A STUDY ON THE IMPACT OF STATE INTERVENTION IN THE DEVELOPMENT AND MANAGEMENT OF MARINE FISHERY RESOURCES WITH SPECIAL REFERENCE TO GUJARAT.

A STUDY ON THE IMPACT OF STATE INTERVENTION IN THE DEVELOPMENT AND MANAGEMENT OF MARINE FISHERY RESOURCES WITH SPECIAL REFERENCE TO GUJARAT

THESIS SUBMITTED TO THE SAURASHTRA UNIVERSITY, RAJKOT
FOR THE AWARD OF
DEGREE OF DOCTOR OF PHILOSOPHY IN ECONOMICS
(UNDER THE FACULTY OF ARTS)

BY

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C E R T I F I C A T E

This is to certify that the thesis entitled "A STUDY ON THE IMPACT OF STATE INTERVENTION IN THE DEVELOPMENT AND MANAGEMENT OF MARINE FISHERY RESOURCES WITH SPECIAL REFERENCE TO GUJARAT" submitted by Shri Christy Fernandez for the award of Doctor of Philosophy embodies the results of the candidate's own research carried out by him under my guidance.

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D E C L A R A T I O N

I hereby declare that this work has been carried out by me under the guidance and supervision of Dr.K.K.Khakhar, Professor, Department of Economics, Saurashtra University, Rajkot. I assure that, the results of this work have not been submitted to any other University for award of Doctor of Philosophy.

Place: Gandhinagar
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I N D E X

ACKNOWLEDGEMENTS

My years as the Commissioner of Fisheries, Govt. of Gujarat, gave me an impetus to work towards understanding the complexities of the fisheries sector and the role of the State in its development and management. That has led to this qualitative, action research emphasizing a problem solving approach in public policy.

First and foremost I acknowledge my thanks to the Govt. of Gujarat for granting me permission and also a year's study leave to carryout this study.

I was fortunate to have *Dr. K.K.Khakhar,* Professor, Deptt. of Economics, Saurashtra University, who has a rare insight into fisheries sector problems as my friend and guide. Both *Dr. Khakhar and Mrs. Ranjana Khakhar* took great interest in my pursuit. Without their constant encouragement and support to me I would not have completed this work. I acknowledge their help with sincere gratitude.

I am thankful to *Dr. A. Mohandas*, Professor and Dean of the Faculty of Environmental Studies, Cochin University of Science and Technology, *Dr. P.T. Mathew,* Principal Scientist, Central Institute of Fisheries Technology*, Dr. Mohan Joseph Modayil,* Director, Central Marine Fisheries Research Institute, *Dr. M.K.R. Nair,* Fisheries Development Commissioner, Govt. of India, *Dr.Y.S.Yadava,* former Fisheries Development Commissioner, Govt. of India, *Mr. Ramachandran Nair,* Research Officer, Department of Fisheries, Dairying and Animal Husbandry, Govt. of India and *Mr. K.R.Narayanan,* former Deputy Director of Fisheries, Govt. of Gujarat for extending all possible support and critical inputs in the conceptualization and presentation of this dissertation. *Mr. Dinesan* had spent long hours to type out the text and I thank him for his willingness to extend such efficient secretarial assistance to me.

The affectionate and encouraging support from my wife and children has been a source of motivation for me always especially in times of monotony and boredom.

There are many more people, particularly some of my friends who have helped me directly or indirectly in this endeavour and I remember fondly the contribution of each one of them and thank all of them.

JAI HIND.

Christy Fernandez

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CHAPTER - 1

INTRODUCTION AND ORGANISATION OF STUDY

I INTRODUCTION

Fish has been an important source of animal protein for more than one billion people of the world. Two thirds of the total food is from the marine and inland capture fisheries. The rest is from aquaculture (FAO, 2002).

Fishing has been a major avocation for the people living in the coastal areas of India. Traditionally they have been small scale, artisanal fishermen belonging to economically and socially weaker sections of the society. Members of more resourceful and mainstream communities have generally kept away from this sector on account of conventional beliefs and religious taboos – though, not uniformly across the country.

Marine fish has been, characteristically, a public goods type common property resource (CPR). Because of the problem of exclusion and fixing boundaries of fishing regimes among those who have competing claims over a given CPR, it is quite difficult to fix and allocate property rights for the purpose of exchange. Whatever rights are created, they are of the type of

use rights emerged over a period of time and held by decentralised fishing communities. Fishing rights are usually held 'communally' or they are community-based. A number of close-knit anthropological communities of fishermen representing different castes and sub-castes, religious and socio-cultural backgrounds use different water- spaces for fish harvesting. The community based organisations (CBOs) of marine fishermen in different fishing locations usually take care of such rights of their members. Though they help their community inmates in resolving conflicts, they can hardly undertake programmes for the development of their fisheries, because of the lack of necessary financial resources and organizational skills. They also find it difficult to constrain behaviour of their inmates for the purpose of conservation of the resource in absence of codified laws and organizational support.

In the above context, it is the duty of the State to undertake the tasks of development and management of marine fisheries sector. Our endeavour in the present study is to clearly identify the role of the State and assess the impact of the government intervention on the development and management of marine fisheries in India in general and Gujarat in particular.

Marine Fisheries Development and State Intervention in India

Prior to independence, a National Planning Committee Report on fisheries commented on this sector as "largely of a primitive character carried on by ignorant, unorganized and ill-equipped fishermen whose techniques are rudimentary, their tackle elementary, their capital equipment slight and inefficient" (Shah, 1948). However, it was considered as a source of revenue for the State. But

very little was spent by the State towards the development and promotion of this sector, except in the erstwhile Madras Province (Anon, 1976).

According to the National Commission on Agriculture (1976), a meaningful move towards modernized marine fishing industry was made with the country's independence, taking into account the vastness of the marine fisheries sector and need to apply tools for more efficient use of its hitherto untapped fish resources. This sector started getting attention of the State in India at the central as well as state-levels with the introduction of the Five Year Plans in the post independence era and through various development schemes introduced by the Central and State Governments. Subsequent events have shown that the State intervention has been the harbinger of development in the fisheries sector in India. Today marine fisheries have achieved a significant role in the economic development, food security and poverty alleviation, besides that of a foreign exchange earner for the country.

Main Objectives of State Intervention

The main objectives of State intervention in the marine fishery development have been: -

(i) Enhancing production of fish and productivity of fishers and fishing industry.

(ii) Increasing per capita availability of fish and achieving higher food security.

(iii) Augmenting export of marine products and thereby increasing foreign exchange earnings.

(iv) Generating employment and higher income particularly for the coastal and rural poor.

(v) Improving the welfare of fishers and their socio-economic standards.

(vi) Adopting an integrated approach for the conservation of resources through responsible and sustainable fisheries management.

Some of these objectives may appear to be contradictory. Increasing per capita availability of fish and higher foreign exchange earning seem to be non-compatible. Enhanced per capita availability of fish for consumers means more supply of fish at cheaper prices, which apparently goes against higher income for fishers. But a closer examination of these objectives would reveal an underlying complementarities aimed at holistic development to "generate sustainable use of the resources, yielding an acceptable profit both to the individual fishermen and society, and a distribution which is considered just and fair, at least by the dominant part of the fishing industry" (Hersoug,1996). These objectives form the criteria for evaluating the performance of development and management plans in the fisheries sector.

The Resource: India

India has a vast and varied marine fishery resource, spread over the Arabian Sea, Indian Ocean and the Bay of Bengal. It has a coastline of 8129 kms. bordering 9 States and 4 Union Territories. The Indian Exclusive Economic Zone (EEZ) as declared in 1977, covers an area of about 2.01 million sq kms with 0.92 million sq kms in the west coast, 0.51 million sq kms in the east coast, and 0.56 million sq kms. around Andaman & Nicobar Islands. The Indian continental

shelf is 0.43 million sq kms. The area is rich in fishery resources. The details of coastline, continental shelf, number of landing centers and number of fishing villages in the coastal States/UTs are given in Table 1-1.

The exploitable marine fishery resource potential of the country has been estimated to be 392 million tonnes per annum. The marine fish production has gone up from a mere 0.53 million tonnes in 1950-51 to 2.97 million tonnes in 1997-98 showing an average growth rate of about 5.5% per annum. However, it has come down to 2.83 million tonnes in 1999-2000.

TABLE – 1.1: MARINE FISHING AREA – COASTAL STATES AND UNION TERRITORIES

	State/Union Territory	Approximate length of coastline (Kms)	Continental shelf ('000 sq kms)	No. of landing centers	No. of fishing villages
1	Andhra Pradesh	974	33	508	508
2	Goa	104	1	88	72
3	Gujarat	1600.	164	286	851
4	Karnataka	300	27	29	221
5	Kerala (P)	590	4	226	222
6	Maharashtra	720	112	184	395
7	Orissa	480	26	63	329
8	Tamil Nadu	1076	41	362	556
9	West Bengal	158	17	47	652
10	Andaman & Nicobar Islands (P)	1912	35	57	45
11	Daman and Diu (P)	27	--	711	31
12	Lakshadweep (P)	132	4	28	10
13	Pondicherry	45	1		45
	Total	8118	530	1896	3937

P - Provisional
Source: State Governments/union Territory Administration.
The Resource: Gujarat

According to a study, the total Maximum Sustainable Yield (MSY) for the marine fisheries sector of Gujarat is estimated as 0.70 million tonnes and an additional harvestable yield of 0.16

million tonnes per annum. Gujarat has recorded the highest even production of 0.702 million tonnes of marine fish in 1997-98 almost reaching the full MSY level. Most of the catch in the Gujarat coast has been demersal and the scope for further expansion is in the pelagic fisheries of inshore as well as offshore areas has been envisaged. The uncontrolled increase in the number of fishing vessels and the present fishing practices, however, have led to a reduction in the catch per unit effort (CPUE), affecting the viability of their operations. Therefore, development of a comprehensive management plan and its implementation has been urgently warranted for the sustainable use of the marine fishery resources of Gujarat, as in the rest of the country

With the introduction of Five Year Plans, several schemes were launched for the development of marine fishery resources in the country. In some of the maritime States, the developments have been rather rapid. In Gujarat, on which this study is focused on, the development began rather slow, but progressed steadily to surpass the performance of other leading States in marine fish production. The traditional fishermen of Gujarat did not have adequate investment capabilities to usher in modern fishing practices. As a result the flow of investment into fisheries sector remained much less than other major sectors in Gujarat, although it has been an economically important activity in the coastal areas of the state. The intervention of the Government, direct or indirect has promoted investment in this sector bringing about progressive changes resulting in a high degree of viability to it. This study is aimed at analyzing and assessing on a macro level the impact of the State intervention in the development and management of marine fishery resources, with special reference to the State of Gujarat.

Composition of Gujarat's Marine Fishing Sector

The marine fishery sector of Gujarat consists of 3 distinct sub sectors, viz, (i) traditional inshore fishing with non-mechanised traditional craft and gear; (ii) the mechanized sub sector with small motorized and mechanized boats; and (iii) deep sea fishing with ocean going vessels.

The traditional sector using boats without any kind of mechanization has been the backbone of Indian fisheries, which accounts for 67% of the current fish production. The small motorised and mechanised boats constitute about 32% whereas the deep-sea vessels have been able to contribute only about 1% of the total marine catch.

The gradual transformation of the Indian marine fishery sector roughly over a period of three decades from a subsistence traditional avocation to that of an industry was mainly through the State support and technical innovation. With the introduction of mechanisation and expansion of the fleet, the marine fish production in the country has gone up from 0.53 million tones in 1951 to 2.96 million tones in the year 96-97 the highest production reported till today. (Anon-2002 b) The harvesting efforts particularly in the inshore waters has almost reached a point of saturation, and the production has come to a plateau. For further increase in marine fish production, the efforts will have to concentrate in the pelagic resources of the inshore and offshore areas, besides managing the inshore resources in a sustainable manner. Though the deep sea and high sea resources remain underexploited, it is a daunting task for the Indian fishermen in the present juncture to harness it to its full potential, without innovative state intervention and technology support. The declaration of EEZ undoubtedly offers an opportunity for Indian fisheries sector to use its resource potential to sustainable limits.

In spite of noticeable growth in marine fish production over the years, the exploitation of the resources was mostly confined to the coastal inshore waters up to 50 m. isobar. The emphasis was on export-oriented varieties like shrimp, lobster and certain varieties of fin fishes. This skewed pattern of exploitation has resulted in the stagnation of shrimp production and reduction in the landing of some of the high valued fin fishes. The shrimp resource was over-fished showing a marked drop in the catch per unit of effort (CPUE). The average yield of shrimp by the deep sea fishing vessels have declined over the years. The encouraging results of shrimp fishing in the 70s by the deep sea fishing trawlers prompted even the small scale fishermen using mechanized trawls to venture into shrimp fishing leading to over-exploitation of this resource. The over-emphasis on shrimp fishing has also resulted in discarding large quantities of fish by-catch during the boom period. at sea or being sold as trash fish without any value addition. It was estimated that about 80 to 95% of catch value was being discarded as by-catch. At least 10 to 20% of this discarded by-catch could have been converted into value added by-products. But hardly any serious attempt was made in this direction, thereby perpetuating waste of valuable species of the marine fish-resource. The aforesaid skewed pattern of exploitation marks the absence of appropriate fisheries management policies and practices

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Schemes of State Intervention

The State intervention for the development of marine fisheries has been mainly through various infrastructure development schemes, investment subsidy schemes, and other promotional schemes initiated by the Central and State Governments. Apart from these, various regulatory and welfare measures have also been undertaken by the respective Governments. Financial outlays for development programmes are reflected in the Five Year Plans and Annual

Plans of the Central and State Governments. Although there has been considerable increase in the Plan outlays over the years, it has not kept pace with the requirement of funds for development needs, particularly for infrastructure development like ports, fishing harbours, landing centers, etc. It has affected the modernization and expansion of the marine fishery sector especially in the deep-sea fishing sector. The Central Plan outlay including the Centrally Sponsored Schemes for the entire fishery sector has gone up from Rs.100 lakhs in the First Plan (1951-56) to Rs.800 Cr. in the IXth Plan (1997-02). The State Plan outlay for Gujarat has gone up from Rs.129.14 lakh in the Third Plan (1961-66) to Rs.3700 lakh in the Ninth Plan. A noticeable disturbing feature however, has been the low level of expenditure in comparison to the Plan outlays, which reflects the slow pace of implementation of the schemes by the Central and State governments.

The Phases of Intervention

The State induced development programmes implemented since the inception of the planning process have produced mixed results. Some of them have been successful while others have failed to achieve the desired objectives. Although there may be some overlapping, the development process over the years can be broadly classified into three major phases. They are: -

(i) Motorisation / mechanisation phase in the early 50s.

(ii) Infrastructure development phase in the 60s.

(iii) Deep sea fishing efforts phase since 1970s

(i) Motorisation / Mechanisation phase

The first phase of development was the introduction of motorisation and mechanisation programme that began in the early years of India's planned development with the

launching of the Indo-Norwegian project in 1952. It has resulted in increased fish production and diversification of fisheries activity. According to Srivastava et al (1986), the fish production in the pre-mechanisation period (1956-69) decelerated at the rate of 3% per annum while it has increased at the rate of 12% p.a. during the post-mechanisation period (1970-81). This phase has also marked the beginning of modernization of crafts and gear as well as the fish processing industry. These developments had a direct bearing on the socio-economic condition of the fishers. The technological upgradation of traditional crafts and fishing methods through motorisation, introduction of improved beach landing crafts, FRP boats, intermediate type off-shore pelagic fishing vessels in the range of 10-14 m., introduction of high-opening bottom trawl etc. have given an unprecedented boost to marine fish production. As on 31.3.2001, there were 10,170 non-mechanised traditional crafts and 18536 mechanised crafts including motorized traditional crafts in Gujarat. The mechanization programme has helped in increasing production, efficiency and earnings. However, the encouragement received by the development programmes has led to an unregulated growth in the number of fishing boats both mechanized and non-mechanised. The phenomenal increase in the number of vessels in turn has resulted in the reduced Catch Per Unit Effort (CPUE) of fish, adversely affecting the viability of fishing operations. This situation has been created by the absence of appropriate resource management measures. The decline in catch has led to severe competition among fishermen for the limited resources, sometimes even leading to bloody conflicts. The fishermen are still not fully conscious of the adverse impact of unregulated fishing practices and the need for adopting responsible fishing practices for a sustainable fishery development.

(ii) Infrastructural Development Phase

The second crucial phase was of infrastructural development. It gave a further fillip to this sector. The development of fishery ports harbours, landing centres, fish handling centres, etc. helped in the expansion and further modernization of the fishing fleet. The State intervention in providing these critical infrastructural facilities prompted the private entrepreneurs to participate in the commercialization of marine fisheries sector to a great extent that in turn enhanced the fish production, its value addition and growth of export in marine products. This phase also saw the entry of non-traditional entrepreneurs into this sector. However, Gujarat, unlike in several other States, saw the emergence of the local traditional fishermen as industrial entrepreneurs setting up modern facilities for value addition and as successful exporters engaged in export of marine products. But development of infrastructure required to convert the traditional subsistence fishery to a modern industrial and commercial fishery, has not kept pace with the demand for such facilities. This was obviously due to the excessive dependence on Government for development of such facilities. The Government cannot fully meet with these demands on account of their limitations of resources. Hence involvement of private sector investors for infrastructure development for port and harbour facilities has to be consciously promoted. Large scale investment is also required for creation of infrastructure needed for preventing wastage of resources by converting discards and by-catches into value added products, for domestic as well as export markets. However, there does not appear to be any well-designed policy initiatives for promoting such private investments in this sector.

(iii) Deep-Sea Fishing Efforts Stage

The third important phase of development was that of introduction of deep-sea fishing policy. The technology, financial resources and manpower required for exploiting deep-sea resources were not available in the country. Hence to begin with it was decided to introduce the charter policy, which was amended from time to time. Though it was launched with great expectations, the implementation of the policy did not eventually produce the desired results. Serious doubts were raised about the sustainability of the deep-sea fishing policy of chartering, joint ventures, etc. Economic and ecological issues have been brought to the fore. Allowing entry of multi-nationals into deep-sea fishing in the context of strategic importance has come into severe criticism. Above all, it has given rise to conflicts between the traditional and mechanized sector against industrial fisheries represented mainly by MNCs. There was unprecedented protest all over the country by the fishermen against the deep-sea fishing policy of the Government. Therefore the Government was eventually forced to scrap the deep-sea fishing policy. In spite of the protests, the fact remains that the deep-sea fishery resources available to India should not be left unexploited. The guidelines issued by the Govt. of India are inadequate for rapid expansion of efforts in this area. Hence a new deep-sea fishing policy with emphasis on appropriate fishery management, and full involvement of native fishermen will have to be formulated. The agenda for it has to essentially take into consideration various socio-economic factors, ecological aspects and international practices in the context of emerging global scenario.

II ORGANISATION OF STUDY

Methodological aspects of the present study are explained as under:

1. The Coverage

This study covers India's marine fisheries sector in general and that of Gujarat in particular for the purpose of analysis. This would help in ascertaining exactly what position Gujarat has been enjoying as against other maritime states and what is its contribution to the overall development of country's marine fisheries sector. It is also important to examine issues related to the development and management of Gujarat's marine fisheries in the national perspective and review the state's fisheries policy with reference to what Central Government has envisaged, so far as the nature and direction of future growth of this sector are concerned. It is obviously more pragmatic to analyse state's marine fisheries in the national perspective particularly in a federal set-up, as it is in the case of India.

2. The Period

As the present study is about analysing the impact of government intervention on the development of marine fisheries of India in general and of Gujarat in particular, the period of planned economic development in India is taken into account wherein the state is expected to play a significant role in the process of development which also includes the marine fisheries sector. Precisely, the study attempts to analyse the development of marine fisheries for the period from 1951 through 2000. The experience of nearly five decades may be considered fairly enough to assess the role that the state has played and what still has to be done, with reference to the

objectives set for its planned, efficient and sustainable development of marine fisheries of India in general and of Gujarat in particular.

3. The Approach

The present study carries a policy-oriented enquiry. It, therefore, prefers to ask "ought to be" type normative questions. Such questions, however, are asked based on what may have been happening in real world situations, i.e., with particular reference to the ground realities. This would, obviously demand to take a positive approach as well.

With the expansion of the role of the government in the post World War – II, in a number of countries of the world and certainly in India during the post independence era, "policy-orientation" has emerged in all scientific enquiries, including of the type this study is about. Policy analysis is supposedly broader and includes more than one discipline and cuts across the existing specialisation (Ham and Hill, 1984). This study, therefore, is an interdisciplinary qualitative research drawing ideas, concepts and theories from a range of disciplines in order to explain the causes and consequences of public policy and actions. This approach makes the present study not only descriptive but analytical and prescriptive for the purpose of policy reformulation. The approach is to take-up the subject matter in the form of a "problem" that policy makers have been facing, locate it in a proper – scientific – perspective and analyse the same with a view of seeking solutions. Thus the study is also an action research as it deals with a concrete problem of inadequacy of management practices in the sector leading to unsustainable exploitation of a valuable natural resource.

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4. Objectives of the Study

Marine fisheries have been a source of livelihood to nine million people of India. The sector has achieved substantial growth through the intervention of the State as a promoter, facilitator, service provider and even as an entrepreneur through public sector undertakings. This work is directed towards better understanding of the issues involved vis-à-vis the local conditions and to suggest improvement in the ongoing practices over a period of time. Thus the objectives of this study are:

(i) To review the current status of marine fishery resources and its exploitation.

(ii) To study the methods and impacts of State intervention in the development and management of marine fisheries with special reference to Gujarat.

(iii) To analyze various practices in vogue in the management of marine fishery resources and their appropriateness for Indian conditions.

(iv) To suggest an alternative approach for sustainable development of Indian marine fishery sector.

5. Hypotheses

There seems to be a strong relationship between the progress achieved in the marine fisheries sector and the intervention of State over the years, through various development and promotional programmes led by budgetary support. This study is an investigation as to how far these interventions have been beneficial or not beneficial and what is the impact of non-intervention on the sustainable exploitation of this natural resource, which has a bearing on the lives of millions of people, who are generally considered as underprivileged, belonging to weaker

sections of the society. Keeping these issues in mind a few propositions are mooted for verification.

(i) State intervention and technological support was necessary for ushering in modernisation and expansion of marine fishery in India as a viable industry.

(ii) State intervention has been beneficial, as it has helped in modernizing the industry and creation of infrastructure for further development of marine fisheries with progressive participation of the private sector.

(iii) Modernisation involving unbridled motorisation and mechanisation has led to overcapitalization, overexploitation and depletion of the resources.

(iv) The development strategy, which gave an impetus to modernisation, was not accompanied by appropriate management measures resulting in unsustainable development and conflicts between various interest groups

(v) Management of a common property like marine fisheries is an area where intervention of the State is a pre-requisite, but the measures taken so far were inadequate, less effective and belated, making the sector increasingly unviable.

(vi) The essence of sustainable development of marine fisheries lies in the simultaneous development of other related activities of the coastal zone ecosystem as a whole. Therefore an integrated management approach encompassing coastal area management and people's participation is the key to sustainable development of the marine fishery sector in India.

6. Types of Data, Sources and Methods of Data Collection:

(i) Types of Data

(a) Policy Content

The analysis seeks data on the 'content' of marine fisheries policy in order to trace how the policy emerged, how it was implemented and what the results were. This implies seeking data on the course of action or a web of decision - including decision to do nothing and action taken without undergoing any process of decision. Thus data on 'actions' as well as 'decisions' are gathered and used for the purpose of analysis.

(b) Policy Process

The analyst has also thought it to be necessary to collect and use information on various stages of policy formulation, i.e., the 'process' of marine fisheries policy, which includes data on the various influences on policy formulation.

(c) Policy Outputs

Since the major objective of the study is to assess the impact of public policy or government intervention on marine fisheries development, the researcher has gathered information on the policy 'outputs' or policy 'impact' and used for the purpose of analysis.

(ii) Sources of Data

Data used in this study have largely been collected from the secondary sources, published by the government and private agencies involved with the development and management of marine fisheries. Such agencies have been working at global levels, such as, FAO, or at national level, such as, FSI, CMFRI, etc., and working at the regional/local levels, such as, the state department of fisheries, co-operatives, credit institutions, fishermen, their associations and/or their community based organisations. Information generated through talking with the officials working with these organisations have also been used, where necessary.

7. Techniques of Data Analysis

The data collected have properly been organized and processed with the help of simple mathematical techniques, such as, averages, ratios, growth-rates, etc. Diagrams have also been developed and used to add to the clarity of analysis attempted in the study.

8. Layout of the Study or Chapter Scheme

The study is organized into the following chapters:

Chapter -1 introduces the background and significance of the study in the first section followed by the second section, which contains the methodological aspects of the study.

Chapter- 2 contains the review of relevant literature in relation to the present study.

Chapter- 3 deals with the current status and development of marine fisheries in the national context.

Chapter –4 examines the present status and development of marine fisheries in Gujarat

Chapter –5 deals with the management aspects of fishery resources.

Chapter - 6 deals with the testing of hypothesis and conclusions followed by the Implication and recommendations.

Summing Up

The present study deals with the issues related to the development and management of a very significant marine food resource of India, namely, marine fish. This introductory chapter has narrated significance of the research undertaken in view of the challenges governments at the national as well as at the state levels have been facing. As explained in this chapter, the present study is about ‘of’’ the policy as well as ‘for’ the policy. Therefore, this study may better be described as an academic exercise concerned with understanding public policy or government intervention applied to the development and management of marine fish resource of India in general and of Gujarat in particular. The present study is also concerned with the solution of the problems faced by the agencies involved. Methodological aspects of the present study have also been explained in this chapter.

CHAPTER - 2

LITERATURE REVIEW

Introduction

A number of scholars, representing various disciplines have discussed the development and management related issues of marine fisheries of developed as well as developing maritime countries. The disciplines range from marine biology, ecology and economics to sociology, anthropology and law, etc. A close review of relevant literature would help a great deal in focusing the research problem selected for the present study in a proper perspective. Such an exercise would also help in developing an appropriate framework for the analysis contained in the chapters to follow.

It is intended, primarily, in the present study to assess the role that Governments have played in the development and management of marine fisheries sector in India in general and in Gujarat in particular. It is further intended to identify challenges faced by those who carry responsibility for the future growth of this sector on a more scientific basis. It is hoped that this exercise would help in identifying areas where the Government is expected to intervene more effectively and also suggest the limitations of the Government intervention. Precisely, the review of literature presented in this chapter would suggest what Government should do and what it should not do for the future development of marine fisheries on a more scientific basis

The Resource Potential

Marine fish is a renewable natural resource. Therefore, development of marine fisheries very much depends on the availability or the resource potential of the Exclusive Economic Zone of India. It is in this context that Somavanshi (1998) discusses the fishery potential of the Indian EEZ, which is estimated as 3.92 million tonnes. The policy orientation for sustainable resource utilisation has to address issues like technological upgradation, diversification, resource specific capture techniques, capacity building, utilisation of low value resources, introduction of fish aggregating devices, application of satellite remote sensing technology for fish location etc. The author also flags the major issues like need for effort regulations, by-catch exclusion/reduction, use of selective and eco-friendly fishing gear, bio-economic approach in general and bio-socio-economic considerations where the coastal communities are involved, prevention of environment degradation, preservation of integration of coastal fishing activity with coastal zone management. Narayanan, et al (2003) also discuss the resource potential available within the EEZ of Gujarat and suggest to use the resource for an export-led growth of marine fisheries sector.

The Resource-Use for Development

Since marine fishing in India is carried out largely by the small scale, artisanal, fishermen, Srinath (1998) observes that development of fisheries sector in India depends to a great extent on the technological empowerment of small fishermen. Despite the efforts towards technology development and transfer, fishermen were not able to use them due to lack of organized effort and effective extension work.

In the above context, the Government in India, at the federal as well as at the state levels adopted a policy of upgrading traditional fishing vessels into motorized boats. Ananth and

Sithadevi (1998) from their surveys, argue that though motorisation of traditional crafts have created a strong base for fish production, and transformed this sub sector, the fishermen face a variety of constraints that hamper reaping the benefits in full. Capital investment was identified as the biggest constraint, followed by availability of engines and after sales services. Lack of knowledge about maintenance of the OBMS, high cost of repairs, inadequate infrastructure for supply of fuel, etc. were other constraints reported by the respondents. The fact, however, remains that such constraints have not reduced the pace of mechanisation.

Institutional Credit

Government in India, therefore, went for creating a network of institutional credit for small fishermen in order to help them getting easy money for the purpose of conversion of traditional crafts into motorized ones.

Palaniswamy and Pathak (1998) have, in the above context, reviewed the role of institutional credit in creation of capital assets and future course of development through credit. According to them the financing institutions, however, are getting conflicting signals about this resource position, declining Catch Per Unit of Effort (CPUE), over capitalization, impact of rising international competition, and lack of clear Government policies on marine fisheries. Consequently, the banks find it difficult to decide whether there is any scope for further financing of fishing units, and if there is scope, the type and number of vessels to be financed. They conclude that fisheries entrepreneurs, government agencies, and policy makers will have to adopt extra confidence building measures for credit institutions and assure them of the long term sustainability of marine fishery sector. They also opine that the financial institutions should also be closely

associated with the development process, along with research institutions, development agencies and planners for proper credit planning.

The above problems, however, did not prevent small-scale fisheries to go for a big technological change. As Achuthankutty and Nair (1996) maintain, there has been a tremendous increase in the inputs by way of personnel and craft since early 1970s, which were the main reasons for the enhanced production of the prawn fishery. The authors point out that the extension of EEZ has had no particular impact on India's marine prawn fishery as the prawn fishing is still confined to the narrow coastal belt within the 40-50 meter depth zone. Exploratory surveys have revealed the potential resources of deep-sea prawns. The marine prawn fishery production can be augmented only through the exploitation of these new resources in the deep sea.

Narayanan, et al (2003) have discussed the growth of marine fishing in the context of resource potential and its utilisation which boosted exports of marine fish from Gujarat. The authors also highlight the changes that have taken place over the last few decades in these areas which suggest growth of fishing operations extended beyond 90 m. depth, increased number of days per fishing trip resulting into increased operational costs, wages and the cost of inputs. Meanwhile the quality and quantity of output have declined. Low value fishes have become the dominant catch. Contribution of prime varieties has dwindled. These changes signal the need for urgent management measures, the authors conclude, and recommend State intervention.

Indiscriminate Growth of Mechanisation

Several authors drew attention towards negative impact of indiscriminate growth of mechanised fishing. Sathiadhas (1998), for example, brought out the structural changes that have

taken place over the years in the Indian fisheries sector and their socio-economic impact. He also drew attention to the decreased catch per unit of effort due to over capacity in fishing fleet. This has affected the traditional fishermen the most. It is now believed that there is no scope to increase fishing effort in the inshore waters and regulation will have to be introduced to control the same. The author considers "co-operative fishing" instead of "competitive fishing" through community participation in fisheries management by creating awareness among fishermen.

The Stagnation Thesis

In the above context, Vijayakumaran, et al (1998) argue that the marine fish production of India has become more or less stagnant in the recent past, which has led to uncertainly in the sustained investment in production sector. The open access system prevailing now in the Indian waters, has resulted in over capitalization, which has been estimated roughly as Rs.33.4 billion. The authors point out that in multi-species and multi-gear fisheries, the catch per unit effort of a given fishing unit does not indicate stock abundance or fishing efficiency. The impact of legal provisions regulating fishing operations in the sea has been examined. The authors also recommend formulation of a comprehensive fishing regulation applicable to all fishing vessels covering the entire EEZ

The Issue of Sustainable Growth

Sheshappa (1998) contends that the crisis in the marine fishery resources emerges out of over-exploitation. Over capacity is the simple most important factor threatening its sustainability, and is the result of too many people depending on a given fisheries for their livelihood. This makes the fishery enterprise less economical. Deterioration of environmental conditions, decline in fish price and increase in fuel price, further aggravate the situation. Consequently the fishermen tend

to ignore basic fishery management principles. They would not be interested in searching for fishery grounds where by catch and discards are low. They may not use environment friendly fishing gear for reducing by-catch, release juveniles, or incur additional cost of effort to recover lost gears causing “ghost fishing”. According to the author in over capitalized fisheries, reduction in fleet capacity is a precondition to the success of management measures, designed to mitigate over fishing.

In the above situation of continued over-fishing and in the absence of effective management controls, Mathew (2000) observes that the current legislations in the country are inadequate to meet with the emerging crisis arising out of over fishing and advocates need for compatible legislative regimes at the national and State levels. It is important that conservation and management are made the collective responsibility of the Union and the State Governments in an integrated manner for which the author recommends that the marine fisheries should be brought under the “concurrent list”. The need for engendering ‘ownership’ of the Code among the State Departments of Fisheries, and the fishing industry besides amongst fishing communities has been emphasized to make the Code more readily acceptable. Also opines that a limited access regime with preferential access to small-scale fisheries is desirable in Indian conditions characterized by large coastal population for whom fishing is a means of livelihood.

Absence of Legislative Control

It will be, however, not true to say that there have been no legislations passed in India to control fishing operations. In this context, Roy-Chaudhary (1997) describes the evolution and impact of various legislations in India, consequent upon the adoption of UNCLOS. The measures taken for protection and preservation of marine environment, marine safety and maritime

surveillance have been dealt with in the Indian context. What is most concerning is the fact that the legislations adopted in India have not taken adequate care of the conservation needs. With the result, Marine fisheries in India have been facing serious threats against the sustainability of the resource.

Some studies have rightly pointed out the role that market demand of fish has played. For example,.Kizhakkudan, et al (2001) trace out how fishing activities in Gujarat got industrialized and how the targeted fishery with different resources gained priority based on the market demand. They also explained how even the so called 'trash' fish which used to get discarded in the sea once, began to find pride of the place in the export basket. They further point out the fact that in spite of the growth of the industry, and the generation of revenue from it, the fishing community does not stand to gain much as it is the middlemen and the industrialists who capitalize on demand and value from the commodity. They argue that the traditional and non-mechanised sector need to be made aware of the strategies of development and management to raise the socio-economic standard. The authors also recommend early implementation of management measure, in the face of growing concern for the fast dwindling stock of commercially important groups like white fish, lobsters, pomfrets, thread fins, perches, skates and penaeid shrimp.

The Management Issues

Gopal, et al (2001) consider marketing as an important area of fisheries management and analyse the landing centres, wholesale and retail markets in Cochin and Veraval for important varieties of fish. They found out the price spread to be very high and the benefit of high price spread accrued to the middlemen to the disadvantage of the consumer and the fishers of reasonable prices.

Some authors have discussed the issues of marketing management with special reference to the export markets. For example, Devadasan (2002) observes that shrimp which contributes only about 8% of India's marine landings, contributes to around 25% of the quantity of the processed marine products exported, and 70% of the total export earnings. Value addition of low value fish and diversification of markets and products are necessary to sustain the Indian exports. He recommends import of fish for processing and re-exports, mainly with a view to better capacity utilisation of the processing infrastructure, which is currently low in the country. He adds that maintenance of quality is important to meet international demands.

Alagaraja (1998) deals with the sampling procedure for collection of fish data and methods for assessing the exploited fish stock in India. Since there is no species-specific fishery in India, new models have to be developed to meet the requirements of multispecies-multi gear fishery. Accordingly two macro-analytic models viz. Maximum Contribution Approach and Relative Response Model are suggested and explained. He points out ways and means to utilize other living resources and explains how exploited stocks are affected by factors, some of which are not fully understood.

Code of Conduct

Mathew (2000) examines the application of the Code of Conduct for responsible fisheries in the management and development of marine small-scale fisheries in India. The genesis of the Code, the problems and prospects of applying the Code, the reservations of some of the signatories to readily implement it, the scope and advantages of implementing it are explained. He has suggested adaptation of the Code to suit the Indian small-scale fisheries.

Clucas (1998) briefly describes the genesis and salient features of the Code of Conduct for Responsible Fisheries. The author observes that the Code recognizes the nutritional, economic, social, environmental and cultural importance of fisheries and the interests of all those concerned with the fishing sector and takes into account the biological characteristics of the resources and their environment, the interests of consumers and others. He points out that though fisheries have substantial social, economic and nutritional importance, it is often not considered important in terms of national food security because it contributes little in the way of calories.

Gordon (1998) avers that increased commercialization of fisheries sector in Asia while benefiting fishermen through higher prices, has tended to displace the livelihood of those who depend on traditional processing or local marketing. The author emphasizes the role of strong and sustainable community level groups, along with the need to empower such groups, giving them greater control over fish marketing and other activities. This is an institutional approach, which expects participation of stakeholders in management of a resource on which they depend for their living.

Human Resource Development and Management

Bailey (1994) observes that small-scale fisheries in South and South-East Asia have undergone dramatic changes. The wide use of capital-intensive technologies has resulted in over-exploitation of the resource base. The changes have encouraged a shift towards urbanization of the industry to the detriment of the small scale fisheries sector. The author reports the evidence to indicate that there has been a net growth in the employment in the fisheries sector. He also questions the generally held notion that the economic condition of fishermen is worse than those

found elsewhere and the small scale fishers are the poorest of the rural poor. According to him the migration is more into the fisheries sector than out of it, which goes to prove that the common belief is misleading. The occupational diversity, that too in a multi-species fishery, with few restrictions to access, the fisher folk seems to be better placed than agricultural labourers.

In view of increased competition in the global market places and changing pattern of demand of fish products the need for trained manpower in fisheries should not be underestimated. In this context, Thampy (1998) reviews the status of fishery education and HRD programmes in the country and observes that they are not fully geared to meet the requirements and challenges being faced by the sector. Therefore diversifications at middle and quality improvement at higher education levels are the immediate needs.

Chong (1994) examines the economics and policy implications of labour absorption capacity in and/or employment creation of fisheries and how such opportunities can be created without jeopardizing the fisheries resource. He opines that limited entry produces displaced labour and capital in a situation of already high unemployment and growing surplus labour. It raises the need to invest in social capital to compensate and support displaced fishermen. According to the author, developing country fishermen have not reached the stage of awareness, understanding and appreciation of the merits of including and excluding fishermen from over exploited fisheries. The development, implementation and enforcement of any management measure which limit entry or constrain fishing will be doomed to fail if no workable alternatives are offered in place of the restrictions imposed. The author concludes that limited entry of fishermen as a management measure is not economically, politically or socially feasible or viable in developing countries.

Hotta (1994) reports that in many Indo-Pacific countries, the coastal fisheries employ a labour force in excess of that merited in an over-exploited resources resulting in declining productivity and incomes. There is thus an urgent need to identify and generate alternative employment opportunities for rural fisher folk. The author recommends transfer of coastal fishermen to offshore operations, aquaculture, post harvest enterprises and recreational fisheries. Besides, possibilities of employment outside fisheries like rural industrialization and development, manufacturing, agriculture, land development schemes, tourism, etc. need to be explored.

The Problems of Access Management

Willmann (1994) points out that the removal of the open access situation in the fisheries of South and South East Asia is seen as one of the principal measures required to effectively address the 'tragedy of the commons' type outcomes, such as: (i) the deteriorating status of coastal fishery resources, (ii) the increasing conflicts between different groups of fishermen, and (iii) the low productivity and incomes of the large majority of the fishing communities. Complementary action is the promotion of alternative employment and income opportunities for coastal fishing communities to facilitate the exit from or non-entry into, economically and biologically over-exploited fisheries. Exit promotion applies both to capital and labour in the fishery sector. According to the author, reduction in dependency on fishing for livelihood needs to be addressed at the household level rather than at the level of individual fishermen.

Sinha and Sampath (1994) give details of the nature and conditions of Indian small-scale coastal fisheries. Attention, has been drawn to the adverse effects of the "open access" situation, which has also encouraged non-fishermen to take an increasingly large role in mechanized fishing

operations. The authors argue that further enhancement of the sector should best be approached within the context of integrated rural development and suggest that steps should be taken to control entry to the fisheries and to allocate exclusive rights, allied with artificial reefs to artisanal fishing communities.

Ben-Yami (1993) recommends that in countries where large coastal populations are making their living out of fishery resources, may adopt following general rules:

i) all fish that can be caught by artisanal fishermen should be caught only by artisanal fishermen;

ii) all fish that cannot be caught by artisanal fishermen but can be caught by small scale commercial fishermen, should only be caught by small scale commercial fishermen;

iii) all fish that cannot be caught by small scale commercial fishermen, but can be caught by medium scale commercial fishermen should only be caught by medium scale commercial fishermen;

iv) Only such fishery resources which are not accessible to any of the above fisheries or which cannot be feasibly caught, handled, and processed by them, should be allocated to industrial, large scale fisheries.

The Perspective of Coastal Zone Management

Qasim (1996) observes that the multiple use of the coastal belt demands rational management schemes to control possible harmful effects (negative externalities) of the activities of one category of users on the interests of other users. Such management would depend on the availability of relevant data and scientific information, generated through regular systematic

monitoring and surveillance, which are the most important components of coastal zone management. Conservation of bio-diversity is critical for the stability of an ecosystem. Urgent measures are required to protect the two endangered ecosystems viz. mangroves and coastal reefs. Pollution in the EEZ, much of which is land-based is a cause of serious concern for the marine ecosystems and it has to be effectively curbed. Cooperation of different institutions and their networking are essential to know the EEZ better for sustainable use of the resource. King and Salagrama (1998), therefore, observe that a technological intervention alone is a poor approach to developing communities. It needs to be taken up in a more holistic way integrating social, economic, and environmental issues into the design.

Satyanarayana and Sen Gupta (1996) deal with the status of coastal pollution in India. The primary sources of pollution include industrial and urban waste, oil pollution, pollution from agricultural activities, and radioactive waste. Major areas of pollution along the coastline are found around six major cities of India. The authors report that studies on the Devnayaka, Kolak, Par, Ambika and Poorna have revealed significant deterioration of the water quality.

Birnie (1996) summarises the guidelines and safeguards contained in the UNCLOS to prevent pollution of the marine environment. The responsibilities assigned under the UN Conference on Environment and Development (UNCED) the Rio Declaration, Agenda 21 and the two framework conventions viz. those on Climate change and on Biodiversity etc. are discussed.

Ching (1994) examines the interactions and conflicts among various coastal activities and considers sustainable fisheries development within the framework of a properly integrated plan for coastal area management. According to the author, effective management of fisheries resources

demands a multifaceted and integrated approach with less adverse impacts from the multisectoral activities and development in the coastal zone and the downstream impacts of various activities in the hinterland. Coastal waters and the components of the biomass are closely linked physically, chemically, biologically and ecologically with the offshore waters. Therefore, the author concludes that sustainable fisheries management requires the adoption of effective management measures for the sustainable exploitation of the fisheries resources and the management of the adverse environmental impacts, which degrade the habitats whether originating from within or outside the sector. Sustainable fisheries management should also include the conservation of critical habitats such as mangrove forests, coastal reefs and estuaries.

According to Ruckes (1994), the primary objective of fishery management is the assurance of sustainable exploitation of fishery resources of which market forces should be used to support management strategies and programmes. Price reflects the relative scarcity of the good and changes in response to variations in supply and demand. Therefore price stabilization schemes are of particular relevance and benefit to the fishermen. The author discusses the pros and cons of the various price formation systems, which exist in fisheries, like direct sales, auctions, contracts, fixed prices and commission sales. He observes that the efficiency of management measures is defined as the achievement of fishery management objectives at the least possible cost. Such costs include scientific research of resources, monitoring and surveillance, administration, communications, sanctions and enforcement. The author advocates that for efficient resource management, there may be a need for collection of data, analysis and study, training of administrators, fishermen and their leaders.

Rahman (1994) argues that the conservation and management of coastal fisheries has to be developed on a logical basis addressing biological, environmental, political and the socio-economic issues. In view of the increasing multiple use areas has to be considered in the wider context of coastal zone management with a bio-socio-economic approach. The natural systems involved comprise an integral totality and it is necessary to treat them as such, if management is to successfully promote the proper use of the resources and the human environment as a whole.

Hameed and Ashok Kumar (1993) review the causative factors for energy wastage in fishing operations and suggest remedial measures. Energy optimization aims at using energy in fishing which leads to the greatest overall benefits of the individual fishing enterprises, national economy and global environment. Fishing gear optimization is one of the approved and generally accepted techniques for the reduction of energy consumption. The authors observe that energy optimization depends on accurate and timely information on navigation acquisition and fishing productivity. An efficient fleet management should be developed and all fishing vessels from a port should be brought under its control.

Ben-Yami (1993) analyses significance of low-energy fishing and problems in reducing fuel consumption. According to the author, lowering fuel consumption in the fisheries sector would require major investments and would not occur without government support and/or enforcement. He also opines that the character and degree of motorisation in artisanal fisheries are strongly affected by socio-economic and policy factors, such as fuel and fish prices, currency exchange rates, import policies and availability of credit. The more expensive engines often involve more expensive boats and bigger investments. This favours the stronger and more affluent fishermen

and boat owners. In some cases it may lead to marginalisation and even social dislocation of the weaker ones.

