CREDITS

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Indian fisheries sector plays an important role in socioeconomic development of the country in view of its potential contribution to national income, nutritional security, employment opportunities, social objectives, and export earnings. The fisheries sector has witnessed an impressive transformation from a traditional subsistence activity to a well developed, diversified commercial enterprise with vast untapped potential. Amidst this steady growth, there are issues of concern like the over exploitation of fisheries resources, sustainability, environmental degradation, ecosystem management, provisions of WTO and pollution which necessitate the need for proper legislation and regulatory measures. It is in this context, policy interventions play a pivotal role in fisheries development. These assume greater significance in the wake of liberalization process presently on in the country. It is necessary to reorient and formulate the policies in fisheries sector to enhance the effectiveness of the sector and to compete at the global level.

It is in this backdrop that the International Seminar on Policy Issues in Fisheries and Aquaculture was organised during 19 December, 2002 jointly by the Asian Fisheries Society (Indian Branch), Indian Fisheries Association and Central Institute of Fisheries Education, Mumbai as part of the Sixth Indian Fisheries forum held during 17-20 December 2002. We are sure the proceedings of this seminar would pave the way for the enunciation of policy measures in fisheries and aquaculture for the benefit of all stakeholders of fisheries sector and society at large.

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Date : 5th July, 2004
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Introduction

Fisheries sector plays a pivotal role in the national economy in view of its contribution to the food basket of the country, nutritional security, social objectives, sustainable large foreign exchange earnings, generation of employment and income besides stimulating subsidiary industries. Rapid growth of fisheries is essential not only for ensuring household food security but also for improving socio-economic conditions of fishers and to earn valuable foreign exchange through export of fish and fishery products.

The contribution of fisheries sector to the gross domestic product (GDP) has shown almost twenty five fold increase from Rs.921 crores in 1980-81 to 22,223 crores in 1998-99 at current prices, compared to eleven fold increase in agriculture GDP during the same period. The share of GDP from fisheries sector has more than doubled from 2.17 per cent in 1980-81 to 4.73 percent in 1998-99. The export earnings from marine products in 2002-2003 was to the tune of Rs.6700 crores which is more than five times the exports made in 1991-1992 of Rs.1376 crores. More than six million fishermen and fish farmers in the country depend on fisheries and aquaculture for their livelihood. In addition another six million people are estimated to be engaged in fishery related ancillary activities.

Indian fisheries, since independence made rapid strides. Annual fish production rose from 0.752 million tonnes in 1950 to 6.30 million tonnes in 2001-2002. It has contributed significantly in providing cheap animal protein to the ever-growing population. The pattern of growth of fisheries has, hence, brought in its wake, uneven development across regions. Coastal waters of marine fisheries have been fully exploited and there are signs of some resources being over exploited. Diminishing natural stocks are threatening the income and livelihood of small-scale producers, bringing about severe conflicts among users and stakeholders. Only 30
per cent of the area suitable for freshwater aquaculture is presently under culture and productivity levels vary across different states and regions. In the case of brackishwater aquaculture, only 10 per cent of the total suitable area is under farming. Shrimp farming which is the mainstay of brackishwater aquaculture has been facing disease, socio-legal and environmental degradation problems. Capital inadequacy, lack of infrastructural support and unorganized markets has continued to affect economic viability of the fisheries sector. Inland fisheries have been showing faster growth (6.6 per cent) as compared to marine fisheries (2.2 per cent) during nineties. Of late marine fishers have been complaining of poor catches. Unfavourable price regime and low value additives have been detrimental to the growth of fisheries sector. Economic liberalisation and globalisation of trade is likely to compound the problem further.

It is in this backdrop that an International seminar on the Policy Issues in Fisheries and Aquaculture was organised on 19th December 2002 during the Sixth Indian Fisheries Forum held at Central Institute of Fisheries Education, Deemed University, Indian Council of Agricultural Research during 17-20 December 2002.
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<td>Dr. Pedro Bueno, Director General Network of Association of ACA</td>
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<td>Dr. Mruthyunjaya, Director, National Center for Agricultural Economics Policy and Research New Delhi</td>
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<td>Dr. V. S. Somvanashi, Director General, Fishery Survey of India Mumbai</td>
<td>Shri J.V.S Dixitlulu, Editor, Fishing Chimes, Vishakhapatnam</td>
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<td>Former Director,</td>
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International seminar on Policy Issues in Fisheries and aquaculture

19 December 2002 at 1000 to 1300 hrs

Dr. S. N. Dwivedi, Chairman of the Session
- Introduced the subject by emphasizing the need for fisheries policies in the context of changes that are taking place at national and international level
- Suggested the efficient use of aquatic resources
- Emphasized the need for new avenues and direction to youngsters aimed at generating employment

Dr. Pedro Bueno, DG, NACA,
- Presented the paper on "A development agenda for Indian Aquaculture: Drawing indications from the regional programme".
- Highlighted the projections for world fish supply and demand.
- Explained the issues of policy environment in the form of priority status, legal framework, institutional support and Industry participation.
- Covered the aspects related to operating environment including its characteristics e.g. more organized, rapid productivity growth, contributing food and nutritional security and exports.
- Expressed the concern about the growing sensitivity to environmental and social issues in the operating environment.
- Highlighted the need for linkages between market access and production practices in the areas of fish health, aquaculture, industry and consumers.
Suggested the elements of working programme which included
a) Regional initiative to support learning and communication to about aquatic resource management,
b) Follow up analysis from DFID of concerned aquatic resources,
c) Promotion of livelihood based approach,
d) Support for pro-poor policies.

Precisely, the elements of the work programme includes
i) Multi-lingual communication hubs,
ii) Livelihood analysis.
iii) Capacity building and
iv) Draft of country strategy paper.

Raised the issues related to aquatic animal health including its role in trade; document better management practices; collaborative programme on aquaculture education; Asia-Pacific Marine fin-fish aquaculture network, address to seed, feed, disease and resource management and people based network supported by an institutional framework.

Concluded that the following policy issues are to be addressed:
 a) Intensified production stressing the resource base and ecological balance,
b) Solving conflicts over resource use, strain management and regulatory capacity,
c) National information system to meet the required demands
d) Weak policy making and its governance.

Shri P. K. Pattanaik, Joint Secretary, Department of Animal Husbandry and Dairying, MOA, Government of India New Delhi

Presented a paper on “Policy Issues in Fisheries and aquaculture in India”.

Stated the objectives of fisheries development in India as
a) Sustainable development with suitable management practices,
b) Utilization of under and unexploited resources,
c) Disease control and surveillance measures,
d) Legislative measures,
e) Human resources development and
f) Building up of reliable database and network based system.
• Stressed upon the marine capture issues of I) constitutional provisions and problems in regulation of coastal fisheries under existing MFRA, II) exploitation of deep-sea resources; CCRF and international agreements.
• Elaborated the problems encountered in shrimp farming, CRZ notification, and Supreme Court judgment 1996.
• Emphasized on the need for implementing the "Precautionary principle" and "Polluter pays principle on the instructions of Supreme Court by the Aquaculture Authority.
• Highlighted the new initiatives already implemented and in pipeline including new FFDA components, Pilot projects, the fore runners for X plan, diversification of culture species, tackling disease out break, use of chemicals/antibiotics, legislation in inland fisheries sector and best management practices and sustainability in aquaculture.
• Indicated the future interventions like:
  i) Comprehensive regulatory framework for aquaculture;
  ii) Environmental conservation,
  iii) Information dissemination,
  iv) International co-operation and co-ordination of production,
  v) Marketing and management measures and participatory approach.

Dr. Samar K. Dutta, Professor, CMA, IIM, Ahmedabad
• Addressed the issues of fisheries subsidy in his presentation "How should India respond to global debate on fisheries subsidies".
• Stressed the need for a debate on fisheries subsidies in developing countries in the light of Doha Declaration.
• Mentioned the goals for utilization of subsidies.
• Suggested different options and conditions for accepting the WTO recommendations including Agreement on Subsidies and Countervailing Measures (ASCM), FAO Comprehensive framework, etc.
• Opined that ASCM category is most favourable for India.

