD Plant	-	-	3	3
Surimi Plant	-	-	5	112

Table 28 : Contribution Of India To World Fish Production, Selected Years

(‘000 tonnes)

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	103,590	88,997	14,593	3,875	2,300	1,575
1995	124,152	102,801	21,351	4,998	2,786	2,212
1996	128,648	105,252	23,396	5,353	3,016	2,337
1997	130,882	105,770	25,112	5,477	3,024	2,453

Totals may not tally due to rounding off.

Source: FAO

Table 29 : Percentage Contribution Of India To World Fish Production, Selected Years

Year	Contribution of India to World Fish Production (Per Cent)		
	Total	Marine	Inland
1950	3.70	2.97	9.40
1955	2.93	2.39	6.62
1960	3.17	2.69	7.00
1965	2.60	1.79	9.97
1970	2.61	1.77	11.21
1975	3.32	2.41	11.44
1980	3.24	2.29	11.67
1985	3.10	2.16	10.24
1990	3.74	2.58	10.79
1995	4.03	2.71	10.36
1996	4.16	2.87	9.99
1997	4.18	2.86	9.77

Table 30 : Fish Production Projections in the Tenth Plan

(in million tonnes)

Period	Marine**	Inland***	Total+
1999-2000	2.83	2.82	5.65
2000-01	2.90	3.05	5.95
2001-02*	2.97	3.29	6.26
2002-03	3.04	3.55	6.59
2003-04	3.12	3.83	6.95
2004-05	3.20	4.14	7.34
2005-06	3.28	4.47	7.75
2006-07	3.36	4.83	8.19

* Base Year

** Marine @ 2.5% Growth Rate per annum

*** Inland @ 8% Growth Rate per annum

+ Total @ 5.44% Growth Rate per annum

TABLE 31 : PROJECTIONS OF FISH SEED (INDIAN MAJOR CARPS AND EXOTIC CARPS) PRODUCTION IN THE TENTH FIVE YEAR PLAN

(in million fry)

Year	Fish Seed **
2001-02*	17000
2002-03	18360
2003-04	19830
2004-05	21420
2005-06	23150
2006-07	25000

* Base Year

** @ 8% Growth Rate