Annamalai and Kandoran (1993) observe that artisanal fishing marked by low energy use continue to be a dominant type of fishing in India in spite of the availability of alternative technologies. Motorisation has been a major innovation in the artisanal sector. But from a purely commercial point of view the investment on motorisation is not a paying proposition. Its main attraction is for the resourceful fishermen to invest their own funds to get a competitive advantage in fishing over their non-motorised rivals. This innovation has also led to regular migration of motorised crafts to distant coasts and into deeper waters. Team ownership of fishing equipments and monetisation of fishing operations are other spin offs from motorisation of artisanal crafts.

The Gujarat Case

Quite a few studies have discussed in detail the current status and development and management issues of the marine fisheries sector of Gujarat. Some of them are reviewed as under:

Somavanshi, et al (1999) discuss the current status of fisheries monitoring, control and surveillance (MCS) in India, with special reference to Gujarat State. The legislations in the country and the agencies involved in MCS are examined in detail. Surveys and research in marine resources are regularly carried out to monitor the status of the fish stocks and to evolve measures for controlling fishing effort, including need for ban on fishing during specific seasons. The authors report that the application of remote sensing technology using satellite imaging for forecasting potential fishing zones in India has been positively received by the fishermen.

Mesh-size regulation is an important area of fisheries management aimed at the conservation of the resource. In this context, Ramesan et al (2001) report that the cod-end size of trawl nets being used in Gujarat has become as small as 10-15 mm. size, causing serious damage to the stock. They report that on an average 0.8 to 1.5 tonnes of by-catch is landed per boat per trip throughout the season. The by-catch includes juveniles of fishes, crustaceans and other non-target organisms, which are sold to the fish meal plants at the rate of Rs.1 to 2/kg. Since there is demand for it, the practice continues unabated, adversely affecting growth and recruitment of resource, which is a major reason for catch depletion in the inshore waters of Gujarat Coast. The authors advocate use of 35-mm. square meshed trawl cod-end to prevent the indiscriminate fishing method. They have also observed that administrative directions and disincentives have not proved to be effective and that a better alternative would be of creation of awareness amongst fishermen about the adverse consequences of using smaller mesh size.

Nair et al (2003) give an overview of the marine fisheries in Gujarat. The authors aver that the developments in fishing methods, increase in intensity of fishing and targeting of specific resources of high economic value have created an impact on the fishery output, and over the years, the quality of the catch has changed considerably. The need for early adoption of resource management measures has been emphasized. Devraj, et al (2001) opine that the implementation of a closed season along Gujarat coasts mostly serves the purpose of a reduction in fishing effort rather than protecting the spawning stocks. Based on the CMFRI (1997) reports it has been pointed out that the present catch has already exceeded the potential yield of 0.57 million tones estimated for Gujarat.

Kizhakudan and Thumber (2003) report that about 95% of the total crustacean landings in Gujarat are by the mechanised sector and the rest by the artisanal sector. The percentage contribution of crustaceans to the total fish catch has increased steadily from 7.4% in 1971-75 to 23.4% in 1996-2000. But the share of penaeid shrimps has been declining and that of non-penaeid shrimp has been increasing. According to the authors the gradual decline in the crustacean resources, conversion of short trip operations (1-2 days) to long trip operations (5-7 days) with targeted fishing in deeper waters for cephalopods and the increased landing of non-penaeid shrimps, has now reduced the status of the much valued crustaceans to the level of a by catch. They also observe that while the percentage contribution of crustaceans to the total fish catch has increased, its value has decreased. The targeted fishery of perches, cephalopods, ribbon fishes and sciaenids, Bombay duck, cat fishes and ribbon fishes have now become the mainstay of marine fisheries in Gujarat.

Kizhakudan, et al (2003) analyze the fin fish resources of Gujarat and find that there has been considerable shift in the dominance of some of the hitherto high valued species. They report a virtual disappearance of white fish, thread fins and pomfrets from the top slots and the dominance of croakers. The growing prominence of cephalopods, some pelagic resources like ribbon fishes, clupeids and carangids and non-penaeid shrimps has diminished the contribution of prominent demersal fish resources. At the same time the share of lizard fish, thread fin breams, cat fishes and elasmobranchs, has been sustained. The demersal fin fishes, have found a new market in surimi processing. The authors conclude that the annual Catch Per Unit of Effort (CPU) has been showing a declining trend, indicating the critical stage of exploited stocks raising questions of regulation and conservation of the resources.

Zofair, et al (2003) report the increase in number of fishing vessels and declining fishery resources in Gujarat. The catch per boat began to decline from 1992-93 onwards and more rapidly after 1997-98. Increasing the fleet size is proving to be counter productive, affecting profitability of fishing operations, and sustainability of the fishery resources. The authors recommend immediate State intervention to establish optimum fleet size based on sustainable field estimates of the resources and to control excess fishing capacity.

Dholakia and Desai (2003) review the status of fishing marine resources of Gujarat and enlist rare and endangered species, vulnerable and threatened species of fauna from the Gulf of Kutch region. The importance of mangroves and coral reefs in sustaining marine fisheries and the need for their conservation are discussed.

Kizhakudan, et al (2003) investigate the nutrient of some of the major creeks of Gujarat, which support the traditional fisheries of the State. Ammonia, nitrates and phosphate levels in these creeks were seem to be influenced by anthropogenic effects, mainly through industrial and domestic discharge. Mangrove vegetation and fishery resources like oysters, clams, shrimps, crabs, mullets, clupeids, cyprinids and perches were reported to be very spare in these creeks now, while semi-fossiled beds reveal a good history of estuarine fauna within region in the past.

Mathai, et al (2003) review the status of fishing technology in Gujarat and discuss strategies for developing responsible fishing. The authors point out that by 1999 the mechanised fleet operating along Gujarat Coast was in excess by 35% of the optimum fleet size, recommended by the National Review Committee (2000). The trawlers, though efficient in harvesting demersal resources, have several drawbacks in terms of energy use, ecological and environmental impacts.

The authors suggest that the excess fishing units need to be phased out through appropriate management measures, especially the non-selective fishing units like trawlers.

Summing-Up:

The review of literature presented in this chapter highlights some important points and provide useful clues for the discussions contained in the chapters to follow. They are as under:

1. Fisheries resource potential assessed for Indian EEZ has prompted technological upgradation more particularly in the in-shore sector where the small scale artisanal fishermen operate their country-crafts.

2. The motorisation of the traditional country crafts and introduction of different types of mechanised boars were made possible largely with the help of intervention by the government and other agencies with easy credit on soft terms, infrastructural support, technical assistance, growth of ancillary facilities and subsidies of various kinds.

3. The above process led to ‘over-capitalisation’ in the fish catch as well as processing sub-sectors with the tremendous increase in the inputs pressed in the marine fisheries sector of India.

4. Marine fish is a renewable and ‘open-access’ type common-property resource, which requires application of suitable resource management practices simultaneously with the process of development. Development and management are the two, inseparable aspects linked to the use of a marine fisheries resource.

5. Fisheries development without care for the management of the resource has resulted into 'over-fishing', which throws open serious management challenges.

6. Marine fisheries has been a constituent of a wider coastal zone eco-system and a number of factors outside the fisheries sector also affect the fisheries resources. Therefore, marine fisheries need to be developed and managed as part of the integrated coastal area/zone management plan.

Additional Review Note on: Code of Conduct for Responsible Fisheries (FAO, 1995)

The Plan documents, of the relevant period, pronounced the objectives of fisheries development in the country. These objectives conveyed the theme for evolving appropriate development policies at the Central and State levels, although there was no formally declared comprehensive marine fisheries policy as a whole, except in the case of the deep sea fishing operations. Development and not management of fisheries, has been the main focus in the policies adopted by the Central and State Government so far. The country now needs a comprehensive marine fisheries policy, keeping in mind the relevant provisions of UNCLOS, Code of Conduct for Responsible Fisheries, Rio declaration of UNCED etc.

The introduction of EEZ, which is the source of 90% of the world's marine fisheries, was aimed at bringing about a certain order in the exploitation of the resources, by assigning rights and responsibilities to the Maritime States. UNCLOS has set the overall agenda of resource utilisation from a global point of view. But it has not been effective in solving the problem of over capacity and over exploitation of stocks (Symes, 1996). This is mainly due to the lack of experience, financial and physical resources of the coastal States (FAO, 1995). The rapid development and

uncontrolled exploitation of the marine fishery resources, has raised serious concerns about the sustainability of the sector. Consequently the Committee on Fisheries (COF) at its 19th Session in 1991 called for the development of new concepts for management of fisheries. Thus emerged the Code of Conduct for Responsible Fishery held in 1992 held in Cancun. It was an important contribution to the Agenda 21 of the UNCED. The FAO, along with the inputs from UN Conference on Straddling Fish Stocks and Highly Migratory Fish strides, and the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, Unanimously adopted the Code in 1995. Unlike the UNCLOS, the Code is a non-mandatory instrument, which provides a framework for national and international efforts to ensure sustainable exploitation of aquatic living resources in harmony with the environment. It prescribes the principles and international standards of behaviours for responsible practices with a view to ensuring effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. The Code in short sets up standards of conduct for all persons involved in the fishery sector. To achieve these objectives the Coastal nations are expected to formulate policies, create appropriate legal frameworks, set up institutions, and support R&D efforts, taking into account the provisions of the Code, as the “right to fish carries with it the obligation to do so in a responsible manner, so as to ensure effective Conservation and management of the living aquatic resource” (Art. 6.1 of the Code).

One of the most important principles of the Code, particularly relevant for developing countries like India is the application of a precautionary approach for conservation, management and exploitation of living aquatic resources, based on the best scientific evidence available. “The absence of adequate scientific information should not be used as a reason for postponing or failing to take measures to conserve target species, associated or dependent species and non-target

species and their environment". (Principle 6.5 of the Code). The Maritime States are also enjoined to establish effective mechanisms for fishery monitoring, surveillance, control and enforcement to ensure compliance with their conservation and management measures.

The State intervention is crucial in giving shape to the provisions of the Code. The responsibility of implementing the policies vests both in the Central and State Governments. The State Governments are still not fully aware and involved in the process of translating the Code into action. The total involvement of the State Government is an absolute necessity, which in turn would help involve the various stakeholders like producers, processors, traders, exporters and the whole fishing community in the adoption and implementation of the Code.

The fisheries sector offers livelihood for millions of people. It is a constitutional obligation for the State to protect their right. (Art. 39 (a) of Constitution of India) to adequate means of livelihood. Demand by the other competing sectors like tourism, industry, etc. should not deprive the fishermen of their basic right for a livelihood. Pollution is a major problem affecting coastal fisheries. The legislation to prevent such pollutions, although exists, is inadequate to protect the inshore waters. The Water (Prevention and Control of Pollution) Act 1974 empowers the State Governments to take appropriate action to protect the coastal waters from land based sources of pollution. But State Governments have not been proactive to this aspect, which needs to be addressed on a priority.

A fundamental change in approach will be required for better management of the fisheries. The present open access system will have to be regulated by appropriate methods for a limited access system. This must ensure equitable distribution and conservation of resources. The Code

inter alia recommends “preferential access” to traditional fishing grounds and resources in favour of. “fishers and fish workers, particularly those engaged in subsistence, small scale and artisanal fisheries, to secure and just livelihood….” (Article 6.18). Such rights can be conferred and ensured only through State intervention. In this context, TURFs wherever existed should be revived and must be given legal protection. The tenets of co-management may also be adopted, for which again necessary legal support has to be provided. With the devolution of power and Panchayatiraj institutions getting prominence in the country, they should be made part of the co-management, scheme, to ensure a wider community based fishing rights system. An important area where State intervention now becomes necessary is to build capacities of such institutions and the stakeholders to handle the new responsibilities. Merely vesting the authority and responsibility for management alone would not suffice.

The Code also advocates integration of fisheries into coastal area management. The Indian marine fisheries is essentially coastal or inshore fisheries. The coastal processes are interlinked and the coastal zone consisting of the ‘dry side’ and the ‘wet side’ constitute an interrelated ecosystem. The management of inshore fisheries cannot be viewed delinking it from the factors that affect this ecosystem. These factors are the watershed, terrestrial and marine biota, human use of land and sea the fluvial discharge, bed load, suspended load and dissolved load, etc.

The Code recognizes the importance of the coastal ecosystem as enshrined in the Article 10 where detailed provisions are prescribed towards institutional framework, policy measures, regional cooperation and its implementation.

Conflicts are to be naturally expected when there are diverse interests competing for limited space and resources as in the coastal fisheries. The conflicts may arise within the sector between artisanal or small scale and commercial fishers, between commercial fishers when different groups use incompatible gear, or when commercial and recreational fishers interests collide. There are also conflicts between fishers and other resource users like agriculture, forests, industry, tourism and even local authorities. It can even involve neighbouring States or neighbouring countries. They cannot be avoided altogether but only minimized through careful handling. Disputes can be solved through the law courts, but it leaves one party unsatisfied and the tension is likely to continue. Therefore, it is desirable to evolve Alternate Dispute Resolution (ADR) techniques. ADR is often through negotiations between the parties, with or without intermediaries like, conciliator, mediator or arbitrator. With goodwill, flexibility and participation of all concerned, solutions emerging out of ADR are generally acceptable to all the stakeholders.

Conflict Control

Article 10 of the Code of Conduct for Responsible Fisheries, specifies that as part of the institutional framework for integration, States should "……. facilitate the adoption of fisheries practices that avoid conflict among fisheries resources users and between them and other users of the coastal area….. [and] promote the establishment of procedures and mechanisms at the appropriate administrative level to settle conflicts which arise within the fisheries sector and between fisheries resource users and other users of the coastal area.

The objectives of Fisheries Management have now gone beyond the biological, economic or ecological issues. It is being viewed as a comprehensive effort involving social, economic and environmental considerations. Therefore, conflict management is becoming a key element of

fisheries management. (FAO 2002). As such the practitioners of fisheries management including the leaders of the stakeholders have to gain the requisite skills for conflict management and alternate dispute resolution techniques. The Sate has to recognize the importance of the hitherto ignored area of activity and evolve appropriate systems in the context of fisheries management. Capacity building of the managers and stakeholders is the key to the success of conflict management exercise.

The integrated marine fisheries for the country should essentially contain the principles of the Code of Conduct for Responsible Fisheries, pertaining to various aspects of production, processing, marketing, resource management, welfare, R&D, international and regional cooperation etc. The Central Government, it is understood, is considering a "Marine Fishing Policy" a draft of which has been moved by the Ministry of Agriculture, Govt. of India (2002). This draft refers to "Fishing" policy giving it a narrow connotation of dealing with harvesting activity only. It has to be a comprehensive "Marine Fisheries Policy" embracing all the activities of the Marine Fisheries Sector. Such a Policy is expected to give the necessary direction for the management of marine fisheries as a whole.

While agreeing to adopt the Code, it is also incumbent upon the Government, to bring to the FAO and other international agencies concerned, the difficulties that the countries like India are facing in implementing the Code. Insufficient financial resources, inadequate technical expertise, competing pressures from economic, social and environmental needs, are hurdles in its implementation.

The Code itself recognises the special needs of developing countries (Article 5). But these issues have not been addressed with due urgency and concern. The role of the State become particularly important in this regard in the years to come.

The pursuit of rapid industrialization and urbanization as well as pollution from domestic and agricultural sources have been causing severe problems in the estuaries and inshore waters of Gujarat. The Chemical industries mostly let out untreated effluents into the estuaries which ultimately end up in the sea. In Midnapore and Porbandar, acidic waste water from the Soda ash emits has made the inshore waters toxic for marine life. Industrial wastes like poisonous heavy metals are allowed to flow into the creeks, estuaries, and the sea, killing marine life. Oil spills from storage tanks, ships, ship breaking yard at Alang cause pollution. High levels of arsenic and mercury were reported from Hiran dam, which flows into the Veraval fishing grounds. Treated and untreated sewage from urban areas are poured into the sea unabated. The toxic effluents destroy the fish and fish breeding areas, adversely affecting the stock. The pollution in the coastal zone is more dangerous than that in the open sea, where it gets diffused to tolerable levels.

The construction of check dams and other impoundments across the rivers and rivulets flowing into the creeks of Gujarat, are causing serious ecological threat, affecting the traditional fisheries, of that region. With low rainfall, and poor flow of water in the rivers, the levels of ammonia, nitrate and phosphates have gone up. Mangrove vegetation and fishery resources like oysters, clams, shrimps, crabs, mullets, clupeids, cyprinids etc., which were abundantly available in the past, have become rare. Reduction in the average rainfall, man-made impoundments along the course of rivers and degradation of the natural ecosystem through pollution have transformed the creeks into saline basins with high levels of pollutants, low level of nutrients and low

productivity, adversely affecting the traditional fishery, and the livelihood of marginal fishermen. (Kizhakudan.S.J et al 2003).

The Coastal Regulation Zone notifications are aimed at minimizing the adverse impact of industrialization, urbanization and other anthropogenic effects on the coastal zone. But the existing regulations are found to be inadequate and their implementation slack, giving yet another example of ineffective State intervention in resource management.

International Cooperation

The marine fishery resources are often transboundary in nature. International cooperation is necessary for conservation and management of such resources. There are about 30 regional and sub-regional agencies viz. Regional Fisheries Management Organisation (RFMOs) have been set up for this purpose. But their effectiveness in achieving their principal objective of fisheries management has been questioned. They are required to work through consensus among members, which is a difficult task. Nonetheless, RFMOs help facilitate and reinforce regional cooperation. The maritime nations are obliged to implement the Agenda 21, the 1995 UN Fish Stocks Agreement, and the 1995 FAO Code of Conduct for Responsible Fisheries. The RFMOs have a role to play in bringing the contracting and non-contracting member countries together in achieving the task of managing the fishery resources.

CHAPTER - 3

CURRENT STATUS AND DEVELOPMENT OF MARINE FISHERIES IN INDIA

Introduction:

Marine fish is a renewable natural resource. Its sustainable use very much depends on the resource potential assessed through scientific methods. In this chapter we have presented current status and the development of marine fisheries sector in India in global as well as historical perspectives. We, first, present the global scenario of the resource potential and its use by the maritime nations across the world, followed by the Indian case of the resource potential, its use and the issues related to the development and management of her marine fisheries sector.

The Global Scenario of Marine Fish Potential and Catch

Based on the analysis of total marine fish landings, the global marine fish production potential has been estimated by FAO, as follows:

(a) Estimate based on world marine landings under present fishing regime. (Potential = 82 million tonnes).

(b) Total individual estimates made for each ocean (Potential = 100 million tonnes).

The difference of 18 million tonnes between the two estimates is expected from optimization of the production in the North Atlantic and increased landing from Indian ocean. But the reliability of the latter estimate is questioned by FAO itself. The estimates for the Eastern &

Western Indian Ocean area, which includes India, Sri Lanka, Palestine, Western and southern sides of Indonesia and Australia as “unreliable”. According to most reliable estimates, 4 million tonnes each can be added from Atlantic and Pacific Oceans and 2 million tonnes from Indian Ocean, to that estimated landings of 82 million tonnes expected to attain in 1999. Although the Indian Ocean has the least developed fisheries, its inshore resources have been exploited to the maximum level. The option lies in expanding effort to offshore areas, but existence of any highly potential fishery in this regime is not beyond doubt. (Garcia & Newton 1994). The FAO (1995) in its report “The State of World Fisheries and Aquaculture” concludes that an additional 20 million tonnes is possible if (1) degraded resources are rehabilitated, (2) underdeveloped resources are exploited further avoiding over fishing, (3) Wastages and discards are reduced, and (4) Mariculture is developed.

The world fish production was first estimated by FAO in 1945, when the focus was confined to marine capture fisheries. According to this estimate the total marine fish catch was about 17.7 million tonnes. (FAO, 1996). Based on the analysis of historical data from 1953 to 1968, Gulland (1971) made the first estimate of global fish production potential as 100 million tones per annum. During the period of 15 years the fish landings were increasing at an annual rate of about 6%.

Global fish production reached a record high in 1994, with a total of 109.6 million tonnes from capture fisheries and aquaculture. The increase was mainly on account of marine capture fisheries followed by inland aquaculture in Asia, particularly in China. Mariculture had only a marginal share. According to FAO (1996), twenty countries account for about 80% of total world production, while ten countries account for almost 70%.

Marine fish production continued to rise globally till 1970 at an overall rate of about 6% per annum (FAO 1993). It had a remarkable growth from 14 million tonnes in 1950 to about 84 million tonnes in 1994 (Granger and Garcia 1997). A significant change in the production trend was the emergence of pelagic species as the dominant group surpassing the high value demersal species, which was showing an increase till mid 1970s. This indicated the depletion of high value fishes and progressive acceptance of hitherto rejected low value fishes. In 1990s, FAO has reported that all of the world's 17 major fisheries were being harvested at or beyond the sustainable capacity and that 9 were in a state of decline.

Fish production of EU countries and USA remained static or improved marginally. But production in Japan continued to slide since 1988. The economies in transition, barring the Russian Federation continued to show a declining trend. The increase in production was the contribution of those classified as Low Income Food Deficit Countries (LIFDCs) like China, India, Bangladesh, Morocco, Indonesia and focusing on aquaculture, relegating Japan to a much lower position.

The first decline in global marine fish catch was reported by FAO in 1990, when the landings came down to 83 MT from 86 MT in 1989. It is pertinent to note that the period 1970-89, witnessed rapid increase in the size of global fishery fleet. According to FAO, the exploration and development of new fishery grounds in the 1960s and 1970s, first by the distant water fishing vessels and later by the coastal States, has not resulted in any appreciable net increase in fish production. Although new resources were added, over fishing and over investment has resulted in the degradation of the resources.

The marine fishery development process is characterized by the “boom and burst” generalized fishery development model, described by Caddy and Gulland (1983). It is composed of four phases viz. 1. Undeveloped, 2.Developing, 3. Mature, and 4. Senescent. This model indicates the theoretical change in yield and relative rate of increase in yield during the development of a fishery. The rate of increase is zero for an undeveloped fishery. It increases rapidly during the phase II and I as it starts developing. As the growth becomes steady, the change starts decreasing and dips to zero when the fishery reaches its maximum production level in phase III. A 1994 study of 200 important species - area combination of marine fish “resources” which contribute 77% of world marine fish production has revealed certain striking conclusions. 35% of these major resources have reached the level of senescence showing a declining trend in yields, about 25% are mature where the production is at a high level of exploitation, reaching a plateau, 40% are still categorized as “developing”. There are none in the “undeveloped” phase, where exploitation is at a low level (Grainger and Garcia, 1997). The FAO, based on traditional stock assessment data, has also concluded that 44% were intensively to fully exploited, 16% were over-fished, 6% depleted, and 3% slowly recovering (Garcia and Newton, 1994). This study also indicated that globally 69% of the known stocks, need urgent management intervention, and that a 30% reduction in fishing effort is required to rehabilitate the over exploited high value demersal marine fish resources. The Indian Ocean region comprises of the FAO statistical area 51 & 57 i.e, Western Indian Ocean and Eastern Indian Ocean areas. The first production by Indian Ocean countries for the period 1992-97 is given in Table 3.1 The Indian Ocean is generally considered to be less developed. But most of the inshore resources of this ocean have been overexploited by the coastal States. Therefore, further possibilities have to be explored in the offshore resources, the potential of which is not convincingly established. The total marine catch from the Western

Indian Ocean has increased from 0.5 MT in 1950s to 3.8 MT in 1992. When a marginal decline was reported on account of fall in the landings of herrings, Indian oil sardines, anchovies etc. The catches in the Eastern Indian Ocean area also has increased since 1950 and almost doubled by the mid 1970s. Five countries i.e India, Indonesia, Malaysia, Myanmar and Thailand contributed 90% of the total marine fish production of this region in 1994. The fisheries off the West and South-west of Australia, of which the lobster fishery is the most important, have also been on the upswing until 1985 when there was a decline attributable to increase in fishing efforts and/or environmental changes. The offshore resources off Indian coast are mainly exploited by the distant water fleet of Spain, France, Taiwan, Japan, Republic of Korea, etc. These catches have registered commendable increase from 325000 tonnes in 1990 to 430000 tonnes in 1993, the beneficiaries being Spain and France sharing more than 50% of these catches.

TABLE 3.1: FISH PRODUCTION FROM INDIAN OCEAN, 1992-97
('000 tonnes)

Country		1992	1993	1994	1995	1996	1997
		Indian Ocean Countries					
1	India	2596	2703	2823	2786	3016	3024
2	Thailand	683	862	814	867	928	906
3	Indonesia	558	617	634	679	716	744
4	Myanmar	618	625	600	606	636	673
5	Malaysia	536	532	528	611	574	567
6	Pakistan	432	499	419	405	395	422
7	Bangladesh	301	341	282	299	328	352
8	Iran Islamic Rep	252	221	217	251	243	239
9	Srilanka	187	205	215	221	214	220
10	Australia	145	150	128	138	132	133
11	Oman	112	116	119	140	120	117
12	United Arab Emi.	95	100	109	106	107	114
13	Yemen	80	86	83	103	101	113
14	Maldives	82	90	104	105	106	108
15	Madagascar	78	86	88	88	88	90
16	Tanzania	61	43	47	50	55	57
17	Egypt	39	46	43	43	44	52
18	Saudi Arabia	46	48	55	46	48	50
19	Mozambique	28	26	23	22	27	31
20	Somalia	21	19	17	16	16	15
21	Mauritius	19	21	19	17	12	14
22	Comoros	12	12	13	13	13	13
23	Iraq	1	2	4	5	12	11
24	Bahrain	8	9	8	9	13	10
25	Kuwait	8	8	8	9	8	8
		Other Countries					
1	Spain	86			141	133	135
2	Taiwan	69			115	110	116
3	France	98			101	89	78
4	Japan	59			56	48	50
5	Korea, Rep. of	31			23	32	38
	Total	7463	8006	7875	8173	8524	8679

Source: Handbook of Fisheries Statistics 2000, Ministry of Agriculture, Govt. of India, New Delhi.

India, along with Indonesia, Thailand and Philippines constitute 73% of the total production of South and South East Asian region. According to the Handbook on Fisheries Statistics 2000 of Govt. of India (Anon-2000), fish production in India has gone up from 7.52 lakhs tones in 1950-51

to 52.62 lakhs tones in 1998-99 at an annual growth rate of 4.1% as a result of various development programmes. India achieved the distinction of being the sixth largest producer of fish in the world.

The Contribution of India to the world fish production is presented in the Table 3-2.

TABLE 3.2: CONTRIBUTION OF INDIA TO WORLD FISH PRODUCTION, SELECTED YEARS ('000 tonnes)

	World Production			Contribution of India					
Year	Total	Marine	Inland	Total	%	Marine	%	Inland	%
1950	19755	17521	2234	730	3.70	520	2.97	210	9.40
1955	28642	24968	3673	839	2.93	596	2.39	243	6.62
1960	36691	32665	4026	1161	3.17	880	2.69	282	7.00
1965	51229	46141	5088	1331	2.60	824	1.79	507	9.97
1970	67279	61277	6003	1759	2.61	1086	1.77	673	11.21
1975	68341	61481	6860	2267	3.32	1482	2.41	785	11.44
1980	75585	67953	7633	2445	3.24	1555	2.29	891	11.67
1985	91553	80888	10665	2839	3.10	1747	2.16	1092	10.24
1990	103590	88997	14593	3875	3.74	2300	2.58	1575	10.79
1995	124152	102801	21351	4998	4.03	2786	2.71	2212	10.36
1996	128648	105252	23396	5353	4.16	3016	2.87	2337	9.99
1997	130882	105770	25112	5477	4.18	3024	2.86	2453	9.77

Totals may not tally due to rounding off.
Source: Handbook of Fisheries Statistics 2000, Govt. of India. (Anon 2000)

The UNCLOS & EEZ

The U.N Convention on the Law of the Sea (UNCLOS) is a new ocean regime introduced in 1982. It was duly ratified and came into force as an international law in November 1994. This was a landmark event in the history of global marine fisheries exploitation. It has established the Exclusive Economic Zone (EEZ) and provided a regulatory framework by improvising the coastal and other States with jurisdictional rights and duties. It offers an international mechanism to pursue sustainable development of the marine and coastal areas. Under Article 57 of UNCLOS, the EEZ "shall not extend beyond 200 nautical miles from the

territorial sea baselines":. It is an "area beyond and adjacent to the territorial sea" for which there is a separate legal regime. Prior to the advent of UNCLOS, the fishery jurisdiction of coastal States was co-terminus with their own territorial waters, which in the case of India was up to 19.2 kms. UNCLOS prescribes that every coastal State should assess the Maximum Sustainable Yield (MSY) that can be harnessed from its EEZ.

The Resource Potential of Indian EEZ

The Indian EEZ falls between lat. 24^{o}N and 4^{o}N on the east and west. The EEZ around the A&N Islands is between lat 14^{o} to 5^{o}N and long. 89^{o} – 95^{o}E. The eastern and western coasts and the area surrounding the islands of A&N and Lakshadweep together has a total area of 2.01 million sq. kms. The area distribution and potential yield is given in the Table 3.3. Only about 10% if the Indian EEZ is being exploited at present.

Table.3.3 :AREA DISTRIBUTION AND POTENTIAL YIELD OF INDIAN EEZ

Region	Area(M.Km^{2})	% of Total	Potential Yield MT	%
West Coast	0.6983	34.74	2.36	60.2
East Coast	0.5155	25.64	1.09	27.8
A & N Island	0.5665	28.18	0.16	4.1
Lakshadweep	0.2300	11.44	0.06	1.6
Oceanic	--	--	0.25	6.3

Source: Somvanshi (1998)

The continental shelf which is considered to be the most productive area covers about 43,8545 sq. Kms. up to 300 m. depth. The current level of exploitation from the shelf area in the west coast is 79.4% and the East Coast is 72.9% of the estimated potential (Somavanshi'98). The oceanic resource is virtually unexploited even now.

Several surveys have been conducted from time to time to assess the potential resources by different agencies of the Central and State Governments. The deep-sea fishing station (now Fishery Survey of India) was set up at Bombay in 1946, and the Central Marine Fisheries Research Institute at Mandapam (CMFRI) in 1947 for survey purposes. The efforts of these organizations have brought out valuable information on the resource potential of the seas around India. The State Govts. on their own also have been conducting similar surveys and studies on resource potential. But there has been no unanimity in their assessments. No effective mechanism seems to have been evolved to reconcile these differences, so much so that several State Govt. agencies continue to maintain their own estimates which are at variance with that of the FSI and CMFRI. Such discrepancies are likely to create problems for adopting any systematic management measures. A mechanism to reconcile data is needed as it is critical for evolving management policies for rational exploitation of the resources. It is an area that deserves immediate attention of the Central Government and Fishery scientists

The potential yield of the Indian EEZ has been estimated indirectly and directly through repeated sampling as reported by several researchers. These estimates vary between 3.59 million tonnes and 4.72 million tonnes.

Based on primary production and fish production trends, several attempts were made to assess the fishery potential in the Indian ocean and the sea around India by Prasad et al (1970), Gulland (1971), Cushing (1973), Jones and Banerji (1973), and Mitra (1973). Prasad, et al (1970) had suggested a resource potential as high as 11 to 12 million tonnes as against a catch of 2.1 million tonnes. But this has been generally considered as an over estimation. According to George, et al (1977), the potential yield up to 200 m. depth is about 3.88 million tonnes. Whereas

Joseph (1987) has estimated it to be 3.59 million tonnes. For depth >200m. George et al estimates a potential yield of 0.5 million tonnes whereas according to Joseph (1987) it is only 83,000 tonnes from the depth zone 200 to 500 m. Mathew et al (1970) estimated the potential yield as 3.74 million tonnes based on secondary production expressed in terms of Carbon ranging from 0.5 to 20.92 gm/c/Sq.m/year. Based on the primary and secondary production rates in the EEZ, as evident from the data of more than twenty years available with the National Institute of Oceanography, Bhargava (1996) estimates the potential yield as 4.72 million tonnes. The wide variation in the estimates exhibits the extreme difficulty in assessing the resources of Indian EEZ, which are dependent on factors like monsoon, upwelling, circulation, freshwater discharge, light penetration, availability of nutrients, etc. that influence the primary and secondary production in the oceans. Based on various exploratory surveys, experimental fishing, and other available scientific data, the average harvestable resource (i.e. MSY) was estimated at 3.92 MT per annum by Sudarsan et al (1990). The major fishery resource potential and estimated yield based on the report of the Working Group on Revalidation of the Potential Marine Fishery Resources of the EEZ of India, appointed by the Government of India in 2000 has estimated the potential resource in the EEZ of India as 3.934 million tonnes (Anon,2000 a). The details are given in Table 3.4.

TABLE 3.4 MAJOR FISHERY RESOURCES POTENTIAL AND PRESENT ESTIMATED YIELD IN INDIAN EEZ
(In '000 tonnes)

Group	1991	2000	Diff
Elasmobranchs	168	71	-97
Eels	7	9	2
Catfish	123	51	-72
Oilsardine	191	295	104
Other sardines	96	101	5
Anchovies	53	142	89
Other clupeids	210	79	-131
Bombayduck	104	116	12
Lizardfish	48	28	-20
Perches	239	227	-12
Croakers	142	273	131
Ribbonfish	311	194	-117
Carangids	447	238	-209
Silverbellies	86	67	-19
Pomfrets	54	46	-8
Mackerel	224	295	71
Seerfish	42	62	20
Tunnies	279	65	-214
Flat fish	38	47	9
Penaeid shrimps	178	194	16
Non-penaeid shrimps	54	139	85
Cephalopods	71	101	30
Priacanthus	55	28	-27
Black ruff	9	27	
Indian drift fish	7	8	1
Deep sea shrimps	3	2	-1
Deep sea lobster	5	1	-4
Oceanic tunas	209	213	4
Bill fishes	4	5	1
Others	443	810	367
TOTAL	3900	3934	34

(*) Source: Report of the Working Group on Revalidating the Potential of Fishery Resources in the Indian EEZ, October 2000.

The inshore waters up to 50 m. depth is considered to be the most productive zone and it contributes about 2.21 million tonnes of fish. The fishing effort so far has been by and large concentrated in the inshore waters, which is only about 5% of the total EEZ. The offshore

and deep sea i.e. 50 m to 500 m. depth has an estimated potential of about 1.4 MT and the oceanic high seas about 0.3 MT. The potential of fishing resources depth wise in the Indian EEZ is given in Table 3.5.

TABLE 3.5: POTENTIAL OF FISHERY RESOURCES IN THE INDIAN EEZ

(Million tones)

Depth range(m)	0-50	50-200	200-500	Oceanic	Total
1	2	3	4	5	6
Demersal	1.28	0.625	0.028	--	1.933
Neretic Pelagic	1.00	0.742	--	--	1.742
Oceanic Pelagic	--	--	--	0.246	0.246
Total	2.28	1.367	0.028	0.246	3.921
Per cent to total	58.1	34.9	0.7	6.3	100.0

Source: Handbook on Fisheries Statistics – 2000 – Govt. of India.

The resources in the inshore waters have almost reached a level of over exploitation. But it has survived a total collapse because of the multi-species nature of the fishery resource in the Indian waters. With the limits of exploitation get overstretched, it is imperative to look beyond, into the deep sea and oceanic waters. Though the resource potential of this region is less than the inshore area, it provides good potential for several species of fish hitherto unexploited or under exploited by the Indian fishermen. The crustacean resources in the offshore area have been comparatively better exploited but the fin fishes, cephalopods, migratory tunas etc. are still remaining underexploited. Several studies have established the potential of these commercially important fishes. Their potential yield and landings are given in Table 3.6.

TABLE 3.6: POTENTIAL YIELD AND LANDINGS OF MAJOR DEEP SEA RESOURCES OF INDIAN EEZ. (in '000 tonnes)

	Potential	Landings	%
Anchovies	240	73	30.4
Carangids	265	54	20.4
Ribbon Fish	270	54	20.0
Coastal Tunas	200	23	11.5
Catfish	310	24	7.7
Perches	250	66	26.4
Deep Sea Lobster/Prawn	12	Neg.	0.5
Cephalopods	180	24	13.3
Oceanic Tunas	500	Neg.	Nil

Source: Handbook on Fisheries Statistics – 2000, Govt. of India.

Concerted development efforts are required to harness these under-exploited resources to enhance marine fish production, which has now reached a plateau. The tuna fisheries of India is a highly potential resource. But its exploitation is still limited to the traditional small-scale sector. The Working Group on Revalidation of Potential Marine Fisheries, has estimated the annual potential yield of tunas as 50,000 MT along the mainland coasts, beyond 50 M depth, 50,000 MT around Lakshadweep coast, about 1,00,000 MT from the sea, around A&N Islands, and about 2,00,000 MT from the oceanic waters. There is a vide gap between this exploitable resource and the present level of production. There is scope for introducing suitable craft and gear for harnessing this fishery (Pillai et al, 1998).

Researchers have given different estimates of potential yield of marine fishery resources of the Indian EEZ, based on different parameters. The details are given in Table 3.7.

TABLE 3.7: MARINE FISHERY RESOURCES POTENTIAL IN THE EEZ OF INDIA: SUMMARY OF ESTIMATES (in '000 tonnes)

Authors/Source	Year	Depth Zone of EEZ	Region				Laksha-dweep	A&N Island	Oceanic Region	Total
			NW Coast	SW Coast	SE Coast	NE Coast				
George et al	1977	0-200 & oceanic	883	1422	674	735	90	160	500	4464
Nair& Gopinathan	1981	Entire EEZ	-	-	-	-	-	-	-	5500
Joseph	1985	0-200 (demersal)	928	438	243	416	-	-	-	2025
Joseph	1987	0-500 & Oceanic	1620	853	425	531	90	160	500	4179
Alagaraja	1989	0-200	1050	900	750	300	-	-	-	3000
James et al	1989	Entire EEZ	-	-	-	-	-	-	-	4500
Sudarsan et al	1190 b	Entire EEZ	->2357<-		->1090<-		63	161	246	3921*
Mathew et al	1990	Entire EEZ	->2390**<-		->660<-		-	690		3740
Desai et al	1989	Entire EEZ								3660
Revalidation Working Group	1991	Indian EEZ	1217	1311	554	321	63	139	295	3900
Bhaskaran Pillai	1995	Indian EEZ								3450
NIO (Sarupriya)#	2000	Euphotic zone	->2400<-							
Current realisation	2000	Indian EEZ								3934

* Includes 4000 t. of demersal resources from 300-500 m depth from areas other than 8oN-100N Lat. Along West coast

** Includes Lakshadweep also

upto 150 m. Personal communication from Dr.J.S.Sarupriya, NIO, Goa

(*) Source: Report of the Working Group on Revalidating the Potential of Fishery Resources in the Indian EEZ, October 2000.

Taking the average annual yield of five years (1993-98), an additional yield of 14,82,633 tonnes of fish can be harvested from the Indian EEZ, assuming the availability of the revalidated resource potential of 39,34,417 tonnes as in Table 3.8.

TABLE 3.8: MAJOR FISHERY RESOURCES POTENTIAL AND PRESENT ESTIMATED YIELD IN INDIAN EEZ (In '000 tonnes)

Resource	Demersal	Pelagic	Oceanic	Total
Potential	2017071	1673545	243800	3934416
Present yield (average of 93-98)	1229888	1221896	Negligible	2451784*
Addl. Harvestable yield	787183	451649	243800	1482632

* Excluding molluscs cephalopods

(*) Source: Report of the Working Group on Revalidation of Fishery Resources in the Indian EEZ, 2000.

Modernisation:

Modernisation of the fishery sector was a conscious effort undertaken and promoted by the Govt. as a part of the State intervention policy to enhance efficiency and productivity. Mechanisation of fleet was essentially a part of this modernization process, to enable fishermen to go into the offshore area and fish for longer duration and for better catch. This objective was indeed achieved over the years.

In the early days of planned development in the country, marine fisheries was small scale in nature without any motorisation or mechanization. Fish was landed in rural communities and marketed locally or regionally in fresh or processed i.e dried form. Limited technical capacity and market demand meant the marine resources in general were not heavily exploited. But motorisation and mechanization brought about substantial changes. Mechanisation of fishing

boats started picking up only by the end of the second Five Year Plan in 1961 when there were only about 2160 mechanised boats in operation. (Srivastava et al, 1986). The upward trend was faster till the 4th Plan period, after which it decelerated to some extent. At the end of the fifth plan in 1979 it was about 13,538.

Mechanisation and Structural Changes

As a result of the various incentive schemes provided by the Government and the profitability attained by the mechanized crafts, the marine fishery sector has undergone major structural changes as is evident from the composition of the fleet and consequent changes in production between 1980 and 1988. The details are given in Table 3.9. The contribution of non-mechanised traditional sector has declined from 60% in 1980 to 8% in 1998. The share of mechanized sector, at the same time increased from 40% to 73%. With the result, annual per capita production per active fishermen registered a decline as against the increase of annual per capita catch by the active fishermen of the mechanised sector.

TABLE 3.9: CHANGE IN COMPOSITION OF FISHING FLEETS, FISHERMEN AND FISH PRODUCTION: 1980 – 1996

	1980	1998
FISHING FLEETS		
Non-mechanised	137000	160000
Motorised	--	32000
Mechanised	19013	47000
Total	156013	239000
ACTIVE FISHERMEN (LAKHS)		
Non-mechanised sector	348	6.5
Motorised sector	--	1.7
Mechanised sector	1.14	2.0
MARINE FISH PRODUCTION (%)		
Non-mechanised sector	60	8.0
Motorised sector	--	18.8
Mechanised sector	40	73.2
ANNUAL AVERAGE PRODUCTION (t)		
Non-mechanised units	6.57	1.3
Motorised units	--	16.0
Mechanised units	32	42.0
ANNUAL PER CAPITAL PRODCTION PER ACTIVE FISHERMEN (Kg)		
Non-mechanised sector	2590	328
Motorised sector	--	2951
Mechanised sector	2560	9767

Source: Sathiadhas et al, 2000.

The marine fisheries sector in the country witnessed an unprecedented growth in the number of fishing vessels, especially those below 20 meter OAL, threatening the sustainability of the sector. The Central Government, therefore, appointed a National Level Review Committee to assess the area wise requirements of different categories of fishing vessels below 20 meter OAL.

The Committee observed that the existing size of the traditional fishing fleet is optimum and no further addition to the fleet is required. However, considering the resource potential and present level of production from the EEZ, beyond 50 meter depth, the Committee recommended an additional 700 new generation resource specific fishing vessels of about 18 meters OAL including trawlers and gill netter-cum- long liners. (Anon, 2000 b).

Positive Impact of Modernisation:

Introduction of motorisation and mechanization had its positive impacts on Indian marine fishery sector. The fishing power has gone up. A commercialized, fishing industry has come into existence. Bigger vessels have been introduced. Better onshore facilities were built up. Port villages have evolved into urban harbour towns. But they are not without its negative impacts as well. Competition has set in when the powerful amongst the players gained major share of catch. Urban non-fishermen entrepreneurs started gaining advantages all over the coastal states with the exception of Gujarat where the fishermen themselves have gained entrepreneurial expertise and became major players in the field. It was a significant achievement of Gujarat fishermen who took good advantage of state intervention and technological support. Generally the motorisation and mechanization did not benefit the rural fisher folk as much as it benefited the fishermen in the urbanized fishing centres. The field realities prove that the fishermen who could invest in more powerful fishing technologies or capable of taking benefit from government development programmes, dominate the scene. They continue to operate in the inshore area, to the disadvantage of artisanal fishers using less powerful craft and gear, even though this was not the intended objective of State intervention in modernization.

Employment opportunities in bigger trawlers have been offered mainly to non-fishermen workers in many places, resulting in displacement of fishermen labourers in the rural areas, affecting coastal households. Modernisation in a sector should generally benefit all the stakeholders in it, by increasing efficiency, relief from drudgery, growing prosperity etc. But the Indian marine fishery sector has not gained much in this respect. The fishing vessels were predominantly owner operated and the crew members are co-adventurers who share the risk involved. Open access system of resource use has continued without any effective management of resource, causing a crisis. And it goes on unabated.

The Challenges:

The rapid progress in mechanization was not accompanied by effective enforcement of appropriate management measures. This has caused overexploitation of the resources, and its depletion to unsustainable levels.

According to Symes (1996), three broad tendencies of modernization had severe impact on the marine fishery industry.

i) Penetration of capital through industrial modes of exploitation into the inshore fisheries. Earlier it was seen only in offshore and distant water fishery.

ii) Appropriation of responsibility for fisheries management from local, industry based institutions and its relocation in the Govt. agencies – national or international.

iii) Globalisation of food system, as a result of which local fisheries no longer enjoy any monopoly in local or national markets, but are increasingly engaged in intensive competition with sources of supply across the world.

These tendencies have progressively marginalized the fishermen and their organizations as economic and social actors. Symes further observes that from the above tendencies, four specific inter related crises can be identified in the marine fisheries sector:

i) Production crises that arise out of over fishing and constraints imposed on the efficiency and freedom of action enjoyed traditionally by fishermen through regulations like total allowable catch quotas, closed seasons, etc.

ii) Crisis of property rights, wherein the individual quota system, licensing system etc. are perceived by traditional fishermen as efforts at privatization, threatening established perceptions of marine resources as common use rights and open access.

iii) Crisis of the markets; resulting from globalisation of the food systems, the transfer of power in the market place from the production to the secondary processors, and multiple retailers who control high proportion of sales of fish in the importing countries.

iv) Crisis of institutions or crisis of management, arising out of replacing traditional forms of social organization for the fisheries management by centralized bureaucratic policy making, often excluding the fishermen organizations from an active influential role, thereby failing to carry conviction and win support among the resource users.