He concluded that
i) Separate out pure public good component of government action;
ii) Start privatization (charging for) of impure public good supplies by government,
iii) Redefine the goals of government actions such that the development actions may be separated from budgetary allocations;
iv) Benchmarking to be based on country's Per Capita Income in Purchasing Power Parity and must be subject of negotiations,

v) Include implications of government inactions (like pollution control) as negative subsidies to come up with an overall measure of subsidies to fisheries,

vi) Retain only value-creating and indispensable subsidies, but rank or prioritize them for getting the maximum out of limited government resources;

vii) Start comprehensive work plan to quickly document fisheries subsidies to strongly put forth country's views of the international forum.

Dr. Mruthyunjaya, Director, NCAP, New Delhi
- Presented a paper on "Fisheries sector in India: An overview of performance, policies and programmes"
- Emphasized the need for investigations related to social processes along with biological for overall development of fisheries sector.
- Elaborated the performance of fisheries sector in terms of growth, contribution in GDP and exports, and its outlay under different Five Year Plans.
- Indicated multiplicity of R & D organizations having duplicity in research efforts and lack of co-ordination.
- Stressed the need on strengthening the institutional credit support and competitiveness in trade (both in international and domestic market).
- Highlighted the researchable issues as: technology, strengthening of data base, documentation of appropriate technologies for fisheries development; economic viability of proven fisheries technologies (hatchery and grow out), sustainability and Institutional and policy aspects.

Dr. V. S. Somvanshi, Director General, Fishery Survey of India, Mumbai
- Presented a paper on "Present issues in Marine Fisheries in India".
- Elaborated the National Marine Fisheries Policy covering the aspects of fishing, marketing, infrastructure, and fisheries relations.
- Explained the Total Allowable Catch aspects such as conservation as a core issue, catch possibilities (rates of fishing mortality to be calculated) and agreement on allocation of resources to different states on scientific basis.
- Suggested that the policy should aim at optimization, enhancing economic gain, equitable distribution and upliftment of socio-economic conditions of the fishers.
Shri J.V.S Dixitulu, Editor, Fishing Chimes, Vishakhapatnam, Andhra Pradesh

- Highlighted the importance of diversification and intensification of existing shrimp trawlers to monofilament tuna long liners for exploiting oceanic tuna species.
- Emphasized on cage culture in pond and open inland and coastal waters,
- Suggested the introduction of appropriate legislation to restrict foreign trawlers and permit Indian trawlers to operate beyond territorial waters
- Stressed the development of technology for domestication of tiger shrimp in a collaborative effort of CMFRI, Cochin and CIBA, Chennai.

Dr. S. C. Pathak, Chief General Manager, NABARD, Mumbai,

- Presented a paper on "Pondering over relevance of age old Indian fisheries policies" covered the issues under the changed Indian fisheries scenario.
- Cautioned the burning problems in the present context with elaboration on the outdated acts and legislation,
- Indicated that fisheries - a state subject, different executing agencies and variation in policies according to geographical, financial and socio-economic status.
- Raised issues related to leasing and licensing, fisheries environment, technology, finance, and social aspects.
- Advocated for a broad based committee to look into various problem issues and a separate ministry for fisheries.

Shri A. Sarvadeva, Director, Fisheries, National Co-operative Development Corporation, New Delhi

- Explained the role of NCDC in fisheries development.
- Questioned the reliability of fisheries database in the country and raised the points of fish conservation through mesh size regulation,
- Stressed the need for ban on destructive fishing methods, leasing policy etc.
- Suggested the need for liberal financial assistance and registration/licensing of fishing vessels to regulate the fishing effort to the optimum level.
Dr. Khairul Azam, Dhaka, Bangladesh

- Profiled the Fishermen community of Kuakata, a remote coastal area of Bangladesh.
- Indicated that more than 12 per cent of the population of the study area depends on fisheries for their livelihood.
- Opined that fisheries community is highly neglected and the per family income was 1020 Taka per month in the study area.
- Stressed on the need for scientist-fishermen linkage.

Dr. S. D. Tripathi, FAO Consultant, Mumbai

- Presented the paper on policy issues in fisheries and aquaculture
- Highlighted the National Agricultural Policy with emphasis on globalization and challenges ahead (sustainability, food and nutritional security, socio-economics and policy issues in marine fisheries).
- Explained the fisheries management issues for marine and inland waters
- Raised the issues concerned with marine fisheries which includes the vulnerable coastal areas, scope of deep sea fishing, import of used foreign vessels for exploitation of oceanic and deep sea fishing (Tunas and cephalopods), quota fishing, hygiene and HACCP.
- Accented on data collection, changed fish stock structure and presence of exotics in hill stream, riverine, estuarine and culture-based fisheries of reservoirs for inland sector
- Suggested that the issues of quality seed production, integrated aquaculture and utilization of seasonal ponds are important for fresh water aquaculture.
- Advocated for cage culture in canals. In the case of brackish water priority for diversification and quality seed production.
- Raised the environmental issues like pollution and man made modifications like dams, etc.
- Highlighted the issues related to gender, human resource development, information technology, responsible fishing, sustainable aquaculture, government intervention, etc.
- Supported the idea of creating a new Ministry of Fisheries to safeguard the interests of this downtrodden sector.
Dr. S. Ayyappan, Director, Central Institute of Fisheries Education, Mumbai

- Presented a paper on the Fisheries policies and Legislation in India
- Emphasized on the enactment of suitable legislation by the different maritime states
- Compared the marine fisheries legislation in the different maritime states
- Stressed on the constraints, failures and lacunae on the existing legislations.
- Highlighted the different policy initiatives and interventions carried out by the government.

Dr. Y. Avnimelech Israel

- Praised the Indians for their capabilities and intelligence in the areas of information technology, which can be utilized for fisheries development.

Dr. P. S. B. R. James, Former Director, CMFRI, Cochin,

- Stressed on the legislation for sea farming,
- Leasing of sea areas for sea farming, socio-economic aspects,
- legislation for conservation and rational exploitation of fisheries resources and sustainable aquaculture.

Shri Pattanaik, Joint Secretary, Department of Animal Husbandry and Dairying, Ministry of Agriculture, New. Delhi

- In his response presentation expressed deep concern about the issues raised.
- Indicated that appropriate action on aspects of conversion of shrimp trawlers into tuna long liners, joint ventures and guidelines for tuna fisheries have already been initiated
- Stressed on the national fisheries policy to be evolved to tackle various issues raised in the seminar
- Opined that development of reservoir fisheries will be covered in X plan.

Winding up the discussions the Chairman stressed on the Comprehensive regulatory framework for the sustainable aquaculture, increased emphasis on participatory management, retaining value creating and indispensable subsidies, equitable distribution of economic gains, relook at leasing and licensing policies:

He emphasized the urgent need for creation of a separate Ministry of Fisheries
RECOMMENDATIONS

The recommendations in the seminar were aimed at providing a base for developing a National Policy on Fisheries inorder to harness the vast untapped growth and potential of Indian fisheries on sustainable basis, strengthen infrastructure, promote value addition and exports, create employment in rural areas, ensure improved socio-economic conditions for fishers and face the challenges of WTO. The specific recommendations are:

• The Indian Fishery Act, 1897, should be replaced and a new comprehensive act should be enacted.

• Inland fisheries to be included in the concurrent list of Indian Constitution.

• Offences related to destruction of habitat and environmental and aquatic life should be made cognizable and non-bailable

• Barring the area-specific requirements, action may be taken to bring in certain degree of uniformity in the Regulation Acts and Rules, based on the economics and operations of fishing vessels to be enacted and implemented by all states.

• There is a need for the formulation of National Quality Standards for fish and fishery products.

• Upgradation of hygienic conditions in the existing harbours and fish landing centres by incorporating HACCP and ISO 9000 requirements in the infrastructure facilities, through centre and state assistance is required to meet the international standards of export market.

• Indian export industry may organize to export branded fish consumable in direct consumer markets of developed countries.

• The Ministry of Agriculture, Government of India, may circulate model bills to state governments for leasing of coastal marine waters for mariculture, and the state governments may make legislations on the subject.
Aquatic quarantine and Inspection Unit may be created under the Ministry of Agriculture to exclusively deal with exotics and quarantine.

Thorough review of fisheries subsidies may be done and only value creating positive subsidies, to be retained.

Comprehensive regulatory framework for sustainable aquaculture including use of chemicals, antibiotics and drugs may be developed.

Creation of an interstate riverine fisheries board may be considered for formulation of a rational and ecologically sound development and exploitation policy for riverine fishery.

National Fisheries Development Board on the lines of National Dairy Development Board may be conceived to enhance fish production and marketing.