The above observations of Symes are mostly based on the experience of developed fishing nations, but they are also applicable to the developing countries like India with marginal changes depending on the experience of specific locations.

The traditional inshore fishers of India have been domestic commodity producers. Sinclair (1985) defines domestic commodity production as a form of production which draws on the household for its labour supply and organizational structure and it depends on articulation with commodity markets to realize the value of what is produced and to acquire both personal consumption goods and the means of production. They generally sell their produce to a merchant, processing company, cooperative or marketing board. Prior to the introduction of planning process in the country, they were left to themselves for survival or growth. With the introduction of five-year plans a series of intervention measures were adopted by the State both at the Central and provincial levels. These measures have indeed helped in modernizing this sector to a considerable extent, but the state intervention has been rather moderate and in some cases negligible in a more important issue like fishery resource management.

Modernization in navigation and in the use of other fishing aides has helped the fishermen in forecasting Potential Fishing Zone (PFZ) and reducing the searching time. The efforts of National Remote Survey Agency (NRSA), Hyderabad was successful in generating information for PFZ based on temperature, photoplanktons, etc. Positive relationship has been established between PFZ and fishable concentrations of commercially important fishes in respect of pelagic and columnar species, if not for demersal species (Pillai, 1998).

With the depletion of resources and increase in fishing, the costs of fish production is making the fishing industry unviable. The introduction of latest electronic gadgets for navigation,

high cost of boat building materials, onboard pre-processing facilities etc. make it more capital intensive and less viable. In this context, cost reduction is the strategy required to be adopted by the fishermen, particularly in the ever rising price of fuel, despite the subsidies provided by the Government. Energy optimization is one of the critical cost saving strategy. Energy optimization does not necessarily mean use of least amount of energy in every situation, rather it means using energy which leads to the greatest overall benefit of the individual enterprise, national economy and global environment, especially relevant at times of scarcity and high prices of petro-products (Hameed, et al. 1991). Building new generation vessels, and optimization of fishing gear are techniques for reducing fuel consumption, but the former is expensive while the latter is a proven method. Along with that, an efficient fleet management system should be developed and all vessels from a point or fish landing center should be brought under its control. There is scope for energy conservation, and adopting alternative source or energy for low energy fishing, provided the fishermen are made aware of the seriousness of the energy wastage and energy crisis. However, this is an area where the state intervention has not made any significant contribution On the contrary the availability of subsidized fuels – diesel and kerosene – have been one reason for the enhanced fishing effort in the coastal waters and consequential rapid depletion of resources in this zone, which is the livelihood for thousands of artisanal fishermen in the country.

To ensure enduring benefits to the vast majority of marine fishermen, there is a need for the provision of an intermediary technology, institutional support and marketing network besides management of resources. It calls for the policies to bring about socio-economic development of the fishing community at par with the rest of the society (Subba Rao, 1988).

Stagnation of Catch in the Inshore Areas:

The estimated MSY of marine fish in Indian EEZ is 3.9 million tonnes per annum. The marine sector production in recent years has been varying from 2.7 to 2.9 million tonnes, which is more than 70% of the MSY. But the fishing effort has been mostly concentrated in the inshore areas, the resources of which have been exploited to its sustainable level or even beyond. The annual growth rate of inland fisheries had reached an average of 5.3% as against the 3.4% of the marine sector during the period 1951-99. Consequently the share of marine fish to the total fish production has declined from 71% in 1950-51 to about 51% in 1998-99. The fish production and average annual growth rate in selected years during the period 1950 to 2000 is given in Table 3.10. Whereas, the State/UT-wise marine fish catch is given in Table 3.10.

TABLE 3.10: FISH PRODUCTION AND AVERAGE ANNUAL GROWTH RATE, INDIA – 1950-99.

Year	Fish Production ('000 tonnes)			Average Annual Growth Rate (%)		
	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	1160	9.53	3.05	7.65
1965-66	824	507	1331	-1.27	16.21	2.95
1970-71	1086	670	1756	6.36	6.43	6.39
1973-74	1210	748	1958	3.81	3.88	3.83
1978-79	1490	816	2306	4.25	1.76	3.33
1979-80	1492	848	2340	0.13	3.92	1.47
1980-81	1555	887	2442	4.32	3.24	3.91
1981-82	1445	999	2444	-7.07	12.63	0.08
1982-83	1427	940	2367	-1.25	-5.91	-3.15
1983-84	1519	987	2506	6.45	5.00	5.87
1984-85	1698	1103	2801	11.78	11.75	11.77
1985-86	1716	1160	2876	1.06	5.17	2.68
1986-87	1713	1229	2942	-0.17	5.95	2.29
1987-88	1658	1301	2959	-3.21	5.86	0.58
1988-89	1817	1335	3152	9.59	2.61	6.52
1989-90	2275	1402	3677	25.21	5.02	16.66
1990-91	2300	1536	3836	1.10	9.56	4.32
1991-92	2447	1710	4157	6.39	11.33	8.37
1992-93	2576	1789	4365	5.27	4.62	5.00
1993-94	2649	1995	4644	2.83	11.51	6.39
1994-95	2692	2097	4789	1.62	5.11	3.12
1995-96	2707	2242	4949	0.56	6.91	3.34
1996-97	2967	2381	5348	9.60	6.20	8.06
1997-98	2950	2438	5388	-0.57	2.39	0.75
1998-99	2696	2566	5262	-9.40	5.25	-2.34
1999-00*	2834	2823	5657	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 3.11: MARINE FISH PRODUCTION BY STATES / UNION TERRITORIES 1990-2000 (in '000 tonnes)

	State/Union Territory	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00
1	Andhra Pradesh	120.35	125.79	113.07	154.32	150.26	151.99	152.05	146.55	150.00	166.48
2	Goa	53.18	47.11	101.49	102.11	98.46	84.21	93.76	88.81	65.84	62.11
3	Gujarat	500.00	516.85	589.00	619.84	645.26	600.00	660.07	745.71	550.00	670.95
4	Karnataka	183.83	181.41	174.19	174.52	173.75	217.52	222.78	189.86	160.61	165.65
5	Kerala	514.24	524.76	496.24	559.20	548.37	532.55	578.92	526.34	583.34	575.50
6	Maharashtra	325.00	390.86	387.55	350.40	357.00	387.00	481.00	453.00	394.88	397.90
7	Orissa	78.00	87.88	119.38	103.93	122.89	123.20	133.46	156.08	124.33	125.94
8	Tamil Nadu	288.95	301.00	008.00	317.72	330.50	340.00	350.79	355.10	359.55	363.00
9	West Bengal	125.00	142.00	145.00	153.00	151.20	153.00	172.00	164.00	171.50	180.00
10	A&N Islands	15.15	25.19	24.17	25.08	26.12	25.68	26.40	27.23	27.40	28.15
11	Daman & Diu	7.73	15.94	13.43	11.53	11.50	15.28	15.28	18.81	26.85	15.95
12	Lakshadweep	7.60	5.81	9.73	9.41	9.75	9.82	11.75	10.55	13.54	13.60
13	Pondicherry	30.62	32.68	35.00	37.78	36.75	36.82	38.55	38.42	38.60	38.62
Deep Sea Fishing Sector		50.00	50.00	60.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
INDIA		2299.65	2447.28	2576.25	2648.84	2691.81	2707.06	2966.81	2950.46	2696.46	2833.85

Source: State Governments/Union Territory Administrations

As stated elsewhere, the State has been the harbinger of development in the fisheries sector in India. The manifestation of the State intervention was through various policy initiatives and implementation of development schemes through the Five Year and Annual Plans. The progress achieved during consecutive plan periods is given in Table 3.12.

TABLE 3.12: 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	1160	47.65	15.23	38.26	7.65
3rd Plan (1961-66)	824	507	1331	-6.36	81.07	14.74	2.95
Annual Plans (1966-69)	904	622	1526	9.71	22.68	14.65	4.88
4th Plan (1969-74)	1210	748	1958	33.85	20.26	28.31	5.66
5th Plan (1974-79)	1490	816	2306	23.14	9.09	17.77	3.55
AnnualPlan(1979-80)	1492	848	2340	0.13	3.92	1.47	1.47
6th Plan (1980-85)	1698	1103	2801	13.81	30.07	19.70	3.94
7th Plan (1985-90)	2275	1402	3677	33.98	27.11	31.27	6.25
AnnualPlan(1990-91)	2300	1536	3836	1.10	9.56	4.32	4.32
AnnualPlan(1991-92)	2447	1710	4157	6.39	11.33	8.37	8.37
8th Plan (1992-97)	2967	2381	5348	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.

An analysis of the catch would indicate that the production was mostly from the inshore shelf area along the East and West coasts, while the areas around the islands and the offshore remain under exploited. The regionwise potential and the yield during 1995 are given in Table 3.13.

TABLE 3.13: POTENTIAL YIELD AND THE CURRENT YIELD IN 1995
(in '000 tonnes)

Region	Potential Yield	Current Yield	%
West Coast	2357	1875	79.4
East Coast	1090	795	72.9
A&N	161	27	16.8
Lakshadweep	246	Negligible	--
	3917	2707	69.1

Source: Somavanshi, V.S (1998)

The above Table also indicates that the overall exploitation in some of the species has been less than the potential yield. While there is scope for further exploitation, there are several species, which are at very high levels of exploitation or dangerously overexploited. The present status of exploitation of different species – stocks along Indian coasts in the 0-50 m depth zone is given in Table 3.14.

TABLE . 3.14: PRESENT STATUS OF EXPLOITATION OF DIFFERENT SPECIES-STOCKS ALONG INDIAN COAST IN THE 0-50 M DEPTH ZONE

Sl. No.	Species	State of Exploitation		
		Full	Over	Under
1	Sardinella longiceps	All along	-	-
2	S.Gibbosa	SE coast	-	West Coast
3	Hisla ilisha	NE coast	-	-
4	Encrassicolina devisi	-	-	All along
5	Stolephorus waitei	-	-	-
6	Rastrelliger kanagurta	All along	-	-
7	Scomberomorus	-	SE&SW coast	-
8	Euthynnus affinis	All along	-	-
9	Thunnus tonggol	All along	-	-
10	A.rochei	-	-	All along
11	Kaatsuwonus pelamis	-	-	All along
12	Kaaatsuwonus pelamis	-	-	All along
13	Megalaspis cordyla	-	-	SW coast
14	Decapterus russeli	-	-	All along
15	Selaroides lepiolepis	SE coast	-	-

16	Atropus atropus	NW coast	-	-
17	Alepes kalla	SW coast	-	-
18	Atule mate	-	-	SW coast
19	Caranx carangus	SE coast	-	-
20	Parastromateus argentus	-	West coast	-
21	Formio niger	-	SW coast	-
22	Trichiurus lepturus	-	East coast	West coast
23	Harpodon nehereus	NW coast	-	-
24	Nemipterus japonicus	All along	-	-
25	Nemipeterus mesoprion	All along	-	-
26	Leiognathus bindus	East coast	-	-
27	L.dussumieri	Tamil Nadu	-	-
28	L.jonesi	Tamil Nadu	-	-
29	Secutor insidiator	East Coast	-	-
30	Tachysurus tenuispinis	-	West coast	-
31	T.thalassinus	-	W&NE coast	-
32	Otolithus cuvieri	NW coast	-	-
33	Johnius macrorhynus	NW coast	-	-
34	J.vogleri	NW coast	-	-
35	J.sina	SW coast	-	-
36	J.carutta	SE coast	-	-
37	Penaeus monodon	East coast	-	-
38	P.indicus	-	East coast	-
39	P.semisulcatus	-	SE coast	-
40	Metapenaeus monoceros	All along	-	-
41	M.dobsoni	All along	-	-
42	Acetes indicus	NW coast	-	-
43	Panilurus polyphagus	-	NW coast	-
44	Loligo duvauceli	All along	-	-
45	Sepia aculeate	East coast	-	West coast
46	S.pharaonis	East coast	-	West coast

Source: - Report of the Working Group for revalidating the potential of fishery resources in the Indian EEZ

The development programmes have given a fillip to the motorisation and mechanisation of crafts and gear. The mechanised crafts were concentrating more on exploitable species. The increasing demand for these varieties especially of crustaceans, have led to their rapid exploitation by mechanised and motorised crafts. At the same time the number of such crafts has been going up unabated. The catch by mechanised and motorised boats were also going up while that of non-

mechanised traditional crafts has been registering a decline over the years. The category wise contribution of fish landings is given in Table.3.15.

TABLE. 3.15: CATEGORYWISE CONTRIBUTION OF FISH LANDINGS
(in '000 tonnes)

Year	Mechanised	Motorised	Non-mechanised	Total
1991	1337430	401197	418635	2157262
1992	1533348	384141	359751	2277240
1993	1528437	332774	314956	2176167
1994	1658803	351841	314497	2325146
1995	1544343	406024	274657	2225024
1996	1665183	445064	270598	2380845

Source: Sathiadhas (1998)

The landings from mechanised crafts has gone up considerably whereas that of motorised vessels remained about the same. At the same time the share of non-mechanised boats has come down substantially over a period of six years. The enhanced number of fishing boats adding to the fishing effort has in turn resulted in the decline of catch per unit effort (Sathidhas'98). This reduction was particularly noticeable in the case of mechanised boats as is evident from the Table 3.16. However, the multispecies nature of the marine fishery of Indian waters provide the resilience to save it from a total collapse, unlike in the case of single species temperate water fisheries. The high value fish may decline giving way to low value fish. In terms of volume, harvest may not decline in spite of surplus fishing effort. In economic value terms harvest may or may not decline depending on market demand.

TABLE. 3.16: AVERAGE CATCH PER TRIP OF DIFFERENT TYPE OF FISHING BOATS (in Kgs)

Year	Mechanised	Motorised	Non-mechanised
1991	461	190	57
1992	363	180	52
1993	364	139	48
1994	308	126	54
1995	307	189	51

Source: Sathiadhas,R (1998)

The deep sea resources of Indian EEZ and the ocean beyond it are not being harnessed despite the availability of some of the exportable varieties of fishes like tuna, cephalopods, deep sea lobster etc. Their contribution to the total fish production of the country is less than 1%.

DEEP- SEA FISHING:

The declaration of the EEZ in 1976 has opened new opportunities for exploration, development and exploitation of marine living resources around India, extending to 200 n.m from the shore. So far the fishing effort has been mostly confined to the inshore areas covering about 5% of the EEZ. With the mounting pressure in this area further intensification of fishing is likely to become less profitable. Recent trends in production have revealed that further expansion of fishing activities in the inshore waters is limited. The deep sea, i.e., beyond 50 m. depth, is generally considered to be a rich area for exploitation. But the viability of its commercial exploitation has not yet been established beyond doubt.

The deep- sea fishing resources is estimated to be around 1.64 million tonnes (Handbook on Fishery Statistics 2000). They include some of the commercially important species like tuna,

tuna like fishes, cephalopods, deep sea crustaceans, fin fishes like priacanthus, perches, nemipterus, etc. for which there is increasing export demand.

The importance of developing deep-sea fishing was recognized as early as in 1970s. Since then several policy initiatives were taken by the Government to promote deep-sea fishing. Lack of knowledge about the resources, absence of deep sea fishing vessels, severe shortage of trained manpower and training facilities, non-availability of adequate finance and above all infrastructure facilities for landing, and berthing, processing and marketing facilities were constraints to rapid development in this field. To meet with these challenges, as a first step, the Government of India had decided to import 30 deep-sea fishing vessels from Mexico in 1976. Out of them 18 vessels were procured for public sector undertakings, private entrepreneurs and cooperative sector fishing enterprises. They were basically meant for catching shrimp. The experience in the use of these vessels, however, did not give any impetus for large-scale investment in the deep-sea fishing activities.

The Indian fishing industry was not geared up and equipped in terms of technology, manpower and finance to embark on deep-sea fishing ventures on their own. Since it was found that indigenous capabilities were insufficient to achieve the objectives in the short run, the Central Government announced a Charter Policy, viz. Deep- Sea Fishing Policy – 1981, for acquiring foreign fishing vessels. Under this policy, permits were issued for 155 vessels in favour of 28 Indian companies. A *pari passu* obligation was attached to the chartering of vessels that the charterers should acquire an equal number of vessels on their own account, within a period of two years.

The deep -sea fishing operation being highly capital intensive and risk prone, the financing institutions were rather shy to finance such ventures. With a view to fill this void, the Government on its own had introduced a scheme for deep sea fishing vessels, through the erstwhile Shipping Development Finance Committee (SDFC). Under this scheme the SDFC had approved credit for 193 trawlers to 98 companies during the period 1976 to 1986. The SDFC was wound up in 1986 and the responsibility of financing such ventures, thereafter, was entrusted with the Shipping Credit and Investment Company of India.

Several deficiencies, causing operational impediments were pointed out in this policy. Therefore a new Charter Policy was announced in 1986, which envisaged acquisition by way of import, indigenous construction or through joint ventures. The *pari passu* condition was withdrawn. Under the new policy, 97 Indian enterprises were permitted to operate 311 foreign fishing vessels. These vessels were operating on a 100% EOU basis. In 1990, their total production was reported as 20,000 tonnes, the highest from the deep sea fishing operations conducted under various schemes by Indian enterprises.

A revised policy, viz. New Deep-Sea Fishing Policy 1991, was pronounced, which allowed joint ventures, test fishing and leasing for deep sea fishing. The vessels acquired under the earlier policies also continued to operate. These policies enabled the Indian fisheries sector to quickly expand their operations into the hitherto unexploited areas of the EEZ and beyond by the vessels of Indian entrepreneurs. Under various schemes, permits were granted to acquired 750 vessels – 312 under the Charter Policy, 129 under Charter obligation and 309 under the export oriented units scheme.

By 1994 the whole scenario started changing. The Indian companies preferred to forego the security deposit as penalty, than to acquire new deep sea vessels as it was found to be more beneficial to them. The Indian chartered vessels were allegedly operating in the inshore waters, encroaching the domain of traditional fishermen and smaller trawlers. There were frequent conflicts between the traditional fishermen, and the charter vessels, joint venture vessels etc. Several complaints of damages to Indian crafts and gears, over- exploitation, under-reporting etc. were also raised. The issue was hotly debated in public fora and in Parliament, along with nation-wide strikes observed by native fishermen. Consequently the Government appointed a "Committee to Review the Deep Sea Fishing Policy". The Committee submitted its report in 1996. All the 21 major recommendations of the Committee were accepted by the Government with some amendments. Accordingly, the existing deep sea fishing policy enunciated by the Government was rescind. It was also decided to evolve a comprehensive Marine Fishing Policy. Pending new policy, the vessels under the charter schemes were phased out by 1996 and the leasing arrangements were concluded by October 2000. No test fishing vessel is in operation. Only about 19 joint venture vessels were in operation in 2001, which were also to be discontinued at the end of the agreement. Of these 15 are tuna long lines working in oceanic waters. Notwithstanding the public opposition to deep-sea fishing policies of the Government, the results of the operations by the vessels acquired under various policy options have indicated commercial viability of deep sea fishing in the Indian EEZ beyond the overexploited inshore waters (Anon., 2000).

In November 2002, the Government of India issued new guidelines, binding on all deep sea fishing vessels operating in the Indian EEZ. Under the new guidelines, permission will be granted only for the following fishing methods.

1. Long lining for tuna
2. Tuna purse seining

4. Squid jigging and squid hand lining

5. Midwater/Pelagic trawling

6. Trap fishing

The areas of operation for deep sea fishing vessels have also been prescribed in the said guidelines. However, the announcement of this policy has also invited fresh opposition to the deep sea fishing policy from the native fishermen.

These guidelines however, would not be enough to gear up the deep-sea fishery development in the desired direction. An integrated approach for technology upgradation, manpower development, infrastructural development, processing facility for diversified production, market development and a well knit marketing network is required to be put in place, if the deep sea resources have to be harnessed at the desired level. As of now, there is a need for new policy initiatives on the part of the Government on an integrated development of deep sea resources especially the oceanic tuna and squid resources and to build up capacities of the native fishermen and gain their confidence to adopt deep sea fishing as a viable option.

In spite of two decades of deep-sea fishing experience, the country does not have the requisite indigenous capabilities even now. India should not hesitate to take external expertise and joint venture programmes for exploiting the EEZ resources in full, by adopting appropriate safeguard measures. Along with that necessary capacity building measures for development of technical and managerial skills must be initiated without any more delay. If we fail to harness the harvestable resource in full, the Article 62 of the UNCLOS on Utilisation of Living Resources, would be attracted, under which if a country does not have the capacity to harvest the allowable catch, it should permit other countries and their nationals to do so from the EEZ of the defaulting countries.

A review of the deep sea fishing policy of the Central Govt. reveals that it was one of ad hocism without clear understanding of the ground realities, often allowing non-fishermen entrepreneurs, whose aim was to make quick profits and exit the scene without any long-term commitment to the sector. This has left the deep sea fishing sector in the lurch, without definite direction for future development and management. Therefore, it is necessary to formulate a comprehensive Deep Sea Fishing Policy without any delay to harness about 1.8 million sq.kms. of India's EEZ beyond 40 fathoms.

MARINE FISH UTILISATION

Fish production, both marine and inland in India, over the years has gone up. It has almost reached a plateau in the marine sector and scope for its further expansion is limited. The annual growth has been less than 1% in the marine sector while it has been about 7% in the inland fisheries. Even offshore and deep sea fishing efforts may not help any quantum jump in production because of the limitations on the quality of resources and capabilities to harness them in a viable manner. So far the contribution of deep-sea fishing in India was less than 1% of the total catch. . Therefore, for the marine sector, the focus has to be on utilizing the harvested fish, to make the best use of it through better value addition and distribution.

Two thirds of the total food fish supply in the world is obtained from marine and inland capture fisheries. According to FAO estimates the world per capita consumption of fish remained unchanged between 13.5 to 14 kg. since 1993-95. Consumption is likely to continue at this level for some more time, at higher real prices in the traditional developed countries. It may go up in the South East Asian, Near East and North African Countries by 2010. It may decline in Sub Saharan Africa and South Asia (FAO 1996). In the Sub Saharan African countries, fish catch has been

declining and fish imports are not likely to go up as their economic outlook remains rather bleak. The production and consumption pattern of North America are not likely to change much in the medium term, although the per capita consumption may go up marginally. The consumption is likely to be at the current level in Western European countries. Its growth in consumption may be low because of low population growth and modest increase in incomes. In the East European countries, consumption may not increase owing to higher prices and lower imports. In the Near East and North Africa the growth may be marginal. Same is the case with Latin American countries. In South East Asia it may grow while in South Asia it may remain low if not decline, as import is not likely to increase and expansion through aquaculture is difficult. In some countries of South East Asia the consumption may go up. Consumption in Japan may grow at a slower pace. China would be a major producer, especially in culture fisheries but may not be a major importer. Therefore its consumption level may stabilize.

According to FAO estimates, globally the potential harvest of capture fisheries will be 85 to 90 million tons under current fishing regimes. If management systems improve and discards are reduced, it may rise to 100-105 million tons. Based on these assumptions, FAO forecasts that under optimistic scenario there may not be any major demand supply gap in the year 2010 at constant real prices (of 1990). The utilisation pattern of fish in India as of the year 2000 is given in Table 3.17.

TABLE . 3.17 PERCENTAGE UTILISATION OF FISH IN INDIA

	India %	World %
Consumed fresh	68.5	67
Frozen	6.5	6.8
Cured	14.0	14.1
Canned	0.3	0.6
Miscellaneous purpose	1.7	1.2
Reduction	8.2	8.5
Offal reduction	0.8	1.7

(Source: MKR Nair, Fisheries Sector Development in Gujarat 2001)

In India, the share of fresh fish consumption has gone up by 3% in the last two decades. The share of frozen fish has remained almost steady. It has dropped by 8% in curing and to a very low level of 0.3% in canning. The traditional methods of curing has failed to meet with the market demands. Similarly the canning technology being used in India has been obsolete and not cost effective, making it less competitive in the market. With the increase in export of fin fishes traditional processing like curing and smoking has declined. The modern facilities set up for processing was mainly aimed at export market.

Domestic consumption of marine fish in India has been mostly confined to the coastal States as the market network in the hinterland continues to be underdeveloped. The consumption in States like Assam, Tripura, Punjab, etc. has gone up but it has been mainly on account of growth in the inland culture fisheries. The monthly per capita consumption of fish by State/UTs is given in Table 3.18.

TABLE.3.18 MONTHLY PER CAPITA CONSUMPTION OF FISH QUANTITY BY STATE / UNION TERRITORIES

State/Union Territory		Quantity consumed (Kg.)		No. of households per 1000 households reporting consumption	
		Rural	Urban	Rural	Urban
1	Andhra Pradesh	0.11	0.08	259	206
2	Arunachal Pradesh	0.29	0.48	151	640
3	Assam	0.43	0.54	942	859
4	Bihar	0.12	0.13	349	358
5	Goa	1.36	1.91	862	817
6	Gujarat	0.02	0.04	79	98
7	Haryana	Neg.	Neg.	1	16
8	Himachal Pradesh	Neg.	Neg.	10	9
9	Jammu & Kashmir	Neg.	0.01	7	19
10	Karnataka	0.14	0.14	135	117
11	Kerala	1.35	1.62	857	828
12	Madhya Pradesh	0.06	0.04	200	149
13	Maharashtra	0.11	0.16	167	259
14	Manipur	0.34	0.44	638	784
15	Meghalaya	0.32	0.47	689	800
16	Mizoram	0.17	0.10	341	318
17	Nagaland	0.26	0.39	501	743
18	Orissa	0.29	1.94	586	884
19	Punjab	0.29	1.94	586	884
20	Rajasthan	Neg.	0.01	7	12
21	Sikkim	0.01	0.08	47	197
22	Tamil Nadu	0.17	0.17	272	339
23	Tripura	0.89	0.89	645	945
24	Uttar Pradesh	0.04	0.02	99	55
25	West Bengal	0.54	0.72	907	804
26	Andaman & Nicobar Islands	1.40	1.05	808	691
27	Chandigarh	0.02	0.01	91	35
28	Dadra & Nagar haveli	0.39	0.28	615	514
29	Daman & Diu	1.07	4.12	520	906
30	Delhi	0.03	0.03	66	73
31	Lakshadweep	3.79	3.61	938	942
32	Pondicherry	0.69	0.71	913	714

Source: National Sample Survey 50th Round

Fish processing in the early years of development was confined to sun drying and smoking. Freezing plants came into existence in the beginning of 1950s, but the quantity frozen was very small. Though canning was also introduced, it could not grow into a major processing activity. In 1960-61, 15732 tonnes of seafood valued at Rs.3.92 Cr. was exported, 60% of which constituted dried fish. The rest was frozen or canned items. By the end of '60s with the increase in demand for frozen seafood, infrastructure for processing came up quite rapidly.

The seafood processing industry has expanded over the years providing direct and indirect employment for over 1.125 million people with a sizeable contribution to the foreign exchange earning. The processing industry has been basically catering to the export demand. Indian processing units have come of age in meeting international quality standards, and are capable of producing 60 odd items of value added seafood delicacies. But the infrastructure utilisation is below their capacities, especially so during the off-season. Despite this, the domestic market has not been served adequately with value added processed seafood processed in the country.

The Problem of By-catch and Discarded Fish:

The problem of by-catch is common particularly in a multispecies fishing, where non-target species get caught incidentally along with the target species. When many species are caught simultaneously as in trawling, it is nearly impossible to apply any fraction of the overall effort to earlier stock. The by-catch includes both landed quantity and that discarded in the sea itself. In India, the landed quantity is considered as by-catch (Rao, 1998).

According to FAO estimates (1996), about 32% (27 million tonnes) of the total reported annual production of marine capture fisheries worldwide was wasted as by-catch and discards. In

the early days of booming shrimp catch in India, the trawlers use to discard large quantities of non-target fish species, as they were of low value, and difficult to bring them to the shore, where the processing facilities and market demand for them was almost absent. There was however no authentic data about the actual quantity of bycatch brought on shore or discarded in the sea. The discards of all fleet in the North East Coast were estimated as 99,000 to 1,30,000 tonnes by Gordon (1991), which was of course considered as exaggerated by several researchers. The reason for discarding are biological (multi species stock) technological (difficulty in targeting specific species for capture) economic (low or nil value for the unintended catch) or legal (quota regulations where it is applicable). Efforts for reducing by-catch include use of selective gears, legal restrictions against discarding the by-catch back into the sea, and offering economic incentives. However, according to FAO (1996), discarding is a consequence of the very nature of fishing and it can be reduced but not completely eliminated.

The quantity discarded in India is getting reduced considerably with the development of refrigerated sea water systems for onboard storage, better infrastructure for processing, increasing demand for fin fish in the export and domestic market, better value realization, and the growing demand for fish feed from the aquaculture sector apart from its use as manure. Many species, which were secondary or rejected in the past, have now become target species. Nonetheless, the location of fishing grounds, onshore facilities, processing facilities and socio economic status of the local consumers determine the utilization pattern of by-catch. The capacity to hold in the vessel and quality of fish decide the discards now. In less developed area, by-catch is still being discarded. Processing and packaging of by-catch as value added products for the domestic market is a viable option to gainfully use them in the best possible way. The underutilized capacity of the processing units can be appropriately modified for converting the by-catch as value added

fish products. It benefits the processors, consumers and the fish producers, while generating additional employment opportunity. It is a better method of resource management especially in the context of resource depletion.

Product Development and Diversification

Product development and diversification has not seriously taken into consideration the domestic market demand. Development of value added products especially from the low value fish often discarded as by-catch, can improve the availability of fish for domestic consumption. These groups of low value fish viz. Crockers, Bombay duck and ribbon fish constitute 60% of the marine fish landing in Gujarat. Value added products in the form of ready to cook or ready to eat delicacies can find good market in the Indian urban centres. Battering, breading, coat up, pickling, marinating, retorting in pouches, moulding and extension are all different methods by which low value fish could be converted for domestic as well as export market. For this purpose, however, necessary physical infrastructure and specially trained manpower are inadequate in the country, besides developing a market for such products.

The physical infrastructure for processing has been built up over the years. They have substantial surplus capacity. It can be suitably modified to cater to the Indian taste. The growing demand for ready-to-cook products like fish fillets, fish steaks, fish kheema, dressed fish, cleaned shell fish, cephalopods etc. would find ready domestic market.

The R&D efforts of the State sponsored institutions like Central Institute of Fisheries Technology (CIFT) have developed several technologies for value added products. But the positive results of State expenditure for technological development have not been fully

commercialized in the field of processed fish products for domestic market. The technologies evolved by these institutions should be put to stringent scrutiny and the matured technologies may be promoted for commercial production. The private sector may be progressively involved in this exercise. The focus of state intervention should now fall on R&D efforts in such product development, their commercialization and market development

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Domestic Marketing

Marketing of fish, either in the domestic market or in the export market, has been a major challenge for the development and promotional agencies of Govts.

In India, as in many Asian countries, the demand for fish has risen faster than supply during the last 10 to 20 years, resulting in rising real prices, improved handling and lucrative opportunities in non-traditional markets like urban centres within the country and new export destinations overseas. (Gordon, 1998). The share of fresh fish in the domestic market has increased by 3% in line with the increase in production (Nair, 2001). This increase is mostly due to the growth in Inland fish production. But the share of fresh marine fish in domestic consumption has gone down. It was mainly due to the increase in the export of more varieties of marine fin fish, which was available earlier for domestic consumption. The operators of trawlers were interested only in exportable varieties. The low value fish was either discarded in the sea itself or used for reduction, as they were not of consumer preference. The lack of infrastructure for marketing fresh marine fish has also been responsible for reduced availability of marine fish for domestic consumption.

According to Sathiadhas, et al (1995), 50% of marine fish was found to be consumed fresh in and around the producing centres, 43% in a radius of about 200 kms. With better network of infrastructure, the distribution can be pushed beyond the existing levels to the hinterland. The utilization pattern of fish varies from State to State. The Table 3.19 gives the pattern of State-wise disposal of catch.

TABLE 3.19: DISPOSITION OF CATCH BY STATES/ UNOION TERRI-TORIES, 1998 (Provisional) in tonnes

State/Union Territory	Total	Marketing fresh	Freezing	Curling	Canning	Reduction	Offal for reduction	Misc. Purposes
1. Andhra Pradesh	410829	372829	7400	23200	--	--	7400	--
2. Arunachal Pradesh	2136	1996	--	--	--	--	--	140
3. Assam	148337	147580	--	--	--	--	--	757
4. Bihar	212320	210297	--	--	--	--	--	2023
5. Goa	67236	48410	--	--	--	--	--	18826
6. Gujarat	631728	180527	147495	99069	--	204637	--	--
7. Haryana	33250	26600	--	--	--	--	--	6650
8. Himachal Pradesh	6786	6786	--	--	--	--	--	--
9. Jammu & Kashmir	18851	18851	--	--	--	--	--	--
10. Karnataka	277985	208244	9722	30328	3090	7	--	26594
11. Kerala	606132	339436	127288	60613	6060	42429	12122	18184
12. Madhya Pradesh	114237	114237	--	--	--	--	--	--
13. Maharashtra	562827	388555	--	141520	--	32752	--	--
14. Manipur	15309	11650	--	3659	--	--	--	--
15. Meghalaya	4459	4205	232	--	--	--	--	22
16. Mizoram	2700	2700	--	--	--	--	--	--
17. Nagaland	4500	4500	--	--	--	--	--	--
18. Orissa	30093	244141	13908	42044	--	--	--	--
19. Punjab	44500	44500	--	--	--	--	--	--
20. Rajasthan	12003	12003	--	--	--	--	--	--
21. Sikkim	140	140	--	--	--	--	--	--
22. Tamil Nadu	415276	282388	30315	96345	--	--	--	6228
23. Tripura	28096	26691	--	453	--	--	--	952
24. Uttar Pradesh	183030	--	--	-	--	--	--	--
25. West Bengal	995000	890900	29200	51000	--	23900	--	--
26. Andaman & Nicobar Island	29026	18028	7861	3137	--	--	--	--
27. Chandigarh	90	90	--	--	--	--	--	--
28. Dadra & Nagar Haveli	40	40	--	--	--	--	--	--
29. Daman& Diu	25163	23936	17265	2143	2675	--	--	148
30. Delhi	4200	4200	--	--	--	--	--	--
31. Lakshadweep	14626	5349	-	6299	198	--	--	2780
32. Pondicherry	43479	34782	50	8647	--	--	--	--
Deep Sea Sector *	30000	30000	--	--				
INDIA	5244384	3866617	390736	568457	12023	303725	19522	83304

* Details not available

Domestic marketing including transportation, storage and processing is mostly in the hands of private sector. The improvement over the years, in transportation and communication, infrastructure like processing and storage has brought about changes in fish marketing to some extent. But traditional channels of domestic marketing still dominate the scene.

The domestic market channels for marine fish are generally dominated by six intermediaries viz. auctioneers, commission agents (for purchase), wholesalers, commission agents (for sales), retailers and vendors. Some of these intermediaries are engaged in more than one activity like wholesale and retail sales. The fresh fish marketing has several patterns of sales channels, passing through as may as 5 to 8 hands before it reaches the end consumer, depending on tradition and marketing network. For example, door-to-door fish vending is common in Kerala whereas it is rare in Gujarat.

Auctioning of fish at the landing site is not practiced as a general rule all over the country. It is not popular in Gujarat, where a system of negotiation and long-term agreement is commonly practiced. Such agreements are between fishermen, commission agents, and wholesalers. The basis for negotiation and long-term agreement is a credit linked marketing arrangement. The price and terms of trade are decided as a part of this long-term agreement. This system has an advantage as it offers a ready credit facility where usual institutional finance is hard to come by. Besides it provides an assured buyer, although it may fetch only a lower price. Nonetheless it has also certain disadvantages in the sense that there is an unmistakable bonding of boats and fishermen with the marketing intermediaries, which in turn leads to the exploitation of the former. At some landing sites, almost 60% of the total trade was being handled by about 10% of such long term trading arrangements resulting in non-competition under an oligopolistic system (Srivastava et

al, 1991). However, over the years some of the nationalised banks and cooperative institutions like NCDC have come forward to provide credit for procurement of assets – crafts & gears – and working capital. This has eased the situation to some extent.

The marketing channels for dry edible fish also follow almost a similar path, as that of fresh fish. Drying surplus fish, which cannot be sold as fresh fish, is a common practice traditionally being followed by the fishermen. It is either sun dried or salt cured. It has a good domestic market demand in the hinterland especially in the North Eastern Region of the country. Dry fish from Gujarat goes regularly even to Kerala. The dry fish sector is facing severe problems of poor quality, lack of innovation to improve quality and lack of adequate transportation facilities. Enhanced export demand for fish traditionally being used for drying, higher demand for fish meal, increased preference for fresh fish, and above all declining availability of fish in the East Coast etc. have also resulted in the decline of dry fish trade. The shortage of fish in the Eastern Coast and a higher production in the North West Coast is an opportunity for Gujarat in the dry fish trade, which has traditionally been a major supplier of dry fish to North-East market. However, the entry restrictions to the North East by militant groups, the risk involved in doing business over there and the difficulties being experienced in recovering the sales proceeds as reported by some traders, are disincentives for promoting dry fish trade in that area. The enhanced availability of inland fish in the North East is also a factor affecting dried marine fish which was once a popular and affordable alternate source of animal proteins to the people of these hill States. The decline in the relative importance of traditional processed fish, result in reduced supply and higher prices for the remote communities, which used to depend on them (Gordon, 1998).

The infrastructure facilities for the domestic market consisting of wholesale and retail markets all over the country are far from satisfactory. Basic amenities like water, selling platforms, storage, ice plants, loading/unloading facilities, parking for trucks, etc. are not adequate in most of the wholesale markets. The retail markets in many places are at unorganized locations like pavements and street corners often in extremely unhygienic surroundings. Modernisation of domestic fish marketing is the need of the hour. Development of a well organized marketing network with cold chain comprising of cold storages, refrigerated trucks, ice plants and retail shops is necessary to take fresh fish to the hitherto unexploited markets in the hinterland, which have very good potential for such products. This would ensure a better price for the producers and easy availability of products to the consumers.

Development of markets and marketing network has been a neglected area over the years, as is evident from the fact that from the Sixth Five Year Plan onwards, the Central Plan did not specifically earmark any budgetary allocation for this purpose. While attention was being given to development of infrastructure like port facilities and landing facilities, an equally important infrastructure facility for marketing did not receive due attention. It is an area where the State intervention has been grossly inadequate. This lacuna deserves to be rectified sooner than later. If past experience is any indication, leaving this responsibility to the individual State Governments, would not produce the desired results. A countrywide marketing infrastructure has to be built up, with private sector participation for which even international development assistance may be obtained. Necessary policy support and incentives support may be offered for private sector participation in this venture, for which the Central Govt. should take initiative without any delay.

Apart from physical infrastructure, it is equally important to strengthen the institutional infrastructure. The Public Sector Undertakings including the Cooperatives in the fishery sector entrusted with marketing arrangements in the past have not been successful either in building up the infrastructure or marketing network through direct sales or through their franchisees. Their dismal performance year after year over the decades drive home the point that they should withdraw from whatever little direct marketing and sales operation activities they were engaged in, over the years. Instead they should change their role to that of facilitators for business promotion, especially in market development leaving the marketing and sales operations to the private sector. The State should redefine the role of Public Sector Undertakings and promotional organisations in line with the current thinking of disinvestments. There are no central PSUs dealing with fisheries, but some of the State Governments have several of them sometimes duplicating the work for no reason. A review of their performance and role is warranted for possible restructuring.

State intervention through extension machinery for modernization, better handling and storage facilities has helped in improving the quality of fish and enhanced shelf life. The onboard use of ice, deep freezers and pre-market processing has reduced the perishability. It has enabled fetching a better price for the catch.

Better transportation and storage facilities have also facilitated transformation of fish marketing from a buyers market to a sellers market. The earlier compulsion to dispose of fish at any price before it gets perished is no more there. Thanks to the incentives provided by the State for modernization and setting up infrastructure especially ice factories and processing units.

Price Spread

The difference between the price paid by the consumer and the price received by the fishermen indicates the price spread. It is an index that denotes the marketing efficiency and the fairness meted out to the producer and the consumer. The efficiency and fairness is depicted by the quantum of price spread that is equivalent to the marketing costs including the cost of transport, storage, display, handling, package, the opportunity cost of marketing functionaries and the transaction costs.

The price of fresh fish has been increasing in the domestic market. While the consumer prices have increased the share of fishermen has decreased with the addition of number of marketing channels. According to a study (Sathiadhas, et al 2000), fishermen's share in consumer's rupee ranges from 30% to 68%. The marketing costs including transportation ranges from 6% to 15% of the consumers' rupee. The wholesalers receive 5% to 32% and the retailers from 14% to 47% of the consumers rupee. The middlemen in the marketing channel often get the benefit, to the disadvantage of the fishermen and the consumers.

The domestic fish marketing continues to follow the age-old system, without any modernization in the marketing process. Several agricultural commodities have regulated markets. This enables the producer to get remunerative prices and the consumer value for money. With the widening demand and supply gap, the fish trade is increasingly becoming a sellers market without the much needed transparency in pricing. This is yet another area for policy initiatives and legislation on the part of the State, for institutional reforms. Such policy initiatives will, essentially have to take into consideration the participation of the stakeholders at the formulation stage itself.

Exports

More than 1 billion people rely on fish as an important source of animal protein. About 30% of their animal protein need is met by fish and fish products. (FAO 2002). The total world trade of fish and its products in 2000, has reached an export value of US $ 55.2 billion and import value of US $ 56 billion. It has been growing at an annual rate of about 8% since 1998. In 2000 Thailand continued to be the largest exporter of fish with US $ 4.4 billion followed by China with US $ 3.7 billion pushing Norway to a lower position.

For many developing countries, fish export has been a major source of foreign exchange. According to FAO, the net export earnings from fish has been more than from other agricultural commodities like rice, coffee, tea, etc. The net receipts of foreign exchange by developing countries from fish exports has seen a 2.5 fold increase between 1980 and 2000. It has increased from US $ 3.7 billion in 1980 to US $ 18 billion in 2000 (FAO, 2002).

International trade in fish has been mostly from the developing countries to the developed countries. Trade among developing countries is still not very substantial, although there is an increasing trend of late in this regard. A noticeable change in the export from the developing countries has been the progressive share of value added products unlike in the past when they were exporting mostly raw materials for further value addition.

The major importers are Japan, the European Countries and the USA. They import about 76% of the total import value (FAO, 2002). Import by developing countries was very low. They mainly imported frozen small pelagics, cured, dried and smoked fish. Now they have also started importing raw materials like fresh tuna and other fin fishes for value addition and re-export.

India is a net exporter of fish. The growth in the export of Indian marine products over the years has been remarkable. The first shipment of frozen shrimps was made in 1953 to USA from Cochin, Kerala. The Indian seafood export was dominated by dried fish until 1960. The exports in the early years were mainly to the neighbouring countries like Sri Lanka, Myanmar, Singapore, etc. The devaluation of Indian currency in 1966 brought about a breakthrough to the commodity exports in the country. The period 1970 to 1985 saw the growth of frozen and canned fishery products. But its growth was moderate, on account of production constraints. After the mid '80s the sector has been making impressive strides both in volume and value. There was an average growth of 50% per annum during the years 1990 to 1995. Economic growth and policies of open trade has promoted expansion of global fish trade. The opening up of Chinese market for Indian seafood in this period was a significant development, which contributed to export of substantial quantity of the comparatively low value fish. The growth of Indian marine product exports has grown from Rs.4.00 Cr. in 1961-62 to Rs. 6444 Cr. In 2000-2001. The details are given in the Table 3.20.

TABLE 3.20: EXPORT GROWTH OF INDIAN MARINE PRODUCTS(1961-62 to 2000-01)

Year	Quan--tity in Tonnes	Value in Rs.Cr.	Average Unit value Realisa-tion (Rs./Kg)	Average Ex. Rate US $	Value in US $ Million	Average Unit value Realisa-tion US $/Kg.	Growth rate %		Value $ %
							Quantity	Value	
1	2	3	4	5	6	7	8	9	10
1950-51	19700	2.46	NA	NA	NA	NA	NA	NA	NA
1961-62	15732	3.92	2.49	NA	NA	NA	-21.30	-15.52	NA
62-63	11161	4.20	3.76	NA	NA	NA	-15.52	NA	NA
1963-64	19057	6.09	3.20	NA	NA	NA	70.75	45.00	NA
1964-65	21122	7.14	3.38	NA	NA	NA	10.84	17.24	NA
1965-66	15295	7.06	4.62	NA	NA	NA	-27.59	-1.12	NA
1966-67	21116	17.37	8.23	NA	NA	NA	38.06	146.03	NA
1967-68	21907	19.72	9.00	NA	NA	NA	3.75	13.53	NA
1968-69	26811	24.70	9.21	NA	NA	NA	22.39	25.25	NA
1969-70	31695	33.46	10.56	NA	NA	NA	18.22	35.47	NA
1970-71	35883	35.07	9.77	7.5578	46.40	1.29	13.21	4.81	NA
1971-72	35523	44.55	12.54	7.4731	59.61	1.68	-1.00	27.03	28.47
1972-73	38903	59.72	15.35	7.6750	77.81	2.00	9.51	34.05	30.53
1973-74	52279	89.51	17.12	7.7925	114.87	2.20	34.38	49.88	47.62
1974-75	45099	68.41	15.17	7.9408	86.15	1.91	-13.73	-23.57	-25.00
1975-76	54463	124.53	22.87	8.6825	143.43	2.63	20.76	82.03	66.48
1976-77	66750	189.12	28.33	8.9775	210.66	3.16	22.56	51.87	46.88
1977-78	56967	180.12	31.62	8.5858	209.79	3.68	-14.66	-4.76	-0.41
1978-79	86894	234.62	27.00	8.2267	285.19	3.28	52.53	30.26	35.94
1979-80	86401	248.82	28.80	8.0975	307.28	3.56	-0.57	6.05	7.74
1980-81	75591	234.84	31.07	7.9092	296.92	3.93	-12.51	-5.62	-3.37
1981-82	70105	286.01	40.80	8.9683	318.91	4.55	-7.26	21.79	7.41
1982-83	78175	361.36	46.22	9.6660	373.85	4.78	11.51	26.35	17.23
1983-84	92187	373.02	40.46	10.3400	360.75	3.91	17.92	3.23	-3.50
1984-85	86187	384.29	44.59	11.8886	323.24	3.75	-6.51	3.02	-10.40
1985-86	83651	398.00	47.58	12.2349	325.30	3.89	-2.94	3.57	0.64
1986-87	85843	460.67	53.66	12.7782	360.51	4.20	2.62	15.75	10.82
1987-88	97179	531.20	54.66	12.9658	409.69	4.22	13.21	15.31	13.64
1988-89	99777	597.85	59.92	14.4817	412.83	4.14	2.67	12.55	0.77
1989-90	110843	634.99	57.29	16.6492	381.39	3.44	11.09	6.21	-7.62
1990-91	139419	893.37	64.08	17.9428	497.90	3.57	25.78	40.69	30.55
1991-92	171820	1375.99	80.08	24.4737	562.19	3.27	23.24	54.01	12.91
1992-93	209025	1768.56	84.61	28.9628	610.63	2.92	21.65	28.54	8.62
1993-94	243960	2503.62	102.62	31.3655	798.21	3.27	16.71	41.56	30.72
1994-95	307337	3575.27	116.33	31.4000	1138.62	3.70	25.98	42.80	42.65
1995-96	296277	3501.11	118.17	31.5000	1111.46	3.75	-3.60	-2.07	-2.39

1996-97	378199	4121.36	108.97	35.7500	1152.83	3.05	27.65	17.72	3.72
1997-98	385818	4697.48	121.75	36.2500	1295.86	3.3.6	2.01	13.98	12.41
1998-99	302934	4626.87	152.74	41.8000	1106.91	3.65	-21.48	-1.50	-14.58
1999-00	343031	5116.67	149.16	43.0300	1189.09	3.47	13.24	10.59	7.42
2000-01	440473	6443.89	146.29	45.4975	1416.32	3.22	28.41	25.94	19.11

Source: MPEDA, An Overview – 2001.

The share of marine products is the highest among the agriculture and allied commodities exported from India as of 2000-01. The percentage share of marine products in the total exports of agriculture and allied products is given in Table 3.21.

TABLE 3.21 PERCENTAGE SHARE IN TOTAL EXPORTS – MARINE AND OTHER AGRICULTURAL PRODUCTS

Product	Share (%) in total export			
	1991-92	1995-96	1999-00	2000-01
Marine products	3.28	3.18	3.21	3.13
Oil meals	2.09	2.21	1.03	1.01
Non-basmati rice	0.58	3.48	0.84	0.39
Coffee	0.75	1.41	0.90	0.58
Cashew	1.52	1.16	1.54	0.92
Basmati rice	1.13	0.80	1.09	1.05
Spices	0.84	0.75	1.11	0.80
Tea	2.45	1.10	1.12	0.97
Agricultural & allied products	17.87	19.12	15.08	13.36

Source: Ministry of Commerce 2002, Sector wise Strategies.

From a turnover of Rs.3.67 Cr. in 1952-53, seafood exports have reached a record volume of 440473 tonnes valued at Rs.6444 Cr. in the year 2000-01. It accounts for 3.16% of the total exports of the country (Anon. 2002 a). But it amounts to less than 3% of the US $ 50 billion worth world seafood market (Devadasan, 2002). A disturbing trend that has been noticed in the recent years is the decline in the current value realization of Indian seafood, although it has been registering overall growth in quantity, rupee earnings and foreign exchange realization.

The export market for Indian seafood has undergone vast expansion and significant changes in market destination and product mix over the years. Export of marine products to major markets is given in Table 3.22. The major markets for these products are Japan, USA, and EU countries, China including Hong Kong, South East Asia and the Middle East. Today India exports marine products to more than 69 countries. Exports to 20 major market destinations and their market share from 1996-97 to 2000-2001 is given in Table 3.23

The USA was the major importer until 1977, when Japan emerged as the single largest importer of Indian seafood. Japan continued to hold this position with a share of 30.56% in value and 15.29 in volume during 2001-02. (Anon 2002 b). China and Hong Kong together were the largest importer with a share of 31.75% in terms of volume. But there was a decline in comparison to the previous year. USA was the second largest market in value terms with a share of 23.86% and 11.55% in terms of volume after Japan. Export to the Middle East countries registered a growth of 11.16% in volume, whereas there was a decline in value terms by 3.86%. Exports to S.E Asia increased by 28.65% in quantity and 13.67% by value, Exports to Australia, South Africa, Venezuela, Panama etc. registered a growth during 2000-01. The changing pattern of major markets is given in Table 3.24.

In the sixties the export scene was dominated by frozen and canned products, mainly shrimp. The export of canned products started declining by the 1980s primarily on account of the high cost of tin cans, which made Indian products non-competitive. The '80s also witnessed arrival of new value added products, enlarging the export basket.

TABLE 3.22: EXPORT OF MARINE PRODUCTS TO MAJOR MARKETS FOR THE YEARS 2001-2002 AND 2000-2001

(Q: Quantity in M.T, V: Value in Rs. Crores, $: US Dollar Million)

Country	% Share to Total		April-March 2001-2002	April-March 2000-2001	Variation	(%)
	15.29	Q	64905	68983	-4078	-5.91
Japan	30.56	V	1820.69	2560.39	-739.70	-28.89
	30.56	$	383.07	562.75	-179.68	-31.93
	11.55	Q	49041	41747	7294	17.47
USA	23.86	V	1421.38	1164.40	256.98	22.07
	23.86	$	299.05	255.93	43.12	16.85
	19.53	Q	82895	68827	14068	20.44
European Union	19.31	V	1150.07	1025.36	124.71	12.16
	19.31	$	241.97	225.37	16.60	7.37
	31.75	Q	134767	182771	-48004	-26.26
China	10.03	V	597.23	827.42	-230.19	-27.82
	10.03	$	125.66	181.86	-56.20	-30.90
	12.35	Q	52424	40748	11676	28.65
South East Asia	9.04	V	538.75	462.97	75.78	16.37
	9.04	$	113.35	101.76	11.59	11.39
	4.51	Q	19159	17236	1923	11.16
Middle East	3.04	V	181.06	188.32	-7.26	-3.86
	3.04	$	38.10	41.39	-3.29	-7.95
	5.02	Q	21279	20161	1118	5.55
Others	4.16	V	247.87	215.03	32.84	15.27
	4.16	$	52.15	47.26	4.89	10.35
	100.00	Q	42470	440473	-16003	-3.63
TOTAL	100.00	V	5957.05	6443.89	-486.84	-7.56
	100.00	$	1253.35	1416.32	-162.97	-11.51

Source: MPEDA Annual Report 2001-2002

TABLE .3.23: EXPORTS OF MARINE PRODUCTS TO MAJOR 20 COUNTRIES

Rank	Country	1996-97	Share %	1997-98	Share %	1998-99	Share%	1999-00	Share%	2000-01	Share%
1	Japan	1886.04	45.76	2326.09	49.52	2295.48	49.61	2272.78	44.42	2560.39	39.73
2	USA	436.05	10.58	583.75	12.43	617.32	13.34	775.35	15.15	1164.40	18.07
3	China	306.88	7.45	695.55	14.81	308.94	6.68	373.02	7.29	648.76	10.07
4	UK	231.22	5.61	92.17	1.96	185.08	4.00	243.83	4.77	305.65	4.74
5	Spain	113.54	2.76	81.45	1.73	137.98	2.98	177.59	3.47	182.14	2.83
6	Hong Kong	236.58	5.74	121.38	2.58	174.08	3.76	171.68	3.36	178.66	2.77
7	UAE	49.40	1.20	134.59	2.87	130.78	2.83	98.28	1.92	156.46	2.43
8	Belgium	94.69	2.30	46.33	0.99	69.47	1.50	120.49	2.35	124.79	1.94
9	Singapore	95.27	2.31	93.62	1.99	86.91	1.88	90.44	1.77	121.19	1.88
10	Italy	112.07	2.72	62.76	1.34	81.59	1.76	93.91	1.83	119.12	1.85
11	Thailand	75.85	1.84	96.62	2.06	93.11	2.01	92.13	1.80	114.61	1.78
12	France	45.48	1.10	18.65	0.40	44.18	0.96	56.12	1.10	72.34	1.12
13	Malaysia	78.26	1.90	68.70	1.46	48.54	1.05	70.43	1.38	66.65	1.03
14	Netherlands	69.24	1.68	19.82	0.42	37.08	0.80	75.05	1.47	63.16	0.98
15	Canada	20.20	0.49	21.06	0.45	37.40	0.81	55.30	1.08	59.67	0.93
16	Vietnam	0.51	0.01	5.39	0.11	0.36	0.01	25.13	0.49	57.38	0.89
17	Greece	45.92	1.11	48.88	1.04	58.43	1.26	34.19	0.67	52.43	0.81
18	Australia	6.28	0.15	17.40	0.37	18.47	0.40	17.26	0.34	51.49	0.80
19	Rep.OfKorea	26.24	0.64	14.13	0.30	7.93	0.17	32.12	0.63	50.38	0.78
20	Germany	33.38	0.81	16.64	0.35	31.70	0.69	50.67	0.99	48.94	0.76
21	Others	158.26	3.84	132.50	2.82	162.04	3.50	190.90	3.73	245.28	3.381
TOTAL		4121.36	100.00	4697.48	100.00	4626.87	100.00	5116.67	100.00	6443.89	100.00

(Rs. crores)

Source:- MPEDA Annual Report 2001-2002

TABLE. 3.24:CHANGING PATTERNS OF MAJOR MARKETS Q- TONNES V- IN Rs. Lakhs

.Years		Japan	Share %	USA	Share %	Euro. Union	Share % countries	Other	Share %	Total
1981-82	Q:	40011	57.07	10528	15.02	9202	13.13	1036	1.48	70105
	V:	20287	70.93	3498	12.23	2755	9.63	2061	7.21	28601
1982-83	Q:	41136	52.62	12276	15.7	7409	9.48	17354	22.2	78175
	V:	26263	72.68	4258	11.78	2734	7.57	2881	7.97	36136
1983-84	Q:	37424	40.38	13496	14.56	9493	10.24	32278	34.82	92691
	V:	24023	64.4	4981	13.35	3763	10.09	4535	12.16	37302
1984-85	Q:	41536	48.19	13647	15.83	8896	10.32	22108	25.65	86187
	V:	26036	67.75	5654	14.71	3471	9.03	3268	8.5	46067
1985-86	Q:	40327	48.21	9519	11.38	14231	17.01	19574	23.4	83651
	V:	31058	67.42	5630	12.22	5944	12.9	3435	7.46	46067
1986-87	Q:	37287	43.44	11347	13.22	17868	20.81	19341	22.53	85843
	V:	32618	61.4	7515	14.15	8426	15.86	4561	8.59	53120
1987-88	Q:	38738	39.86	14444	14.86	22816	23.48	21181	21.8	97179
	V:	32618	61.4	7515	14.15	8426	15.86	4561	8.59	53120
1988-89	Q:	35811	35.89	13531	13	33824	33.9	16611	16.65	99777
1988-89	V:	35684	59.69	7012	11.73	12449	20.82	4640	7.76	5978
1989-90	Q:	38763	34.97	13802	13	36970	33.35	21308	19.22	110843
	V:	34566	54.45	7833	12.34	15530	24.46	5570	8.77	63499
1990-91	Q:	38092	27.32	16155	11.59	42964	30.82	42208	30.27	139419
	V:	45827	51.3	10931	12.23	23189	25.96	9390	10.51	89337
1991-92	Q:	39480	22.98	20844	12.13	55604	32.36	55892	32.53	171820
	V:	63345	46.04	15464	11.24	39587	28.77	19193	13.95	137589
1992-93	Q:	41240	19.73	20141	11	67582	32.33	80062	38.3	209025
	V:	80190	45.34	19048	10.77	51152	28.92	26466	14.96	176856
1993-94	Q:	44985	19	26152	10.72	71857	29.45	100966	41.39	243960
	V:	118567	47.36	30617	12.23	64529	25.77	36643	14.64	250356
1994-95	Q:	53500	17.41	32102	10.45	71224	23.17	150511	48.97	307337
	V:	164382	45.98	49023	13.71	72630	20.31	71492	20	357527
1995-96	Q:	51789	18	26008	8.78	87212	29.44	131268	44.31	296277
	V:	157669	45.03	36626	10.46	91187	26.05	64629	18.46	350111
1996-97	Q:	64656	17.1	29792	7.88	71192	18.82	212559	56.2	378199
	V:	188604	45.76	43605	10.58	79011	19.17	100916	24.49	412136
1997-98	Q:	70955	18.39	32914	8.53	34875	9.04	247074	64.04	385818
	V:	232609	49.52	58375	12.43	41253	8.78	137511	29.27	469748
1998-99	Q:	67277	22.21	34472	11.38	54261	17.91	146924	48.5	302934
	V:	229548	49.61	61732	13.34	68462	14.8	102945	22.25	462687
0-01	Q:	68983	15.66	41747	9.48	68827	15.63	260916	59.24	440473
	V:	256039	39.74	116440	18.07	102536	15.91	169374	26.28	644389

Source: MPEDA Annual Report 2001-02

Cephalopods (cuttlefish, squid and octopus) and fin fishes like pomfret, ribbon fish, seer fish, mackerel, reef cod, croakers, snappers, etc. found a higher position in the Indian exports. According to the marine products export review 2000-01 of Marine Products Export Development Authority, frozen shrimp continued to be the largest item of export, with a share of 25.40% in volume and 69.55% in value (Anon –2000). Frozen fin fish with 48.34% share in volume and 13.58% in value constitutes the largest item of export in terms of quality. It has registered a growth of 62.15% in terms of volume, 62.78% in rupee earnings and 53.96% in terms of foreign exchange realization, which was a remarkable fete in the recent past. Export of frozen cuttlefish and squid had reached a plateau, whereas that of octopus had declined. Export of live items except aquarium fish had a growth of 31.58% in terms of value. Chilled items and dried items also registered increase in terms of value. Value added non-conventional items like surimi, seafood mix, frozen Baigai, crab, clam, mussel meat etc. have also shown an increase in exports. The item wise export of marine products is given in Table 3.25.

The product preferences also vary in different countries. While USA prefers peeled shrimp, Japan favors headless, shell on varieties. EU countries import IQF shrimp in cooked and frozen forms, along with cephalopods. Frozen fish is the market leader in South East Asia and the Middle East.

TABLE. 3.25: ITEM WISE EXPORT OF MARINE PRODUCTS

Q: Qty in M.Tonnes V: Value in Rs. Crores $ US$ Million

Items		2000-01	Share %	Growth %	1999-00	Share %	Growth %	1998-99	Share %	Growth %
Frozen Shrimp	Q	111874	25.40	1.45	110275	32.15	7.60	102484	33.83	1.15
	V	4481.51	69.55	22.94	3645.22	71.24	8.98	3344.91	72.29	6.51
	$	985.00	69.55	16.28	847.07	71.24	5.85	800.22	72.29	-7.64
Frozen Fish	Q	212903	48.34	62.15	131304	38.28	20.96	108556	35.83	-42.27
	V	874.68	13.58	62.78	537.34	10.50	8.55	495.03	10.70	-31.88
	$	192.25	13.58	53.96	124.87	10.50	5.44	118.43	10.70	-40.92
Frozen Squid	Q	37628	8.54	7.76	34918	10.18	8.26	32254	10.65	-8.10
	V	324.43	5.03	9.31	296.8	5.80	10.36	268.93	5.81	-0.72
	$	71.31	5.03	3.39	68.97	5.80	7.20	64.34	5.87	-13.90
Frozen Cuttlefish	Q	33677	7.65	2.68	32799	9.56	-5.18	34589	11.42	-7.16
	V	288.99	4.48	0.97	286.22	5.59	4.72	273.31	5.91	-15.49
	$	63.52	4.48	-4.50	66.51	5.60	1.71	65.39	5.91	-26.71
Others	Q	44391	10.07	31.59	33735	9.83	34.67	25051	8.27	3.87
	V	474.28	7.36	35.09	351.09	6.86	43.48	244.69	5.29	3.73
	$	104.24	7.36	27.64	81.67	6.86	39.54	58.53	5.29	-10.05
Total	Q	440473	100.00	28.41	343031	100.00	13.24	302934	100	-21.48
	V	6443.89	100.00	25.94	5116.67	100.00	10.59	4626.87	100	-1.50
	$	1416.32	100.00	19.11	1189.09	100.00	7.42	1106.91	100	-14.58

Source: Marine Products Export Review – MPEDA 2000-01

A salient feature of the marine products exports of India is the pre-eminence of shrimp as the most important item in the export basket. Though it constitutes only 8% of the total marine capture fisheries, it constitutes about 25.40% of the total quantity of marine product exports and about 69.55% of the total earnings as of 2000-01. As the supply of shrimp from capture source is dwindling, world over, increased attention is being placed on aquaculture. Shrimp cultivation has started in India also since 1980. The initial success, has prompted entrepreneurs to adopt intensive, unscientific, culture practices, causing serious environmental problems and social tensions. This has resulted in a ban on aquaculture in India for some time. But with the

establishment of the Aquaculture Authority of India in 1995 and introduction of specific guidelines, the coastal aquaculture has started picking up. In terms of volume the share of cultured shrimp in the total export of shrimp from India has gone up from 37% during 1990-91 to 59% in 2000-01. In terms of value the share has gone up from 57% in 1990-91 to 86% in 2000-01. (Anon, 2002 c).

The Marine Products Export Development Authority (MPEDA) established in 1972, is the agency entrusted with the responsibility of facilitation and promotion of seafood production. The exporters and production infrastructure, including fishing vessels are required to be registered with the MPEDA. The details of such registration/deregistration are given in the Table 3.26.

TABLE 3.26: INFRASTRUCTURE REGISTERED, DE-REGISTERED WITH THE MPEDA

Category	Regd. as on 01.4.2001	Capacity in MT	Regd. During 2001-02	De-Regd. During 2001-02	Regd. as on 31.3.2002	Capacity in MT
Exporters						
Fishing Vessels	1500	N.A	206	155	1551	N.A
Freezing Plant	14721	N.A	437	40	15118	N.A
Canning Plant	388	8905.800	31	63	356	8982.540
Agar Agar	13	47.500	0	8	5	16.500
Ising Glass	4	0.145	0	0	4	0.145
Ice Plant	1	10.000	0	0	1	10.000
Fish Meal Plant	156	3155.000	6	3	159	3708.500
Peeling Shed	12	229.000	0	2	10	211.000
Conveyance	605	3804.300	52	265	392	3745.700
Cold Storage	531	N.A	20	0	551	N.A
Dry Fish Storage	484	108799.500	30	36	478	116989.500
AFD Plant	216	11540.000	10	4	222	11728.000
Surimi Plant	3	3.000	0	1	2	2.000
Fresh/chilled fish	9	314.000	0	0	9	324.000
handling centre	0	N.A	22	0	22	N.A
Premises to handle live fish	0	N.A	14	0	14	N.A

Source: MPEDA – Annual Report 2001-02

The seafood processing industry in India has built up substantial production capacities in the country over the years. But the decline in the capture fishery resources, the reduction in size of prime varieties of fish, predominance of low value fish in the catch and a global recession has led to severe under utilisation of the built up production capacity in the country. Aquaculture could fill the gap to a certain extent in the case of shrimp resources. But the problem continues. The Liberalization in imports consequent upon the withdrawal of quantitative restrictions, enables the Indian seafood industry to import 125 species or groups of fishes crustaceans etc. This opportunity can be gainfully utilized for better capacity utilisation of our processing plants.

The international trade in fish products has been facing new challenges. Some of these issues though appear to be bonafide, there are genuine apprehensions that they are being imposed surreptitiously as non-tariff barriers to protect the interest of the developed countries. Some of these are (i) the changes in quality control measures in the major importing countries, towards a preventive Hazard Analysis and Critical Control Point (HACCP) – based strategy; (ii) the concept of risk assessment concern regarding over-exploitation of resources; (iii) environmental consensus; and (iv) insistence on traceability and labeling. Reports of over fishing and presence of dangerous antibiotics have caused concern amongst discerning consumers. The range and types of labeling like the country or ocean of origin, eco-labeling, organic product labeling, etc. have left the consumers confused about the fishery products.

The Indian fish processors are aware of the gravity of the situation and have started taking appropriate measures to counter the adverse impact of the emerging contingencies, especially to meet the shift in emphasis from food quality to food safety.

Financing of Fisheries Development

India after independence has adopted planned economic development as a strategy. Accordingly, the development programmes are implemented through Five Year Plans and annual plans by the Union and State Governments. The State interventions are mainly effected through these development programmes. They may be Central Schemes, Centrally Sponsored Schemes, and State Schemes. The plan outlays cover various schemes for all the three sub sectors viz. marine, inland and coastal aquaculture. The Central Govt. have been financing schemes in the respective plans for specific purposes depending on the priorities assigned to each of them in a particular plan period.

The plan outlays increased during each of the Five Year Plans is given in Table 3.27. Up to the end of the VIII Plan, the Centre and State/UT Govts. Together have expended about Rs.2932 Cr. for various development programmes in the fisheries sector as a whole. Although disaggregated figures are not available, the major share of it has gone to the marine sector.

TABLE 3.27: INVESTMENT IN VARIOUS FIVE-YEAR PLANS
(Rs. in Crores)

Plan	Total Plan Outlay	Outlay for Agri. & Allied Sectors	Outlay for Fisheries	Percentage of Total Outlay	Fisheries Outlay for Agri. & Allied sectors
I Plan	1960	294	5.13	0.26	1.74
II Plan	4600	529	12.26	0.27	2.32
III Plan	7500	1068	28.27	0.38	2.65
IV Plan	15902	2728	82.68	0.52	3.03
V Plan	39322	4302	151.24	0.38	3.52
VI Plan	97500	6609	371.14	0.38	5.62
VII Plan	180000	10574	546.54	0.30	5.17

SOURCE: Ministry of Agriculture, Fisheries Division.

Infrastructure

Infrastructure facilities developed in the public and private sector provide the backbone of fisheries development. Major infrastructural development has been in the creation of landing and berthing facilities at the major and minor ports and at the widely dispersed landing sites along the coastline. They have contributed to the increase in production and improvement in quality of fish, besides development of ancillaries in the local areas. The plan schemes were introduced for infrastructure development from the mid-sixties onwards. The outlays and expenditure incurred for the major and minor fishing harbours is given in Table 3.28. The numbers of minor fishing

harbours and fish landing centres commissioned/under construction by State/UTs is given in Table 3.29. Besides these, separate fishing harbours have also been built in the major commercial ports.

Under a plan scheme introduced in 1964 and continued through successive Five Year Plans with some modifications, fishing harbours and fish landing centres are being set up in the maritime States. Accordingly the Central Govt. have approved 6 major fishing harbours, 50 minor harbours and 171 fish landing centres as Central Sector/Centrally Sponsored scheme since its inception up to 2002-03. All the 6 major fishing harbours, 33 minor fishing harbours and 130 fish landing centres have so far been completed/commissioned. The rest are under different stages of completion.

The facilities provided under the Scheme are fishing harbours, fish landing centres, backwater wharf, jetty, dredging, reclamation, quay auction hall, ship way, workshop, net mending shed, other ancillary facilities for repairs and maintenance etc. The coastal States provide 50% of the capital cost of setting up these facilities. The entire cost of fishing harbours in the major Port Trust areas, is met by the Central Government. The construction, maintenance, management and operation of the fishing harbours and fish landing centres are the responsibility of the concerned State/U.T Governments.

The fishing harbours are used for berthing, fishing vessels and providing handling facilities on the shore. The conditions of these harbours are far from satisfactory. Hygienic handling facility at the harbours and fish landing centres is the key to maintaining quality of the raw material for processing. There is no state of the art fishery terminal anywhere in the country. Involvement of

private sector in the development of fishery harbour and port facilities should be encouraged for further expansion of these facilities as State funding is increasingly becoming hard to find.

TABLE 3.28: MAJOR AND MINOR FISHING HARBOURS – OUTLAYS AND EXPENDITURE (Rs. in lakhs)

Plan Period	Major Harbours		Minor Harbours	
	Outlay	Expenditure	Outlay	Expenditure
Third Plan	5	12	--	--
Three Annual Plans (1966-67 to 1968-69)	253	3	295	157
Fourth Plan	1350	158	600	485
Fifth Plan	1800	1210	1200	321
Annual Plans (i) 1978-79 (ii) 1979-80	 500 550	 308 206	 600 --	 394 1
Sixth Plan	1700	1320	1900	1795
Seventh Plan	1700	1684	1900	2169
Annual Plans (i) 1990-91 (ii) 1991-92	 492 500	 492 545	 432 600	 432 600
Eighth Plan	5213	4575	4675	4893
Ninth Plan	14000*			
1997-98 1998-99	2000* 2000*	1903* 1069*		

@ includes fish landing centers; also includes major and minor ports

Source:- Handbook of Fisheries Statistics 2000

TABLE 3.29: NUMBER OF MINOR FISHING HARBOURS AND FISH LANDING CENTRES COMMISSIONED / UNDER CONSTRUCTION BY STATE / UNION TERRITORY

	State/ Union Territory	Minor Fishing Harbour		Fish Landing Centres	
		Commis-sioned	Under Construction	Commis-sioned	Under Construction
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

Source:- Handbook of Fisheries Statistics 2000
Dept. of AH & Dairying, Ministry of Agriculture, Govt. of India, New Delhi.

Summing Up:

An overview of global expererience in the development and management aspects drawn for the comparable cases of maritime nations is discussed in this chapter with a view to learn from the global experience in designing the state intervention and public policy. Data collected on the development of marine fisheries sector and role played by the state in this regard have been analysed in this chapter in the historical perspective. The present status of India's marine fisheries sector has also been discussed, highlighting its development as well as management challenges. India's marine fisheries policy – with a particular reference of her policy regarding deep-sea fishing

and joint ventures has been analysed critically. The analysis presented in this chapter provides useful for discussion, followed in the next chapter, on the status of development of marine fisheries of Gujarat with a view to know the impact of state intervention and the development and management challenges involved.

CHAPTER - 4

STATUS AND DEVELOPMENT OF MARINE FISHERIES IN GUJARAT

Introduction

The State of Gujarat is situated between 20.1 degrees and 24.7 degrees North latitudes and 68.4 degrees and 74.4 degrees East longitudes, on the north-west coast of India. It shares an international border with Pakistan on its north and northwest boundaries. It has a land area of 195,984 sq km. and a population of 50.59 million people (2001 census). The density of population is 211 persons per sq. km. Fisheries provide livelihood for about 4.5 lakh people of Gujarat.

Marine fishing in Gujarat has been an important economic activity. Its contribution to the State Domestic Product (SDP) was 0.84 percent in 1980-81, which went up to over 1.60 percent at the close of 1990s. With the total annual production value of around Rs. 1300 crores and creation of employment for more than one lakh active fishermen, marine fisheries of Gujarat provides an important source of livelihood to over three lakh people.

Government of Gujarat has remained very active in bringing about technological changes, infrastructural development and institutional support to transform the nature of fishing from subsistence to a modern sector. The phenomenal growth of this sector is evident from the fact that during the last four decades (1960 –2000) the total fish production increased 50 fold, while the value of fish production increased by over 500 times.

The rapid growth of marine fisheries in Gujarat has, recently, been facing the problem of stock-destabilisation with fluctuation in fish landings. The biological over-fishing is marked in Gujarat with decreasing size of fish caught in all categories and the large amount of catch of trash fish and decreased catch per unit of effort. This has led to economic over-fishing, which is evident from the increased costs of fishing with the growth of fishing operations in various depth-zones.

It is in the above context that this chapter attempts at analyzing the growth and present status of marine fishing in Gujarat, which presents serious thinking on the perception about the role of the State. The government intervention does not simply include the 'development ' concern. The objective like the sustenance of the resource is equally important which demands constraints on the use of the resource and expects fisheries to be more responsible. This problem is analysed in the present chapter, keeping in mind the role that the State has played so far in the development of marine fisheries sector of Gujarat and what the State further needs to do in favour of its sustainable development.

The Anatomy of Marine Fisheries Sector of Gujarat

Gujarat is divided into 25 revenue districts of which 13 are coastal districts. They are Kutchh, Rajkot, Jamnagar, Porbandar, Junagadh, Amreli, Bhavnagar, Anand, Kheda, Bharuch, Surat, Navsari and Bulsar. Gujarat has a coastline of 1600 km with sand belts, gravel patches and salt marshes. There are two gulfs, viz. the Gulf of Cambay and the Gulf of Kutchh. The southern coast of the Gulf of Kutchh is characterized by coral reefs, tidal mudflats and coral islands. The Rann of Kutchh is a vast area of marshy saline mudflats.

The estimated EEZ off the Gujarat coast is about 214,060 sq. km, which is approximately 10.6% of the total EEZ of India. Gujarat has an estimated continental shelf area of 164,000 sq km, which is about 32.54% of the total shelf area of the country. The shelf area is characteristically wide and provides an extensive fishing ground. The minimum width of the shelf off Gujarat coast is about 58 miles and the maximum 191 miles. The gradient varies between a minimum of 1:537 and a maximum of 1:176. The average secondary production in the shelf area is twice that of the East Coast and the total production from the continental shelf area is twice that of oceanic production. There are 82 rivers passing through the State with a total river length of about 3685 km. and an estuarine area of about 21,230 sq km. The distribution of seacoast by the Districts of Gujarat is given in Table 4.1

TABLE 4.1: DISTRIBUTION OF SEACOAST BY DISTRICTS

District	Length in km.	Share %
Kutch	406	25.4
Rajkot	26	1.6
Jamnagar	342	21.4
Junagadh (including Porbandar)	261	16.3
Amreli	62	3.9
Bhavnagar	152	9.5
Anand (including Kheda)	51	32
Bharuch	127	7.9
Surat	83	5.2
Valsad (including Navsari)	90	5.6

Source: Narayanan K R et al

Some of the basic data on marine fisheries of Gujarat vis-à-vis the country as a whole is given in Table 4.2

TABLE 4.2:A FEW BASIC DATA ON GUJARAT COMPARED TO THE COUNTRY AS A WHOLE

Parameter	Units	Gujarat	India	Gujarat's Share (%)
Coastline	Km	1600	8041	19.90
Continental Shelf Area	Lakh Km^2	01.64	05.06	32.41
Exclusive Economic Zone	Lakh Km^2	02.14	20.20	10.59
Brackish Land	Lakh Ha.	03.76	14.22	26.44
Potentials for brackish culture	Lakh Ha.	01.87	08.67	21.57
Total Fishermen (1997)	Lakh No.	04.49	67.63	06.67
Total Active Fishermen	Lakh No.	01.57	24.85	06.32
Total Fish Landing Centers	Nos.	881	3937	22.38
Marine Fishery Potential	Lakh Tonne	07.03	39.00	18.03
Total Fishing Fleet (1999)	Nos	25985	280491	09.26
Mechanized Boats (1999)	No	11372	53684	21.18

According to the livestock census 1997, the total population of fishers inclusive of both inland and marine sector of Gujarat was 449,440, out of which 230,305 (51.24%) were males and 219,135 (48.76%) were females. The sex ratio is 956 females per 1000 males. The fishers engaged in the marine sector were an estimated 2.75 lakhs (61.19%) and in the inland sector were 1.74 lakhs (38.81%). The fishers living in the coastal districts and the number of active fishers amongst them are given in Table 4.3. There are about 32855 household units in the marine sector

TABLE 4.3: FISHERS IN COASTAL DISTRICTS OF GUJARAT (1997)

District	Total Fisher-Population	Active Fishermen
Jamnagar	24380	5574
Rajkot	8229	2149
Bhavnagar	6265	2638
Amreli	36904	17876
Junagadh	69134	22051
Porbandar	26733	7922
Kutch	15532	5973
Anand	4796	2328
Bharuch	19579	6649
Surat	62297	25685
Valsad	68380	26004
Navsari	35398	12789
Total	377627	137638

The details of active fishers in the coastal districts of the State based on their activities are given in the Table 4.4. According to Devraj et al (2001), although the per capita fishing area has declined in Gujarat, the fishermen of Gujarat have more fishable area compared to their counterpart elsewhere in the country.

TABLE 4.4: ACTIVITY WISE DETAILS OF FISHERIES IN COASTAL DISTRICTS

District	Full Time Fishing	Part Time Fishing	Fish Marketing	Gear Mending	Fish Pro-cessing	Others	Total Active
Jamnagar	4913	138	246	64	15	198	5574
Rajkot	464	1243	242	173	3	24	2149
Bhavnagar	1401	125	1023	0	89	0	2638
Amreli	9186	215	3439	1913	2568	555	17876
Junagadh	12290	1292	2260	1259	3995	955	22051
Porbandar	3678	436	637	1681	589	901	7922
Kutch	3308	476	821	83	1104	181	5973
Anand	951	58	503	33	17	766	2328
Bharuch	4359	1048	843	375	19	5	6649
Surat	20821	1494	1274	1252	167	677	25685
Valsad	12977	6831	2518	1946	87	1645	26004
Navsari	4585	1913	869	4224	13	1185	12789

People from different communities are engaged in fishing activities in the marine sector. The major communities are Kharwas (Hindu), Kolis (Hindu), Miyanas (Muslim), Machiyaras (Muslim), Badela & Goghlliya (Muslim).

The Hindus are the dominant community followed by Muslims. The fishermen, are categorized as Other Backward Communities for availing benefits under the Govt. schemes.

The Resource Potential (Maximum Sustainable Yield)

For systematic development of any fishery, it is essential to get the basic data on the resource potential. Keeping this in view several exploratory surveys have been conducted from time to time mainly at the behest of the government either at the Centre or the State. The first such survey was conducted in 1900-02 by the steam trawlers ST William Garrick and ST Meena on the northwest coast, during the days of the Bombay Presidency. To provide necessary research support to the industry, the Deep Sea Fishing Station was set up at Bombay in 1946, which helped in generating some basic data on the resource potential of the Gujarat coast, even before the independence of the country.

Surveys were carried out later by the Government of India vessels MT Ashok and MT Pratap in 1949 and MFV Jyoti and MV Tapasi in 1950 – 51. These surveys have indicated that the fishing grounds off Saurashtra coast were rich in demersal fishery. The exploratory and commercial fishing operations by the Japanese trawler MV Taiyo Maru No 17 during 1951 – 54 and the bull trawlers of the New India Fisheries, ‘Arnala Raj’ and ‘Satpati Pilotan’ had established the presence of highly productive demersal fishery resources off Dwaraka and Kutch coasts.

In 1995, the Fisheries Survey of India ((FSI) quantified the MSY of the Gujarat coast at 703,000 tonnes. The details are as follows:

Demersal fish	-	392,400 tonnes
Crustaceans	-	36,000 "
Cephalopods	-	26,000 "
Pelagic resources	-	258,000 "
Total:		703,000 tonnes

Stock-assessments

In 1962, the Department of Fisheries of the government of Gujarat, introduced exploratory fishing using otter stern trawlers, viz. MFV Silver Pomfret, MFV Indian Salmon and MFV Gulf Shrimp, which gave valuable information on the quantity and quantity of the resources. Gujarat was the first State to have its own survey vessels in the country This was a pioneering effort where the state played the pivotal role of a catalyst to promote private sector investment in fishing in Gujarat during the subsequent years.

Several other survey operations were also conducted using smaller vessels, over the years, by the Deep Sea Fishing Station and the Exploratory Fishery Project, which has helped in assessing and mapping the marine fishery resources of the northwest coast that includes the Gujarat coast.

On the basis of data generated from various studies, George, et al (1977) estimated the exploitable fishery resources of the northwest coast comprising of Gujarat, Maharashtra and Goa as 8.80 lakh tonnes.

The second phase of exploratory surveys were conducted by the chartered Polish industrial vessel MT Muraena in 1977, which surveyed fishing grounds up to 170m depth along the Gujarat coast. According to the results of these surveys the MSY of the Gujarat coast has been estimated as 7 lakh tones, comprising of mid-water 2.5 lakh tones and demersal 4.5 lakh tones per annum.

Subsequent surveys were conducted by the Fishery Survey of India deploying the Dutch survey vessels Matsya Nereekshani and Matsya Varshini in 1979– 80. Later another survey vessel, Matsya Mohini was inducted for deep-sea survey. Species-wise yield patterns, made available through these surveys provided a better assessment of the demersal stock in the fishing ground along the Gujarat coast. Thus the MSY of demersal finfish stock was estimated as 3.9 lakh tones in the continental shelf of Gujarat (Joseph, 1980). The species-wise details are given in table 4.5.

TABLE 4.5: DEMERSAL FINFISH STOCKS IN THE CONTINENTAL SELF ON GUJARAT COASTS(in tonnes)

Depth(m)/Species	0-50	50-100	100-200	200-300	Total
Area (Sq. Km)	64760	25035	6730	2325	98850
Sharks, Skates & Rays	11230	1833	309	41	13413
Eels	2081	210	22	32	2345
Catfishes	19600	3202	506	-	23308
Ribbon fishes	50551	15018	3577	14	69160
Perches	10102	855	157	15	11129
Pomfrets	18293	748	20	-	19061
Protonebia diacanthus	6307	2354	41	-	8702
Other sciaenids	84146	3928	814	143	89031
Lizard fishes	3802	1197	910	-	5909
Polynemids	1753	118	2	-	1873
Threadfin breams	7980	3949	2922	199	15050
Chirocentrus spp.	2795	783	243	-	3821
Goat fishes	4102	1449	271	-	5822
Caranx spp.	2795	783	243	-	3821
Chorinenus spp.	1521	311	88	-	1920
Bulls eye	627	3080	1309	659	5675
Bombay duch	25285	17	-	-	25302
Seer fishes	4519	958	137	-	5614
Mackerels	3336	1000	72	-	4408
Horse mackerel	7436	6014	2013	-	15463
Scads	3983	2011	1245	-	7239
Clupeids	12538	1193	91	-	7239
Other fishes	35070	4871	696	82	40719
Total	32075	55493	15446	1185	392399

The Working Group on revalidation of fishery potential in the Indian EEZ 1991 has estimated 1.43 million tonnes as the potential yield in the northwest coast. The details are given in Table 4.6. This has been revised as 1.20 million tones by the working group of 2000.

TABLE 4.6: Potential yield of northwest coast (up to 500 m depth) (in '000 tonnes)

Depth Zone	*Potential yield*
0 to 50 metres	
Demersal	535.7
Pelagic	331.0
Total	866.7
50 to 100 metres	
Demersal	274.3
Pelagic	161.0
Total	435.3
100 to 200 metres	
Demersal	104.3
Pelagic	27.0
Total	131.3
200 to 300/500 metres	
Demersal	0.4
Pelagic	0.0
Total	0.4
Grand Total	
Demersal	914.7
Pelagic	519.0
Total	1433.7

Source: Report of Working Group on revalidation of Fishery potential in the Indian EEZ - 1991

The commercially important fishes occurring along the Gujarat coast, with their common names, scientific names and local names are listed in Table 4.7.

Table 4.7: Commercially important fishes occurring along Gujarat Coast

Family/Group	Common Name	Scientific Name	Local Name
Elasmobranches	Sharks	Carcharhinus spp.	Magra
		Scoliodon spp	Musi
	Skates	Sphyrna spp	Kanner
		Pristis cuspidatus	Churria Jumbo
	Rays	Rhynchobatus spp	Boother
	Rays	Aetobatus spp	Himanucus
Sciaenidae	Croakers	Johnius spp.	Dhoma
		Otolithes spp.	Koth
		Sciaena spp.	Dhoma
	Jew fish	Protonebea diacanthus	Ghol
Ariidae	Cat fishes	Arius spp.	Khaga
Trichuridae	Ribbon fishes	Trichurus spp	Pata, lapdi
Stromateidae	Silver pomfret	Pampus argenteus	Vichhuda
	White pomfret	P.chinensis	Paplet
	Black pomfret	Parastromateus niger	Halwa, Adadiya
Clupeidae	Indian shad	Hilsa toli	Chakai
	Giant Herring	H.ilisha	Palla
	Ox eyed Herring	Ilisha spp.	Katti
Chirocentridae	Wolf Herring	Chirocentrus spp.	Dai
Lutjanidae	Snappers	Lutjanus spp.	Ratda/Tam/Gurnkha
Haemulidae	Silver grunt	Pomadasys hasta	Karkara
Sparidae	Silver bream	Argyrops spp.	Krea
Nemipteridae	Threadfin breams	Nemipeterus spp.	Ranifish
Harpodontidae	Bombay duck	Harpadon nehereus	Bumla
Polynemidae	Threadfin	Polynenus indicus	Dara
		Elentheronema tetradactylum	Rawas
Congridae	Golden eel	Congresox spp.	Wam
Mugilidae	Grey mullet	Mugil spp., Valamugil seheli	Boi Mankan
Scombridae	Seerfish	Scombromorus spp.	Surmai
Engraulidae	Golden Anchovy	Coilia dussumeri	Mandeli
Penaeidae	White shrimp	Penaeus indicus	Jhinga
	Tiger shrimp	P.monodon	Tiger Jhinga
	Brown shrimp	Metapenaeus spp	Chamari/Kapsi
	Kiddi shrimp	Parapenaeopsis spp	Kolmi
Palinuridae	Rock lobster	Panulirus sp.	Titan
Cephalopods	Squids	Loligo spp.	Narasinga
	Cuttle fishes	Sepia spp.	Narasinga

Source: Local Names of Marine Fishes– Govt. of Gujarat

The MSY of demersal finfish resources has been estimated in different depth zones as shown in Table 4.5. According to data available, it is estimated that the demersal resources are to the tune of 3.92 lakh tones per annum of which 81.6% would be from 0 – 50 m depth, 14.2% from 50 – 100 m depth, 3.9% from 100-200 m depth and 0.3% from 200 – 300/500 m depth. Up to 50 m the prominent species are stakes, rays, ribbon fish, eels, catfish, perches and pomfrets. In the 50 – 100 m depth zone the ribbon fish, sciaenids, threadfin breams, horse mackerels and bull's –eye have the major share. Between 100 – 200 m the major species are ribbon fish, threadfin breams, horse mackerels, scads and bull's-eye, whereas the 200 – 300/500 m zone is dominated by bull's-eye.

The survey data has been found inadequate for estimation of the crustacean stock. The FSI quantified a MSY of 36,000 tonnes of crustaceans from the Gujarat coast. The Working Group on revalidation of potential marine fisheries resources of EEZ of India (1991) has estimated the annual catch of penaeid shrimps as 1643 tonnes and non—penaeid shrimps as 14,385 tonnes in the 0 – 50 m depth, based on the historical data of landings between 1985 and 1989. But the actual production figures have been showing a much enhanced level in subsequent years, as is seen from the table 4.8.

TABLE 4.8: SHRIMP LANDINGS IN GUJARAT

Year	Total Marine Fish Landing (Tonnes)	Total Shrimp Landing (Tonnes)	Share of Shrimp to Total Marine Fish Landing (%)
1960-61	79412	2338	2.94
1970-71	151190	9532	6.30
1980-81	218872	16742	7.65
1990-91	500162	24187	4.84
1996-97	600068	50670	7.68
1997-98	702395	48823	6.95
1998-99	551660	50627	9.18
1999-00	670951	56442	8.41
2000-01	620474	53983	8.40

The Gujarat coast has a good stock of cephalopod resources. The FSI has estimated an MSY of 26,600 tonnes per annum, 76% of which is from in-shore waters up to 50 m depth. The MSY of pelagic resources of Gujarat coast was assessed to be 248,000 tonnes, about 199,000 tonnes from the 0 – 50 m depth and 49,000 tonnes from the 50 – 200 m depth.