A separate Ministry of Fisheries may be created at the Centre.
FISHERIES POLICIES AND LEGISLATION IN INDIA

S. Ayyappan, S. C. Mukherjee*, R. S. Biradar* and K. Venkateshwaran*
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Versova, Mumbai - 400 061

Introduction

Fisheries sector, which plays a very important role in the socio-economic development of the country, has been recognized as a powerful income and employment generator as it stimulates the growth of a number of subsidiary industries and is a source of cheap and nutritious food besides being a valuable foreign exchange earner. Most importantly, fisheries is a source of livelihood for a large section of the economically backward population.

Fish production in the country has increased from 3.84 million tonnes in 1990-91 to 5.66 million tonnes in 2000-01, of which 2.81 million tonnes were from the marine sector. The growth rate in marine fisheries in recent years has been slow (an average of 2.32% during 1990-91 to 1999-2000) compared to inland fisheries (average of 8.38% during the corresponding period). India is the fourth largest producer of fish in the world. It is also the second largest producer of inland fish. Fisheries sector provides employment to 7 million fishermen. The share of fisheries sector in GDP was 1.4% in 1998-99 equal to 4.7% of the contribution from agriculture.

Fishery Resources

India is endowed with vast and varied fishery resources, an outline of which is given below:

**Marine Fishery Resources**

- **Coastline**: 8129 km
- **Continental shelf**: 0.50 million km²
- **Exclusive economic zone**: 2.02 million km²
- **Estimated annual production potential**: 3.90 million tonnes
- **a) From area within 50-m depth**: 2.21 million tonnes
b) From area beyond 50-m depth

**Inland Fishery Resources**

- Rivers and canals: 0.20 million Kilometers
- Area under reservoirs: 3.15 million Kilometers
- Tanks and ponds: 2.25 million Kilometers
- Beels, oxbow lakes and derelict waterbodies: 0.82 million Kilometers
- Brackishwater area: 1.24 million Kilometers
- Estimated annual production potential: 4.5 million tonnes

**Marine Fishery Legislation in the Maritime States of India**

While fisheries is a state subject under the Seventh Schedule of the Constitution of India (Item 21 in the State list), fishing and fisheries beyond territorial waters are in the Union List (Item No. 57). Though matters relating to fisheries development, including inland fisheries and fishing within territorial waters, are within the purview of state governments, the Government of India through the Ministry of Agriculture (Fisheries Division in the Department of Agriculture and Cooperation) has been playing a catalytic role in the promotion of newer ideas and propagation of better technologies including invitation of external participation wherever necessary.

There are 10 maritime states/union territories in India, viz. Gujarat, Maharashtra, Karnataka, Goa and Kerala along the west coast, bordering the Arabian Sea; and Tamil Nadu, Pondicherry, Andhra Pradesh, Orissa and West Bengal along the east coast, bordering the Bay of Bengal. The two island union territories, viz. Lakshadweep, and Andaman and Nicobar Islands are situated in the Arabian Sea and Bay of Bengal, respectively.

The introduction of small mechanized boats of 9 to 10 m has rapidly caught on since the 1960s, and at present, about 53,000 such boats are operating in the inshore area, engaged mostly in bottom trawling, gill netting and purse-seining. During the 1970s, purse-seining was introduced for pelagic shoaling fishes like mackerel and sardines. It was in this backdrop that the scope and possibility to safeguard the interests of traditional fishermen were recognized by the 10th Meeting of the Central Board of Fisheries held on 22-23 March, 1976.
at New Delhi. Based on its recommendations, the Central Government constituted a committee in May, 1976, for the purpose of examining the questions of delimiting the areas of fishing for different types of boats. The Committee submitted its report in December, 1978, with a model Marine Fisheries Regulations Bill. The model bill was circulated to all maritime states and union territories for enacting suitable legislation.

Eight of the states, viz. Maharashtra, Karnataka, Goa, Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal, have already enacted suitable legislation. The Government of Pondicherry has issued executive orders, whereas Gujarat is yet to enact suitable legislation. The Union Territory of Lakshadweep has prepared a draft "Lakshadweep Marine Fishing Regulation Act" which is yet to be enacted by the Parliament, whereas the draft Andaman Nicobar Islands Marine Fisheries Regulation Act is yet to be passed by the Pradesh Council.

Comparison of the Marine Fisheries Legislations in Maritime States

Under the marine fishing regulation act, the procedure for licencing of fishing vessels is simple. Owner makes an application to the Authorised Officer in the prescribed proforma furnishing all the particulars. The application is submitted along with prescribed fee and registration certificate. Authorised Officer/Licencing Officer makes enquiry about the condition of the fishing vessel, fishing gears and accessories. Adjudicating Officer can impose penalties in case of violation of any of the provisions of the act and can cancel, suspend and amend the licenses. There is also a provision for the constitution of Advisory Committee in acts of some states like Maharashtra and Karnataka. Zonation and other fishing regulations in different states are summarized below:

**Maharashtra**

(i) Operation of trawl net by mechanized fishing vessels is prohibited from the seashore to 5 fathoms and 10 fathoms depth zone in specified areas;

(ii) Fishing by mechanized fishing vessels is banned from 1st June to Narayal Purnima;

(iii) Operation of trawl gear by mechanized fishing vessels is prohibited between 6 pm and 6 am;
(iv) Fishing by mechanized fishing vessels of any type with more than 6 cylinder engines is prohibited within the territorial waters of Maharashtra up to 12 nautical miles;

(v) Purse-seine shall not be operated by any mechanized fishing vessel within the territorial water of Greater Mumbai, Thane, Raigad, Ratnagiri and Sindhudurg districts;

(vi) Mechanized fishing vessels operating purse-seine gear beyond the territorial waters shall not land the catch caught by such gear in any port other than Mirkarwada (Ratnagiri Port).

Goa

(i) The area up to 5 km from the coast-line is the specified area and mechanized fishing vessels are prohibited from fishing in the area;

(ii) Restrictions on mesh size of nets, i.e. 20 mm for prawn and 24 mm for fish.

Karnataka

(i) The area up to 6 km from the shore or up to 4 fathoms (whichever is farther) is reserved for traditional crafts;

(ii) Mechanized boats (up to 50' length) are allowed to operate beyond 6 km; Deep-sea vessels (of 50' and above) are required to operate beyond 20 km.

Kerala

(i) The area from shore up to 30-m line in the sea along the coast from Kollencode in the south to Paravoor, (Pozhikkara) a length of 70 km, is called the First Zone.

(ii) The area upto 20-m line in the sea along the coast line from Paravoor in the south to Manjeswar in the north for a length of 512 km is called the Second Zone;

(iii) Mechanised fishing except fishing by motorized country craft is prohibited in the First and Second zones. Only fishing with country craft and traditional craft is allowed in these zones.
(iv) The Government Notification prohibiting the use of purse-seine, pelagic trawl and mid-water trawl in the territorial sea was squashed by the High Court on 9.4.1986.

Tamil Nadu

(i) Areas up to 3 nautical miles are reserved for traditional non-mechanised boats;
(ii) Mechanized boats are permitted to use areas beyond 3 nautical miles;
(iii) Fishing within 100 m below a river mouth is prohibited;
(iv) No fishing gear of less than 100-mm mesh from knot to knot in respect of net other than trawl net shall be used;
(v) The number of mechanized fishing vessels which may be used for fishing in any specified area shall be decided by the Authorized Officer.

Andhra Pradesh

(i) The area upto 10 km from the shore is reserved for traditional craft;
(ii) Mechanised boats are allowed to operate beyond 10 km.

Orissa

(i) Non mechanized traditional craft shall be allowed to operate freely without restriction. Waters up to 5 km from the shore have been exclusively reserved for such fishing craft.
(ii) Mechanized fishing vessels up to 15 m in length shall be allowed to operate beyond 5 km from the coast.
(iii) Mechanized fishing vessels of 25 GRT and above or 15 m length shall be allowed to operate beyond 10 km from shore.

West Bengal

(i) The area up to 15 km from the shore is reserved for traditional fishing craft and craft fitted with engines less than 30 hp.
(ii) Fishing craft fitted with more than 30-hp engine are allowed to operate beyond 15 km.
Constraints, Failures and Lacunae

Powers

With regard to the authority and power sanctioned to the enforcing officers by the law, it can be said that it is not sufficient. The authorized officer need be given the power to arrest. In the absence of speed boats, the authorized officers shall not be in a position to cover the area of jurisdiction. Sufficient manpower specially trained for actions need be put under the command of the authorized officer. The authorized officer and his staff should be provided with arms not only to prevent commission of offence but also to maintain law and order in the sea.