The MSY estimates of 7.03 lakh tones made by FSI covers the entire continental shelf and slope taking into consideration the current production, standing stock as well as natural instability parameter of the respective stock. Gujarat has recorded the highest ever production of 7.02 lakh tones in 1997-98. The marine fish-landing trend is evident from the following table 4.9.

TABLE 4.9: LANDING AND DECENNIAL GROWTH OF MARINE FISH

Year	Fish Landing (Tonne)	Decennial Growth (%)
1960-61	79412	-
1970-71	151000	90.36
1980-81	218000	44.77
1990-91	500462	128.66
1997-98	702000	-
1999-00	670951	-
2000-01	620474	23.98

The fish landing has reached the full MSY level in 1997-98 and the average production was over 6.0 lakh tones during 1991-2001. With this level of production, there is very little scope for expansion in the traditional fishing grounds in the continental shelf. The option left is to adopt good management practices in this region and to expand further exploitation towards the outer continental shelf and deep-sea regions, which remain almost unexploited. The stock in this zone comprises of mainly sciaenids, ribbon fish, elasmobranches, cat fish, perches, threadfin breams, horse mackerel, bull's eye, tunas and tuna-like fishes, for which a new market is emerging fast, particularly for export. Harnessing of these resources would naturally require diversified fishing, different from what has been hitherto followed.

Marine Fish Production in Gujarat

Fish production in India has shown an impressive growth over the years since 1950 – 51. The marine fish production has increased approximately by six times and inland fish production by eleven times over the 1950 – 51 level (Nair, 2001). On an all India basis, the inland production has been increasing steadily almost at the rate of 7% per annum while the growth has been less than 1% in the marine sector. But the marine fish production far outweighed the inland production in Gujarat as is evident from Table 4-10.

TABLE 4.10: MARINE AND INLAND FISH PRODUCTION OF GUJARAT 1960-61 TO 1993-94

Sr.No.	Year	Fish Production in Tonnes			Value in Lakh of Rs.
		Marine	Inland	Total	
1	1960-61	79412	NA	79412	175.75
2	1961-62	85114	-do-	85114	212.35
3	1962-63	82681	-do-	82681	248.35
4	1963-64	85000	-do-	85000	249.00
5	1964-65	89017	-do-	89017	288.36
6	1965-66	109907	-do-	109907	403.00
7	1966-67	115175	-do-	115175	420.00
8	1967-68	124882	-do-	124882	503.02
9	1968-69	131748	-do-	131748	576.11
10	1969-70	139995	-do-	139995	640.51
11	1970-71	151190	-do-	151190	780.65
12	1971-72	147023	14167	161190	780.65
13	1972-73	151203	14560	165763	1054.23
14	1973-74	177647	16400	194047	1685.98
15	1974-75	157430	7455	164885	1543.74
16	1975-76	208300	12695	220995	3342.52
17	1976-77	225279	15361	240640	5249.04
18	1977-78	176895	13135	190030	3496.99
19	1978-79	229971	15651	245622	5821.10
20	1979-80	206749	16343	223092	5944.85
21	1980-81	218872	17331	236203	6751.91
22	1981-82	220607	19323	239930	7365.43
23	1982-83	192669	19750	212419	8335.05
24	1983-84	223201	21108	244399	11338.04
25	1984-85	200708	23814	314522	16060.71
26	1985-86	306577	24172	330740	18328.41
27	1986-87	315942	24451	340393	20895.00
28	1987-88	327560	2251	350111	22896.17
29	1988-89	414075	22135	436390	27314.85
30	1989-90	432364	27146	459510	29385.38
31	1990-91	530017	39870	569887	51802.47
32	1991-92	500462	45687	546149	41039.35
33	1992-93	609103	51154	660257	68900.93
34	1993-94	619836	65019	684855	82142.48
35	1994-95	645261	70100	715361	101017.61
36	1995-96	598351	60158	658509	59933.20
37	1996-97	660068	65278	725346	111130.94
38	1997-98	702352	70450	772802	126609.70

The marine fish production in Gujarat has gone up from a mere 7942 tonnes in 1960 – 61 to the highest level ever of 702,000 tonnes in 1997-98, after which it has been registering a declining trend. The marine fish production trend of Gujarat vis-à-vis India is given in Table 4. 10-A.

TABLE 4.10-A: MARINE FISH PRODUCTION TREND OF INDIA AND GUJARAT FROM 1950-51 TO 2000-01 (In lakh Tonnes)

Year	India	Growth Rate	Gujarat	Growth Rate	% share of Gujarat
1950-51	5.34	0.00	0.00	0.00	0.00
1960-61	8.80	6.48	0.79	0.00	8.98
1970-71	10.86	2.34	1.51	9.11	13.90
1980-81	15.55	4.32	2.19	4.50	14.08
1990-91	23.00	4.79	5.00	12.83	21.74
1999-00	28.34	5.12	6.70	21.38	23.64
2000-01	--	--	6.20	-7.46	-

Source: Gujarat Fisheries Statistics – 2000-01

Between 1960-61 and 1970-71, the growth in marine fish landing in Gujarat was 90.36%. The decennial growth from 1970 – 71 to 1980-81 was 44.77% while the same during 1980-81 to 1990-91 was a record 128.66%. But the decade 1990-91 to 2000-01 saw the lowest growth rate of 23.98% although he annual fish landing in 1997-98 was the highest ever achieved. This period saw Gujarat reaching the highest position in the country among all the coastal States in marine fish production. The increase in production was mainly due to the introduction of FRP boats, and intensification of mechanised fishing by adding more gill-netters and trawlers. The reduction in the cod-end mesh-size and shifting of fishing operation to the North-Western virgin fishing grounds off Kutchh are other reasons for the spurt in production.

Veraval, Mangrol and Porbandar contributed the largest share of fish landed in Gujarat. This is followed by Valsad, Kutchh, Jamnagar and Amreli districts. The district-wise landing of marine fish in Gujarat during 2000-01 is given in table 4.11.

TABLE 4.11: District wise contribution of marine fish landing in Gujarat–2000-01

District	Landing (Tonnes)	Share (%)
Junagadh	318340	53.27
Valsad	93194	12.93
Kutchh	64697	11.18
Jamnagar	72552	10.68
Amreli	52166	09.39
Bhavnagar	4640	00.57
Surat	9681	01.31
Bharuch	2046	00.33
Anand	1442	00.22
Rajkot	1716	00.12
Total	620474	100.00

Source: Gujarat Fisheries Statistics – 2000-01.

According to the Fishery Survey of India (Bulletin 20 and 25) Gujarat has an MSY of 2.5 lakh tones of midwater and 4.5 lakh tones of demersal marine fish resource. Against this annual potential the yield was 7.03 lakh tones in 1997-98, surpassing the MSY. The production continues constantly above 6.00 lakh tones in the last few years. Therefore, there is no scope for further expansion of fishing activity in the cost off Gujarat in a sustainable manner, particularly from the in-shore continental shelf area.

The catch composition of marine fish in Gujarat has undergone substantial qualitative change over the years. The catch consists of demersal, columnar and pelagic species. Their composition for selected years since 1960-19661 is given in Table 4.12.

TABLE 4.12: THE CATCH COMPOSITION OF MARINE FISH LANDING IN GUJARAT FOR SELECTED YEARS

Year	Demersal Species [Catch in tonnes & Percentage in Total]	Columnar/Pelagic Species (Catch in tonnes & Percentage in Total)	Other Species (Catch in Tonnes & Percentage in total)
1960-61	22181 [27.93]	39570 [43.83]	17661 [22.24]
1970-71	31107 [20.57]	69002 [45.64]]	51081 [33.79]
1980-81	95629 [43.69]	86404 [39.48]	36839 [16.83]
1990-91	248609 [49.68]	182731 [36.51]	69122 [13.81]
2000-01	293433 [47.29]	133332 [21.49]	193709 [31.22]

Source: Gujarat Fisheries – 2001-2001.

It may be seen that there was a trend of constantly higher percentage share of demersal species than the others since 1980-81 onwards. This can be attributed to the enhanced bottom trawling introduced in the fishery since the late seventies. It also indicates the need for stepping up mid-water fishing to reduce the pressure on bottom trawling.

The catch composition and the decadal change over five decades of selected varieties of fish species that are commercially important is given in Table 4.13. In the sixties, the share of prime quality finfish was quite substantial constituting 25% of the total catch. The less important finfish was about 30%, crustaceans about 10% and the low value fish about 35%. But with the increase in demand for exportable varieties of fish and increase in fishing effort in the in-shore areas the structure in the groups of landed fish has undergone drastic variation. The share of low value fin fish like croaker, anchovy, ribbon fish, eels, etc has gone up to about 55%. But the contribution of prime quality fin fish like pomfrets, seer, mullet etc. has come down to about 10%.

The new entrants like cephalopods have registered a share of 4% while the export-oriented crustacean varieties has gone up to 10%, by the decade ending 2000-01. It is a distinct characteristic of Gujarat marine catch composition that five comparatively low value fish varieties, viz. Bombay duck, croacker, ribbonfish, coilia and non-penaeid shrimps constitute about 67% of the total catch whereas, they constitute only about 20% in the landings of the rest of the country (Devaraj et al, 2001).

A disturbing feature that emerges now is the presence of substantial quantities of early juveniles and sub-adults of several commercially important fishes in the catch. The indiscriminate fishing of whale sharks, for its fins and liver along the Gujarat coast is yet another matter of concern. They are an endangered species and conservation measures are required to be taken urgently by the Government. The CMFRI have identified 9 species including pomfrets and ribbon fish are quite distressed in their stock. A few more species may also be very distressed but it is difficult to establish their status beyond doubt as the gears used are not species specific to ascertain which are the particular varieties facing decline.

TABLE 4.13: CATCH COMPOSITION OF SELECTED VARIETIES OF FISH SPECIES SHOWING DECADAL CHANGE

Fish Variety	1960-61	1970-71	1980-81	1990-91	2000-01
White Pomfret	3413 [04.30]	6199 [04.10]	9539 [04.36]	10694 [02.14]	9169 [01.48]
Black Pomfret	1699 [02.14]	4432 [02.93]	3248 [1.48]	2141 [00.43]	2567 [00.41]
Bombay Duck	22320 [29.37]	48411 [32.02]	36270 [16.57]	72712 [14.53]	86085 [13.87]
Crocker (Dhoma)	4657 [05.86]	5054 [03.34]	59999 [27.41]	184851 [36.94]	197006 [31.75]
Prawn/Shrimp	2337 [02.94]	9532 [06.30]	8550 [03.90]	10724 [02.31]	9013 [08.70]
Cephalopod	00.00 [00.00]	00.00 [00.00]	5182 [02.37]	12380 [02.47]	22857 [03.68]
Jew Fish	13397 [16.87]	10630 [07.03]	5848 [02.67]	13010 [02.60]	8814 [01.47]
Elasmobranches	1790 [02.25]	5891 [03.90]	6306 [02.88]	9580 [01.90]	14079 [02.27]
Clupaeids	6909 [08.70]	5919 [03.91]	5518 [02.52]	7773 [01.55]	11186 [01.82]
Golden Anchovy (Coilia)	3736 [04.70]	3029 [02.00]	7631 [03.49]	16648 [03.33]	2694 [00.43]
Perch	[00.00] [00.00]	00.00 [00.00]	560 [00.26]	3805 [00.76]	6942 [01.12]
Seer Fish	00.00 [00.00]	00.00 [00.00]	4169 [01.27]	6331 [01.27]	7706 [00.34]
Thread Fin	00.00 [00.00]	00.00 [00.00]	206 [00.09]	2328 [00.47]	2079 [00.34]
Catfish	946 [01.19]	2093 [01.38]	6625 [03.03]	12435 [02.48]	19568 [03.15]
Ribbon Fish	00.00 [00.00]	00.00 [00.00]	4104 [01.88]	40906 [08.17]	38429 [06.19]
Total Marine Fish Landing of the State	79412	151190	218872	500462	620474

[The Figures in Tonnes and the figures in the parenthesis indicate the percentage in the total marine catch)

Source: Gujarat Fisheries Statistics – 200-2001.

Deep Sea Fishing in Gujarat

Surveys off Gujarat coast have established that there are abundant deep sea demersal resources. These stocks consist mainly of thread fin bream, bulls eye, skates, cat fish, ribbon fish, Indian drift fish etc. But there were no fishing vessels or trained manpower for harnessing these resources. When the Govt. of India announced the deep sea fishing policy during 1972-73, the Gujarat Fisheries Development Corporation (GFDC), one of the public sector undertakings of the State Government, opted for procuring two Mexican trawlers, which were basically deep-sea shrimpers. These two vessels were procured and commissioned in January 1979. They started outrigger shrimping operation from Porbandar, but the shrimp catch was found to be poor. The operation was discontinued, as they were commercially unviable. It was then that all the Mexican vessels, owned and operated both by private entrepreneurs and Government companies, found the highly lucrative shrimp fishery in the sand head grounds off Visakhapatnam, in Andhra Pradesh. The two vessels of Gujarat also joined them and their operations turned out to be very profitable. Even though commercially the operations were beneficial to GFDC, the prime objective of State interventions through the PSU to develop the deep-sea fishing activities, off Gujarat coast was defeated since the vessels did not operate in the north west coast.

The GFDC also chartered five pairs of deep-sea bull trawlers from Singapore in 1983, under the Charter Fishing policy of Govt. of India. They were in operation between June 1983 and June 1988. The operations were successful and proved the commercial viability of deep-sea fishing off Gujarat coast. The catch composition consisted of pomfret, shark, croakers, snapper, eel, mackerel, barracuda, lizard fish, squid, cuttlefish, etc. Under the then Charter Policy of Govt. of India, about 80 deep sea vessels were in operation off the Saurashtra and Kutchh, coasts especially in the winter months, thereby proving the abundance of valuable resource in this region.

Except for this knowledge about the viability of deep sea operations, fisheries sector in Gujarat did not benefit from the deep sea fishing policy of the Central Government, announced from time to time.

Taking a cue from this, it is essential to expand fishing operations to the deep sea and contiguous areas in the north west coast without any lapse of time. For this purpose, appropriate policy measures are required to be taken by the Central Government. Besides, there is a severe shortage of onshore landing and berthing facility for such large ocean going vessels. The fish catch is also different from the conventional species, available in large quantities. Specialised processing facilities have to be set up for value added diversified products made out of this new resource. The domestic market is not adequately developed for non-conventional varieties of deep-sea fish. It warrants focused effort to develop domestic market for such products.

There is further scope for augmenting fish production along Gujarat coast through deep sea fishing by establishing new fisheries through mid-water trawling, squid jigging and tuna long lining. Though the number of commercially important deep sea species is limited, their availability is abundant. (Somavanshi, 2001). Larger vessels with modern equipments, new technology, and shore based processing facilities are required for developing this resource. Two other areas of prime importance are technological upgradation of those existing fishing vessels which can be converted into deep sea fishing vessels, and creation of trained manpower for deep sea fishing operations, particularly in diversified fishery technologies. It is a sunrise sector, where State intervention is urgently warranted. Focusing in deep sea fishing is important as a strategy for Gujarat, since there is no scope for expansion of fishing activity in a sustainable manner in the inner continental shelf area.

Use flow of Fish Landed in Gujarat

The fish produced in Gujarat are mostly used for domestic consumption outside the State or for export purposes. There is a dearth of disaggregated statistics on the use flow of marine fish landed in Gujarat. According to the statistical documents of the State Fisheries Commissionarate, there has been fluctuations in the use pattern from year to year. The details for the last few years is given in Table 4.14.

TABLE 4-14 DETAILS OF USE FLOW PATTERN OF FISH IN GUJARAT 1993-94 TO 2000-01

Year	Fresh Fish (Tonnes)	Dried Fish (Tonnes)	Fish Meal (Tonnes)	Fish Manure (Tonnes)	Fins & Maws (Tonnes)
1993-1994	20281	33701	25648	1179	116
1994-1995	25149	34428	25385	1354	102
1995-1996	19037	36772	23541	1001	130
1996-1997	31032	35059	15787	1360	414
1997-1998	15424	36915	15746	1519	87
1998-1999	15818	20091	4849	1171	10
1999-2000	11708	22508	3985	1129	15
2000-2001	12734	18985	4061	1427	28

Source: Gujarat Fisheries Statistics – 2000-01.

Consumption of Fish in Gujarat

Fish does not play a substantial role in the food security of Gujarat, as local consumption of fish has been believed to be very low. But of late the consumption seems to have gone up as reported by the Gujarat State Commissionarate of Fisheries. The total consumption and the per capita consumption has been fluctuating although it has registered an increase from the 1991-92 level as evident from Table 4.15.

TABLE 4.15 PER CAPITA FISH CONSUMPTION IN GUJARAT 1990-91 TO 2000-01

Year	State's Fish Consumption (Tonnes)	Population Estimates (Lakhs)	Per Capita Consumption (Kg/Year)
1991-92	153662	413	03.72
1992-93	217314	425	05.11
1993-94	339030	433	07.83
1994-95	304898	440	06.93
1995-96	250649	448	05.59
1996-97	308002	457	06.74
1997-98	360485	464	07.77
1998-99	415073	478	08.68
1999-00	523910	495	10.58
2000-01	417102	505	08.26

Source: Gujarat Fisheries Statistics – 2000-01.

The domestic consumption is in the form of fresh fish or dry fish. Dry edible fish in Gujarat is mostly consumed in the tribal pockets and urban centres like Ahmedabad, Baroda, Surat and in smaller towns in the hinterland. A major part of the dry edible fish is transported out of the State to the Sewri market in Mumbai, from where it is dispatched to various centres, even to the North Eastern States and Southern States of the country.

From the landing centres, fish is carried to the assembly centres, on head loads of baskets, hand carts, three wheelers, mini trucks etc., from where it is transported either by rail or road to the hinterland markets. Sale of fish by weight has come into wider practice. Weighing and grading has become a common practice in the State. Dry fish is packed in bundles and fresh fish is ice packed generally in tea chests. Now refrigerated vans have been pressed into service, mainly to transport processed fish for export purposes. The transportation infrastructure is grossly inadequate for marketing of fresh fish to the remote areas in good quality and in hygienic conditions. Cold chains, cold storages, retail market outlets in hygienic conditions are yet to be set up in adequate numbers to cater the domestic market. The difficulties being experienced in the

domestic fish marketing have been brought out elsewhere in, Chapter-3. State intervention as a facilitator for private sector investment in setting up modern domestic fish-marketing infrastructure network deserves priority action.

Since 1996-97 the total share of fish sent out of Gujarat, including export have shown a downward trend, indicating a higher consumption within the State. According to the estimates of Commissionarate of Fisheries, Govt. of Gujarat, the share was as low as 31.11% in 2000-01. The details are given in Table 4.16.

TABLE 4. 16: YEAR WISE DISTRIBUTION OF FISH PRODUCED IN GUJARAT – 1993-94 TO 2000-01.

Year	Total Production of the State (Tonnes)	State's Consumption (Tonnes)	Share (Percent)	Fish diverted outside the State including the overseas export (Tonnes)	Share (Percent)
1993-94	684855	339030	49.50	345825	50.50
1994-95	715361	304898	42.62	410463	57.38
1995-96	658509	250649	38.06	407860	61.94
1996-97	725346	308002	42.46	417344	57.54
1997-98	772802	360485	46.65	412320	53.35
1998-99	631728	415073	65.70	216655	34.30
1999-00	741281	523910	70.68	217371	29.32
2000-01	661064	415771	62.89	245293	37.11

Source: Gujarat Fisheries Statistics – 2000-01.

The increase in consumption of fish within the State, contrary to what has been generally believed, brings to the fore the importance of the fisheries sector vis-à-vis the food security and protein needs of the State. The positive trend towards the growth of domestic consumption also indicates the expansion of marketing network and creation of more employment opportunities in the marketing of fish.

The Price-spread

The price spread at Veraval was found to be very high during periods of low price and high catch, and low during high price and low catch season. (Gopal et al, 2001). This phenomenon is due to the consumer's choice for a price limit. When the catch is low and price high, the marketing margin is kept low whereas when the catch is high and prices low at the landing sites, the marketing margin is kept high. The benefit of lower price at the landing centres is not shared with the consumer or the producer by the marketing functionaries, creating a bigger price spread, taking away the large share of the benefits of lower prices. There is a vast difference in the price spread, assuming that the marketing cost per kg. of fish is the same.

Marketing studies in 1996-97 at an all India level, report that the fishermen's share in the consumer's rupee ranges from 30% to 68% depending on the species/group of marine fish (Sathiadas, 1998). Marketing costs including transportation varies from 6 to 13%. The wholesalers get 5 to 32% and the retailers 14 to 47% of the consumers' rupee. State wise analysis indicates that the fishermen in Gujarat get 37 to 83% of the consumer's rupee while in Maharashtra it is 36 to 81%. This improvement in the share of consumer rupee for fishermen in Gujarat, is a progressive trend.

The State intervention has not been effective in the marketing of fish, especially in the domestic market. The cooperative societies and the public sector undertakings of the State Govt. have made some efforts towards market intervention but they have not created any major impact. A different strategy is required, to realise a better price for the producer, through greater involvement of the fishermen in marketing effort. The prevailing system in Gujarat, where the catch of traditional small fishermen is bonded to wholesalers who are also moneylenders, makes it difficult to ensure a better share of the price spread to the producers. Breaking such a nexus is not an easy task. There is no regular established system to provide information on the ruling prices to the fishermen, enabling them to bargain with the traders. But Gordon (1998) has observed, that information about prices does little to improve the bargaining position of the fishermen. However, there are interesting reports of fishermen of late using mobile phones from their boats in the sea to ascertain market conditions especially of prices to their advantage – indeed a benefit of modern communication facility. Suitable legislation for establishing a system of transparent sale of fish at the landing site, creating awareness amongst the producers, enhancing their carrying capacity, and a viable credit system would go a long way in improving the situation. Formation of Self Help Groups of primary producers, building up their credit worthiness, and confidence amongst financing institutions are the primary tasks required to be undertaken by the state sponsored development promotional agencies, on a priority basis.

Exports of Marine Products from Gujarat

Marine products used to be exported from Gujarat coasts, even before organized efforts were made in this direction under the aegis of the Govt. agencies. Sun dried and salt cured

Bombay duck, shark fins, golden anchovy, and air bladder of jew fish, thread fin, etc. were the major products of export in the earlier days, to Sri Lanka, Singapore, Malaysia, etc.

Exports started picking up with the beginning of trawling in the Gujarat coast. With the landing of exportable varieties of fish and shrimp, freezing plants were set up in Veraval and Porbandar in the early '70s. In the initial days the exports were through the Bombay port. By 1972-73, direct export of fish began from the Gujarat coasts, through Veraval, Porbandar, Kandla and Okha Ports. The exports have been registering a steady growth as can be seen from the details given in Table 4.17.

TABLE 4.17: THE GROWTH OF EXPORT OF MARINE PRODUCTS AND THE SHARE OF GUJARAT VIS-À-VIS THE COUNTRY

Year	India (Quantity – Tonnes)	Gujarat (Quantity – Tonnes)	Share of Gujarat (%)	India (Value – Crores Rs.)	Gujarat (Value – Crores Rs.)	Share of Gujarat (%)
1971-72	35903	208	00.59	04.55	00.40	00.99
1972-73	38903	352	00.90	59.72	00.73	01.22
1982-83	78175	5341	06.83	361.36	17.48	04.84
1990-91	139419	22155	15.89	893.37	00.73	01.22
1991-92	171820	30547	17.78	1375.89	132.84	09.65
1992-93	209025	44478	21.28	1768.56	190.12	10.75
1993-94	243960	59897	24.55	2503.62	275.65	11.01
1994-95	307337	86987	28.30	3575.27	417.84	11.69
1995-96	296277	81603	27.54	3501.11	388.20	11.09
1996-97	378199	123213	32.58	4121.36	570.58	13.84
1997-98	385818	125561	32.54	4697.48	637.85	13.58
1998-99	302934	70432	23.25	4626.87	367.46	07.94
1999-00	343031	74618	21.75	5116.67	389.38	07.61
2000-01	440473	121159	28.19	6443.89	615.65	09.55

Source: - Gujarat Fisheries Statistics – 2000-01.

The export basket of marine products from Gujarat has undergone substantial changes. From the export of dry fish in the '60s it has graduated to exporting high value added IQF shrimp

products in the '80s. The predominance of shrimp and high value fin fishes continued, up to the mid nineties. Since then there has been a decline in shrimp exports. Instead, fin fish; squid and cuttlefish became the major constituents of exports from the State. The product wise export from Gujarat is given in Table 4.18. The trend since 1994-95 shows that increase in export from Gujarat was from the frozen finfish category. The highest export from Gujarat was in 1997-98 when the share of finfish was 58.94% while that of shrimp was only 18.63%.

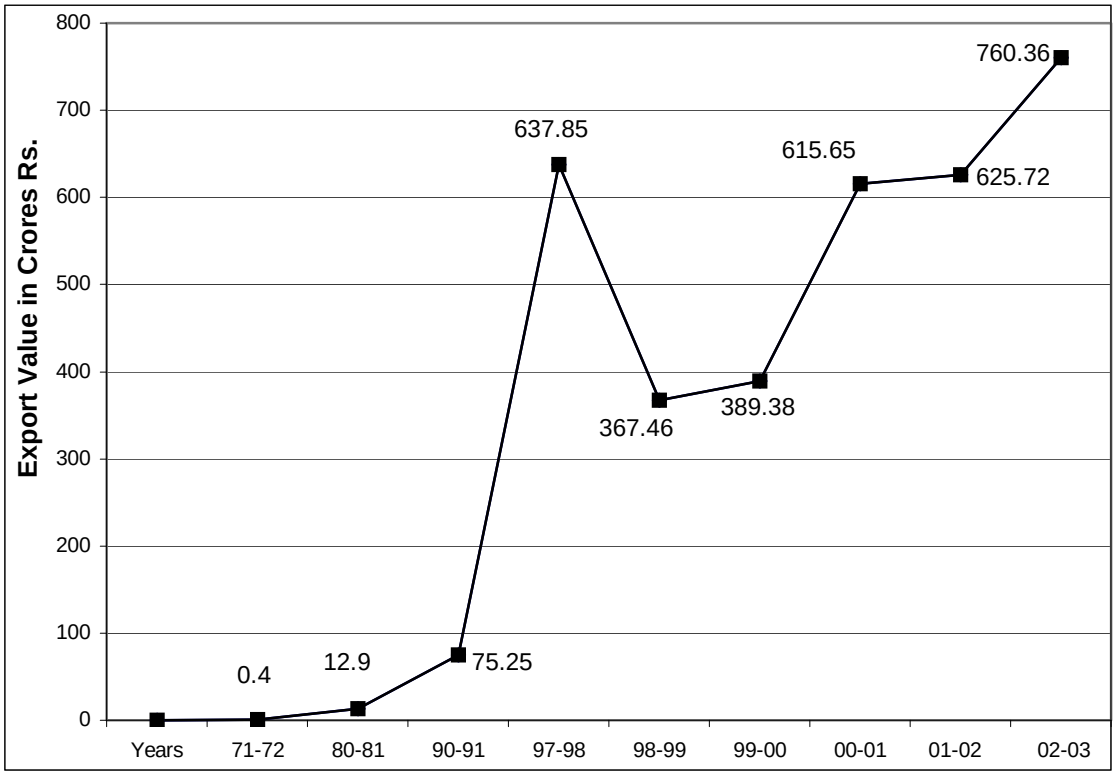
TABLE 4. 18: PRODUCT WISE EXPORT OF MARINE PRODUCTS FROM GUJARAT – 1992-93 TO 2000-01 (Quantity in Tonnes & Value in Rs. Crores)

Year	Frozen Shrimp	Frozen Lobster	Fr.Cuttle/ Fillets	Frozen Squid	Frozen Fish	Surumi	Dried Items	Others	Total Exports
92-93									
Qty	4808	632	3195	6714	28133	00.00	00.00	96	43578
Value	55.64	16.78	12.62	26.17	74.08	00.00	00.11	00.11	185.40
93-94									
Qty.	5255	518	6100	5066	42498	00.00	00.00	356	59793
Value	78.72	14.18	33.28	22.58	119.34	00.00	00.00	01.36	269.46
94-95									
Qty.	7773	410	7614	9990	60741	00.00	00.00	459	86897
Value	122.12	16.16	45.07	46.44	186.46	00.00	00.00	01.89	417.84
95-96									
Qty.	5295	516	6417	10577	59223	00.00	00.00	530	82558
Value	88.97	18.83	35.15	54.88	194.47	00.00	00.00	02.98	395.28
96-97									
Qty.	5969	388	7451	14188	91816	00.00	00.00	3401	123213
Value	05.03	15.35	45.40	74.72	317.88	00.00	00.00	22.20	570.58
97-98									
Qty.	6275	380	7630	9432	97195	00.00	00.00	4649	125561
Value	118.89	14.01	55.07	50.14	375.97	00.00	00.00	23.77	637.85
98-99									
Qty.	4951	304	6475	8099	46129	00.00	00.00	4474	70432
Value	80.84	10.21	33.24	46.62	170.98	00.00	00.00	25.56	367.45
99-00									
Qty.	2806	225	3705	8229	53361	4831	1383	79	74619
Value	48.50	10.06	21.22	50.38	215.04	35.67	08.12	00.39	389.38
00-01									
Qty.	2886	110	13066	8331	74300	6968	841	17657	124159
Value	55.79	06.06	80.22	52.03	333.90	44.14	04.68	39.02	615.64

Source: Gujarat Fisheries Statistics – 2000-01.

The export from Gujarat had registered a drastic decline in 1998-99 and 1999-2000. But the exports have recovered in 2000-01. A noteworthy development is the growing trend in the exports of surimi, a value added non-conventional product from Gujarat. It shows that there is good scope for non-traditional value added products from Gujarat for export market. Further expansion in processing capacity required, if any, should be in this direction only. The chart 4-1 indicates the trend in exports in terms of value from Gujarat over the years.

CHART – 4.1 EXPORT TREND IN TERMS OF VALUE



Source: Gujarat Fisheries Statistics – 2002-03

Mechanisation of Fishing Crafts

The fishing fleet in Gujarat coast consists of non-mechanised traditional crafts, motorised traditional crafts and mechanised trawlers. The composition of the present fleet is given in Table 4.19.

TABLE 4. 19: THE COMPOSITION OF FISHING FLEET IN GUJARAT (2002-03)

Type of Fleet	Nos.
Traditional	10430
Motorised	7809
Mechanised	11859
Total	30098

Source: Gujarat Fisheries Statistics – 2002-03.

The crafts in the marine sector are of the following types

i. Traditional non-mechanised boats like flat bottom canoes, vahans, lodhiyas, machhwas, hodis, etc.

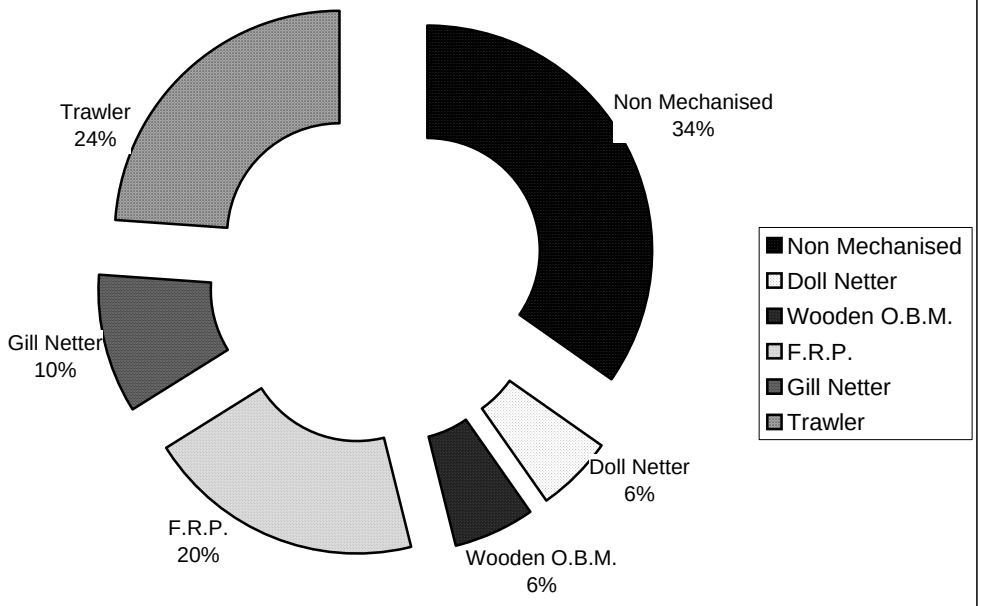
ii. Wooden dugout canoes with OBMs

iii. Wooden bag netters, (dol) gill netters with OAL ranging from 10 to 14.8 metres fitted with IBMs or OBMs.

iv. Trawlers with OAL ranging from 14.8 metres and above.

The chart 4.2 indicates the category wise fishing fleet of Gujarat as in 2002-2003

Chart 4.2 Categorywise Fishing Fleet of Gujarat at 2002-03



Source: Gujarat Fisheries Statistics – 2002-03

The non-mechanised traditional boats are the mainstay for the livelihood of the lower end artisanal fishermen who still continue to be in the subsistence level. These non-mechanised crafts consist of dugout canoes, keeled and planged boats, and flat bottom boats. They may be made of wood or FRP and are designed to meet the specific characteristics of the shore. The growth in the number of non-mechanised boats has been comparatively lower than that of the mechanised boats, as can be seen from Table 4. 20.

TABLE 4. 20: GROWTH OF MECHANISED AND NON-MECHANISED BOATS REGISTERED IN GUJARAT

Year	Mechanised Boats	Non-mechanised Boats	Total
1960-61	314	3217	3531
1970-71	1254	3691	4945
1980-81	3459	6023	9482
1990-91	8140	8677	16817
2000-01	18536	10170	28706
2001-02	19092	10414	20506
2002-03	19668	10430	30098

Source: Gujarat Fisheries Statistics, 2000-01

In 1960-61 the share of non-mechanised boats was as high as 91%. It has declined to 63% in 1984-85, 40% in 1994-95 and 35.43% in 2000-01. At the same time the share of mechanised boats has increased to 64.57%. The average growth rate of mechanised boats in the last one decade was 9.34% as against 0.64% of the non-mechanised boats (Anon, 2002 d). By the year 1991-92 the number of mechanised boats was more than the non-mechanised boats.

Fish-production by Different Categories of Boats

The marine fish production from powered and non-powered crafts has also undergone change as is evident from the Table 4. 20-A.

TABLE 4. 20-A: DETAILS OF PRODUCTION BY DIFFERENT CATEGORIES OF VESSELS 2000-01 (in tonnes)

1	Mechanised trawlers	403295	65.00 %
2.	Motorised/Gill/Doll nets	154650	24.92%
3.	OBM with FRP/Wooden	38247	6.16%
4.	Non-powered traditional	24282	3.91%
	T o t a l	620474	100.00%

Source: Gujarat Fisheries Statistics – 2000-01.

Motorisation and mechanisation were the major instruments of state intervention in the development of marine fisheries in Gujarat, which has resulted in the rapid increase in fish production. Motorisation was started as early as in the '50s during the days of the erstwhile Saurashtra State, when it had received a few low horse power out board motors (OBM) and inboard engines through a Technical Cooperation Mission (TCM). The first motorisation was on a 25 ft. dugout canoe (hodi) in the Jaleswar village near Veraval with a 3 HP OBM.

The first inboard engine was a 6 HP Saab fitted in a "lodhiya" vessel of Veraval in the year 1956. This was followed by introduction of a mechanisation programme through a loan and subsidy scheme of the Government. With mechanisation it became necessary to modify the traditional vessels in their design and structure. The first 20 mechanised boats were introduced with improved hull designs in consultation with the FAO expert Mr. Paul Zeiver, a naval architect. The mechanisation was only an improvisation of the existing vessels and very little new designing has gone into the boat building technology.

To impart training in the new method of fishing a Fishermen Training Centre was established at Veraval in 1956. Fishermen youth were selected and trained on board a 46 ft. long vessel. Six more 33 ft. long boats were introduced in 1961 by the Government for demonstration of fishing mostly using gill nets. The period 1961-66 saw intensification of motorisation using OBMs. Motorisation as an intermediate technology, was proved to be generally successful as it has enhanced the viability of the artisanal fishery

In 1962, the State Department of fisheries introduced three trawler cum gill netters of 14.8m, OAL for demonstration cum exploration. The result of their operations off Kutchh, Saurashtra and South Gujarat coasts for demersal fish up to 35 fathoms was very encouraging. They demonstrated the methodology of stern trawling for demersal fish and the economic viability of the operations. This was a turning point in the history of modernisation of marine fishing in Gujarat. The mechanisation was generally accepted and trawling was gradually gaining momentum. The implementation of the World Bank aided fishery project in the State gave further impetus for mechanisation of boats using inboard engines. The increase in demand for shrimp, mainly for export purposes, better catch and enhanced returns, availability of credit and assistance by way of subsidy from the State and financial institutions paved the way for rapid growth in the size of the fishing fleet. The growth of fishing boats registered in Gujarat is given in Table 4. 21.

TABLE-4. 21 ANNUAL GROWTH OF FISHING BOATS REGISTERED IN GUJARAT

Year	Trawler Fishing Boats	Gillnetter Fishing Boats	Fiber glass Boats	Wooden Canoes (OBM)	Others (Doll Netters)	Total Mecha-nised	Total non-mecha-nised	Total
1980-81	1781	622	0	843	213	3459	6023	9482
1981-82	1780	672	0	908	247	3607		
1982-83	1705	721	0	1343	247	4016		
1983-84	1757	774	0	1458	256	4245		
1984-85	1855	867	0	1566	289	4577		
1985-86	1919	956	0	1673	310	4858		
1986-87	2062	1050	0	1854	347	5313		
1987-88	2230	1124	226	1776	359	5715		
1988-89	2522	1756	492	1806	427	7003		
1989-90	2712	1770	859	1822	486	7649		
1990-91	2814	1946	1044	1838	498	8140	8677	16817
1991-92	3055	2211	1386	1862	510	9024		
1992-93	3456	2315	1618	1957	524	9870		
1993-94	3941	3058	2161	1813	530	11503		
1994-95	4634	3110	2545	1814	545	12648		
1995-96	5685	3143	2810	1817	562	14017	8646	22663
1996-97	6027	3205	3012	1827	600	14671	8851	23522
1997-98	6390	3275	3551	1854	628	15698	8918	24616
1998-99	6749	3482	3998	1899	635	16763	9222	25985
1999-00	6787	3764	4347	1895	663	17456	8819	26275
2000-01	6948	3375	5162	1813	1238	18536	10170	28706
%	24.20	11.76	17.98	6.32	4.31	64.57	35.43	100

Source: Gujarat Fisheries Statistics 2000-01

The trawlers being generally used in Gujarat are 12.72 to 14.8m OAL which are found suitable for operation even up to 70 m. depth and for voyages up to 5 days duration. They can be used both as trawlers and gill-netters depending on the availability of catch.

Reasons for Growth in Mechanisation

The comprehensive growth of mechanisation was the result of various encouraging factors.

i The comparatively easy availability of institutional credit on liberal terms and Govt. subsidy.

ii The high profitability achieved by the initial investors and the low investment on mechanisation.

iii The rising price of fish, making it attractive to the producers.

iv The increasing demand for export market, especially generated through shrimp resources.

The mechanisation had an impact on almost every aspect of the fishermen's life and activity – in the socio-economic conditions, production technology, production, utilisation, marketing and saving behaviour of households (Srivastava et al, 1986).

The most significant feature was that, the benefits of motorisation/mechanisation in Gujarat went largely to traditional fishermen than to non-fishermen unlike in several other States. Notwithstanding the charge that it benefited the better off than the poorer ones, this was a positive feature of the modernisation programme in the Gujarat marine fisheries sector.

The modernisation brought changes in the wage payment system- from sharing to fixed money wages in the mechanised boats.

The traditional technology, especially in the use of cotton yarn in making fishing nets was replaced by modern synthetic yarn. Although this had affected the village industry based on cotton yarn, the use of synthetic yarn enhanced the efficiency, life of the net, number of units carried in the craft, and depth of operation bringing in better profitability, for both mechanised and non-mechanised boats. (Pravin et al, 1998).

The modernisation involving mechanisation also brought along with it modern shore facilities in the areas of handling, processing and marketing. This has in turn led to the creation of modern infrastructure in major fish landing centres converting them into urban port towns. Mechanisation has been the harbinger for development of entrepreneurship and industrialization in the major fishery centres of Veraval, Porbandar, Mangrol and Okha.

In short, the State induced mechanisation programme had several benefits – economic efficiency, favourable income and asset distribution, increased employment and better availability of fish for domestic consumption.

Impact of Mechanisation

The rapid growth in the number of mechanised vessels has had both positive and negative impact on the marine fisheries of Gujarat. The total fish production has increased considerably over the years, but the composition and quality have undergone substantial changes. The bottom trawlers produce about 71% of the total marine fish landings in Gujarat. They use nets with a cod-end mesh size as small as 10 m.m. The effective trawling time is about 2 hours. Because of the

small mesh size, juveniles of prime varieties of fish and small size fishes get caught as by-catches causing ecological imbalance and reduction in future yield. As a result, there has been a reduction in average catch per trip. The details are given in the Table 4. 22. The trawlers are engaged in multi-day fishing mainly for prawn and cephalopods. In that process large quantities of by-catches are being discarded in the sea itself. This goes on unabated in the absence of any effective regulatory mechanism for resource managements.

TABLE 4. 22 AVERAGE CATCH PER TRIP OF DIFFERENT CATEGORIES OF FISHING CRAFTS

Year	Trawler (Kg)	Gill/Bag Netter (Kg)	Dugout (OBM) (Kg)	Non-Mechanised boats (Kg)
1991-92	1754	429	162	138
1992-93	1733	491	116	172
1993-94	1656	403	115	204
1994-95	1808	390	99	183
1995-96	1618	371	120	266
1996-97	1559	400	122	299
1997-98	1702	293	136	232
1998-99	1477	337	86	149
1999-00	1576	307	110	142
2000-01	1393	361	127	220

Source: Gujarat Fisheries Statistics 2000-01

The National Level Review Committee Anon, 2000-e) to assess the area-wise requirement of different categories of fishing vessels below 20 m. OAL (2000) has opined that there is little scope for expansion of traditional types of mechanised vessels. The Committee suggested addition of new generation resource specific fishing vessels of about 18 m. OAL including trawlers and gill netters-cum-long liners. According to the recommendations of the Committee 4000

motorised and 75 mechanised fishing vessels could be added to the Gujarat fleet. With this addition, the fleet strength of Gujarat available at the end of the IXth Plan period (1997-2002) is expected to be as follows: -

1	Traditional	-	8370
2.	Motorised	-	8283
3.	Mechanised	-	8440
	Total	-	25093

Per-capita Availability of Fishing Area

With the increase in fishing vessels and unrestricted entry of fishermen, the per capita availability of fishing area has been reduced considerably as evident from the Table 4. 23. The data shows that the number of mechanised boats surpassed that of non-mechanised boats by the year 1991 and the trend continued thereafter, while the growth of non-mechanised boats was marginal. The mechanisation aided by State support led to rapid increase in the number of fishing crafts. The pace of growth in mechanised vessels was faster than growth in fish production. This has led to a decline in Catch Per Unit Effort (CPUE). But the mechanisation spree continued unabated on account of the increase in price of fish arising out of higher demand for both domestic and export purposes. In fact it is the export orientation of marine products that has laid the path for rapid mechanisation and expansion of the fishing fleet.

TABLE 4.23: AREA (IN HA) OF INSHORE AND OFFSHORE SEAS AVAILABLE PER ACTIVE FISHERMEN AND FISHING BOAT

	Area available per fishing unit (ha)		Area available per active fishermen (ha)	
	Inshore (0.50 m) depth	Offshore (50-200 M.) depth	Inshore (0.50 m) depth	Offshore (50-200 M.) depth
I. Off Gujarat				
1961-62	1453	2214	554	843
1976-77	1095	1669	288	439
1980-81	862	1314	177	271
1990-91	499	760	136	207
II. In Indian seas as a whole				
1961-62			77	215
1976-77			56	157
1980-81			44	122
1990-91			28	76
1995-96			18	50

Source: M.Devaraj et.al 2001

The area available per active fisherman in Gujarat has declined from 554 ha to 136 ha in the inshore areas and from 843 ha to 207 ha in the offshore areas, over a period of 3 decades. But the decline in area was more sharper on an all India basis (Devaraj et al 2001). Therefore, the area available for Gujarat fishermen is estimated to be more than what is available for those in other parts of the country.