Physical Demarcations

To the law makers and administrators, the demarcation of different specified areas are theoretical, based on either the depth of water column the distance from the shore based on longitude and latitude. For the fishermen and law implementing authority, such boundary demarcations are unreal unless identified with markings. It has been suggested in the past to station marker buoys in the sea, at least in good fishing grounds where competition between traditional and mechanized sector takes place. However, the problem is less acute with the increased use of GPS by fishing vessels.

Inter-State/Inter-Zone Migratory Fishing

The Regulation Acts/Rules are silent about the inter-state migration of fishermen which has become their customary right due to years of continuous practice and may perhaps be a right guaranteed under the Constitution. Similarly, it is possible that fishermen from the zone of jurisdiction of one authorized officer migrate to another zone, for fishing as a customary right. The Regulations/Rules have not provided any inbuilt mechanisms to sort out such issues.

Sharing of Common Migratory Fish Stocks

In Indian coastal waters, the pelagic shoaling fishes like mackerel, oil sardine, etc. form a sizeable fishery in the states of Goa, Karnataka and Kerala. In a hypothetical situation, it could be assumed that the simple stock of fish, if harvested in a particular state, the fishermen of other states could be
badly affected. There is no inbuilt mechanism specified in any of the States Regulation Acts/Rules to regulate such common fishery resources.

**Peoples' Participation and Constitution of Board**

Fishing regulations by design restrict people from the use of a public resource which may be regarded as a right. If a legal action is to be effective, it must be acceptable to a majority of people who are being restrained. In this regard, only the acts of the states of Maharashtra and Karnataka have the provisions for people's involvement. In Maharashtra, the Advisory Board with the District Magistrate as the Chairman and the District Fishery Officer as the Member-Secretary with co-opted members representing other departments, fishermen and trade recommends to the Government the regulations to be enforced. Thus, the acceptability of the regulations by the people can be greater in Maharashtra. As against this, the Act of the State of Karnataka has also provisions for constitution of an Advisory Board with the Director of Fisheries as the Chairman, and official and non-official members of not more than 15, nominated by the Government to advice the Government on the enforcement of the provisions of the Act. Here also, the acceptability of the regulation by the people can be greater.

But the states of Goa, Kerala, Tamil Nadu and Orissa do not have this arrangement.

**The Marine Products Export Development Authority Act, 1972**

The Marine Products Export Development Authority (MPEDA) was established in 1972 under an Act of the Parliament, viz., the Marine Products Export Development Authority Act, 1972 (Act 13 of 1972), under the Ministry of Commerce, Government of India, when it was felt and declared that it is expedient in the public interest that the Union should take under its control the marine products industry. The functions of the Authority laid down under clause 9 of the Act are as follows:

(i) It shall be the duty of the Authority to promote by such measures as it thinks fit, the development under the control of the Central Government of the marine
products industry with special reference to exports: (ii) without prejudice to the
generality of the provisions of the sub section (1) the measures therein may
provide for - developing and regulating offshore and deep-sea fishing, and
undertaking measures for the conservation and management of offshore and
deepsea fisheries; registering fishing vessels, processing plants or storage
premises for marine products and conveyances used for the transport of marine
products; fixing of standards and specifications for marine products for purposes
of export; rendering of financial assistance or other assistance to owners of
fishing vessels engaged in offshore and deep-sea fishing and owners of processing
plants or storage premises for marine products and conveyances used for the
transport of marine products, and acting as an agency for such relief and subsidy
schemes as may be entrusted to the Authority: carry out inspections of marine
products in any fishing vessel, processing plant, storage premises, conveyance
or other place where such products are kept or handled, for the purpose of
ensuring the quality of such products: regulating the export of marine products:
improving the marketing of marine products outside India: registering of exporters
of marine products on payment of such fees as may be prescribed: collecting
statistics from persons engaged in the catching of fish or other marine products,
owners of processing plants or storage premises for marine products or
conveyance used for the transport of marine products, exporters of such products
and such other persons as may be prescribed or any matter relating to the
marine products industry and the publishing of statistics so collected, or portions
thereof or extracts there from: training in various aspects of marine products
industry: and such other matter may be prescribed.

The Marine Products Export Development Authority Rules 1972

The MPEDA Rules 1972 was made in exercise of the powers conferred
under Section 33 of the Marine Products Export Development Authority Act.,
Section 32 of the Rules empowers the Authority to undertake various measures
on the discharge of its functions, in additions to the functions specified under
Sub section (2) of Section 9 of the Act.
Policy Initiatives

Draft Marine Fishing Policy

Draft marine fishing policy submitted by the department of Animal Husbandry and Dairying, Ministry of Agriculture, (Government of India) in February, 2002, seeks to bring the traditional and coastal fishermen into the focus and a harmonized development of marine fishery both in the territorial and extra territorial waters of our country. The theme of comprehensive marine fishing policy is enshrined in the National Agriculture Policy promulgated by the Government. The policy objectives are: (a) to augment marine fish production of the country up to the sustainable level in a responsible manner so as to boost export of sea food from the country and also to increase per capita fish protein intake of the masses, (b) to ensure socio-economic security for the artisanal fishermen whose livelihood solely depends on this avocation and (c) to ensure suitable development of marine fisheries with due concern for safeguarding the rich bio-diversity.

The policy measures suggested for harvesting sectors include protection and consideration of subsistence-level fisherman, area demarcation for traditional, motorized and mechanized sectors, motorisation of traditional craft, provision of infrastructure support in terms of landing and berthing facilities for deep-sea vessels, introduction of more resource-specific vessels of above 20-m length, special incentives for wholly Indian-owned vessels for venturing into international waters and engaging in fishing in the EEZ of other nations under license, regulation of fishing capacity and incorporation of code of conduct for responsible fishing operations into every component activity.

For post-harvest operations, the draft policy includes implementation of international quality regimes such as hazzard analysis and critical control points (HACCP), ISO 9000 and Codex Alimentaries for fish and fishery products, harmonisation of existing domestic standards with the International Standards, packaging and bar-coding of fish and fish products, legislation to streamline hygiene in fishing harbour/pre-processing and processing centres and protection of consumer rights. The draft policy envisages registering and licencing of all fishing units up to 20-m OAL, replacement of open access to limited access in
coastal areas, evolution of standards for construction of fishing vessels, especially below 20-m OAL, uniform closed seasons for neighbouring states, ban on destructive methods of fishing, regulation of mesh size in different parts of the fishing gear, prohibition of catching of juveniles and non-targeted species and discarding of less preferred species once they are caught, open-sea cage culture, and promotion of resource enhancement programmes.

Fishermen welfare programmes under the draft policy include, strengthening co-operative movement to treat artisanal fisheries including OBMs, and small mechanized boats up to 12 m at par with agriculture, small scale fisheries involving mechanized boats under 20-m OAL at par with small scale industry and fishing vessels above 20 m and fishing activity involving mother ships or factory vessels as industrial activity, implementation of unified fishermen housing scheme and ensuring safety at sea. The draft also envisages treating of full-time/occasional fishermen whose households do not own a boat at par with landless labourer and giving them special care and protection.

Further, the draft policy lays emphasis on HACCP in effluent discharge systems mandatory, planting of mangroves and sustainable changes in coastal regulation zone keeping in view the topography in each region.

For infrastructure development for marine fisheries, the draft policy includes drawing up of development of infrastructure for the next ten years, exploring private sector initiative through build-operate-own and Build-Operate-transfer and changing of user fee for the infrastructure to generate adequate resources for the upkeep and maintenance of the facility. The draft policy also envisages introduction of fresh legislative instruments for quarantine, movement of aquatic animals, introduction of fresh fishing units, conservation of resources and its recoupment, endorsing international laws and conventions in marine fisheries sector, and use of information technology and strengthening of database.

This draft was discussed and approved at the all India Meeting of Secretaries of Animal Husbandary and Fisheries held during 14-15 November, 2002, at New Delhi.
Broad Guidelines for the Operation of Indian Deep-Sea Fishing Vessels in Indian EEZ

Outline of broad guidelines circulated by the government for operation of Indian deep sea fishing vessels in the Indian EEZ are given below:

Permission in writing (LOP) is required from the nodal ministry for operating any fishing vessel in Indian EEZ. Presently, permission is accorded only for the following methods:

(i) longlining for tuna
(ii) tuna purse seining
(iii) squid jigging and squid hand lining
(iv) mid water/pelagic trawling and trap fishing

The operation of Indian deep-sea fishing vessels will be governed by the executive orders issued/to be issued from time to time. The area of operation of the deep-sea fishing vessels will be regulated by the instructions/orders issued by the Government of India from time to time. For proper monitoring of the operations of Indian deep sea fishing vessels and sea safety point of view, it is mandatory for all deep-sea fishing vessel operators to report their vessels' position, intended course and speed and area of operation with latitude and longitude to Coast Guard at 08.00 hours daily or any other time specified by the authority. Date of commencement of voyage, likely period, together with crew list should be furnished to Coast Guard and Fishery Survey of India, Mumbai, before each sailing. Intimation on completion of each voyage shall also be furnished to these agencies on return. The operator shall furnish an undertaking to the effect that (a) they will not resort to any type of fishing other than what has been permitted to them, (b) the company will not exploit any endangered species of marine turtles, mammals and fish species and the vessel will not resort to bottom trawling/pair trawling/bull trawling and (c) will not violate the Code of Conduct for Responsible Fisheries (CCRF). The operator should take clearance from the Government for assignment of foreign crew. All the vessels should be fitted with INMARSAT 'C' or comparable terminal with GPS facility as prescribed by the Government. Vessel Monitoring System (VMS) shall be set up by each vessel.
within the period to be stipulated by the Government of India. The base port for operation of vessel would be any one on east coast and one on the west coast. Government reserves the right to inspect the vessel and machinery, and equipments on the vessel and shore-based processing plants of the company at any time without notice. The operator should submit the voyage report in the prescribed format to Fishery Survey of India, Mumbai within 15 days from the date of completion of each voyage. Government reserves the right to impose any other conditions from time to time. Penalty will be levied for any violation, which shall be decided by the Government. Besides, the letter of permission is also liable to be cancelled without notice, if any one or more of these conditions is not followed or violated and shall have the right to seize the vessel.

Meeting of the Ministers of Fisheries / Lieutenant Governors / Administrators

A Meeting of the Ministers of Fisheries/lieutenant Governors/ Administrators of Coastal States/UTs was held on 9th September, 2002 at MANAGE, Hyderabad. States of West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka and Gujarat, and The Union Territory of Andaman and Nicobar Islands participated in the meeting. The issues raised by the state governments were discussed and the points that emerged include the following:

(i) Diversification of cultured species, mariculture activities and river/sea ranching programmes to be undertaken
(ii) Laboratory facilities for disease diagnosis to be enhanced
(iii) Proper fish market facilities to be developed
(iv) Development of suitable intermediate craft and optimization of fleet in coastal waters
(v) Provision of sea safety equipment to fishing craft
(vi) Dredging and maintenance of fishing harbours
(vii) Part of the cess on marine product exports to be given to states. The matter to be taken up with MPEDA and the Ministry of Commerce
(viii) Deep-sea fishing policy to be evolved
(ix) Uniform ban period for fishing to be adopted in all coastal states
Subsidy for electricity charges in fisheries was also discussed and it was felt that subsidy is to be encouraged only for technology improvement and research innovations in the light of WTO norms.

Inland Fisheries Legislation

The subject of legislating for the protection of freshwater fishes was opened with an inquiry made so long ago as 1869 by Dr. F. Day of the Madras Medical Services, who had been placed on special duty for that purpose. This was followed by a resolution issued in October, 1871 on Dr. Day's report for the North-Western Provinces, in which he recommended a Fisheries Act. Dr. Day's recommendations as well as the action taken on proposals made up to 1888 by the various local governments were summarized in a note prepared for the Agricultural Conference held at Delhi in that year. The Government of India enacted the Indian Fisheries Act, which came into being in 1897. The object of the enactment was to prohibit the use of dynamite and poison in all territorial waters and to make the provisions of the Bengal Private Fisheries Protection Act, 1889, of general application. It also empowers each State Government, with the previous sanction of the Central Government, to make rules and to apply them to any selected streams or other waters which are the property of the State, or to any other streams or other waters with the consent of the persons owning them or interested therein.

This Act also provides suitable penalties for breaches of the proposed law and of the rules made thereunder, and it confers on person specially empowered by the State Government, power to arrest without warrant for offences against such law or rules. This Act shall be read as supplemental to any other enactment for the time being in force relating to fisheries in the territories to which this Act extends. This is a small piece of legislation containing only seven sections. Section 1 deals with the extent of the Act while Section 2 provides that Act is a supplement to other fisheries laws. Section 3 is a defining section which defines the expressions "fish", "fixed engines" and "private water". Section 4 provides for destruction of fish by explosives in inland waters and on coasts and Section 5 deals with destruction of fish by poisoning of waters. Section 6 provides...
protection of fish in selected waters by rules of State Government, whereas Section 7 is a penal provision providing for arrest without warrant for offences under this Act.

There is a general impression that the Indian Fisheries Act of 1897 is an inland fisheries act. The act, of course, appears to be concerned only with inland fisheries, because the act provides that the word "water" includes the sea within distance of one marine league (3 nautical miles or 5.56 km) from the sea coast (Explanation No. 4 (2) of the Act).

Erstwhile Punjab (before partition) was perhaps the first state to introduce legislation for conservation of fisheries. The Punjab Fisheries Act II of 1914 was passed, and later amended and revised from time to time. States of Himachal Pradesh, Haryana and the Union Territory of Delhi also follow more or less Punjab rules. Some states like West Bengal, Uttar Pradesh, Andhra Pradesh, Madhya Pradesh, Karnataka, Kerala, Tamil Nadu, and Jammu and Kashmir have some rules for fisheries regulation. Many states in the North-East region have no fisheries legislation.

The Act of 1897 has been adopted, by promulgating Rules under Section 3 of this act and through various amendments, at the state-level, various states with references to the 'multifarious provisions pertaining to about 51 different regulatory activities, comprising mainly limited accesses, licensing of gear, gear restriction, leasing and auctioning. However, the salient drawbacks are as follows:

i) Prohibition of capture of breeders and fishing of immature fish are lacking in Manipur and Tripura

ii) Restrictions of jute retting and timber seasoning are enforced only in Assam, Tamil Nadu and West Bengal

iii) Restrictions on electric fishing do not exist in a large number of states

iv) Similar is the case with specifications on maximum time of fishing or maximum volume of fish

v) Construction of weirs/dams are regulated only in MP and UP, while restrictive legislation on aquatic pollution exists only in Orissa, Tamil Nadu and Uttar Pradesh
Government of Assam has introduced a policy on 'Fish Seed Industry' in the state in 2001, with the following broad aims and objectives:

- To augment quality fish seed production for advancement of aquaculture in the state.
- To protect the bio-diversity of economically important indigenous fish species of Assam in the natural ecosystem by adoption of adequate conservation measures.
- To take steps by Government to augment quality fish seed production and encourage aquaculture in the State in order to provide protein rich fish to the people of the State at affordable price and to strive to attain self reliance in the production of marketable fish in foreseeable future.

In order to translate these aims and objectives into action, the state Government has proposed establishment of eco-hatcheries, standard size of brood stock, partial replacement of brood stock with wild stock, prohibition of breeding and propagation of banned exotic fishes, registration of fish seed producers and growers, easy and unrestricted transport of fish seed in the state, suitable regulations for river rehabilitation and stock enhancement, protection of spawning grounds, establishment of seed banks at Government of Assam hatcheries and fish farms, standardized measurement tools and dissemination of technical know-how. Government of Assam will also offer incentives to fish breeders in the form of training from time to time, providing quality fish seed at subsidized rates to raise brood stock and also provide awards/strive for social recognition.

**Inter-State River Management Conflicts**

In a federal set-up, there are inbuilt strains between the Union Government and the states, which are independent and coordinating authorities, and not subordinates to the Central Government. Entry 14 of list II of Article 246 places agricultural research and education under the State List, whereas regulation and development of inter-state rivers and river valleys under Entry 56 of List I (Union List). The recent history of the country is replete wit inter-state river disputes. As
the ownership and rights vest with multiple agencies, it becomes difficult to have a coordinated approach. Whereas Article 262 provides mechanisms for resolving disputes or complaints with regard to waters of inter-state river and river valleys, no such mechanisms exists for regulation of fisheries of such rivers on uniform basis.