The construction of fishing vessels continues unabated especially in the boatyards of Junagadh and Porbandar districts. Now that the fleet size has reached its maximum recommended level, further addition has to be discontinued without any delay. Thereafter new boats have to be built only as a replacement for the retired vessels. It is an important decision to rationalize the size of the fishing fleet as a part of an effective management programme. But it may

invite opposition from the boat builders, as well as potential boat owners. Alternative opportunities have to be found out for the boat building yards and the potential owners have to be educated about the possibility of the unviability, if more boats are added to the existing fleet. All kinds of financial assistance and subsidies may be discontinued for building new boats, except in the case of replacements. The fishermen organisations should be effectively used as a vehicle to convey the unviability of further enhancement in the fleet size with traditional type of crafts. It should be made clear to them that unrestricted entry would depress incomes, because the cost of operation would increase while the share of harvest will be reduced, as it will have to be distributed to larger number of participants and that the reproductive capacity of the heavily fished species would be threatened beyond repair affecting replenishment of stock. Creation of awareness along with strict enforcement of mesh size regulation are essential actions required to sustain the Gujarat marine fisheries. Both of these activities are basically the responsibilities of the State Govt. Nonetheless, the preparedness of the State machinery seems doubtful in this regard.

The mechanisation of crafts in Gujarat was smooth, beginning with motorisation of traditional crafts and gradual introduction of mechanised trawlers (Srivastava, et al 1986). This, according to John Kurien and Sebastian Mathew has created a healthy and complementary relationship between the traditional and modern sectors. The level of mechanisation was very low before the active intervention of the State. The State induced introduction of mechanisation has helped in the accelerated growth of fishing effort, productivity and production in Gujarat.

Use of Gears

Fishermen of coastal Gujarat use the traditional gears like cast nets, staked/bag nets, surface/drift gill nets, bottom set/anchored gill nets, etc. which are all generally gears of artisanal fishery. The mechanised gear consists of trawl, gill and 'dol' nets. With the advent of trawling, trawl nets made of synthetic yarn have become popular. Surveys of fishing tackles carried out from time to time shows impressive growth of fishing gears. In the 1977 livestock census, the total number was only 3.35 lakh units. It became 5.13 lakhs in 1982 and 10.56 lakhs in 1988. The 1997 census estimates it as 12.09 lakh units, the details of which are given in Table 4. 24. These figures, however, keep changing as additions and replacements take place often.

TABLE 4.24: THE DETAILS OF FISHING GEAR UNITS IN GUJARAT AS PER 1997, LIVESTOCK CENSUS

Fishing Gear	Operating Units (Nos)	% in total
Trawl nets	22267	01.86
Cast nets	35806	02.96
Bag nets	36902	03.05
Gill/Drift nets	431202	35.68
Stationery nets	682457	56.47

Source: Gujarat Fisheries Statistics – 2000-2001.

In the mid fifties, the gill nets and bag nets were made of cotton yarn. Italian hemp was used in bottom set gill nets and dol nets. Synthetic nylon twine was introduced in Saurashtra in 1955 under the TCM. Its durability and compactness attracted the fishermen who readily accepted the synthetic material, which got established very soon. By 1960, about 50% of the fishermen had started using synthetic twine for net mending. The subsidy provided by the Government has hastened the adoption of modern gear materials. By the late '60s polyethylene twine became

popular, followed by nylon monofilament nets. Their use have been facilitated by the liberal assistance given by Government and the net making factory of the Gujarat Fisheries Central Cooperative Association, which was set up in 1964. This plant is credited to be the biggest net making unit of its kind in the cooperative sector in the country. It has 12 net making machines with an annual capacity to produce 180 tonnes of nets, nylon monofilament twine and HDPE twine. The introduction of synthetic net making materials has helped the sector to modernise fishing gear and to improve the efficiency of operation.

Development of Infrastructure

An area where the impact of State intervention has been very significant was in the development of physical infrastructure. There are about 190 marine fish landing centres in the State located in 179 coastal fishing villages. The details of these landing centres are given in Table 4 .25.

TABLE 4.25: DISTRICT-WISE DISTRIBUTION OF MARINE FISH LANDING CENTRES AND VILLAGES IN GUJARAT

District	Fishing Villages		Landing Centres	
	No.	Percentage	No.	Percentage
Kutch	59	32.96	69	31.58
Rajkot	6	3.35	6	3.16
Jamnagar	20	11.17	20	10.53
Junagadh	24	13.41	26	13.68
Amreli	7	3.91	8	4.21
Kheda	1	0.55	1	0.53
Bhavnagar	5	2.79	6	3.16
\Bharuch	15	8.38	15	7.89
Surat	13	8.38	10	5.26
Valsad	29	16.20	38	20.00

Source: Gujarat Fisheries Statistics – 2000-2001

Out of the total Fish Landing Centres (FLCs), the largest number is in Kutchh district followed by Valsad, Junagadh, Jamnagar and Bharuch. Of these FLCs only 20 have landing facilities like Jetties and Harbours. Others are mostly beach landing centres with no shore facilities worth the name. Veraval was the first fishing harbour developed in the Sate in the early sixties under an FAO project. Further development of Veraval and Mangrol fishing harbours were carried out under a World Bank Integrated Fisheries Project. They were commissioned in 1985 and 1986 respectively. Based on the experience of these projects, another fishing harbour was constructed at Porbandar and commissioned in 1991 with 50% assistance from the Central Govt.

The erstwhile pre-investment Survey for fishing harbours, Bangalore, now known as the Central Institute of Coastal Engineering for Fishing (CICEF) was entrusted with the task of preparing a master plan for development of small fishing harbours along the coast of Gujarat in the early '80s. Accordingly a Master plan was drawn up and their development activities have been taken up in a phased manner. So far 4 fishing harbours and 17 fish landing centres have been commissioned. Of these, the fishing harbours located at Veraval, Mangrol and Porbandar, where modern landing and berthing facilities are provided, have become grossly inadequate with the rapid increase in the number of mechanised boats operating from this coast. The fishing harbours and fish landing centres constructed/commissioned are given in the Table 4. 26. The State Govt. has now prepared a revised master plan for developing 23 fish landing centres, including expansion of some of the existing ones, during the Xth Plan period. This would help provide better facilities for handling fish, ensuring better quality and price, at the same time reducing pressure at some of the existing landing centres. The new landing centres bring about a shift in marketing activity and associated shore activities generating additional job opportunities.

TABLE 4.26: FISHING HARBOURS AND FISH LANDING CENTRES CONSTRUCTED/ COMMISSIONED IN GUJARAT

No.	Name of Fishery harbour/ F.L.C	District	Fisher-men popula-tion	Nos. of Fishing Boats			Fish Production	Sanc-tioned cost
				Mech.	N.Mech	Total		
1	Veraval – FH	Junagadh	24749	3590	29	3616	174792	900.00
2	Porbandar –FH	Porbandar	23219	2424	53	2477	93427	276.00
3	Mangrol I+II-FH	Junagadh	6383	1549	--	1549	36738	901.00
4	Jakhou I+II-FH	Kutch	1038	31	3	34	5390	1143.60
5	Jafrabad I+II-FH	Amreli	17892	290	20	310	42768	25.00
6	Navabandar	Junagadh	10841	236	68	304	42527	163.30
7	Rahoara	Amreli	4768	141	69	210	21564	43.450
8	Umarsadi	Valsad	6899	189	9	198	15455	5.00
9	Mangod dugari	Valsad	3658	85	3	88	9536	38.740
10	Kosamba	Valsad	8470	405	90	495	7212	13.00
11	Vansi borsi	Navsari	3171	105	54	159	6536	16.00
12	Umargaon	Valsad	2176	248	21	269	4505	1.00
13	Onjal	Valsad	5204	204	29	233	4267	42.00
14	Salaya	Jamnagar	5520	291	39	330	3541	17.00
15	Dhamlej	Junagadh	4392	636	8	644	2656	31.00
16	Sachana	Jamnagar	2943	150	28	178	2650	20.00
17	Dholai	Valsad	2481	180	52	232	2097	54.660
18	Kolak	Valsad	3155	22	11	33	1623	4.150
19	Madhwad	Junagadh	4415	390	14	404	1233	17.760
20	Chorwad	Junagadh	2176	320	73	393	688	46.120
21	Hiakot	Junagadh	894	259	--	259	522	0.710

Source:- Handbook of Fisheries Statistics – 2000, Govt. of India, Min. of Agriculture

Creation of infrastructure like, ice and cold storage facilities was a major step towards modernisation. This was initiated through State intervention. The importance of preserving the quality of fish was recognised by the then Governments as early as in the '60s. As a result, five ice plants were set up under the TCM assistance. None of the above ice plants are in existence now. But they paved the way for private sector initiatives in this field, in the years to come which has

helped in modernizing the Fisheries Sector in Gujarat. Several ice and cold storages were set up in the private and cooperative sector subsequently, which today cater to the need of the fishermen.

Development of Ancillary Facilities:

A number of other infrastructure facilities have also come up in the coastal areas providing forward and backward linkages much needed by the marine fishery sector. They include processing units for value added product freezing plants, frozen storages, fish meal plants, fish pulverizing plants, boat building yards, net making plants, service stations, etc. The details of such facilities are given in Table 4.27.

TABLE 4. 27: DETAILS OF ANCILLARY FACILITIES AVAILABLE IN GUJARAT IN THE MARINE FISHERIES SECTOR – 2000-2001

Facility	Total Units (Numbers)	Capacity
Ice Factory	688	12.522 TPD
Cold Storages	247	16.441 Tonne
Freezing Plants	61	4452 TPD
Frozen Storage	56	26.818
Fish Meal Plant	03	413 TPD
Fish Pulverizing Plants	56	1202 TPD
Boat Building Yard	42	380 units/year
Net Making Plants	09	608.9 TPD
Service Stations	69	

Source:- Gujarat Fisheries Statistics 2000-01

Capacity utilisation of processing plants

The fish-processing infrastructure in Gujarat has been built up over the years with the growing demand and incentives provided by the Government. The processed fish is mainly meant for export purposes and very little goes to the domestic market.

There were 61 freezing plants, by the year 2001 with a total capacity of 4452 tonnes per day. But their capacity utilisation has been even less than 20%. Shortage of raw material is cited as the main reason for the poor capacity utilisation. The decline in the availability of exportable varieties of fin fish and non-availability of raw-material from neighbouring States have aggravated the situation. Aquaculture has not been able to fill this gap in Gujarat as is the case elsewhere in the country.

The fish meal plants and the fish pulverizing plants also face similar problems. The situation is not likely to improve unless steps are taken to prevent discarding of by-catches at the sea, and over fishing, especially of the juveniles and sub adults. Besides, further addition of processing capacity for traditional products should be scrupulously prevented. No State assistance should be extended for any traditional processing units. However, value addition for specific markets in the form of IQF, sashimi, etc. may be encouraged. As a change in strategy, the excess capacity now available can be utilized, if the low value fish landed in Gujarat and that discard in the sea is used for producing value added products for the domestic market. That would require, new technological and appropriate changes in the manufacturing process for diversified production. Also needed is developing a market for such processed fish items in the domestic market, which of late has started accepting imported processed fish delicacies at least in the major urban centres. It is an area where State intervention is urgently needed

The economic liberalization and WTO agreements have generally been beneficial to the fishery sector in India, except in the case of certain non-tariff barriers built up by importing countries. The withdrawal of quantitative restrictions enables import of fish from outside the

country. The import tariffs have also come down. This is an option worth considering, especially for producing value added products for export. The idle capacity available with the existing processing plants can thus be utilized fruitfully. This option deserves serious consideration, as there seems to be limited scope of expanding the fishing resources or possibility of substantial increase in production from the Gujarat coast.

Diversification in fishing into deep sea and oceanic areas has to be accompanied by complementary shore facilities. The existing harbour facilities are grossly inadequate and more and better landing facilities, hygienic handling and storage facilities are required to be built up. The Govt. of Gujarat has been paying special attention for the development of ports in the State. There is a need for at least one state-of-the-art deep sea fishing port and more fishing harbours in Gujarat which may be built with private sector participation. Since they are very specialized ports, the State may consider providing adequate incentives for private sector investment.

Cooperative and Public Sector Undertakings in Gujarat Fisheries

The State intervention for development of the fisheries sector has been mainly through budgetary support extended by the Central and State Governments. The development schemes are implemented by the field organisations. The regulatory and budgeted development functions are vested in the Commissioner of fisheries, Govt. of Gujarat. The commercial activities are carried out by the Gujarat Fisheries Central Cooperative Association (GFCCA), which is the apex federation of the fisheries cooperatives in the State. The Gujarat Fisheries Development Corporation (GFDC) was a public sector company under the Govt. of Gujarat incorporated under

the Companies Act. But this company was wound up and the activities handed over to the GFCCA.

Fishery Cooperatives in Gujarat

There are 289 primary cooperative societies in the marine fishery sector in Gujarat. There are 268 cooperative societies in the inland sector. Out of the total 557 fishermen cooperatives, only about 411 are active. They are engaged either in production, processing and /or marketing. These cooperatives are brought under the apex federation viz. The Gujarat Fisheries Central Cooperative Association Ltd. which was established in 1956 by the erstwhile Saurashtra State as the Central marketing association, for intervention in marketing of dry fish. Over the years, it has grown into the principal agency for the execution of various development and promotional programmes of the Government, besides carrying out a host of commercial activities.

The authorised capital of the GFCCA is Rs.1150 lakhs and paid up capital is Rs.86.16 lakhs as on 31.5.1998. The shares are held by 400 primary cooperatives, 3349 individuals and the State Govt. 90% of the paid up capital is contributed by the Govt. of Gujarat and 9 of the 16 members Board of Directors are nominated by the Govt. The rest of the Directors are elected by the member Cooperatives and individuals. Though a cooperative, for all practical purposes, it functions more like a public sector undertaking. All major decisions are taken as per the policy directions of the State Govt., thereby curtailing the desired flexibility required for a commercial activity. Nevertheless the organisation does impart a sense of partnership to the fishermen who have a stake in the future of the sector.

The major activities of the GFCCA are as follows:

1) Building of wooden and FRP boats through their boat building yards.

2) Fabrication and supply of fishing gear and synthetic twine.

3) Supply of marine diesel engines, OBMs and spare parts.

4) Providing bunkering facilities and operating diesel outlets.

5) Marketing of fresh fish.

6) Exploitation of freshwater reservoirs and production of fish seed, and promotion of aquaculture.

7) Channelising the welfare programmes of the Government including implementation of the Group Insurance Programme for the fishermen.

The Integrated Fisheries Development Programme under the World Bank was partly executed through the GFCCA. The loans for procurement of boats and trawlers for fishermen taken from the nationalized banks were routed through the GFCCA. The fishermen have defaulted payment of their dues for one reason or another and the out standings have mounted manifold which are shown against GFCCA. The marketing linked credit arranged through GFCCA under the project thus did not meet with the desired objectives. Instead, it added to the liability of the apex cooperative federation. Besides the non-payment of dues to the lending nationalized banks by the beneficiaries has caused a serious credibility problem for the genuine fishermen's need for credit in the years thereafter. In spite of these constraints, the GFCCA has been reputed to be generally a profit making enterprise and it continues to be a major vehicle of State intervention in development and welfare measures in the Gujarat fisheries sector.

The Gujarat Fisheries Development Corporation (GFDC)

With the emergence of deep sea fishing as an option for marine fisheries development, the State Government of Gujarat had set up a public sector company viz. the Gujarat Agro-Marine Products Ltd. as a subsidiary of the Gujarat Agro-Industries Corporation, in 1971. The authorised share capital of the company was Rs.500 lakhs and the paid up share capital was Rs.193.77 as on 31.3.1995. In 1980, this Company was converted into a full-fledged independent corporate entity in the name of Gujarat Fisheries Development Corporation.

The principal objective of setting up this Company was to undertake pioneering role in deep-sea fishing, in the west coast. But in the course of time several other activities were added on to it often duplicating the efforts of GFCCA, thereby affecting the viability of both the organisations. The Mexican vessels acquired by GFDC, for deep-sea fishing, instead of operating off the Gujarat coast, demonstrating the potential in the north west region, were transferred to the east coast to be operated from Vizag, on the plea that the operations in north-west coast was uneconomical. At the same time the vessels chartered by it under the Chartering Policy operating in the north-west coast were making handsome profits. The company, could procure two vessels against its charter obligation to get 5 pairs of such vessels, but could not fulfill its commitment to procure the rest. Though the decision to transfer the deep sea vessels to the East Coast helped the company to earn profits, its primary objective to demonstrate deep sea fishing as a profitable venture in the sea off Gujarat coast was not fulfilled. To that extent the State intervention did not produce the desired result with reference to GFDC's mandate to be the pioneer in deep sea fishing on the Gujarat coast.

After three decades of avoidable duplication in functions, the Government finally decided to wind up the GFDC and merge its activities with that of the GFCCA, as a part of the public sector reforms undertaken by the State Government, which was albeit a welcome decision.

With the reform process in progress, it is time to think whether the State Government should continue to hold the majority share in the GFCCA. As the role of Government, in changing the State should endeavor to strengthen the fishery cooperative institutions in the State and withdraw from the management of the GFCCA. The bye-laws of the GFCCA may be suitable amended and its management should be carried out on sound commercial principles of the cooperative Societies. This would ensure better participation of the stakeholders in the management of fishery sector in Gujarat.

Research, Extension and Training

R&D is a key input in every sphere of development activity in fisheries. The efforts of the R&D institutions of the Govt. of India are supplemented by the research institutions of the State. The field application research programmes in Gujarat were being coordinated by the Gujarat Aquatic Service and Fisheries Research Institute at Okha, in Jamnagar District - a State organisation -through its units at Sikka, Porbandar, Veraval and Surat. They have been engaged in marine fishery resource survey, research on utilisation of trash fish, bacteriological research, water pollution studies, breeding and hatching of shrimps, culture of oysters etc.

With insufficient budgetary allocation and limited in-house capabilities, the State R&D institute could not deliver the desired results. There is no scope for a research institution like this

to stand alone in the future when a multidisciplinary approach is needed. Marine fisheries is one such area for that multidisciplinary approach is needed. The State R&D institution may at best be a catalyst for coordinated R&D effort on frontier areas of fishery development and management in association with reputed national organisations like ICAR, CMFRI, CIFT, CIFNET, CIFE, etc. and international agencies. Such linkages are indeed beneficial for technical and financial aid. But they are also important for developing various soft skills in the management of resources in the complex field of marine fisheries sector and human resource development. These institutions are the source of sound scientific basis for informed decision making. Each one of them cover specific areas of its specialization like biology, ecology, technology, economics, marketing, social service etc. They generate database for monitoring, analysis, and policy formulation. They also assess and monitor the stock levels, impact of changes like fishing pressure, pollution, habitat attention etc. on the stock and the ecosystem.

The research activities under the fisheries department of Gujarat have been transferred in 1998 to the newly established Fisheries College, Veraval, under the Gujarat Agricultural University. This R. & D. centre is yet to make any significant contribution in the development and management of marine fisheries in Gujarat.

Extension

Extension education is one of the most important instruments for empowering the fisher folk. It is one of the principal responsibilities of the State particularly in the development phase. Extension is considered to be the most effective mechanism to take new technology to the actual

users. Transfer of technology at the grass root level involves constant interaction with the end users. An extension wing has been set up in the commissionarate of fisheries for this purpose.

The activities of the extension wing include social marketing of concepts, good management practices and technological innovation. through rural camps, film shows, rural fairs etc. Use of multimedia has of late become very popular in extension methodology. But the extension machinery seem to lack in skill to conceptualize emerging issues so as to build the capacities of the beneficiaries. As a result they have not proved to be effective in empowering the fisher folk to rise up to the daunting task of meeting the challenge that they are faced with, especially in the context of intense competition and commercialization, in spite of advancement in technology. To that extent the State intervention in this arena has not been successful. There is a need for continuous operation and monitoring of marine fisheries extension schemes, so as to positively influence the fishermen on their felt and unfelt technological requirements. Integrated projects with educational and service facilities would reduce the time lag in adoption and diffusion of technological and management innovations among fishermen.

Training

There are 11 fisheries colleges in the country, besides 8 fisheries institutes under ICAR, which are engaged in post graduate education and research. The Gujarat State Government has one fisheries college under the Gujarat Agricultural University and their training centres located at Veraval, Porbandar and Valsad. These centres have been imparting skills on conventional mechanised fishing and fish processing. The modern marine fishery sector has been undergoing rapid changes which demand acquisition of new skills both at the operational level as well as

managerial levels. Expertise in diversified fishing techniques, use of modern fishing devices, resource conservation and management etc. are the new areas where attention has to be focused upon. The contribution of State Government in the field of training has been of great significance in getting the manpower trained in the early days of modernisation. Now the training programmes warrant a thorough revamping to meet with the demands of liberalization and technological expansion. The training institutions require upgradation and the syllabus needs to be revised thoroughly for this purpose.

The technical staff of the promotional agencies of Govt. and cooperatives also require specialized training in areas like resource conservation and management, environmental impact analysis, use of modern equipments, latest craft and gear techniques, handling and post harvest technology, along with capacity building for manpower development.

Employment Aspect

Fishing as an avocation, remains the last option for the coastal labour force, which generally lacks training and capital. Nevertheless, the Marine fisheries sector has been offering full time or part time employment opportunity for about 98732 active fishermen of Gujarat. The marine sector fishermen get 170 to 230 fishing days in a year. They are also engaged in related activities like fish marketing, boat building, gear mending, service centres and other miscellaneous jobs. In addition to that there are several opportunities in the ancillary industries, as in processing, machinery manufacturing, maintenance of processing equipments, refrigeration, packaging, handling equipments, manufacture and maintenance of fishing equipments, electronic gadgets, fabrication, repairs to vessels, painting, dry docking, transportation, etc. These facilities gradually

give rise to the development of urban amenities, which in itself is not a bad thing to happen. But experience has shown that these improvements have generally helped the urban settlers more than the rural fishermen work force. The employment opportunities created afresh needed new skills and the beneficiaries were by and large not rural fishermen workers from fishing villages, but urban migrants.

The State induced development efforts have been rather skewed in favour of a vertical integration of the sector to the disadvantage of the less privileged section of the fishermen groups and consequential rapid depletion of resources. As Emerson (1980) observes integrating a fishery "vertically" in improving catch technology, expanding shore facilities, adding value through processing, reorganizing markets etc. without considering the benefits of "horizontal" integration in enabling low income participants in a fishery to benefit from interaction with the non-fishery groups and to respond to opportunities for non-fishing employment will end up in escalating the scale of failure of a fishery that may soon become biologically exhausted.

In the rapidly changing scene of a resource, the traditional non-motorised fishermen need special protection especially in terms of employment and livelihood, till other productive and profitable alternatives are available to them.

Growth of job opportunities in the marine fishery sector has come to a plateau. With modernisation and rationalization of fishing operations, the labour input gets reduced. At the same time demand for more and more jobs is mounting. The fishery sector in future will not be in a position to provide adequate employment opportunities to new job seekers. Therefore, alternate

source of employment outside the fishing sector has to be developed. It has certain advantages like absorption of surplus labour, encouragement to mobility of fishermen, and provision of security against uncertainty arising from market or resource fluctuation (Panayotu, 1982). Since creation of employment in non-fishery sector has not been growing adequately in the Sate to absorb the surplus labour in the fishery sector, one of the major objectives of fishery development and management turns out to be employment generation within the sector itself. Even for reducing the pressure on fishing from a management point of view, it is essential to divert the additional workforce away from the fishery sector. The State intervention has not been effective in achieving this objective. As a result the fishermen without work, especially the younger generation are forced to migrate from fishery dependent villages. The state and parastatal agencies should aim at generating professionalism, so that the new generation of fishermen can meet the challenges of globalisation and an industry that constantly has to adapt to changes.

Financing fisheries development in Gujarat

Budgetary support by the Central and State Governments through five-year plans and annual plans has been the main source of funding for fisheries development. These are supplemented by aid from international agencies, institutional financing and of course the private sector investments. The international aid was mainly under the World Bank, for Integrated Fishery Project. The Special Package for Grow More Food, and the assistance under the Technical Cooperation Mission of the U.N. The institutional finances are from nationalized banks and refinancing institutions like NABARD and cooperative funding agencies like National Cooperative Development Corporation (NCDC). The details of annual outlays and expenditure during the Five Year Plans is given in Table 4.27

TABLE 4. 27: EXPENDITURE UNDER FIVE YEAR PLANS (GUJARAT)

Plan	Years of coverage	Provision (Lakhs Rs.)	Expenditure (Lakhs Rs.)	%
I	1951-56	44.00	38.00	86.36
II	1956-61	69.52	66.37	111.51
III	1961-66	129.14	185.00	143.26
Three Annual Plans	1966-69	239.71	151.00	62.99
IV	1969-74	350.00	361.72	103.36
V	1974-78	522.50	522.80	100.06
Two Annual Plans	1978-80	577.00	514.92	89.24
	(including the World Bank Project of Rs.63.23 lakhs)			
VI	1980-85	2000.00	1922.00	91.03
VII	1985-90	2426.00	2110.34	87.00
One Annual Plan	1990-91	400.00	334.93	83.73
One Annual Plan	1991-92	597.00	511.23	85.63
VIII	1992-97	3700.00	3588.09	96.98
IX Plan	1997-02	10400.00		
	1997-98	1051.86	899.92	85.56
	1998-99	1450.00	1355.56	93.49
	1999-00	1765.00	1632.51	92.49
	2000-01	1875.00	1613.00	86.03
	2001-02	1200.00	--	--

Source: Gujarat Fisheries Statistics – 2000-01

The first and second Five Year Plans for the Gujarat, region of the erstwhile Bombay State, were implemented by the then Saurashtra and Bombay States. In the early fifties, Govt. provided newly designed fishing boats with inboard engines on a loan-cum-subsidy basis to the fishermen. Low power inboard engines received under the TCM along with nylon twines were also granted to fishermen on a loan-cum-subsidy basis. Early steps for modernisation were undertaken under the Grow-More Food scheme and the TCM during the first two Five Year Plans. During the 3rd Five Year Plan, loans were granted to fishermen at subsidized interest rates. In the 4th Five Year Plan the loan system was discontinued and substituted by a subsidy at different rates until

1978. Under the World Bank project, an interest free loan of Rs.25,000/- per unit was given for mechanised boats of 14.8 m. OAL and above, with a provision for moratorium for seven years.

Role of Subsidy

The thrust in the first three Five Year Plans was on increasing fish production in the marine sector. The number of vessels, engines, gear units, etc. financed over the years is given in Table 4. 28. The emphasis during the period was on mechanisation of fishing crafts, setting up modern facilities for processing, preservation and marketing. The development efforts were supported through the State aid in the form of subsidy for the following:

i) Subsidy on small fishing equipments/fishing gear like nets.

ii) Subsidy on non-traditional boats

iii) Subsidy on OBMs/Inboard engines

iv) Subsidy on FRP Boats

v) Subsidised service charges for boats/engines through specified service stations.

vi) 100% exemption in the Sales Tax and Excise duty for diesel used in fishing boats.

vii) Subsidised Kerosene for OBM operation.

viii) Subsidies to processing units as applicable to other industrial units.

The pattern of subsidy has undergone changes from time to time depending on the priorities assigned and budgetary constraints. From 1966 onwards, development of infrastructure was given priority for which new schemes were launched. The development schemes under various plans have undergone changes depending upon the priorities identified and fixed from time

to time. The profile of schemes for the period of 1997-2002 is given in Table-4.29. As a result of these schemes, it was possible for the fishermen to avail infrastructural facilities, adopt new technology, more efficient crafts, gears and latest electronic gadgets for navigation fish finding and safety in the sea. The adoption of innovative technologies has transformed a substantial portion of the fishing activity from a subsistence to a commercial level. But at the same time they have turned out to be capital intensive.

None of the commonly used definitions is found adequate for a comprehensive analysis of the effect of subsidies on trade and natural resource use. The FAO expert held consultation in Dec. 2000 and identified 4 categories of subsidies as they could not find a single definition for subsidies (FAO, 2002).

As a strategy for development to exploit the resources rapidly and competitively, subsidies were given to individual beneficiaries, firms, and public and private sector corporate bodies. This indeed has helped in expanding the fisheries activities and in enhancing production. But such government subsidies have also led to uncontrolled creation of fishing capacity in the form of number and size of fishing crafts, gear and engines resulting in resource depletion. These subsidies are being dubbed as "perverse" support from government causing market distortions and destroying the natural resources. Local fishers sustained themselves for centuries without subsidies, while industrial fishers have to be subsidized by the society at large. With the over capitalization, it is not profitable to operate the fishing vessels unless they are subsidized. Hence they are given interest free loans, outright cash award on crafts and gears, tax holidays, tax-free fuel, etc. Experience has shown that these subsidies not only encourage and reward over fishing

but also promote complete waste, of a precious natural resource. It is a classic case where the welfare measure of Govt. turns out to be an ecological disaster.

As quoted in the work of Suzuki et al (1982), subsidies are given for fisheries to the tune of US $ 54 million an year, world over, to catch US $ 70 million worth of fish!! In the OECD countries, the subsidy is as high as 17% of the landed value of fish. But in India it is not more than 1.5 to 3% of the total landed value. By WTO formula for calculating subsidies, India has negative subsidies for export of agricultural products. The subsidies given today are within the tolerance limit of what is known as measure of Aggregate Support, stipulated by the WTO.

The subsidy given today for fishing vessels is comparatively very small in relation to their cost. But still more and more boats are added enhancing fishing capacity. So, subsidy is not the only cause of over capacity in Gujarat and elsewhere in the country. It is the absence of any control over fishing effort, and quantity of fish caught which is responsible for building up over capacity. It is also not a tenable argument that a Government subsidy given to fishermen has led to the depletion of resources. But distorted market signals guide to unsustainable investments. When supply of fish was inadequate, prices would rise, encouraging investments in fishing vessels. This, in turn, adds on to the fishing capacity accelerating collapse of a fishery, through depletion of resource.

TABLE 4.28: DETAILS OF CRAFT AND GEAR FINANCED OVER THE YEARS

Item	1951-61	1961-66	1966-69	1969-74	1974-80
OBM (No.)	295	488	2	109	153
Inboard Engine	116	403	187	344	1635
Improved boats (No.)	100	308	231	308	497
Trawlers (No.)	0	0	0	0	342
Gear materials (Ton)	0	143	97	187	75

Source: Commissionarate of Fisheries, Gujarat.

TABLE 4.29: PROFILE OF THE SCHEMES FOR THE PERIOD 1997-2002

Sl.No.	Minor Head of Development	Ninth Plan 1997-2002 Outlay	Annual Plan 1997-98		Annual Plan 1998-99		Annual Plan 1999-00		Annual Plan 2000-01		Annual Plan 2001-02	
			Outlay	Expend-iture	Outlay	Expend-iture	Outlay	Expend-iture	Outlay	Expend-iture	Outlay	Of which capital
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Direction & Administration	360.00	20.00	7.28	20.08	20.71	29.15	26.30	33.59	13.27	26.22	0.00
2	Inland Fisheries	2441.00	378.42	341.92	383.35	487.68	320.60	343.54	282.89	260.50	200.70	0.00
3	Brakish water Fisheries	450.00	15.48	6.38	21.95	21.49	21.36	29.54	23.77	21.72	22.87	0.00
4	Marine Fisheries	4451.00	267.61	32.84	288.35	342.73	608.20	581.01	1033.93	715.14	318.79	176.01
5	Processing Preservation & Mkt.	150.00	37.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Extension & Training	273.00	17.00	14.92	18.58	16.30	15.68	13.44	15.10	15.11	11.00	0.00
7	Fisheries Co-operative	640.00	294.49	282.56	294.68	101.55	149.20	46.43	76.70	21.54	32.41	13.00
8	Other expenditure	1035.00	25.00	15.00	40.00	40.00	100.00	50.00	60.00	19.69	60.00	10.00
9	Research & Education	500.00	100.00	0.00	0.00	0.00	34.00	88.12	25.01	0.30	0.01	0.00
10	Boarder Area Sub Plan	100.00	25.00	0.00	0.01	0.00	0.01	0.00	0.01	0.00	78.00	78.00
11	Tribal Area Sub Plan	0.00	224.00	172.2	317.00	296.14	442.80	417.91	430.00	525.70	416.00	0.00
12	Special Component Plan	0.00	46.00	26.10	46.00	28.96	44.00	36.22	44.00	20.37	34.00	0.00
TOTAL FISHERIES		10400.00	1450.00	899.72	1450.00	1355.00	1765.00	1632.51	2025.00	1613.34	1200.00	277.01

Source: Commissionarate of Fisheries, Gujarat.

Institutional Finance

The financial institutions provide short-term finance as defined by the Govt. Fishery being a "priority" sector, has been eligible for "concessional credit terms" as applicable to agriculture, attracting private investment. The NABARD has been providing refinancing support to the commercial banks, State Cooperative Banks, Rural Agricultural Development banks, etc. The refinancing by NABARD helped the lending banks to offer credit at concessional rates to the beneficiary borrowers. In the marine sector, NABARD had supported 20% of deep sea fishing vessels, 45% of mechanised fishing vessels, 60% of OBMs and 49% country crafts. (Pathak, 2001). NABARD has also participated in the Integrated Fisheries development project under the World Bank. They have estimated a credit requirement of about Rs.566 Crores for marine fisheries by the end of the IX th Plan i.e 2001-02. They have, however, envisaged a lower credit need and potential investment in the marine sector in comparison to the freshwater fisheries and brackish water fisheries during the IX th Plan period as shown in Table 4. 30.

TABLE 4.30: CREDIT NEEDS OF VARIOUS SECTORS – IX TH FIVE YEAR PLANS
(Rs. in lakhs)

Sector	Total investment credit for the plan period	Credit flow through Public Sector Banks
Freshwater Fisheries	5264	3947
Brackish Water Fisheries	2046	1528
Marine Fisheries	752	566
Total	8062	6041

(Source: Pathak, S.C., 2001)

Other than NABARD, the major agency providing institutional finance, particularly for fishery cooperatives, has been the National Co-operative Development Corporation (NCDC). They

have provided financial assistance to the tune of Rs.32.62 Cr. from 1974 – 75 to 1996-97, 90% of which has gone to the marine sector (Biswas, 2001) for the country as a whole for purposes like replacement of mechanised boats, infrastructure for fish landing, post harvest facilities marketing, processing, transportation, etc.

The projects in the fishery sector availing institutional finance have had a mixed experience. Some of them were successful, while others have failed miserably. Because of these failures, the sector has been often dubbed as unviable, a contention, strongly countered by Pathak (2001). But the adverse criticism and the poor record of recovery has affected the credibility of the sector, resulting in reduced flow of credit to the sector. The past experience, obstacles in the export front like non-tariff barriers, declining resource base, social conflicts etc. are perceived as serious risk factors by the banks and other financial institutions. Therefore it is necessary to take conscious efforts for building up the confidence of these institutions, if the marine fishery sector has to sustain its development.

Summing-up

This chapter has analysed in detail the growth of marine fisheries sector and its present status in Gujarat. It is clearly noticed that the State has played a crucial role in the accelerated development of marine fisheries sector in Gujarat. The over-emphasis on the 'development' aspect has led the sector into over-fishing as measured through various parameters. The over-fishing may, however, be also attributed to the increase in population pressure and lack of occupational diversification among fishermen youth. Rise in prices in the domestic as well as overseas markets have prompted fishermen for intensive fishing of certain species of fish. The growth of ancillary

sector and expansion of capacities in the fish processing activity has exerted more pressure on fish catching. Easy finance and various kinds of subsidies extended to marine fisheries sector for the development considerations have pushed more boats into fishing as compared to what the basic resource can offer catch on a sustainable basis. This has, obviously, led the sector into over-fishing and warned all concerned to give a serious thought on the management aspects along with the development of marine fisheries in Gujarat.

CHAPTER -5

DEVEVELOPMENT AND MANAGEMENT OF MARINE FISHERIES

Introduction

India, like many other developing countries has been following a "develop first, manage later" approach in the fisheries sector. But development and Management are complementary functions required at all stages of the expansion of a fishery for its rational utilisation. Development in this context is the expansion of effort for the utilisation of fishery resources to achieve the declared objectives, through enhanced application of one or several production inputs viz. capital, labour, energy, etc. Management is the organisation of fisheries development to meet the socio-economic objectives and resource utilisation policy through maintaining fishing effort at the level corresponding to the selected objectives. As Hersoug (1996) observes, both "development" and "management" are aiming at the optimum or best possible use of the fishery resource. According to Panayotu (1982), development without management is likely to be self-defeating even if the resource potential is available, since development creates profits, which attract new entrants until the profits get completely dissipated. In a way management is a part of the comprehensive plan of development. It is not confined to biological aspects of fisheries alone but encompasses the economic, social, political and environmental factors as well. As such, the main objective of fishery development and management of any country is to obtain maximum net economic and social benefits to its people. To achieve this objective, the fishery resources have to be conserved and maintained at a sustainable level, as it is often difficult to correct a past mistake. But in a

heterogeneous fishery sector as in India, the identification of appropriate management practices is, indeed, a difficult task.

Needs of Resource Management

Traditionally, it has been the belief that the sea and its wealth belonged to none but to everyone. The fish stock has been considered as a common property, which can be exploited free by anyone.

Modernisation has led to overcapitalization and commercialization of the marine fisheries resulting in rapid resource depletion. But the fish stock being a renewable resource can be regenerated for exploitation for ever, through resource management, where the harvest is kept within the limits of what the resource base is capable of sustaining in the long run. The condition precedent for any such management effort is that, somebody must have the right and the means to control access to the resource. Usually there are clearly defined property rights to resources, which are enforceable through legal and judicial framework of the State. In the case of marine fisheries in India, there are no established property rights so as to solve the problem of exclusion. Hence there is no particular incentive to keep the harvest within sustainable limits. The fishermen seem to believe that a fish spared today is somebody else's catch tomorrow. This situation leads to the 'assurance problem' and creates dilemma for an individual fisherman - whether or not to comply with the needs of conservation of the resource. This is typically known as 'contributor's dilemma'. If a fisherman is not assured of the cooperative behaviour of the others, and with the result, if contributor's dilemma is not solved, one is most likely to free-ride over the common-property type marine fish resource and eventually may become prey to what Hardin (1968) has

described as “the tragedy of the commons” Lack of clear property rights leads to irrational behaviour of the society. The inability to devise clear property rights may be considered as a failure of the state.

Role of the State

In this background, it becomes the responsibility of the State to intervene through appropriate resource management measures to ensure sustainable development of the sector. Even when there is established rights to harvest a certain amount of fish through catch quotas or have rights to engage in harvesting through fishing licenses, the State has to be in the picture for managing the resource through policy instruments. It is a fundamental principle that in natural resource management, both private sector and public sector will have to be fully involved.

The development and management measures are generally undertaken by the State, more so in the case of developing countries. The common development measures are as follows: subsidies for motorisation, mechanisation, fuel, credit, marketing, production infrastructure, post harvest technology, promotion of cooperatives or public sector undertakings, resource allocation, creation of alternative employment, R&D and HRD. The management measures are as follows: catch quotas, area/seasonal closure, gear regulations, trawl ban, limiting number of boats, license fee, auction of property rights, and allocation of community rights for fishing. While the Govt. at the Centre and in the States were enthusiastic about implementing development measures they were rather slow in adopting regulatory measures aimed at management of resources.

Management Needs in Marine Fisheries

Marine fisheries sector world over, is facing a serious challenge of declining productivity in spite of technological innovations and developmental advancements. Both in the fully expanded fishery and in developing fisheries, new technologies were adopted and encouraged. Use of more efficient modern equipments meant higher level of exploitation bringing in its wake faster depletion of limited resources. The promotion of fisheries and its modernization were mostly in the commercial fishery sector at the cost of small scale and traditional artisanal fishery. The promotion of fishery generally followed by the developed countries in the early days was focused on development and of expansion of the fishery with comparatively lesser attention to the management aspects. This pattern was almost blindly adopted by the developing countries which has adversely affected the resources base. Exploitation in several cases has surpassed the sustainable levels. The catch per unit effort has been dwindling, adversely affecting the income to fisher folk, and availability of fish to the consumers. The pioneering policy initiatives for management of fisheries also came from the major developed countries threatened with severe crisis to their commercial fishery. The management principles, thus evolved over the years, were mainly to cater to the demands of such commercial fisheries.

The initial management efforts were confined primarily to the conservation of resources. The biological and bio-economic models of fishery management, though important, did not take a holistic approach for sustainable development of fisheries keeping the fishers at the centre stage. This, over the years, has proved to be unsustainable. An ecologically sustainable and socially acceptable model is required for the sustainability of fisheries in the developing countries especially, the seafood dependent developing countries. In several such countries fisheries have

reached their limits of further growth and have to essentially look at sectors allied to fisheries or outside it for their survival. Under the Code for Responsible Fisheries, long-term sustainable use of fishery resources is the overriding objective of conservation and management. In this context an alternative approach to fisheries development and management as an integral part of the wider coastal area management becomes necessary since fisheries form part of the broad coastal ecosystem.

Reference to the Resource

The role of State is significant in designing appropriate management framework and procedures. It is the responsibility of the State to ensure that the level of fishing permitted is commensurate with the level of fishery resources. The third world may not have the expertise and wherewithal for that purpose. Hence it is necessary to promote international cooperation and coordination in collection and exchange of information, research in conservation and management and other issues related to capacity building in fisheries development and management.

The developing countries have their common problems of fisheries management. Therefore a common alternative strategy with appropriate changes to meet with specific conditions may be evolved and adopted. The modernization of the fishery sector in India has essentially been the result of State intervention in the development era. It may be the case with most other developing countries as well. In the development phase, most of the countries have adopted mechanisation more specifically through increased use of trawler, which was believed to be a byword for modernization. In this regard, developing countries have followed the path of advanced countries. This has undoubtedly helped them in enhancing production in the early days but

gradually it proved to be detrimental to all the stakeholders and the ecosystem. The expansion of fishing efforts in these countries was so far confined to the inshore areas and to enlarge its scope into the respective EEZ has not borne the desired results.

Identification of Specific Reasons of Over-fishing

The reasons for decline in the output of fisheries are not only those relating to over fishing. The impact of pollution, destruction of spawning grounds and nurseries like coastal wetlands, mangroves, coral reefs, disruption in reproductive cycle etc. have their deleterious effects on the fish population.

The demand for seafood has increased manifold. With new technologies, powerful crafts, modern fish finding equipments and more efficient gears, the fishing capacity has gone up. With improvement in inland transportation, cold chains marketing network and higher living standards, consumption of fish has increased, generating additional demand and boosting further fishing activity. The unrestricted harvesting has been destroying the fisheries all over the world. The global fish production clearly indicates that the period of abundance is over.

The dwindling resource, surplus fishing capacity, decline in production, increasing population pressure, low mobility of artisanal fishers, high cost of energy, slow progress in transfer of technology and gains of efficiency, mounting environmental pollution and impact of climate change are all challenges to the third world fishery development and management. It is also an opportunity for the developing countries to rehabilitate the dwindling stock as early as possible and

to manage them which is very critical for many of the seafood dependent countries for meeting their protein need and food security.

Constraints against Management Plans

There are several factors hampering adoption of management programmes like technical and administrative complexities, coercive aspects of application of regulations and political unwillingness to change patterns of distribution of profits. The net profits that can be derived from better management of existing fisheries are several times higher than that from developing new stocks. (FAO. Tech. Ppr. 224). There is a growing awareness amongst the developing countries that full realization of fishery potential depends on its management and that the benefits from management now overweighs those of development.

The extension of the national jurisdiction to 200 mile EEZ is an opportunity for the coastal States. Along with this comes the responsibility of efficiently harnessing the resources in their extended area. Although this right has been bestowed on the coastal States as early as in 1982, the fishing is still confined to the narrow inshore coastal belt which has been overexploited by the developing countries. Under Article 61 of the UNCLOS, the coastal States are required to ensure through proper conservation and management measures that the maintenance of the living resources in the EEZ is not endangered by overexploitation. Under the Code of Conduct for Responsible Fisheries, State has been entrusted with certain responsibilities. The Code prescribes that the State formulate policies, create appropriate legal framework, set up institutions and support R&D efforts, taking into account the provision of the Code with a view to achieve the objectives and to ensure its sustainability.

The unsustainable fishing practices and the decline in marine fishery resources have been matters of concern since the days of Adam Smith. While dealing with various aspects of fisheries along with that of land and mines, Adam Smith refers to increasing demand, productivity, need for technological improvements in the means of production, prices, uncertainty in the fishing industry and the adverse impact of bounty (subsidy) given to bigger vessels in England. Adam Smith writes on the herring buss Bounty, granted only to larger decked vessels;

"…it had ruined the boat fishery, which is by far the best adapted for the support of home market and the additional bounty …….. upon exportation carriers the greater part, more than two thirds of the produce of the buss fishery abroad". He concludes "……. The usual effect of such bounties is to encourage rash undertakes to adventure in a business, which they do not understand and what they loss by their own negligence and ignorance more than compensates all that they can again by the utmost liberality of Government" (Smith, 1937).

Fisheries Management Models Limited and Over-simplified

The concept of fisheries management as it is known today is mainly evolved in the context of mature and often overexploited fisheries of the developed countries. These management practices were based on certain concepts of models which are rather oversimplified, but provide insight into the dynamics of fisheries and the problems of its management.