Aquaculture

The high growth rate of the economic activity of culture of shrimp in the coastal areas has been accompanied by many controversies in many countries in the region. In India, shrimp aquaculture and its unregulated growth during the early nineties also resulted in the matter being taken to the supreme court as a public interest litigation (PIL). The Hon'ble Supreme Court by its order on December 12, 1994, directed all the respondent states not to permit the setting up of any industry or the construction of any type on the area at least up to 500 m from the sea water at the maximum high tide. It was subsequently amended on March 3, 1995, directing the state to meticulously follow the Coastal Regulation Zone (CRZ) Notification of February 1991 issued by the Ministry of Environment and Forests (MoEF). On the directions of the Hon'ble Court, the National Environmental Engineering Research Institute (NEERI), Nagpur, submitted its reports on aquafarms in the coastal areas of the country. The Hon'ble Court in its hearing on May 09, 1995, issued interim orders banning conversion of agricultural lands and salt-farms into commercial aquaculture, withdrawal of ground water for aquaculture purposes and setting up of shrimp farms or any aquaculture farms in the area of dispute thereafter.

The Hon'ble Court finally directed among other things, in its Judgement dated December 11, 1996, that the shrimp culture industry/shrimp ponds were covered by the prohibition contained in Para-2(I) of the CRZ Notification. Based on one of such directions, the Aquaculture Authority was set up through a Notification dated February 06, 1997, under the provisions of the Environment (Protection) Act, 1986.

Review petitions were filed by the Union Ministry of Agriculture, some of the affected coastal states, the MPEDA, various aqua farmers and associations...
against the said judgment. The review Petition(s) came up for hearing on March 21, 1997, and initially one month's stay on the implementation of the judgment dated December 11, 1996, was granted. Subsequently, the case came up for hearing on April 25, 1997. Thereafter, the review petition(s) were referred to a bench of three Judges. The case was heard partly on August 19, 1997, when the Court directed that the stay on demolition would continue, but no fresh stocking of shrimp would take place in farms which were required to be demolished.

While admitting the Review Petition (Civil) No. 573 of 1997, by order dated October 31, 2000, the Court identified the Aquaculture Authority for submitting a comprehensive Environment Impact Assessment Report. The Report was submitted by the Aquaculture Authority on April 27, 2001.

The Report suggested that legislation should be enacted to regulate the following:

- Preventing construction of shrimp farms in mangrove areas, other sensitive areas and in agricultural land
- Setting up of the farms in relation to agricultural land/village
- Compulsory EIA for larger farms
- Wastewater quality standards and effluent treatment plants
- Use of chemicals and drugs
- Licensing and mandatory application of code of conduct

Recently, the Department of Fisheries, Government of Andhra Pradesh, has submitted a draft bill on regulating the quality of the shrimp seed produced in the hatcheries since at present, the hatcheries are in the private sector and the department has no control over testing facilities for checking the quality of the seed in respect of white spot disease. The draft was attempted as shrimp culture is affected by the white spot disease and infection through the seed was one of the important factors for vertical transmission of the disease. Hence, the department has proposed Enactment of Aquaculture Seed (Quality Control) Bill. The bill has been vetted by the Law Department and is pending with the Government for enactment. The salient features of the bill are as follows:
• It stipulates on the quality of the seed, brooder stock and labeling of the quality of seed
• Stipulating norms for size, weight, purity and disease-free parameters for seed
• The Government will have powers to regulate import and export of aqua seed
• The aqua seed testing laboratories will be set up
• The department will have powers to register hatcheries, fish seed farms and conduct inspections
• Notifying and regulating the varieties of seed to be used for aquaculture
• The constitution of Aquaculture Seed Committees
• The Aquaculture seed registration and certification
• The department will have powers to levy penalties

Other Legislations Related to Aquaculture

Some of the prominent laws which address aquaculture related activities are the Wildlife Protection Act, 1972; the Coastal Regulation Zone notification published in “the Law Relating to Protection of Coastal Areas” (amended by notification dated 18.08.1994 and the Supreme Court Judgment dated 18.04.1996); the Environmental Protection Act, 1986; and the various laws effected by individual states with reference to mesh-size regulations for fishing nets. Further, safeguards for wetlands and mangroves and biodiversity as well as prevention of introduction of exotic species are envisaged in the National Biodiversity Strategy and Action Plan, and the Biodiversity Bill being currently finalized.

The provisions made under the CRZ laws requires a total ban on shrimp farming activity within 500 m of the high tide mark on the coast. Shrimp farmers all over the country have sought the amendment of the CRZ law and the introduction of the Aquaculture Authority Bill, which will allow them to continue shrimp culture, albeit in a more controlled and planned manner and to reclassify aquaculture under agriculture and not industry. The debate over this Bill continues.

The recently formulated Code of Conduct for Responsible Fisheries, promoted by the United Nations, lays down legal, institutional and consultative...
The recently formulated Code of Conduct for Responsible Fisheries, promoted by the United Nations, lays down legal, institutional and consultative framework for sustainable shrimp culture. Planning and regulatory methods and tools along with economic incentive schemes, the development of a voluntary code of practice and effective monitoring of implementation by participating countries are some of its main features.

Incentives/Assistance for Fisheries Development

Development of freshwater aquaculture has been one of the most important production-oriented programmes implemented through Fish Farmers Development Agencies (FFDAs). These agencies extend a package of technical, financial and extension support to fish farmers. In order to boost inland fish production, assistance in the form of subsidy is given to fish farmers for construction of new ponds, reclamation/renovation of ponds and tanks, inputs for the first year of fish culture, running-water fish culture, integrated fish farming, fish seed hatchery, fish feed mills, etc. Assistance is also given to progressive fish farmers who have achieved an average productivity of 3 t/ha/annum as an incentive for purchase of aerators to raise it further. During the Ninth Five Year Plan, new components such as freshwater seed prawn hatcheries, laboratories, soil and water testing kits, hatcheries for ornamental fish etc. were added. Similarly, technical, financial and extension support to small scale sector is extended through Brackishwater Fish Farmers' Development Agencies (BFDAs).

For motorisation of traditional craft, 50% of the cost of engine is provided as subsidy (subject to a maximum of Rs.10,000 for OBM and Rs.12,000 for IBM) which is equally shared by the centre and the states. Besides, a sum of Rs.6,000 is also provided as grant to fishermen for the purchase of gear. The cost of central excise duty of the HSD supplied to mechanized fishing vessels below 20 m is fully subsidized (Rs.0.35) and is borne on 80 : 20 basis by the centre and the states. Under the centrally sponsored fishing harbour facilities at major and minor ports, 100% grant is provided to the Port Trust for construction of fishing harbours at major ports. In case of minor fishing harbours and fish landing centres, the cost is shared on 50 : 50 basis by the centre and the states. Under
the World Bank assisted shrimp and fish culture project, the pattern of assistance (90%) is as IDA loan assistance and CSS with 50% central share. Welfare programmes for fishermen include development of fishermen villages, insurance for active fishermen and saving-cum-relief for fishermen.

Suggestions

➢ The Indian Fishery Act, 1897, should be replaced and a new comprehensive act should be enacted.

➢ Inland fisheries to be included in the concurrent list of Indian Constitution.

➢ Offences related to destruction of habitat and environmental and aquatic life should be made cognizable and non-bailable

➢ Barring the area-specific requirements, action may be taken to bring in certain degree of uniformity in the Regulation Acts and Rules, based on the economics and operations of fishing vessels to be enacted and implemented by all states.

➢ As far as possible, the demarcation system may be made uniform for which the entire coast-line may be considered as a unit or alternately, the east coast and the west coast may be considered separately, with area-specific requirements as exception.

➢ The system of licensing needs to be extended to motorized and non-motorised craft also.

➢ Satellite-assisted vessel monitoring system may be introduced in the EEZ for both Indian-owned and foreign vessels.

➢ Each state/union territory may organize a separate enforcement wing for the implementation of acts and rules.

➢ In order to have a broad consent of different interest groups in the implementation of acts and rules, advisory committees may be constituted at district and state levels.
Creation of an Interstate Riverine Fisheries Board may be considered for formulation of a rational, and ecologically sound development and exploitation policy for riverine fishery.

Cutting and evisceration, and icing of fish onboard vessels of size more than 50' may be made compulsory. Similarly, installation of fish hold temperature recorder also may be made compulsory for vessels above 50'.

Implement packing and labeling requirements of processed fish products for domestic consumption.

Fish markets of standard design may be constructed and selling of fish in the open be banned by local self-governments.