The characteristics, prospects and experiences of international fisheries, especially in relation to the developed countries, were the basis for evolving the development and management principles and practices hitherto known in the marine fishery sector. Industrial fishery development

models developed in the advanced countries have been generally adopted by most of the developing countries including India in framing their development policies and strategies. The characteristic features of developing countries like abundant labour, scarce capital, low technology, administrative limitations, underdeveloped markets and the constraints like high cost of energy, growing scarcity of resources etc. have not been fully taken note of in all its ramifications while formulating their development programmes. The adverse consequences of such development strategy are being felt now and management measures are being adopted to counter them. Moreover the introduction of the Law of the Sea has brought in its wake new responsibilities for the developing maritime States, and they are obliged to consider management of marine fishery resources as a priority issue.

Fisheries management is broadly defined as "the pursuit of certain objectives through direct or indirect control of effective fishing effort or some of its components" (Panayotu, 1982). Its objectives depend on the needs of the individual countries and the level of development of their fisheries. It is not confined to the biological aspects of fisheries alone. Generally the goal is maximization of net benefit – biological, environmental, socio-economic and political to the society through sustainable exploitation of fishery resources. There are no laid down criteria to categorize the level of development of a fishery either as fully developed or as one in the process of developing. Irrespective of the category to which they belong, countries undertake development and management of marine fishery resources for enhanced economic returns, food supply, exports, employment, welfare of fishers and conservation of resources. In short, development and management aim at rational utilisation of the natural resources viz. marine fisheries.

Several conceptual models have been evolved to give a framework for the management of marine fishery resources. They are broadly examined hereunder.

Biological Model for Fisheries Management

The beginnings of fisheries management have almost invariably been based on its biological aspects. (Hersoug, 1996). Modern fisheries management found its origin in Europe following industrial revolution and the over-expansion of Northern Fisheries.

Mechanised trawling introduced in the North Sea towards the end of the 19th century resulted in lower Catch Per Unit Effort (CPUE) i.e catch per day per trip (Gulland, 1974). The fall in CPUE led to the information of agencies like the International Council for the Exploration of the Sea, International Pacific Halibut Commission and International Pacific Salmon Fisheries Commission. The biological knowledge emerging out of their studies formed the basis for the Biological theory of fishery management propounded by Milner B.Schaefer in 1954. This was further fine-tuned by Beveston and Holt and subsequently by Gulland. The biological model of Schaefer presents the relationship between the fish yield (CPUE) and the fishing effort. Accordingly as Hersoug observes if the objective is to maximize fish production, the optimum exploitation of fishery resource is defined as Maximum Sustainable Yield (MSY) i.e., the maximum catch that can be obtained on a sustainable basis.

This model was built on the assumptions, that fish stocks are inherently stable, behave predictably under moderate levels of exploitation and tend towards an equilibrium state. The Total

Allowable Catch (TAC) can be assessed by calculating the proportion of the adult stock that could be extracted trough fishing without endangering its sustainability (Symes, 1996).

This model takes into account only a simple fishery consisting of one species exploited by one group of fishermen using the same method of fishing. According to this model, initially there is an almost proportionate increase in the catch, as the rate of exploitation increases. Gradually the growth rate declines and the yield curve reaches the highest level of production. This level is viz. Maximum Sustainable Yield (MSY). In the early days the main objective of fisheries management was to achieve this level for full utilisation of resources and its conservation. Failure to achieve MSY was even considered as "wasting" the fishery resource. Over fishing of parent stock affects the recruitment, especially if the fishery exceeds MSY, which has a long-term adverse impact on the fishery. Over fishing is not the only factor causing collapse of fisheries. There are natural phenomena like long-term climate change affecting geographic distribution of resources and the biotic capacity of the environment. But there are enough evidence as in the case of Peruvian Anchovy, Atlantic- Scandinavian herring, North Sea herring, Namibian Pilchard, Californian Sardine, etc. to establish that over fishing did result in their decline.

Biologists while upholding the MSY model are generally of the view that it is an over ambitious strategic objective for fishery management. Instead they recommend catch levels below MSY to eliminate uncertain negative impact of over fishing. Since reliable scientific data and advise is often lacking, it is difficult, if not impossible, to estimate MSY in many cases.

Although MSY became a key reference point for Fishery Management it is no more considered as an abstract concept providing the ideal theoretical guide to management objectives. MSY assumes that most fish stocks are inherently stable, they behave predictably under moderate levels of exploitation, and that they trend towards an equilibrium state. MSY level has come to be considered as illusory, as stocks of fish do not behave in such a simple manner. Since it is not always easy to determine precisely the stage when the MSY occurs, it is difficult to determine MSY and the stock abundance required to achieve it. Thus MSY does not help in reaching a decision on fishery management (Gulland, 1974). Panayotu (1982) considers MSY "too risky" an objective for development or management. It has also been challenged by economists. Accordingly to them, attainment of physical yield makes no economic sense. The MSY, however, is still considered a key reference point for fisheries management.

Bio-Economic Model for Fisheries Management

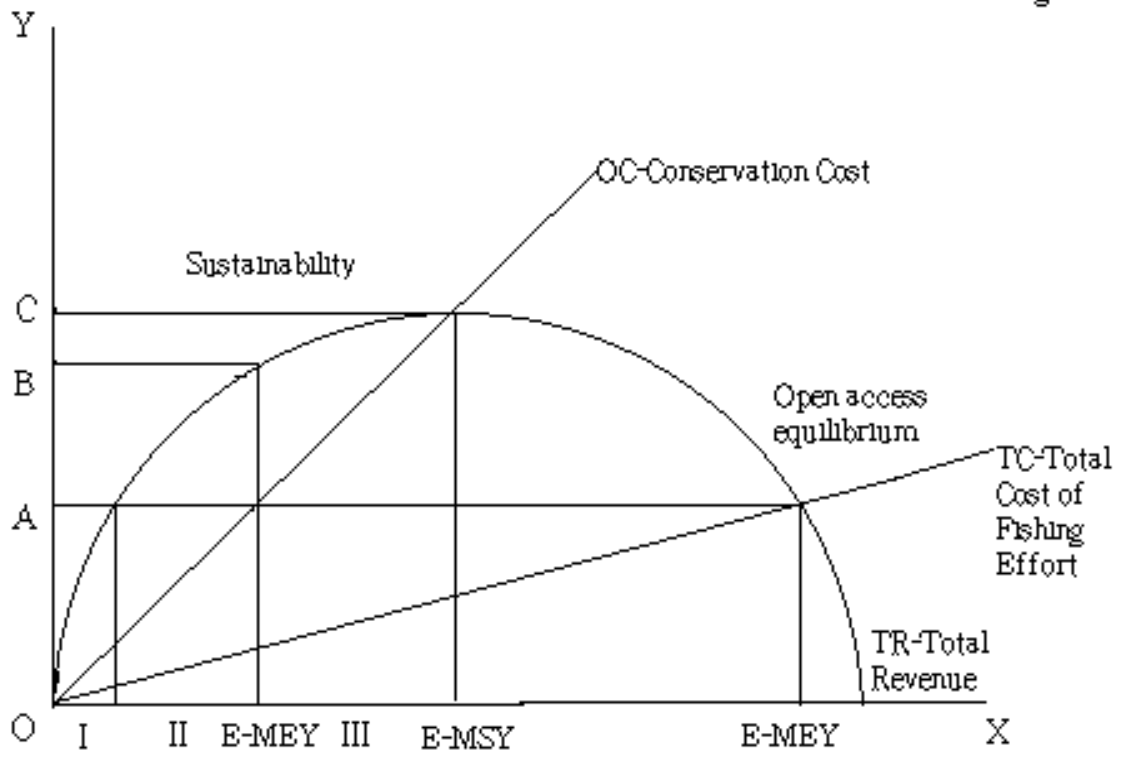
The growing realization that fisheries management cannot be confined to biological aspects alone has prompted scientists and economists to look elsewhere. Thus the MSY concept has been redesigned by the pioneering work of Scott Gordon – Schaefer bio-economic model depicting the management goal to achieve the Maximum Economic Yield (MEY). This model is presented hereunder as Figure 5-1.

In this model, equilibrium catch is plotted against the fishing effort. Fishing effort has been shown on the OX –axis. Whereas, the catch (yield) is shown on the vertical axis OY. The figure also explains that the fish yield is a function of efforts applied on a given stock-size. Therefore, OX axis also shows the size of the stock. In the beginning of the efforts applied (stage I), relatively

more fish could be caught because a little effort applied on a huge unexploited stock could give more yield as shown by OA on the vertical axis. In the next stage (stage II), AB amount of more fish was caught, which also suggests that efforts applied still on the larger unused stock can give more catch per unit of effort. It can further be noticed that the cost increases with increasing effort. But since, the yield increased at the higher pace, resource revenue also increased. During this second stage, the difference between total cost (TC) and total resource revenue (TR) is greatest, which suggests that maximum profit could be availed because of more efforts applied on relatively large unused stock. This difference between the two (TR –TC) is a measure of resource rent.

Figure-5.1

Gordon-Schaefer Bio-economic Model of Fisheries Management



Fishing Efforts

Had there been a monopolist or the resource was privatized, the entrepreneur would have stopped fishing at this stage in order to maximize his individual profit. If the entry is free in the market, more entrepreneurs would enter, lured by the fact of fishing being a high profit yielding enterprise. Eventually a fishery of the type, depicted in the figure, reaches to the level of maximum sustainable yield in the third stage as shown by E-MSY on the horizontal axis. OC , on the vertical axis shows the maximum yield that can be harvested on the sustainable basis. Enough is still left for the subsequent rounds of fishing. If the effort is constrained at E-MSY, the OC yield can be harvested on the sustainable basis for the long time in future.

The bio-economic model of Gordon-Schaefer also takes into consideration only one stock. The yield is maximum at MSY. The biological model considers E-MSY as an ideal situation, which has been challenged by economists. According to economists, both income and costs have to be taken into account for arriving at the Maximum Economic Yield (MEY) level by optimizing difference between total income and total costs. This was possible during the second stage of fishing effort when the difference between costs and revenue was maximum. At this stage it takes less effort. But fishing cannot be restricted at this level in an open-access fishery. As long as there are profits to be made, new entrants would appear on the scene and fishing effort would expand until a zero-profit or open access equilibrium is reached. In the figure, E-MEY is open-access equilibrium level of fishing effort. Precisely, this is the stage where fishermen have taken away a large amount of fish from the waters and much less is left for the future. As management objective, therefore, the total cost curve (TC) needs to be shifted up and converted into a curve of conservation cost, i.e., OC. This may imply making entry costly, removing subsidies, charging fees, etc.

The bio-economic model has been generally hailed as an acceptable parameter for fisheries management due to its scientific legitimization, uncomplicated form and ease of application and its "guarantee" of success in ensuring the maintenance of stock levels" (Symes, 1996). But it has been questioned on the ground that it does not take into account the tendency towards instability within the oceanic environment, and that it over simplifies the behavioral characteristics of different fish stock (Caddy and Gulland, 1983) besides ignoring the complex species interactions with the marine eco- system. It does not recognize the disruptive efforts arising from the complex dynamics of scarce resources, technological development and human behaviour.

Bio-Socio-Economic Model for Fisheries Management

The economic objectives focused in the bio-economic model were found to ignore the social effects of fisheries management. The purpose of managing fisheries is perceived to secure higher incomes and social benefits to fishermen. This school of thought has resulted in the emergence of the new concept viz. Maximum Social Yield (MSocY or Optimum Yield (OY). This is based on the assertion that economic yield cannot be considered without relation to distributional effects while not ignoring the biological and economic aspects of management. Social issues often tend to alter economic solutions (Hersoug 1996) in real life situation as in fisheries management.

MSY is basically a modification of MEY, incorporating factors like improvement of socio-economic conditions of small-scale fishermen, generation of employment opportunities and improvement of income distribution. This is the level of catch and fishery effort that provides the best possible solution to social problems of poverty and distribution. Introduction of these social

considerations may limit the speed with which management measures are implemented, or it may justify a more intensive rate of fishing than is justified on purely economic grounds. Panayotu (1988) calls the level of effort below MSocY as socio-economic-over exploitation. MSocY is more applicable and politically acceptable in the case of small scale and artisanal fisheries in which socio-economic considerations over ride biological and economic considerations. Nonetheless, MSocY is estimated, incorporating both biological and economic aspects of fishery management and not independent of MSY and MEY. In an open-access fishery of a developing country like India, where fishing is still a livelihood avocation for many, MSocY may be a best possible rate of exploitation.

As Troadec (1983) observes, a fishing policy has several benefits as its major objectives would have to be based on an appropriate analysis of all relevant factors involved in it. From that angle a critical analysis and assessment of the biological, bio-economic and social aspects of fisheries would contribute to a better appreciation of the long-term advantages of management and the available options for adoption of management decisions.

Ecosystem Approach to Fisheries Management

A new concept that is emerging now is the Ecosystem Approach to Fisheries (EAF) Management. It is still in the formative stage FAO has evolved preliminary draft guidelines for it, in an Expert Consultation on Ecosystem-based Fisheries Management held in Reykjavik, Iceland from 16-19 Sep. 2002. This initiative was supported by the World Summit held in Johannesburg, held from 26-August to 4th Sep. 2002.

The Reykjavik declaration recognized the importance of interaction between fishery resources and all components of the ecosystem, including the environment, and the need to conserve marine environments. The EAF implies the introduction of ecosystem considerations into all dimensions of fisheries, not confined to its management alone. The guidelines are however limited to marine capture fisheries.

The draft guidelines are aimed at facilitating and encouraging responsible management and responsible fisheries, taking the ecosystem as a whole, and recommends some methods, approaches, and controls that can be used in environmental conservation and restoration. Since they are still draft guidelines they are not being discussed in detail. These guidelines are targeted at fisheries management and not at coastal zone management. But conceptually an ecosystem approach is a right step. Nevertheless, the study would like to aver that a more appropriate approach would be an Integrated Coastal and Marine Ecosystem Concept for marine fisheries management, as solution for the problems of marine capture fisheries will have to be sought simultaneously from areas outside fisheries. For a developing country like India, a Coastal Area Marine Ecosystem (CAME) concept is possibly the better alternative.

Reference Points for Fisheries Management

Setting up of objectives and targets are fundamental to the management of fisheries. It is equally important to prescribe certain Reference Points for rational exploitation of the fishery resources and to assess the effectiveness of the measures adopted for management of fisheries. Reference points are defined as a conventional value, derived from technical analysis, which

represents a state of the fishery or population, and whose characteristics are believed to be useful for the management of the unit stock. (Caddy and Mahon, 1995).

For the success of an effective management programme all the stakeholders and interest groups of a fishery will have to agree to common management objectives, whether they are for export, domestic consumption, tourism or for some other objectives. They must be able to understand and appreciate the objectives in relation to the characteristics of the fishery. The absence of clearly defined management objectives is a major impediment for establishing and adhering to the reference points (Smith et al 1993). The identified objectives are formulated into conceptual reference points, which in turn are converted into technical reference points, like MSY, MEY, mortality rates, catch rates, mean fish size, etc. They are quantified on the basis of biological and economic characteristic of the fishery. The technical reference points are classified into Target Reference Points (TRPs) and Limit Reference Points (LRPs).

Traditionally the Target Reference Points (TRPs) indicate a desirable status of the stock or fishing activity. The commonly used TRPs are MSY, MEY, yield per recruit area, and size of the fish caught, natural mortality rate or recruitment on spawning stock size. Management of a fishery using TRPs entails constant monitoring and timely modification to the management measure.

The Limit Reference Points (LRPs) indicate an undesirable level of fishing activity. It may reflect a minimum condition like precariously low spawning biomass or a maximum condition like high rate of decline in stock size or a high mortality rate (fishing mortality expresses the proportion of individuals, removed by fishing in relation to the population being fished during a given period of

time.) To protect a fishery from such a damaging situation, where continuity of production is in danger, immediate actions like substantial reduction in fishing effort or periodic closure of fishery may have to be taken. Reference points indicating such a “red alert” situation are referred to as Threshold Reference or as Limit Reference Points (LRPs). Most of the LRPs are also variations of the TRPs based on MSY, stock recruitment or other biological considerations or economic considerations. But such reference points cannot be applied universally in all situations, for example economic reference points may not be practicable as reference points for management in the case of straddling stocks or highly migratory resources. Similarly there has to be separate reference points evolved for stock building of overexploited fisheries.

The Advisory Committee on Fisheries Management of the International Council for the Exploration of the Seas (ICES) - the world’s oldest intergovernmental organisation for marine service, in its 1987 report has observed that TRPs like MSY are biological reference points intended to provide guidance for management and such biological reference points cannot serve as universal targets. Therefore the recent thinking is not to treat them as TRPs. The MSocY or the OY is not considered as a Technical Reference Points, as it has no single technical definition.

There are several uncertainties in the estimation and application of reference points in fisheries management. The uncertainties or incompleteness of knowledge about the state or process of nature make quantification of reference points difficult. Rosenberg and Restrepo (1993) have identified five types of uncertainties, viz. measurement uncertainty, process uncertainty, model uncertainty, estimation uncertainty and implementation uncertainty. These uncertainties arise out of statistical errors, environmental trends, or errors in population analysis, wrong

decisions or inefficient management framework. Though no formal definition has been accepted, risk is generally defined as the average loss or forecasted loss when something bad happens. According to Francis (1993) harvesting may be considered if it maintains a spawning stock biomass above 20% of the virgin stock level at least 90% of the time. Generally levels of risk around 10% will be justified as acceptable. The fishery managers will have to develop means of evaluating the cost of these uncertainties and define acceptable levels of risk, of risk, and of short-term yield, which can be foregone to reduce them. (Caddy and Mahon 1995).

The TRPs and LRPs are in a way a set of rules under which a fishery has to be managed. Generally both TRPs and LRPs are used to frame the strategy for managing a fishery. The management measures may be in the form of input controls or output controls. The input controls are in the form of limitations on size and fishing power of vessel and gear, restrictions on credit, limited licenses or limited access schemes. The output controls are restrictions on the characteristics of the catch like size and species composition, the total amount of fish harvested annually (i.e Total Allowable Catch – TAC) by individual vessels (individual transferable quota system) or controls on landings through taxes.

The success of evolving a framework for management reference points, their acceptance and continuity depends on appropriate institutional mechanism for consultation with the stakeholders, review, monitoring and/or modifying the system periodically. The lack of inadequacy of the institutional framework for implementation may be as significant a contributory factor in the failure of fisheries management as it appears to be in the case of fisheries development. (O'Boyle, 1993).

The developing countries are still unable to utilize these specific and technological advancements in the management of their fisheries, due to the high cost of application and the technical complexities. They have to mostly rely on qualitative or semi-quantitative criteria as LRPs in the absence of detailed information required for evolving mathematical models. For them a precautionary approach, as recommended by the Code of Conduct (1995) of United Nations for responsible fisheries may help in setting practical limits for exploitation of resources. Article 6 of the Code states that the States shall be more cautious when information is uncertain, unreliable or inadequate. They may apply a precautionary approach taking account of the best scientific evidence available. The absence of adequate scientific information shall not be used as a reason for postponing or failing to take measures to conserve target species associated or dependent species and non-target species and their environment.

As Caddy, et al (1995) conclude, the reference points evolved so far are technically complex, that require enormous data collected systematically over many years, are fought with uncertainty and need good judgment for their application. Due to their high cost of application and technical complexities, these tools are outside the reach of small stocks and developing countries. Even when the background pre-requisites are available, they have not always provided adequate basis for sustainable harvesting of resources, because strict rules for their application have not been followed. They are also of the view that these methods will not be applicable in the foreseeable future in the developing countries. Consequently they will have to use the best available information to define an acceptable level of risk, and to agree upon Target and Limit Reference Points, consistent with the reduction of stock to acceptable levels. They may have to

adopt TRPs & LRPs which will be simple criteria, based on experience derived from other similar fisheries or from generalization about other fisheries.

Fishery management reference points are ultimately set by convention. (Caddy and Mahon, 1995). Where data and expertise are available and cost effective, the reference points may be evolved based on the technical aspects and evaluation of risk and uncertainty. They can also be set on intuition, traditional knowledge or plain common sense. As long as they are responsible and adopted in a participatory manner ensuring public justification with prior agreement by the participants they should serve the purpose as reference points. The UNCLOS is a reference point on national and international fisheries management. Articles 61 to 64 provide the criteria for managing stock within a single EEZ.

Techniques of Management

In the past, management efforts were confined to conservation of resources only. The realization that the full potential of a fishery cannot be harnessed unless comprehensive management plans are adopted made the policy makers and researchers to look for techniques of management.

Formation of management policies and programmes must be proceeded by independent studies on the subject of fishery. The current status should be evaluated to access the stock biomass, fishing infrastructure, manpower, development potential etc. The stock assessment should consider the current state of fishing and possible consequences of different levels of fishing, the technical aspects of different strategies for the development and management of fisheries. The

management programme must be in line with the stated objectives and assigned priorities. The mechanisation for implementation of the programmes and to monitor it, will have to be appropriately positioned.

The management techniques mainly consist of regulatory measures to control different operations in the sector. They are aimed at conserving the stock, prevent over capitalization and avoid conflicts to achieve the declared objectives of development. These regulations were either applied through controlling effort, or changing the distribution of that effort or composition of the catch. The techniques commonly being practiced are the following:

1. Selective Controls on Catch:

It is either through restricting the age and size of the catch or species in a multi species fishery. By prohibiting fishing in areas and seasons when the young ones are large in number, the yield of a stock can be improved. Prohibiting the landing, its marketing and processing of fish small in size is another method of selective controls. Although the improvement is limited – say 10 to 20% - and is difficult to implement in a multi species fishery its impact cannot be ignored. Regulating the use of widely used gear causing over exploitation and promoting the development of new gear, for catching under exploited species helps in maximizing the yield. Selective control, by itself has limitations, as it cannot prevent acquisition of additional fishing inputs affecting the management programmes. Besides selectivity involves distributional implications, which is likely to affect the small fishermen, who would oppose such regulations. Moreover in multi species fisheries with multi-gear operations, enforcement of gear selectivity is difficult and expensive. It can be complementary to other measures to regulate fishing rate.

2. Seasonal and area closures:

Seasonal and area closures are a widely practiced control measure. It helps in improving the productivity of the resource by ensuring uninterrupted spawning and protection of juveniles. It also aims at controlling total effort and catch. But such closures, adversely affect the small-scale fishermen, who are left idling during the off-season, without mobility to fish in other inshore areas or in the offshore. As a means of controlling total catch or effort, such closures are not found to be very effective, as the fishermen tend to expand their efforts during the open season to make the best use of it for compensating the loss in the closed season. (Panayotu, 1988). Experience has shown that enforcement of such closed seasons is also not very easy often leading to serious conflicts, among fishermen groups and between fishermen and enforcement authorities.

3. Regulating Fishing Rate:

Controlling fishing rate is a more effective management measure to prevent over fishing. The control of fishing rate corresponds to the over fishing mortality. (Troadec, 1983). Fishing mortality expresses the proportion of individuals removed by fishing in relation to the stock during a given period. It is difficult to measure this in actual time. It has to be decided from other factors like total catch, the biomass, fishing effort, or catch capacities. The fishing mortality can be regulated through catch quotas restricting fishing effort or catch capacities. The risk in adopting these factors as management tools is that there is no strict relationship between fishing mortality and each of these factors individually. They are complementary to each other and failure in any component would cause distortion in management programmes. But control of fishing rate causes severe political, theoretical and operational problems, especially in livelihood fisheries as in India.

4. Catch quotas

In the simplest form, the total authorised catch is fixed every year. This method makes it possible to preserve the stock at the desired production level. But it cannot prevent the tendency to the increase in cost of production, since individual fisherman is inclined to enhance his catch capacities to obtain a larger quota or to maintain his share in the face of rising competition. To avoid the disastrous consequences, global quotas, were divided into national quotas and to groups of fishermen allowing them to decide the most appropriate measures to manage the quota. Thus the overall quota was divided between the individual operators in the form of individual fishing rights. (Christy, 1973). By doing so the individual operators may minimize the cost of production and to maximize the profit. They may also cooperate with the regulatory measures. But this system has serious problems in implementation, mainly on account of the fluctuations in the stock biomass. In order to control fishing mortality by regulating catches, it is essential that the stock biomass remains small or that its variations are known, failing which it may cause increase in cost or distortion in fixing quotas. Situations like seasonal variation in short life span species like shrimp, cephalopods and internal fluctuations of biomass, will have to be carefully considered while fixing quotas. There are also problems in administering the quota system. It is difficult to monitor and control catches effectively, because of the high mobility of the fishing operations, large number of landing sites, and variability experienced in a multi species fishery. All the more complex is the situation in countries, which do not have the requisite expertise to enforce such control measures. False reporting of catches is a frequent phenomenon and the administrators are often unable to check the accuracy (FAO, 1980). Notwithstanding these shortcomings, this is found to be a practical method for regulation of fishing effort, especially in the fisheries where the stock is fairly stable and where the catches can be controlled.

5. Regulation of fishing effort and control of catch capacities

One of the prime objectives of management is to control total fishing effort, without bothering much about the method of production, unless social considerations demand sacrifice of some efficiency to maintain employment or to improve incomes of artisanal fishermen. Regulating fishing through removal of excessive fishing effort is considered to be an effective mechanism to control catch capacities.

In order to control fishing mortality exerted by a vessel, it is necessary to control the fishing mortality in each unit of fishing effort, its individual fishing power, the actual fishing time and the total number of vessels. Regulation on fishing time alone is insufficient. Reduction in fishing time will show some improvement but this will be offset by increasing catch capacities. This method of regulation is considered to be simple, as it would be sufficient to determine the fishing capacity of each authorised type of vessel and to limit their number to the level of maximum effort required. This can be administered through a licensing system. But in practice, it is neither possible nor desirable to restrict the fishing power of a vessel, like tonnage, engine power, fish finding equipments, fishing gear, abilities of the crew etc. Such restrictions would compel the fishermen to forgo the technological improvements and the gains in efficiency. Even if it is possible to regulate the physical characteristics of a vessel, the expertise and performance of the fishermen would enable him to catch more fish with the same means and time. It is a generally accepted fact that limiting the means of capture is, more reliable from the point of view of conservation of the resources and the cost of monitoring it is much less. Despite several advantages, there are difficulties, like political reluctance, administrative capabilities and cost of enforcement, which are

required to be taken into account while assessing the desirability of adopting this method of regulation.

6 .Economic mechanism for regulation

A fishery well managed through appropriate regulatory mechanism produce economic surplus or resource rent adding value to the ordinary return on capital and labour employed for harnessing it. Such a fishery can be controlled by removing the added value enabling it to stabilize at that level. The added value can be removed by levying a fee for the license before the catch is taken or as a tax or price control after the catch is taken. But economically and politically such a move would not be readily acceptable since it may reduce employment opportunity on account of the reduction in effort, though it is meant for the improvement of the stock. In any case the incremental value added, should preferably not allowed to be re-invested in a developed fishery to prevent over capitalization and over-equipping of vessels

7. Territorial Use Rights in Fisheries (TURFs)

Territorial Use Rights in Fisheries (TURFs) is a method of regulation through leasing of resource (biomass). Under this method, the resource (biomass) itself is allocated to the fishers instead of individual catch quota. The advantage here is that the operators themselves will strive to reduce cost, and try to manage the fishery resource allocated to them. This will also reduce the pressure on the regulators in monitoring the application of the regulations. The mobility of the resource is the major constraint in widely adopting this method. This system has been in practice in several traditional fisheries as exemplified in Japan, Brittany (France), Italy and Sweden, mostly in sedentary fishing or comparatively low mobile stock. In all such instances the fishermen

themselves were able to unofficially divide the resource amongst themselves, control the competition between them by regulating access and participation in the fishery, limit individual and total fishing effort and thereby achieve better exploitation of the stock in biological and economic terms. But they would require scientific support to determine the suitable fishing rate, catch quota, age, species selection etc. for optimum exploitation.

Territorial use rights in fisheries (TURFs) have been traditionally in practice in several parts of the world, especially in establishing exclusive rights in sedentary fishery resources. They are also being practiced in lagoons, along beaches, coral reefs and in access where Fish Aggregation Devices (FADs) are being used. The community fishing rights and other forms of proprietary rights have been the rule rather than the exception in many traditional coastal fisheries until recently when they began to breakdown under population pressure, technological advances and the general acceptance of marine resource as a common property with open-access (Panayotou, 1982). These are being considered as important intervention mechanisms for fishery management enabling efficient production of net benefits and equitable distribution of benefits. The adoption of EEZ is also a practical application of TURF. The rights offered under any form of TURF, is believed to prevent the damaging consequences of open access to the marine fishery resources, adding efficiency to the management system adopted in a fishery. The TURF also offers an opportunity for improving the welfare of small-scale fishing communities in developing countries. The average income of small-scale fishermen, especially of developing countries is extremely low due to various socio-economic factors including the problems arising out of common property condition. If the common property condition is revised and through better management, economic rents are produced, the benefits can be shared by the small-scale fishermen, improving their

income. Community control of the means of production through TURF may help improve the livelihood of the artisanal fishermen, if such controls are effective, failing which, it may create monopolies of the local powerful fishermen, making them a class of “sea lords” enjoying uneven “sea tenure” (Christy, 1992).

The seas and oceans have been considered as common properties. Theoretically owned by all the people, the coastal commons is held in trust by the Government and its uses decided by the Government. Common property resources are there to which access is both free and open to a set of users or potential users. If the users or potential users do not control access to a fishery, even though it may have the right to do so, the condition of common property exists. (Christy, 1992). “Common Property” relates to the conditions governing access to the resources and not to the nature of the owners or the nature of those who exercise jurisdiction or control over the resource. Because of the common property condition, there is a tendency to waste the resource physically, by exploiting it beyond the maximum sustainable yield, as there is no incentive for individual fishermen to conserve the resource for the future, which is not assured for him. Since there are no restriction on the application of capital and labour there is often the tendency to launch too much effort on too little resource. In an uncontrolled, open fishery because of the abundance of resources in the initial stages and subsequent increase in price as the production goes down, there will be surplus profit attracting more fishermen. Entrance of more fishermen will add to the total costs without increasing total revenue. New entrants will be dissuaded only when total costs reach total revenue and the economic rent (i.e., difference between total revenue and total costs) gets dissipated. Effective TURFs will prevent such an event of dissipation of rent.

The common property condition causes damages than benefits. It is a generally held view that the open access system of the marine fisheries is the major cause for unbridled exploitation of the resources and that introduction of restrictions is necessary for the sustainability of marine fishery resources. The open access characteristic may provide more employment opportunities where alternate job opportunities are not available. But when alternative opportunities improve, this perceived benefit disappears, though the damages caused to the resources would continue to have its after effects. The common property condition would also cause conflicts, between different interest groups or even same interest groups. The conflict may be between fishermen using different gears for the same resource, or between large and small fishermen, using different kinds of gear for different stocks but in the same geographical location or between mobile trawlers and fixed gear fishermen groups.

The objective of TURFs in the context of developing countries especially of India is to develop a system of tenure that would ensure economic and social benefits to the small-scale fishermen. But the issue of determining the rights in a TURF is very complex. Conceptually it is difficult to define property in the sea because of the fluidity of the medium and the mobility of its resources. Tradition and cultural practices and belief-systems also have to be taken into consideration while determining TURFs.

In order to make the TURF effective, certain rights have to be exercised. They are the following: -

1. Right of exclusion which means the right to limit or control access to the territory.
2. Right to determine the amount and kind of use within the territory.

3. Right to extract benefits from the use of resources within the assigned territory.

4. Right to future returns from the use of territory through a fixed tenure.

These rights enable the beneficiary to enjoy the ownership of a right of use and not the ownership of the resource.

The TURFs can be owned by an individual, a group of individuals, a cooperative, a private enterprise, a community, a national government or even a multinational agency. A community-based ownership of a TURF is more advantageous to ensure a better deal to the small-scale fishermen. As Christy (1992) has observed, the community would be in a position to choose whether it wishes to extract resource rents, to increase the income levels of its fishermen, to increase employment opportunities or to achieve a continuation of these goals. It could also determine the kind of gear to be used, the technology to be adopted, the time and season for fishing, and other management measures. Exclusive territorial rights provide a strong incentive for ensuring that management measures are respected.

TURFs have the greatest advantage in managing a resource. It facilitates the imposition of management measures and its enforcement comparatively easy, as the TURF ensures an exclusive right to the product during the tenure of the arrangement.

There are several natural and social conditions that influence the creation and/or maintenance of effective TURFs. They include those related to resource, definability of boundaries; technology based cultural attitudes, wealth distribution effects, governmental systems

and legal and institutional framework. The effectiveness of TURF in terms of efficiency criteria can be measured by economic or non-economic values associated with territorial use rights. Effectiveness in terms of social criteria, depends on how the wealth is redistributed. (Christy, 1992).

Who is benefited out of TURFs is a question frequently raised from several quarters. It has been stated above that individuals or a host of other groups can avail a TURF. If it is confined to a few individuals, it may be disadvantageous to the small-scale fishing communities. It would reduce their accessibility to the fishery resources. It may even make the smaller fishermen totally dependent on the TURF holder, whose interest is to maximize profit by reducing labour or adopting other cost saving measures, which is detrimental to the smaller fishermen. Compensating the fishermen by extracting a resource rent through taxes may be possible but often difficult to implement and it may be even inadequate to make up the loss suffered by them through loss of access to the resource. A desirable option will be to grant TURFs to the small-scale fishing communities to manage them. This would enhance the possibility of ensuring welfare to them. The local community of fishermen would be able to manage the TURF more efficiently through active participation in decision-making. They can decide on the level of exploitation, level of employment creation, select craft and gear of their choice, adopt technological innovations, as well as other management measures like seasons of fishing etc. An exclusive right for use of territory is a strong incentive for adopting management measures, at a lower implementation cost.

The experience of adopting TURF has not been always positive. There were instances of breakdown of TURFs in the absence of institutional protection to the owners of TURFs. Traditional

territorial rights have not been able to withstand the pressures arising from large-scale increase in the value of access to the territory, because of the lack of institutional protection. Technological advancements like mechanisation of crafts and gears have also led to the breakdown of traditional territorial rights. The costs of acquiring and maintaining of TURFs have also been very high and the benefits perceived to be comparatively low. The legal and institutional protection for traditional territorial rights have not been ensured by several countries where such systems were in practice. But of late the situation seems to have changed globally. The cost of acquiring TURFs has come down and the benefits gone up on account of the scarcity of the resource. With better control and surveillance system in the sea through navy, coastguards, etc. defending TURFs has become comparatively easy. In the changing scenario, community based local TURFs may be an effective management mechanism, especially for the developing countries, but it depends on the willingness and the ability of the State to make decisions on the distribution of wealth. Without state intervention and full support, enforcement and protection of TURF for local communities will be difficult. The revival of such traditional community rights necessitates identification of the factors responsible for their breakdown. Revival would also mean explicit allocation of the coastal resources to artisanal fishermen, dividing coastal resources among fishing communities, regulating entry into coastal fisheries and encouraging exit from the artisanal fishery by creating more attractive employment opportunity outside the fishery.

Fishermen's Organisations and Management

Natural resource management is required to look beyond individual problems. It has to take into account the interrelationship between and within the natural systems, including community participation, so as to adopt ecologically sustainable practices.

The fundamental principles of fisheries management are efficient allocation of resources and an equitable distribution of wealth generated out of it. Both of these are expected to achieve through participation of fishermen's organizations in the management of fishery resources. The fishermen who have first hand information are considered to be effective in decentralized decision making. As the beneficiaries, they are likely to act more responsibly in their own interest. Decision-making is more efficient in the case of individuals or individual firms than in the case of organizations. But coordination and cooperation is better achieved in a decision taken collectively by organisations. Therefore decision making through organizations is preferred to that of individuals for reasons of equity than efficiency. Giving fishermen's organisations the power to decide how fish stocks are utilized may be a way to avoid inequities associated with inequitable distributions of skills and property among fishermen (Hannesson, 1988). However, the outcome of giving fishermen's organisations a say in fisheries management depends to a large extent on the economic framework and philosophy prevailing in each country.

Fishermen's organizations are basically aimed at promoting their own interests, through agitations, lobbying or such other activities. But when such organizations are exposed to competitive markets, they may also get interested in attaining economic efficiency, by reducing costs and improving quality of products. Once they know of the benefit of preventing over-exploitation and hopeful of a better harvest in the future they may adhere to the management measures.

The involvement of fishermen's organisation in fisheries management may vary in degrees ranging from vesting the total responsibility of managing a fishery in their organisation to that of a simple advisory role. The role can be anything between these two extremes.

There are a variety of rights system followed in different countries. Japan has a unique legally defined and protected territorial rights for fishing in the inshore waters. Korea has a similar system. New Zealand has an individual transferable quota system. Australia has a license and individual saleable quota system. Ireland has introduced a transferable catch quota system. These systems were generally initiated by the respective governments but in many cases the fishermen organizations were either not keen about it or even opposed the move, especially in such fisheries where there was excessive fleet capacity and over exploitation of resource. According to Hannesson (1988) fishermen organizations have at least occasionally proved their strength to lobby for their interests, but seldom were directed towards furthering better management of fish stocks. Their efforts were traditionally aimed at strengthening their position in the market place or seeking concession and support from Governments or negotiating wage settlements and working conditions. The EEC experience shows that when fishermen organizations were involved in the management of national catch quotas, it was done more for the purpose of market regulation than for managing the fish stock.

There were instances when fishermen organizations regulated catches as in the case of Atlantic Fishermen's Union in New England, but their primary objective was to obtain better price and not conservation of stocks. However, in an indirect way it did help to some extent in limiting the catch and thus conservation of stocks.

After reviewing the experiences of different countries on the role of fishermen's organisation Hannesson (1988) concluded that there is not much of evidence of collective fisheries management by fishermen. Their role in establishing fishing rights was more for solving conflicts over limited fishing space while the element of conservation effect was only incidental. Some fishermen organizations took enthusiastically their role in regulating market prices, but not in conservation efforts, probably because of the immediate and certain incentive arising out of the former and lack of adequate incentive in the latter.

The role of fishermen organizations in evolving and managing fisheries varies in different countries. In Japan, New Zealand, Canada and U.K, they had positive role in the management of fishing rights. In Scandinavian countries they were mostly concerned with the management of onshore facilities. In the industrialized countries participation of fishermen organisation was not merely being viewed in terms of equity but to promote greater efficiency through their involvement in decision-making.

In the developing countries, these organizations were successful in getting some recognition in matters relating to the management of harvesting fish but not any definite role in the management of fishery resources. The fishermen movement in India, under the banner of National Fisher peoples Forum (NFF) and its allies have demonstrated their role and effectiveness in a different manner. Thousands of fishers joined hands in Gujarat, Maharashtra, Goa, Kerala, Tamil Nadu to fight against over exploitation of the resource by trawlers. They have succeeded in focusing the issue which compelled the Central Government and the State Governments to pass legislations to regulate fishing, including declaration of closed seasons.

The need for involving fishermen in fishery management efforts is increasingly gaining attention. The question is how to ensure it. Necessary institutional build up taking into consideration the traditions, and socio political situations, with or without government intervention would be a practical approach. Such institutions should be empowered with adequate legal framework for their effectiveness, for which state support is inevitable.

Co-management in fisheries management

A system of co-management or community based management where the fishermen join hands with the authorities entrusted with formulation of policies and their enforcement is assumed to be a viable option which enlists cooperation of the fishermen in the management of a fishery. A co-management strategy aims at devolution of powers to local fishermen organizations based on democratic principles. There are several examples of such traditional institutions like the cofradias and prud'homics of European Union and Fisheries Cooperative Associations of Japan, participating in co-management programmes. Co-management would help identify social objectives and lead to their incorporation in fisheries management strategies. Institutions like co-management system or without the backing of formal law have been found to be particularly successful in the case of open inshore, artisanal and non-industrialized fisheries. Their adaptability to more complex situations and offshore and distant water fisheries is doubtful. Co-management is often criticized as yet another example of Government talking about grass roots participation and consultation, but doing the opposite. This criticism carried weight particularly since most developing countries lack the institutional framework, within which a co-management approach could succeed. For the success of co-management approach, genuine fish workers organisations are a condition precedent, for

which appropriate capacity building exercise is necessary. A bottom-up co-management approach that is cost-effective, participatory and enjoys the confidence of genuine fish workers might work successfully in developing countries.

These traditional institutions inculcate a sense of ownership and partnership encouraging them to share responsibilities of management. They are also a source of 'data' and knowledge of ground realities, which are valuable assets for the management of resources. The fishermen know about the resource position and they even caution the authorities about its decline. But their warning signals are seldom taken note of and acted upon. The authorities tend to ignore them. A partnership between the fishermen organizations and the State agencies would be comparatively easier and more cost effective for the enforcement of conservation and management of fishery resources. When the fishermen are made aware of the real dangers of over exploitation, they welcome regulations and cooperate with the enforcement authorities. The more transparent the regulations are the better their acceptance, by the stake hlders.

The management system hitherto followed based on biological and bio-economic models need a thorough re-appraisal, especially in the context of the developing countries. The fishermen should be brought to the centre of developing and implementing management programmes. Although they may compete among themselves for the same reasons, they would come together and cooperate when they are aware about the danger of unbridled exploitation. Competitive exploitation can be replaced by cooperative management if the involvement of fishermen is ensured in the planning and implementation of management programmes.

It may be observed that there is no maritime society, which is unable to invent and implement its own rules for resource exploitation and for the sharing of the resources. It may be either in the form of marine territorial use rights, or those imposed by the village community ownership or religious taboos attached to unhealthy fishing operations. It will be very coercive and socially very costly for the transgressors to ignore such community regulations (Collet, 1996).

The peoples management programme, will have the strength and knowledge of traditional management practices and day-to-day experience of the issues of fishery resources. If the local community is economically dependent on the resource, they would tend to protect it, especially if they know that the resource will not be taken away by any outsider. The real users who wish to enjoy a resource for years to come, would welcome an intelligent management programme (Suzuki, et al 2002). In such a circumstance no one from the community would venture to violate the general consensus. Each one would realize that respecting the right of others is a better way to defend ones own rights.

A cooperative management mechanism would minimize the need for state intervention, as the enforcement of regulations become the responsibility of the users of the resource itself. The Governments should recognize this aspect and include such management partnership as a part of their development intervention. As Collet (1996) observes, “Without involving the cooperative action of fishermen and their institutions in management decisions, there can be no end to the global depletion of fishery resources. Ninety percent of the world’s fishermen live from small scale, inshore fisheries which yield more than half the world’s fish harvest”.

The fishermen with their wealth of knowledge and experience, and with the help of social, technical and biological research can develop appropriate system for management of marine resources

Community management of marine fisheries at local levels

In the developing countries, including India, development of marine fisheries was equated to unbridled mechanisation, which has proved to be detrimental to the artisanal, traditional fishermen for whom fishing is the livelihood. A new development concept, focusing on environment and sustainable development, involving the community is required to be evolved, for protecting the environment and the natural resource. Communities which live in small location specific and occupation specific communities and depend directly on natural resources for their livelihood are referred to as "Ecosystem people or communities" (Dassmann, 1988) indicating their close linkages with the nature. Since fisheries and fishery related activities have been their major source of livelihood, fishermen may also be categorised as "Ecosystem People". Fisheries are a common property resources to which fishermen generally has access (Gordon, 1954). With the declining fishery resources and various pressures mounting on it, this sector is fast becoming the last resort of employment even for fishermen traditionally engaged in it. To correct the vulnerability of a marine fishery, factors outside it also will have to be dealt with, while strengthening the sustainability of the mega-ecosystem in which it is an integral part. There is a need to re-establish relationships with the oceans and seas in which the fishers seek their livelihood (Kurien, 1998). To achieve this relationship, establishment of property rights through appropriate aquarian reforms is considered a positive step forward. The question is about the framework for such reforms. The commonly practiced property right regimes are: (1) an open access regime only with the privilege

of possession; (2) a state property regime; (3) a private property regime; and (4) a common property regime where a group of co-owners enjoy rights and duties with respect to the use and management of the resources claimed by them. Baland and Platteau (1966) classify common property regime into unregulated and regulated regimes. The former is more like an open access regime and the latter like private property regime of a group of co-owners.

In the given state of the management of marine fisheries in most of the developing countries, where the legal framework is either non existent or insufficient, its application weak and its transaction cost high, variants of a regulated common property regime where the community takes the responsibility to manage and nurture the resource based on sound ecological principles, may be a practical solution. The structure of such variants depends on the resource position of the coastal zone as a whole, level of exploitation, socio-economic condition, development of infrastructure and the political sensitivity of the locality. The awareness of the beneficiaries about the need for adopting management practices, involvement of civil society organisation, institutions like cooperative societies, self help groups, local self Govts., intervention of promotional and facilitation agencies of the Government etc. would determine the pace at which an ecosystem based community management system can achieve the objectives.

An aquarian reform giving primacy to actual fishers should also form part of the fishery management policy. The Aquarian reform may give effect to a policy of exclusion:

(i) All fish that can be caught by artisanal fishermen should be caught only by them.

(ii) All fish that cannot be caught by artisanal fishermen, but can be caught by small-scale commercial fishermen should be caught only by small scale commercial fishermen.

(iii) All fish that cannot be caught by small-scale commercial fishermen, but can be caught by medium scale commercial fisheries should only be caught by medium scale commercial fishermen.

(iv) Only such fishery resources which are not accessible to any of the above fisheries or which cannot be feasibly caught by them alone should be allocated to industrial large-scale fisheries.

It may be possible to introduce such regulations through appropriate craft and gear restrictions with active monitoring and management of fisheries through community participation and of authority to the community.

Traditional Resource Management

Traditionally, the local communities have enjoyed certain rights and privileges on the adjoining marine resources in the form of customary fishing rights, marine tenure, etc. It will be difficult and expensive for the State to assume the responsibility of enforcing all management measures. There are instances where the resource conservation is stronger where access to fishing area is limited to traditional users who maintain effective control. Where such customary fishing rights exist it should be strengthened, where it has gone into disuse effort may be made to resurrect it. But as Johannes (1982) points out “It would be a mistake to romanticize traditional island fishermen to view them as ideal conservationists living in perfect harmony in nature and one another”.

Alternate Strategy for Resource Management in Coastal Fisheries

Fisheries is a renewable natural resource but its continued availability to future generations depend on its sustainable exploitation. The resource base is the capital which produces an annual yield which may be exploited. The resource base should not be harvested, in excess of what can be regenerated. By sustaining the resource base the yield is available year after year. This is particularly important for fisheries of the developing countries where it is still a means of livelihood for millions of people.

State intervention through new technologies and financial aids was the prime move behind fisheries development in the developing countries. These State aided development programmes led to rapid expansion of fishery activities depleting the resource base through excessive exploitation. This has prompted many small fishers to invest more in new technologies, more powerful fishery crafts and gear adding further pressure on their resource. To reduce this pressure and to enhance the sustainability management efforts are required to be undertaken urgently. The measures undertaken so far by the developing countries were mostly aimed at conservation of resources, which is not enough. A more holistic approach of 'Resource Management' is required to be adopted for achieving sustainable use of marine fishery resources.

The prime objective of marine fisheries management is the sustainable development of the managed fisheries. Development of a fishery to be sustainable, ensuring attainment and continued fulfillment of human needs for present and future generations, it must satisfy economic, social, biological and environmental objectives. Fisheries has to be viewed as an integral part of the coastal ecosystem with interdependent relationship. Today, sustainability of marine fisheries is

threatened by coastal degradation. Hence it is necessary to take appropriate corrective measures for preventing coastal degradation.

To reduce the pressure on the resource base and to increase productivity several methods are being adopted by the concerned authorities, as measures for resource management. Limiting entry is often recommended by experts as the most effective measure to reduce fishing effort. Limiting entry as a policy may not deliver the desired objective as it limits only the entry of labour without limiting flow of capital, additional fishing capacity, capital-intensive technologies and entry of people newly taking up fishing on a full time or part time basis. There are obviously serious problems in adopting and implementing such measures. One method of restriction is to discontinue the liberal financial assistance in the form of subsidy and loan for investment in fishing crafts and gears. Issuing limited number of licenses preferably to owner operated boats for different zones has been experimented within Malaysia. Such arrangements are planned, implemented, monitored and enforced by the fisheries administration with varying success. But these regulations could not achieve the desired objective mainly on account of the low involvement of the fishermen.

Community based Territorial use Rights in Fisheries (TURFs) is yet another method of restricting entry. But the seasonal mobility of fishermen and the movement of fish stocks make TURF difficult to implement. Maintaining access rights for the migrating fishermen while restricting their numbers, and allowing the TURF owning community to charge users fee is a way out. Demarcation of TURFs boundaries, monitoring and enforcement of fishing rights within the

assigned territory, the limitations of institutional and organizational capacities of the community to a TURF based management regime are other obstacles to this system.

Introduction of a tax on fishing inputs or on output is also a possible method of restricting entry into fisheries. But it may not be easily acceptable politically, socially or economically as it would further burden the small-scale fisheries and may force the inefficient one out of the fishery. If the revenue thus generated can be ploughed back to the community, the opposition to such a measure could possibly be reduced.

Exit promotion of both capital and labour is a complementary programme to rationalize the strength of fishermen and fishing capacity. Fishermen may be encouraged to invest in other economic activities including fish marketing and processing instead of continued investment in the harvesting sector. Programmes aimed at limiting entry or promoting exit can be made attractive if only there are alternative employment opportunities. State intervention for income diversification and liberal incentives including access to credit are required along with measures to create awareness amongst the fishermen about the disadvantages of overexploitation of resources and need for adopting management measures.

Relocation and transformation of fishers from overexploited fisheries has been found to be successful to some extent in Malaysia and Indonesia. Such a programme depends on the population density and availability of uninhabited but suitable areas for resettlement.

Though restriction on entry of new capital intensive technologies, capacity and labour into fishery is necessary to reduce the ever increasing pressure, its application as a management measure will not be readily acceptable in the developing countries either politically, socially or even economically. Besides, their Governments may not have the expertise and wherewithal and cost effective mechanism to check such entry and enforce the policy. Therefore at present in the existing circumstances limiting entry through stringent measures is not a priority option, at least for the developing countries and the least in India as a policy towards management of fisheries.

The coastal settlements in the rural areas depend on fisheries, agriculture and in some cases forestry for their livelihood. The coastal resource system consists of both the "dry side" (Coastal hinterland & low lands) and the "Wet side" (Coastal waters and deep sea). The coastal natural resources cannot be managed effectively by taking individual resource separately from each of them. Their development and management must be taken in an integrated manner for long-term sustainable use and perpetual maintenance of the environment.

Coastal zone is an area with unique features consisting of different ecosystems, providing an array of goods and services to the society, stretched across a variety of activities based on the multiple resources available in the area. There is an interrelationship between these ecosystems; one affecting the other. The pollution in the landward area, affect the marine life. Deforestation leads to soil erosion affecting coral reefs, sea grass beds and other downstream life systems. The destruction of mangroves affect the breeding grounds and nurseries disturbing life cycles of several crustaceans and other varieties of fish, which in turn leads to decline of stock. All these will have direct or indirect impact on the socio-economic aspects of the entire coastal community.

The sustainability of the development activities in the coastal area is key to the sustainability of coastal fisheries as well. But to improve the sustainability of the coastal zone development as a whole, fisheries has only a limited role. One has to essentially look at sectors outside fisheries to find satisfactory solutions. The problems are of varied nature contributed by fisheries and those contributed by other external factors. Several environmental changes have been the result of lack of awareness by the fishers themselves. Over fishing, destructive fishing practices, pollution from fishing facilities and fishing vessels, poor aquaculture practices, destruction of mangroves, wetland, etc., are all problems caused by the fishing sector itself. Land based pollution from urban centres, industries, agricultural run off, tourism, oil tankers, ships, oil rigs, destruction of marine life habitats like mangroves, wet lands, coral reefs, estuaries, deforestation and consequential soil erosion etc. are often the result of thoughtless unplanned development efforts by sectors outside fisheries. Poor database, poverty and lack of alternate employment, inefficient market systems, legal, institutional and administrative problems, vague jurisdictional functions and legal mandates, lack of coordination among various agencies, inadequate planning, and management skills, capacity for monitoring, evaluation and weak enforcement machinery, aid and abet the problems of fisheries and the coastal zone as a whole.

The common property nature of many of the coastal resources makes its efficient and sustainable use difficult. In the absence of effective property rights and their enforcement, markets often fail and these results in externalities, the costs of which are often not taken into account in decision-making. These market failures are often compounded by policy failures, resulting sub optimal use of the resources and consequent environmental damage.

The concept of Integrated Coastal Area Management (ICAM) aims at sustainable development through an integrated, multi-sectoral, multi-disciplinary, strategic approach to the efficient allocation of scarce resources among competing users. An underlying basic principle in the integration of fisheries management with the Costal Area Management Plan is that sustainable development of a coastal area should not be at the expense of fisheries resources. Sustainable fisheries management requires adoption of effective management measures for the sustainable exploitation of the fishery resources and the management of adverse environmental impacts, which degrade the habitats whether originating from within or outside the sector. .

Management of fisheries has so far been on a sectoral basis, focusing on issues and impacts within the fishery sector such as overexploitation, overcapitalization, and consequential waste, conflict between the traditional fishermen and the industrial offshore fishing fleets. Such a sectoral approach cannot find lasting solutions for problems being faced by marine capture fisheries particularly in multi-species tropical fisheries as in India. A multifaceted and integrated approach as a part of the overall Integrated Coastal Area Management Plan (ICAMP) is the need of the hour. It can address the impacts of the multisectoral activities and development in the coastal zone and hinterland arising from competing users of the resource. The pre-requisite is to have a sustainable fisheries management plan itself to become part of the ICAMP. A sustainable fisheries management should aim at sustainable benefits for fishermen in terms of nutrition, employment, equitable distribution of benefits and avoidance of intra and inter sectoral conflicts.

For sustainable fisheries management, pressure on marine stock is required to be reduced. In other words, alternatives to fishing have to be developed through economic

diversification of the coastal zone as a whole. Opportunity for creation of further jobs in the overexploited fisheries is limited. Modernization involving use of more efficient equipments would further reduce the labour component while increasing pressure on already overexploited resource. Essentially other avenues will have to be explored. The objective is to find alternative avocation for the surplus labour force in the fishery sector. Development of other rural enterprises is a viable option. Fishers may be encouraged to combine non-fishing activity along with fishing. They may have to switch over from low productivity fishing activity to other activities offering higher incomes.

Production of value added products from fish is an activity where the surplus fishermen and women job seekers could be gainfully engaged. They can be organized into Self-Help Groups and necessary inputs and finance given along with arrangements for marketing their products. Traditional processing like drying, salting and smoking in the fishing villages may not be very rewarding any more. In the days to come ready-to-eat and ready-to-cook products with quality assurance can find market with the increase in income of the urban and semi-urban consumers.

The focus has to be directed to non-fishery employment and rural industrialization utilizing the local resources, in the coastal zone, as a part of the coastal area management plan. The small-scale industrial sector has the highest potential to generate employment opportunities. Policy intervention by the State to promote rural enterprises including service activities is a viable option to diversify income sources not only to fisher folk but also to other job seekers in the rural area as a whole.

The alternatives available are agriculture, animal husbandry, land development, manufacturing and cottage industries. The agricultural sector including animal husbandry as such

may not offer much opportunities to fishermen as unemployment is rampant in those sectors also and the scope for further expansion is limited. Opportunities are available in food processing and land development, which has the potential to absorb labour. Rural industries particularly the small-scale sector encompass a variety of activities in manufacturing, construction and in the cottage industry sector. The fishermen who do not possess the requisite skill will have to be trained for these sectors.

Tourism, especially eco-tourism and aqua-tourism is a sunrise sector where fishermen could find alternative job opportunities. Conducting tours for diving, snorkeling, surfing, etc. and activities like cleaning and maintenance of beaches can engage a sizeable number of fishermen within their own native villages or adjacent areas. Other related activities like recreational fishing, prevention of degradation of recreational fishing grounds, replanting and maintenance of mangroves, reclamation and rehabilitation of the breeding grounds and nurseries in the coastal habitats, stock enhancement programmes, constitution and maintenance of artificial reefs, shoreline protection and erosion control programmes can create more employment opportunities in the coastal area as a part of the Coastal Area Management Programme.

If coastal zone as an organically linked mega ecosystem is taken together for a holistic planning and management programme, the fishery sub ecosystem can achieve sustainable development. The pressures in the overexploited fishery sector can be released and the non-fishery sectors can offer complementary opportunities. If there is mobility to sectors outside fisheries, the pressure from new entrants and additional capacity building would come down.

Effective management of a coastal fishery demands a multifaceted and integrated approach through an Integrated Coastal Area Management Plan. It should take into account the

impact of development activities in the hinterland and those within the fisheries sector. The conventional fishery management practices would still be needed. The difference is that in addition to them the externally generated impact in the coastal zone, ecosystem as a whole is taken into consideration, while formulating fishery management programmes, since the latter cannot be seen in isolation.

Integrated Co-management of Coastal Fisheries – An Eco-cluster model

Developing countries like India, where marine capture fisheries essentially mean coastal fisheries is beset with problems of overwhelming demand on the limited space and resources of the coastal area. They are generally characterized by over-fishing, declining resources, degraded mangroves, corals, sea grass beds, organic and inorganic pollution emanating from domestic, agriculture and industry, conflicts between artisanal and industrial fishers, land and sea based multi use conflicts or even loss of fishing grounds. The management of coastal fisheries aims at ecological sustainability, which is intrinsically linked to sustainability of the coastal area. Harmonious and integrated development of the complementary and competing interest like fisheries, agriculture, aquaculture industry, tourism, urbanization etc. is critical for achieving this sustainability. This aspect has to be taken into account while formulating policies for development and management, if the fisheries sector has to make optimal contribution for the socio-economic welfare of the Society.

The proposed strategy is one of integrated co-management of the coastal area ecosystem along with the management of the marine ecosystem. Confining the management efforts to the

marine ecosystem alone would be a narrow approach, which is inadequate from a macro-management perspective for sustainable development.

The ecosystem management is “the maintenance of ecological relationships between harvested, dependent, and related species.” As well as “ the prevention of change or minimization of the risk of change in the marine ecosystem, which are not potentially reversible.” In practice, the way of managing entire ecosystems is not yet known. (Garcia, 1996). Accordingly, management has to be flexible, adaptive and experimental at scales compatible with the scales of critical ecosystem functions (FAO, 1998).

In the Indian context a comprehensive integrated and cost-effective management approach broadly adopting the principles of Integrated Coastal Area Management involving the local community is a practical approach to manage the problems of coastal fisheries. State intervention in such an effort is a critical input. Geographical locations in the coastal area with pre-eminence of fishery activities and the ecosystem around it may be identified as “Coastal Fisheries Eco-clusters” (EFEC). Here the emphasis is on the ecosystem of the “coastal area” as distinct from the “coastal zone”. The term ‘coastal zone’ refers to the geographic area defined by enabling legislation for coastal management. The ‘coastal area’ in this context, need not necessarily confine to the coastal zone. It covers a wider area, which may include the coastal zone as defined in the Coastal Regulation Zone (CRZ) notifications under the Environment (Protection) Act 1986, and Rules thereunder. According to this legislation CRZ constitutes only the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action in the landward side up to 500 meters from the High Tide Line and the land between the Low Tide Line and the

High Tide Line. The 'coastal area' extends beyond the CRZ. The term 'integration' refers to collaboration among numerous government and private economic sectors and "comprehensive" refers to the scope of development, control and resource management.

The Coastal Fisheries Eco-Cluster is a geographical area with a variety of natural resource systems. They include mangrove, wet lands and other inter tidal systems, the sea grass system, coral reef systems, sandy beach systems, salt marshes, Lagoon and estuary systems, etc. The objective of CFEC development will be the focused management of the area, ensuring active participation of the local community and concerned Government agencies, without ignoring any of the socio-economic and ecological components.

The objectives of Integrated Development of CFEC is to provide a framework for environmental planning and management focusing on coastal fishery clusters through co-coordinated effort of various agencies and the beneficiaries. The first step towards it is the identification of the problems and issues of the Fishery Clusters. The reasons behind them are to be analysed through a diagnostic study. This initial study may be carried out by an interdisciplinary technical team of professionals in consultation with the stakeholders. The findings and recommendations of the Technical Team are discussed in a CFEC Management Committee, a body that may consist of the representatives of stakeholders, concerned government agencies, local self-government bodies, fishermen community leaders, and other civil society organisations. The Management Committee is expected to prepare a management plan and an action plan for that particular CFEC. The District Panchayt would be the implementing agency. The Fisheries Department in the State Govt. would be the nodal agency for the CFEC programme.

The Central and State Governments are required to provide necessary legislative and policy support for implementing the programme, besides monitoring the implementation of the management plan.

Financing such a programme may turn out to be a constraint. But the individual government agency has its own budget for development programmes that can be utilized as per the management plan. Conservation-oriented investment opportunities including environmental rehabilitation may be identified and encouraged as a complement to the development based funds. Financial assistance may also be sought from bilateral or multilateral development agencies.

The key to the success of CFEC programme lies in the degree of participation by various agencies particularly of the beneficiaries. Co-management which has been mentioned elsewhere, is considered to be an effective mechanism to ensure better participation. However, it presupposes that the stakeholders are made aware of their role and responsibilities. A capacity building exercise has to be an essential component of the CFEC programme.

A countrywide Integrated Coastal Area Management Plan may take a long time for implementation. But CFEC model can be implemented in phases to handle the coastal fishery management without any delay. The operational details of the programme, and the administrative set up may vary depending on the local conditions of each of the CFEC. Such details can be worked out more effectively by the local self Govt. bodies like the Panchayats, and the State Govts can co-ordinate such plans for comprehensive action.

Fisheries Management in India

The Indian Constitution is federal in character with a Union Government at the Centre for the entire country and State/Union Territory Governments for the States/UTs respectively. The responsibilities of governance is categorized into three lists viz. List-I, where the Central Government have exclusive powers, List-II where the State Governments have exclusive authority and a List-III where both the Central and the State Governments exercise powers concurrently with a pre-eminent position for legislation by the Central Government. The Entry 57 of List-I in the Seventh Schedule specifies fishing and fisheries beyond territorial waters as the Union Subject. Entry 21 of List-II enlists the control and regulation of fishing and fisheries within territorial waters as the State subject.

The Indian marine fishery resource is an open access resource and the fishing effort still remains mostly unregulated. The export-led development of Indian fisheries, did bring in unprecedented benefits, but also brought in its wake serious problem of resource depletion. The biggest challenge for Indian marine fisheries today is its management. It is a highly complex issue on account of the widely scattered fishing grounds, lack of reliable data on stock, the diversity in the resources and exploitation methods. The administrative structure of the country also adds to the complexity which can be seen from the multiplicity of agencies involved at the Union and State Government levels.

The development of marine fisheries in the territorial waters is the responsibility of the State Governments, while matters relating to fisheries beyond territorial waters is under the

jurisdiction of the Central Government. The Department of Animal Husbandry and Fisheries under the ministry of Agriculture in the Government of India is the nodal administrative Ministry in charge of matters pertaining to fisheries administration. This Department lays down the national policies on development and management of fishery resources and promotion of fisheries industry. It provides technical and financial assistance to the Central and the State Government agencies for fisheries development both in the inland and marine sector. Matters pertaining to export promotion of marine products are dealt with by the Union Ministry of Commerce and Industry, through the Marine Products Export Development Authority.

The Government of India and the State/UT Governments have enacted several legislations for protection and conservation of marine ecosystem. They regulate various activities related to the marine environment.

1. The Indian Fisheries Act, 1897 regulates the fishing actibvities in general, including fishing mesh size of fishing gear. It also regulates fishing of pearl oysters and the collection of certain types of shells. This Act was inherited by the Government of India and is applicable to the inland and marine fisheries.
2. Maritime Zones Act, 1976. They categories various marine zones such as territorial waters, EEZ, continental shelf etc.
3. The Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981 & the Maritime Zones of India (Regulation of Fishing Vessels) Rules, 1982.
4. The Water (Prevention and Control of Pollution) Act, 1974 for controlling pollution arising from land-based resources. The jurisdiction of this Act is up to 5 Km. in the sea.

5. The Indian Merchant Shipping Act, 1958 for controlling pollution arising from ships and offshore platforms. Its jurisdiction is up to the limits of EEZ and provisions of the Act have been extended to the maritime. The Act also deals with prevention and containment of pollution of the sea by oil from ships, vessels and offshore installations.
6. The Indian Ports Act, 1908.
7. The Wild Life Protection Act, 1972. Marine animals registering a decline in their population have been declared endangered species under this Act.
8. The Environment (Protection) Act (EPA), 1986. It is an umbrella Act for dealing with environment related matters. Under Sec. 3(1) and 3(2)(v) of this Act, a Notification has been issued defining the Coastal Regulation Zones (CRZs), as the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by the tidal action in the landward direction up to 500 m. from the high tide line and the land between the low tide and the high tide line. It imposes certain regulations on setting up industries, its operations and processes in the respective zones.
9. Coast Guard Act, 1950.
10. The Marine Products Export Development Authority Act, 1972.
11. The Marine Fishing Regulation Acts of the Maritime States.

TABLE 5.1: DETAILS OF MARINE FISHING REGULATION ACT (MFRA) PASSED BY VARIOUS STATES/UTS:

Name	Area Covered
1. Kerala (1980)	Traditional – 10 Kms. Mechanised Board below 25 GRT. Beyond 10 Kms. Mechanised Board above 25 GRT beyond 23 Kms
2. Goa (1980)	Traditional Boats – 5 Kms. Mechanised Boats beyond 5 Kms.
3. Maharashtra (1981)	Traditional Boats – 5 to 10 fathom
4. Orissa (1982)	Traditional Boats – 5 Kms. Mechanised Boats up to 15 m. beyond 5 Kms. Mechanised Boats above 15 m. beyond 10 Kms.
5. Tamil Nadu (1983)	Traditional Boats – 3 na. Mile Mechanised Boats beyond 3 na. Miles.
6. Karnataka (1986)	Traditional Boats – 6 Kms. Vessels up to 50 ft. beyond 6 Kms. Vessels above 50 ft. beyond 20 Kms.
7 Andhra Pradesh (1994)	Traditional Boats – 10 Kms. Mechanised Boats beyond 10 Kms. 20 m. LOA & above. Beyond 23 Kms.
8. West Bengal (1994)	Non-mech. Boats – Upto 9 m – up to 8 Kms. Non-mech. Boats – Above 9 m – up to 20 Kms. But not below 8 Km. Mech. Boats – Above 15 m – beyond 50 Km. but not below 20 Km.
9.Pondicherry	Agreement executed – Traditional Boats – 3 miles. Mech.Boats– beyond 3 miles
10. Gujarat (2003)	Non-mechanised Boats – up to 5 n.m (9 Kms.) Mechanised Boats – Beyond 9 Kms.

The legislative measures dealing with fisheries sector in India, has not been focusing on the conservation and management of marine fisheries. According to Mathew (2000), they have been mainly used for the purpose of maintaining law and order at sea rather than for fisheries management. The only Indian legislation, that talks about "undertaking measures for the conservation and management of offshore and deep sea fisheries" is the MPEDA Act.

A legislation that regulates marine fishing to some extend has been passed by the respective coastal States in the name of Marine Fishing Regulation Act, based on a model law, suggested by the Central Government in the early 1980s. Now all the Maritime States/UTs have passed necessary legislations - Gujarat being the last to do so. The details are given in the Table 5.1. This legislation does not include explicitly any conservation and management measures. The emphasis is on regulating the operation of fishing vessels in the territorial waters with the objective of protecting the interests of traditional fishermen, and to avoid conflicts between the mechanised and non-mechanised vessel operators. The inshore area, which is under the jurisdiction of the State Governments, is the most exploited zone, which requires urgent managerial intervention. The Central Government will have to take priority action for encouraging the State Governments to make necessary legislations to conserve and manage the inshore fisheries. If need be a model Act may be recommended to the State Governments in this regard.

The above legislations, strictly speaking, do not constitute any external input for management of fishery. However, the regulation specifying gear, mesh size, closed season etc. may be interpreted as some attempts at managing the marine fishery resources. But from the experience of enforcement of whatever rules and regulations that are in position now, it emerges that prescription for effective management are easy to state but difficult to implement due to a variety of reasons, whether economic, social or political, or on account of the very vastness and complexity of the fishing area.

Dwindling fish stock, over-exploitation, poaching and the open-access system, are issues demanding constant monitoring and control for sustainability of the fisheries. Notwithstanding the

inadequacy of legislations, several Monitoring, Control and Surveillance measures (MCS) are being followed by the Central and State Governments, as a part of their management efforts. The Indian Coast Guard was established under the Coast Guard Act, 1978. The MCS functions at the national level under the Maritime Zones of India Act 1981. They identify fishing activities within the Indian EEZ, inspects vessels landing at Indian ports and ensure that the statutory records are maintained, carry out boarding checks at sea of vessels of all nationalities, protect endangered marine species, and offenders are dealt with as per law.

A licensing system is being followed by the Maritime States for management and control of fishing crafts in the designated zones within the territorial waters. The mechanised and motorised crafts are given separate licenses for purse- seining, gill netting, dol net fishing, hook and line fishing, trawling, etc., (Somavanshi et. al 1999). The existing regulatory provisions in eight maritime States of India are given in Table 5.2. The port of operation and landing places are also mentioned in the licenses issued to the fishing boats.

TABLE 5.2: PRINCIPAL REGULATORY PROVISIONS GOVERNING FISHING IN MARITIME STATES OF INDIA, OTHER THAN GUJARAT AND WEST BENGAL.

State	Non-mechanised Traditional Boats	Mechanised Boats up to 15m. LOA	Vessels>25 GRT or >15 m LOA
Maharashtra	Trawling prohibited in less than 5 fathoms off Thane, Raigad and Mumbai		
Goa	Restricted to <5 km. from shore	Restricted to >5 km. from shore	
Karnataka	Restricted to <3 n.mi. from shore	1. Shrimp vessels Sept. <1.5 km; Oct-May 3-10 n.mi. from shore. 2. Large vessels>10 n.mi. from shore	Rampani boats to operate between 15 Sept. and 15 April
Kerala	For traditional fishermen, up to 10 km. from shore (approx. 30 m. depth)	Vessels >25 GRT beyond 12 b.mi. Mesh must exceed 35 mm.	
Tamil Nadu	Restricted to <3n.mi. from shore	Restricted to >3n.mi. from shore	
Andhra Pradesh	Restricted to <10 km. from shore	>10 km. from shore, except vessels >20 m.LOA restricted to >23 Km. from coast	
Orissa	Restricted to 5 km. from shore	Restricted to beyond 5 km. from shore	No restrictions beyond 25 n.mi.
Pondicherry	Restricted to >3n.mi. from shore		

Source: Somavanshi et al. (1999)

The Gujarat State has recently enacted the Gujarat Fisheries Act 2003,. The rules thereunder are awaited. The State has been encouraging a closed season between 1st June and 15th August even before the enactment came into force, by withholding diesel and kerosene and through restrictions on “creak pass” issued by the Department of Customs.

The MFRAs of the respective State Govts. have provisions to regulate the type of fishing gear, their mesh size and to restrict the fishing area. As of now, these are the only tools available for management of fisheries and to control fishing efforts in the Indian marine fishery sector, which are grossly inadequate.

The fishing vessels in Gujarat are registered by the Kandla Port Trust in areas around Kandla, Gujarat Maritime Board in Saurashtra and South Gujarat areas, Marine Mercantile Department in Jamnagar area and Department of Customs in the South Gujarat area. The agency concerned with the management of fisheries in the State has no role in this regard. It is an unsatisfactory arrangement, involving multiple agencies, which are not directly responsible for the management of marine fisheries. This arrangement needs to be changed and a unity in command is required to be brought in for effective management control.

Conflicts between the vessel operators of Gujarat and Maharashtra have often surfaced, as over 1000 boats of South Gujarat, offload their catches in the ports of Maharashtra, due to the inadequate on-shore infrastructure and easy accessibility to the Bombay market. No lasting solution could be arrived at in spite of bilateral discussions by the two State Government authorities.

International conflicts are common in the exploitation of marine fisheries. There have been frequent events of conflict off Jakhau andin Kori Creek area as well as the north west continental shelf. There is no clear demarcation of international boundary in this area between India and Pakistan. Indian coastguard often spot the Pakistani fishermen fishing in Indian territory and are

taken into custody. Similar instances take place from the Pakistan territory as well some times even as a retaliation measure. The fishermen of both the countries, knowingly or unknowingly cross the 'No Fishing Zone' and International Border Limits to fish in the highly productive fishing grounds. Once the fishermen are caught by the authorities, protracted efforts are made by both the sides to get them released. No effective solution has been worked out so far by the two countries to prevent recurrence of such events, while allowing the exploitation of the resources. This has resulted in unmitigated hardship to the poor fishermen of both the countries.

International Environmental Policy With Reference to Fisheries Management

Management of living marine resources is governed by several international agreements. They are in addition to the regulations of the respective maritime Nations. There are several aspects of management which cannot be implemented by any single State. International cooperation in such matters have to essentially follow certain universally accepted principles and the maritime States who are signatories to these agreements are obliged to comply with them through their implementation. The most prominent and significant agreements are the following:-

The United Nations Convention on the Law of the Sea (UNCLOS)1982

The Third United Nations Conference on the Law of the Sea (UNCLOS – 1973-82) stipulates the jurisdictional rights and duties of coastal and other States over the Exclusive Economic Zone (EEZ). It was finally ratified and adopted in 1994. The UNCLOS under Article 56 bestows rights and jurisdiction over EEZ subject to certain conservatory duties. The sovereign rights are exclusive rights given to the coastal states but not the full sovereignty as it enjoys in the case of territorial waters. The jurisdiction over the EEZ is not exclusive and runs concurrent with

that of other States in relation to flag state of vessels, marine scientific research, protection and preservation of the marine environment etc.

Article 61 of UNCLOS stipulates that the coastal States should ensure through “proper conservation” and management measures that the maintenance of the living resources in the EEZ is not endangered by over exploitation. Under this provision the Maritime nation concerned is enjoined to rebuild, restore, or maintain any fishery resource and the marine environment.

Article 62 of UNCLOS requires the coastal States to determine the Total Allowable Catch (TAC) and allocate it, for optimum utilisation. Under this article, coastal States are given wide powers to enforce their regulations in the EEZ.

Art. 245 – 65 of UNCLOS enables all States and international agencies to conduct Marine Scientific Research subject to the provisions of the Convention, for peaceful purposes, conducted with “appropriate” scientific methods and means “compatible” with the UNCLOS.

Art. 192 of UNCLOS emphasizes that “States have the obligation to protect and preserve the marine environment”.

Under Art. 194 (1), the State must take steps to ensure that activities under their jurisdiction and control do not cause pollution to other States or their environments and that pollution is contained within their national jurisdiction. The State should prevent pollution from land based sources, vessels, seabed installations used for harnessing natural resources, dumping of

wastes, airborne sources, and pollution arising from activities for exploiting deep seabed resources beyond EEZ.

UNCED 1992

UNCED 1992 is a non-binding declaration. The Agenda 21, which is the action programme for the 21st century enshrined in the Rio de Janeiro declaration of UNCED in 1992 reaffirmed the 1972 Stockholm Declaration, which recognizes the sovereign right of States to exploit their own resources in line with their environmental policies. The Rio declaration improves on it adding "developmental policies" to it. While enjoying the rights by the States, they are also expected to fulfill certain responsibilities, which are "common but differentiated". To achieve sustainable development, environment protection must constitute an integral part of the development process. Whenever necessary, effective environmental legislations may be undertaken and adopt a precautionary approach depending on the capabilities of the State. Accordingly "When there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". The declaration suggests that national environmental impact assessments be undertaken for activities "likely" to have "significant adverse impact on the environment".

The Convention on Climate Change under the UNCED is aimed at taking measures to prevent rise in sea level. The convention on biodiversity is related to the living organism of the sea. Both are particularly relevant to the massive ecosystems. India has ratified these two framework conventions.

Marine Pollution

The environmental impact of the rapid economic development, particularly industrial development in Gujarat on marine fisheries has not been studied in detail. Increased human activity, heavy industrialization, effluent discharge, soil erosion and suspended sedimentation adversely affect the productivity of the inshore areas and consequently the fish production. The coastal pollution accruing from untreated or partially treated industrial and other urban effluents flowing into the sea, oil spills, chemical pollution, etc. will adversely affect the ecosystem, especially of the Gulf of Kutch area. The typical water pollutants and their effects is given in the Table 5.3. The mega oil refinery in the Saurashtra region, is becoming a major threat to the fragile coral reefs and the mangrove ecosystem of the National Marine Park. Another oil refinery is being set up in the same region making the situation more critical. The Coastal Zone Regulations of 1991 have imposed certain restriction on the industries operations and processes in the Coastal Regulation Zones (CRZs). The State Government of Gujarat is yet to finalise its Coastal Zone Regulations, which are important to regulate various development activities in the coastal areas.

Summing –Up

This chapter has discussed at length the development and management aspects of marine fisheries, taking them as inseparable from each other. Rather, development without management would be self-defeating. The management need for a public good and a common property type natural resource is obvious because it is always exposed for free-riding and over-use. Various resource management models discussed in this chapter very clearly suggest that it is quite difficult – though not impossible - to address resource management issues, typical of a resource like marine fish. The bio-economic resource management model of Gordon-Schaefer indicates that

though the concept of Maximum Sustainable Yield is very useful, as it helps in deciding the limits of the resource use, individuals influenced by the profit motive will not restrict efforts till the revenue generated is higher than the cost of harvesting the resource. This is explained with the help of the concept of Maximum Economic Yield and open-access equilibrium point. Other concepts like Optimum Social Yield may also guide the management strategies. But it appears quite difficult to decide biological, economic and social optimalities together in a single model. Besides, one has to take into consideration the ecological and environmental concerns while designing strategies for the management of a marine fish resource. Marine fishery is a constituent of a given coastal zone eco-system. Therefore, it is pragmatic to perceive and develop marine fisheries development and management plans within a broader framework of coastal area management.

CHAPTER – 6

CONCLUSIONS AND POLICY IMPLICATIONS

Introduction

Based on the analysis, it is now possible to summarise the conclusions drawn in the previous chapters and suggest – as implications- some action plans and clues for the policy reformulation, where necessary.

1. Marine fish is a complex type of natural resource. It is fugitive, highly uncertain and variable because of the characteristics, typical of this resource. It is biological and, therefore, renewable. Its stock in a given fishery is subject to fluctuations because of the population dynamics and a number of factors – such as, life cycles of different species, their predatory-prey relationships, migratory behaviour and environmental as well as ecological factors affecting their stocks. It is, therefore, not surprising to learn that often most stock assessments fail to provide accurate picture of the stocks and prove misleading.

2. The above conclusion is true for both- the maritime countries of the industrialized West as well as developing countries like India, with varying degree of reliability. So far as India is concerned, we have noticed in the beginning of the Third Chapter that attempts made by different agencies in India at different points of time give assessments of the stock of the same kind of

resource with wide variations and make them non-comparables. Besides, because multi-species nature of Indian fisheries, there are added complexities in stock-assessments. In general, our ignorance about the fish stocks has always remained larger than our knowledge.

3. It is, however, true that because fisheries in India are multi -species, it carries greater resilience as compared to the single-species fisheries of a number of maritime nations of the West and do not succumb to total collapse.

4. One important lesson that needs to be drawn is that a country should avoid committing a disproportionately large amount of 'fixed' capital in fishing, handling and processing sectors for a resource which is less known, uncertain and highly variable.

5. It was irrespective of the above realities that the Governments at the Center as well as States in India went for ambitious plans of development of their respective fisheries under what had come to be popularly known as 'Blue Revolution'. Sizeable investments were committed for the development of the infrastructure by the State and fishermen in fish catch and firms in the ancillary sectors were offered a number of incentives and promotional schemes. This led not only to the transformation of the subsistence nature of fisheries into the modern one, but also led the sector, unknowingly, into what is known as biological and economic over-fishing.

6. It was noticed while analyzing data on the development of marine fisheries, for the country in general and Gujarat in particular in the Capter-4 and Chapter –5, respectively, that the biological over-fishing became visible as measured through decrease in the catch per unit of effort (CPUE),

increased amount of trash, small and juvenile fish, decreased area per-boat for the fishing operations and loss of bio-diversity in the form of disappearance of high-priced fish of some important specie-groups.

7. Though there is some correspondence in biological and economic over-fishing, they often do not strike simultaneously. Biological over-fishing suggests over-use of the resource in the physical terms, measured in terms of weight or numbers. Whereas, economic over-fishing is measured in terms of the difference between the revenue generated and costs involved in fishing related activities. Revenue is usually decided by the market prices, which are influenced more by the market demands. Till the marine fish continues getting higher prices in the local as well as overseas markets and costs remain below the revenue, people involved in the fishing will continue earning profits, in spite of the fact of decreasing catch per unit of effort, at least in the short-run, if not in the long-run.

8. So far as cases of the development of marine fisheries in India in general and in Gujarat in particular is concerned, growth has remained skewed and confined to the inshore-sector. It was largely because the large amount of high-priced species were available within the inshore waters wherein small artisanal fishermen have been operating their boats through generations. This has helped on one hand in improving their economic well being and has threatened the resource with over-crowding in the limited area, on the other hand.

9. Fishing in offshore and deep-sea areas has still been a far cry on account of a number of factors, besides the limited resource availability in such areas. Types of vessels, equipments and skills are required appropriate to the type of resource existing in deep-sea zone in particular. Though the government pressed in a deep-sea fishing policy, it met with a very limited success. Deep-sea vessels operators came into conflicts with the traditional fishermen as and when they tried to chase the same resource.

10. In spite of the fact of a limited success and the deep-sea still being a zone of troubled waters, this is the area, which has been possessing development potential. Deep-sea fishing in India has been an area of opportunities as well as of challenges.

11. It sounds quite interesting to note that multi-species nature of India's marine fish resource has provided resilience to save it from total collapse. What is important, however, in this context is not the volume but composition of the fish being harvested. In the case of Gujarat, over-fishing of the resource has resulted in low-priced, trash fish displacing high priced species, to almost near irrecoverable levels.

12. In the light of the constraints, such as:(I) reaching the maximum sustainable yield level in the inshore areas, and (ii) practical difficulties in promoting fishing into deep-sea areas, the marine fisheries sector in India needs to focus on better utilisation of the harvested fish through value addition processes and better distribution practices.

13. Capacities of fish-processing and infrastructural facilities in India have expanded fast over the years but their utilisation has remained below the installed capacities. If India goes for better product development and diversification, especially for the low value fish or the fish being discarded as by-catch, then the new value added products can be made available in the domestic markets in more quantities and the protein needs of masses can better be satisfied.

14. The State sponsored institutions in India have successfully put in R&D efforts and developed a number of production technologies for the value-added products. But their results have not been fully commercialized.

15. In view of the significant amount of idle capacity available in the processing sector, India can import raw fish for processing and value addition for the purpose of exports.

16. India is a leading exporter of fish and processed sea- food. The Marine Export Development Authority (MPEDA) is entrusted with the responsibility of facilitating sea-food exports. India has to maintain international standards of food-safety. Though the appropriate measures are being taken in this direction, emphasis needs to be shifted from maintaining food quality to food safety.

17. Institutional infrastructure for the growth of marketing network has been quite weak in India. Public Sector Units and Co-operatives were given direct responsibilities, to some extent, for marketing the marine fish. But their performance in direct selling has not been found satisfactory.

18. It needs, however, to be noted that the state intervention through extension machinery for modernisation, better handling and storage facilities, on-board use of ice and deep-freezing, pre-market processing, better transport and storage facilities, etc., have significantly reduced the perishability, and hence, enabled fetching better price for fish.

19. It seems, looking to the price-spread and the distribution of gains, that the middlemen in the marketing of fish have been getting more benefit to the disadvantage of the fishermen and consumers.

20. Though the State has intervened in a big way for the development of marine fisheries in India, and in spite of the fact that fisheries have been identified as a priority sector, this sector has failed in getting its due share in plan outlays as compared to those allocated for the development for agriculture and allied sectors. Besides, the amount spent on various schemes was less than what was earmarked during various plan periods.

21. Though experience of Gujarat is not much different from that of the country as a whole, Gujarat has been enjoying a special status of being number one state so far as the growth of marine fisheries sector is concerned. To achieve this fete the State has played both direct and indirect role in the development of this sector in Gujarat.

22. The status of the development of marine fisheries sector of Gujarat, as emerged through a comparative picture presented in this study, very much reveals that the development of marine

fisheries in Gujarat has helped the actual fishermen to gain advantage in comparison with those of the rest of the country.

23. It is evident from the data presented in this study that the Government of Gujarat had made pioneering efforts in conducting surveys for the assessment of fish-stocks available for harvesting off the coasts of the state.

24. Although 7.03 lakh tones of marine fish was estimatedas the potential stock (MSY) which can be harvested annually on sustainable basis, the production-based MSY was found to be around 6.20 lakh tonnes per annum - which was average marine fish production for the decade of 1990s.

25. There is very little scope for expansion of fishing in the inshore areas, because whatever amount of the marine fish-resource is being harvested, it is from this area of 0-50 mt. depth only.

26. The option left for the development of marine fishing in Gujarat suggests that fishing can be expanded only in the outer continental shelf areas and into the deep-sea fishing region. If the resource potential available in this region is systematically used, Gujarat can include much more diversified species in her marine food basket.

27. Marine fish production in Gujarat has shown impressive growth over the years since 1950-51. It has also outweighed the inland fish production of the State.

28. It is quite interesting to note that the trends of marine fish production in Gujarat has always registered higher growth rate as compared to that of the country as a whole. With the result, marine fish production of Gujarat has improved its share in the total marine fish production of India.

29. The increase in the marine fish production in Gujarat was mainly due to the introduction of FRP boats, increased fleet size of mechanised boats and intensive fishing undertaken by gill-netters and trawlers, besides reduced codend mesh- size.

30. The catch composition of marine fish in Gujarat has undergone substantial changes, with a constantly increasing percentage share of demersal species than the others, because of the enhanced bottom trawling.

31. In the initial decades of fisheries development the share of prime quality high-priced fish was quite substantial in the total catch. But with the intensive fishing in the inshore areas, the contribution of high-priced prime varieties went down, and the share of low-valued fish has increased.

32. The trend in present catch composition of marine fish in Gujarat is disturbing, as it includes substantial quantities of early juveniles and sub-adults of several commercially important fishes.

33. Deep-sea fishing in Gujarat has remained – as has been seen for the country as a whole – one of the most difficult and challenging areas of marine fisheries development. The efforts initiated

in this direction by the Gujarat Fisheries Development Corporation in 1972-73 was not successful. But the results of deep-sea fishing experiments off the Gujarat coasts would have been different and profitable in the long run, if the vessels were allowed to be operated in the northwest coast instead of shifting them into the eastern coast. Gujarat Fisheries Development Corporation again chartered five pair of deep-sea trawlers in 1983, which could successfully operate between 1983-88 and were found commercially viable. Thus, if the right types of vessels are selected and put into use in the right locations, deep-sea fishing can still assure good catch of the species which are limited but abundant.

34. Once the fish used to play an insignificant role in attaining food security in Gujarat because local consumption of fish was quite low. The recent trends suggest that the local consumption of fish in Gujarat has improved. The share of total fish which was being sent out of Gujarat has also been decreased presently. This is a positive trend towards the growth of domestic consumption. This has boosted marketing net-work as well as created more employment opportunities in marketing of fish in Gujarat.

35. The export basket of marine products from Gujarat has undergone substantial changes – from the exports of dry fish in the 1960s to exporting high value- added products in 1980s – which continued up to mid-nineties. It is, however, quite serious to note that the exports of marine fish from Gujarat in the most recent years has registered a reduction.

36. Growth of mechanisation in fisheries has been spectacular. Mechanisation of fishing boats has been a major instrument of the state intervention which resulted in the sizeable growth of marine fish production in Gujarat.

37. The comprehensive growth of mechanisation was the result of a number of contributory factors, such as: easy availability of institutional credit on liberal terms, state subsidies of various kinds, relatively low investment requirements and high profitability during the initial period of development of marine fisheries in Gujarat.

38. Modernisation of marine fishing brought changes in the system of wage payment – from sharing the catch to fixed money wages – particularly for those engaged in trawlers.

39. Though the state induced development of marine fishing in Gujarat brought a number of useful changes, the negative impact does not seem to be less serious. It includes:

(I) biological over-fishing as evident from the decrease in catch per unit of effort

(ii) increase of the catch of juveniles and sub-adult fish and by-catch

(iii) stock-destabilisation caused by intensive fishing

(iv) mechanisation benefited more well-off fishermen

(v) price-spread benefited more the middlemen at the disadvantage of consumers and producers

(vi) modernisation reduced labour inputs and thereby job opportunities

40. Fishing efforts in India in general and in Gujarat in particular have remained mostly unregulated. The legislative measures dealing with the fisheries sector have not seriously focused on the conservation and management aspects. Legislations passed in various states – including Gujarat- do not include explicitly conservation and management measures.

Summing –up

Time to say a final word!

It is very clear from the discussions carried so far, based on the analysis of data collected in time-series on global to national and local fisheries, that the management of a natural resource like marine fish- in any part of the world- is a complex task because of the very nature of the resource. The resource is biological, regenerative, fugitive, migratory, uncertain, less known and highly variable. Markets tend to fail in assisting decisions whether related to the development or management of such a resource. Therefore, State has to play a due role. In majority fisheries of the world, and certainly in India, the State behaved enthusiastically with this resource and paid far more attention on the development aspect. Whereas, the development and management aspects in marine fisheries have to be considered inseparable from each other. So far as our study is concerned, we have found that the State intervention was the catalyst or engine of growth till the State fisheries sector reached the level of Maximum Sustainable Yield. Had the State not been proactive, the vast unexploited stock of fish could not have been used and the sector would not experienced what is known as the 'blue revolution'. But the conservation and management of the resource deserved equal, if not greater attention along with the development. It seems that State's inaction by not intervening in the management of the fisheries has led to the current state of affairs, i.e., depletion of the marine fish resource. This implies that the role of the State continues to be important in the management of the fisheries resources just as it had played an important role in the development of the sector.

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