There is a need for the formulation of National Quality Standards for fish and fishery products.

Upgradation of hygienic conditions in the existing harbours and fish landing centres by incorporating HACCP and ISO 9000 requirements in the infrastructure facilities, through centre and state assistance is required to meet the international standards of export market.

Indian export industry may organize to export branded fish consumable in direct consumer markets of developed countries. For this purpose, exporter should be organized into a single company, the individual firms becoming the federated units of the company.

Andaman and Nicobar Islands may be identified as a processing location into which foreign raw material may be imported, processed and exported. Technical, infrastructural and high speed transportation facilities to be developed in Andaman and Nicobar Islands to facilitate processing eastern raw material and western trade.

Imaginatively designed products may be developed to suit the taste of the rich and wealthy. Test products should be developed by research wings.
of both public and private institutions, and evaluate their acceptance at internal supermarkets.

- Non-traditional areas of fish consumption should be exposed to fish and fish products through sales promotion techniques concentrating on exhibition in local fairs and display in local newspapers and radio.

- Develop and promote products in which fish is only an ingredient and locally available cheap grains, roots and vegetables. The local people will have a stake in developing and marketing fish-based products that bring in value to their low-priced food material.

- The Ministry of Agriculture, Government of India, may circulate model bills to state governments for leasing of coastal marine waters for mariculture, and the state governments may make legislations on the subject.

- The governments of Gujarat, Pondicherry, Lakshadweep and Andaman Nicobar Islands may enact the Marine Fisheries Regulation Acts and Rules and also implement the same urgently.

- Aquatic quarantine and Inspection Unit may be created under the Ministry of Agriculture to exclusively deal with exotics and quarantine.

- Network of diagnostic laboratories for aquatic animal health may be established.

- Regulation for use of antibiotics and drugs in particular and aquaculture inputs as a whole may be formulated.

- Legislation for conservation of resources and germplasm needs to be finalised.

- Concurrency and compliance of India to adopt Code of Conduct for Responsible Fisheries, international fishery and related conventions and agreements for effective conservation, management and development of living aquatic resources, may be pursued.
Aquaculture as well as artisanal fisheries including OBMs and small mechanized boats up to 12 m may be treated at par with agriculture, so that it receives all the incentives/concessions so far given to agriculture.

Subsidy may be given to fishermen on safety equipment to be procured and kept on boat.

National Fisheries Development Board on the lines of National Dairy Development Board may be conceived to enhance fish production and marketing.
Inland Fisheries

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

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

The Indian reservoirs being largely in the tropical to sub-tropical regime are highly productive from the biological point of view. This productivity can be optimally utilized by stocking a right mix of Indian major carps. Otherwise, the productivity goes sheer waste. To tap the inherent biological productivity of the reservoirs, the success achieved in Gobindsagar, Himachal Pradesh needs to be replicated in the other reservoirs of the country also. Within a span of 4-6 years, a modest increase to 50 kg/ha/yr. can increase the fish production by 2.5 times from this resource and also bring in additional employment.

Aquaculture

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

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

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

Indian Fisheries Legislation of India

Present-day conservationists and planners owe their gratitude towards Sir Arthur Cotton and Dr. Francis Day who drew attention of the then Government of India in the year 1873 towards widespread slaughter of fish, fry and fingerlings, and pleaded the urgency to adopt legislative measures to conserve the fisheries resources. Nothing was done for many years. By 1888 the question again forced its way to the front and it was considered by the agricultural conference held at Delhi in that year. The Government of India enacted the Indian Fisheries Act, which came into being in 1897.

The Act highlighted the following:

1. Use of destructive methods of fishing such as dynamiting or other substances in inland and coastal waters (up to one marine league) was prohibited. Similarly, poisoning of water with noxious materials was also prohibited.
2. Provincial governments were empowered to make rules in selected waters for protection of fish with previous notification, restricting the creation and use of fixed engines (dams, weirs, bar pattas, etc.) for catching fish; to put a limit on mesh size, size of fish and catch, and to ban the fish in certain seasons and certain places for a period of 2 years (declaration of closed season and sanctuaries).

**Present Status of Inland Fisheries Legislation in India**

Erstwhile Punjab (before partition when extended from Peshawar to Delhi) was perhaps the first state, which introduced legislation for conservation of fisheries. The Punjab Fisheries Act II of 1914 was passed. It was amended in 1923 and revised in 1941, 1966 and 1971. For regulating fisheries in canals, separate rules were framed and notified by the Punjab Government in 1924 in the form of Rules for Regulating Fishing in Government Canals and Rules for Regulating in Headwaters.

Under the Punjab Fisheries Rules, which are also followed by and large by the states of Himachal Pradesh, Haryana and the Union Territory of Delhi, the fishing rights of the notified public waters are put to open auction on or after 1st July every year and the period of lease extends from 11th of September to 21st August of the next year. The fish exploited by the lessee is regulated.

Many states in the North-East region have no fisheries legislation. Rajasthan enacted fisheries legislation in 1984. Some states like West Bengal, Uttar Pradesh, Andhra Pradesh, Madhya Pradesh and Kerala have some rules for the regulation of fisheries. The State of Uttar Pradesh put a ban on the capture and sale of juveniles (5.1 to 23.4 cm in length) from 15th July to 30th September and of spawn from 15th July to 30th September and of spawn from 15th June to 31st July from the prohibited areas. From 1953, in Madhya Pradesh, fishing of rohu, mrigal, catla and mahseer of less than 22.9 cm length are prohibited. Many riverine areas have been declared as sanctuaries in Madhya Pradesh, Himachal Pradesh, Delhi, Jammu and Kashmir, Karnataka, and Tamil Nadu. Mesh regulations are observed in many places such as Manipur, and Andaman and Nicobar Islands. Nets having a minimum mesh size of one inch are generally permitted for fishing in the reservoirs. The use of explosives and poisonous substances for the capture of fish is prohibited in many states like Jammu and Kashmir, Himachal Pradesh, Andhra Pradesh, Karnataka, Uttar Pradesh and Kerala.
Regulations of Fisheries

The complexity of factors involved in the regulation of fisheries, domestic and international, is often underestimated. Fishing is still largely an activity to harvest wild stocks of highly ambulatory animals. These animals cannot be fenced in a limited area or with marked ownership. This makes fisheries of open water a "common property resource" with its related problems. Apparently, rivers and streams may look to be poor relations of seas but they have been the cradles of major river valley civilizations. Therefore, regulatory measures need to be blended with other environmental protection measures such as,

a) Limited access
b) Leasing and auctioning
c) Closed seasons
d) Licensing of gear
e) Gear restrictions and
f) Proposals for reform

The operation of various fisheries laws in a country has not yielded the desired result. Although the preambular declarations are very lofty, at implementation stage hardly anything is achieved. The following proposals may merit attention:

i) The anachronistic Indian Fisheries Act 1897 should be repealed and new comprehensive act should be brought after taking stock of all the change in the last five decades.

ii) Keeping in view the diverse local conditions, the Central laws may be of limited avail. But, related rules should be promulgated within the basic framework of a comprehensive Central Act.

iii) Inland fisheries should be included in the concurrent list of Indian Constitution so that the Union Government can also frame laws for any part of the country.

iv) Past experiences have revealed that anti-pollution laws such as Water Prevention and Control of Pollution Act 1974 and Related Rules 1975 and other laws have more bark that bite. Notwithstanding the historic decision
of Supreme Court in M.C. Mehta and other Vs Union of India, Sri Ram Food and Fertilizers Industries Vs Union of India 1986 LJ 251 (SC), anti-pollution laws in general have been devoid of teeth. The benefit of variance in scientific opinion to prove a point often benefits the defendants. It is suggested that the onus of proof should be shifted to those who deny from those who affirm.

v) Though the element of deterrence is not the sole basis of law, punishment prescribed in fishery laws is very mild. Even in the matter of adulteration of food and drugs, it becomes difficult to bring the offenders to book. But, in case of a fishery, violation of rules is not taken very seriously even by the people.

vi) An expert committee of jurists should examine the possibilities of making offences relating to destruction of environment and aquatic life cognizable and non-bailable.

vii) The enforcement machinery needs strengthening though it may lead to increase in financial liability of development department. Without adequate manpower and social ethics, it is difficult to implement even ideally conceived laws. Schedule A in Fisheries Act 1948 (U.P.) lists more than 20 districts and various riverine stretches where fishing is prohibited during breeding months. Will these areas be ever policed without manpower? The duty of the planners, conservationists and decision-makers does not end by adding new law to statute book unless it is administered properly. People’s participation and awareness campaigns are recommended.

Policy Issues

The aquatic ecosystems, specially the open waters, have been subjected to may threats primarily emanating from man-induced modifications at various stages of the trophic structure. The problem is more acute in a developing country like India, where biomass economy has to stay with 75% people dependent on agriculture.

Open-water Fisheries

The development of inland aquatic resource for enhanced fish production in our country is a must to obtain the required quality of this important animal protein constituent in the diet of the expected populace in years to come. But it is at a critical point in its development. In case of our rivers and floodplain wetlands, degradation and lose of habitat is increasing day by day and a national
perspective as well as mass awareness is essential regarding utilization of these common property resources. The moot point is, can the fishery of rivers be improved? The environmental status of rivers is such that enhancement of fish yield appears to be a distant possibility, the multiple use nature of this resource makes implementation of ameliorative measures impractical. Evidently, conserving the fish germplasm is more important than getting more yield, as we cannot afford to lose our biodiversity, the fish fauna in particular, in view of maintaining an ecological equilibrium.

Reservoir Fisheries

There is immense potential to increase fish production from reservoirs simply because of the vastness of this resource and its untapped potential. Moreover, this is the only aquatic resource whose hectarage is expected to increase with increase in population. Scientific technologies are available for developing its fishery. Besides adding to the production basket, it has also the capability of providing vast employment to the poorest of the poor fishers. The fact remains as to why the yield from Indian reservoirs is so low in spite of the fact that many reservoirs have indicated high to very high levels of primary and secondary production? Micro-level reasons may be many, but inadequate management of reservoirs, with due importance not given till recent past, may be attributed as the major constraint for such a situation. Moreover, lack of efforts to understand ecological variables associated with reservoir productivity may be identified as another reason for this impasse.

Aquaculture

Aquaculture is already contributing the major share in inland fish production. But much more is possible from this resource in future. Besides proper extension machinery, research inputs in the field of genetics, nutrition and disease control are the need of the hour to achieve the required enhanced fish production from the resource.

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

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

All these contemporary global initiatives to which India has been a signatory call for concurrence and compliance, and greater interaction with the countries in the sub-region and at the international level. These developments also call for a more prominent role to be played by India.

**Marine Fisheries**

Entry 57 of List 1 of Seventh Schedule of the Constitution specifies fishing and fisheries beyond territorial waters as union subject, whereas Entry 21 of List II speaks of fisheries as a state subject. Reading both the entries together, it follows that control and regulation of fishing and fisheries within territorial waters is the exclusive province of the state, whereas beyond the territorial waters, it is the exclusive domain of the Union. The Ministry of Agriculture as per its allocated business, helps the coastal states and union territories in the development of fisheries within territorial waters, besides attending to the requirements of the sector in the exclusive economic zone (EEZ). Therefore, management of fishery resource in the country, including exploitation in the EEZ requires retrospection in terms of the present policy and legal framework supporting fisheries sector and also a close coordination between the Centre and the states.

**Management and Policy Intervention**

The issues pertaining to marine fisheries in India are not unique to the country, but common to most tropical developing countries and need to be addressed through proper policy supports. Some of them are of very serious nature involving food security, environment, economy and livelihood of the marginal fisher-folks. The fisheries sector in India, as is well known, is governed by the state governments as well as the Central Government through different ministries which unfortunately play varied roles, whereas the marine living resource cannot be partitioned on the basis of terrestrial boundaries creating balkanization of the country and managed through convenience-based governance. The need for an integrated national policy on marine fisheries becomes immediately obvious, particularly in the present context of overexploitation in the share zone, under utilisation in the off-shore/oceanic zone, sectoral conflicts, economic waste under employment and protein food contribution to the nutritional basket of the country.
Coastal Marine Fisheries—problems and Prospects

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

Management of Open Access Marine Fisheries

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

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

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

**Licensing of fishing boats**

At present, the mechanized fishing vessels alone are licensed. The system of licensing needs to be extended to motorized and non-motorized craft as well. Licensing will be helpful to maintain an inventory of all categories of fishing vessels. New vessels may be permitted to be acquired only as a replacement of a vessel of equal size and capacity. The priority of licensing should be shifted from a means of mere revenue earning to a system of regulating the number and type of fishing vessels.

Another management option that has been considered for this area is to encourage small trawlers to diversify into fishing activities that can be practiced further offshore, in order to reduce overcrowding in coastal waters and reduce the pressure on the fish stocks. However, few fishermen are equipped for such ventures and there is a need to provide support to this category as also technical information on the availability of resources or the best fishing methods with which to target them.

**Poverty in artisanal sector**

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

In the light of National Environment Policy, policy supports need to be extended to the artisanal and small mechanized fishing sector.

**Small-scale fisheries**

Owing to the steady growth of mechanized gear, the small-scale sector contributes only 13% to the overall production currently. This situation is a source of major concern in view of the large number of people involved in the traditional fishing sector warranting priority attention through appropriate policy interventions leading to their amelioration, reduction in the wide disparity between the different income groups, of fishery labour, elimination of conflicts and clashes between different interest groups and reduction in indiscriminate exploitation of young fish. Fishing pressure needs to be restricted in the inshore waters.
Policy options for mechanization of large country craft

There is a strong possibility of successfully fitting the artisanal craft at 9 m OAL from among the existing fleet with energy efficient 26-HP in board engines for offshore pelagic fishing for the distant pelagics like the sharks. By introducing such a programmes the production gap for the mid-shelf grounds (50 to 200-m depth) could be bridged and most of the idling fleet put to active use. Besides, the problems of unemployment, under employment and economic waste would be reduced.

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

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

Offshore resources

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

The existing regulatory policies also restrict fishing season, fishing areas and the mesh size of gear. However, there is no monitoring and surveillance system available with the concerned implementing organizations. Voluntary compliance by the fishermen to operate in the areas allotted to them is totally absent and encroachment by the larger mechanized vessels in the areas demarcated for the artisanal craft continues. The Central Government has now proposed to introduce a vessel monitoring system, which is expected to resolve the problem. Similarly, the Central Government should also consider providing a fresh model bill to the states/union territories to enable them to revive their Marine Fishing Regulation Acts on the basis of their present requirements and also global initiatives to which India is a signatory.

Deep-sea fishing

Realizing the potential for increasing the production from the outer continental shelf, the Government of India took several initiatives. Permission was given under a policy programme, for the introduction of about 180 fishing vessels of 23 to 27 m OAL classes for operation in the Indian EEZ. But most of them concentrated along the north-east coast to exploit mainly the virgin sand-head resource for shrimp. The effective implementation of the deep sea fishing policy for non-shrimp resources could have resulted in the harvest of deep-sea and oceanic resources which shall offer a potential of about 1-7 million tones, value addition and export. But this programme went into a rough weather with all the fisheries associations protesting against the policy and objection to the operation of deep sea vessels in the Indian EEZ. Consequentially, the Government of India constituted a Committee (Murari Committee) and recommended to review the policy. This committee recommended, among others, the cancellation of all the licenses issued under the policy. The government considered the recommendation and finally serrated the deep-sea fishing policy of 1991.

Utility of fishery infrastructure

At present, there are only six major and 27 minor fishing harbours in the country, but those are not adequate for the landing and berthing 53 000 small and 780 large trawlers. There is an urgent need to construct more harbours to
accommodate even the existing fleet and the future expansion with purse seines and long liners.

Since there is core infrastructure those could be constructed under the build own operate and transfer (BOOT) concept of the National Environment Policy. Privatization of fisheries infrastructure assumes considerable significance.

Cold chains linking all major, medium and small cities and towns in the country would also be planned under BOOT program exclusively for fish marketing to facilitate (a) remunerative prices to the producer of both marine and inland fish, (b) elimination of marine fish discards and (c) availability of fish to the consumer at fair prices.

Neglect of fishers

The traditional fishermen are caught in the low-income trap due to diminishing returns. Marginalisation of artisanal fishing by mechanization creates conflicts among fishermen and warrants immediate attention. There is no scope to increase fishing efforts in the inshore waters as it is already over-exploited. It becomes essential to introduce regulations to keep the level of fishing efforts under control. Responsible fishing by voluntary reduction of fishing effort and mesh-size regulations of various gears is an important need. Community participation in fisheries management should be introduced by creating awareness among fishermen and encouraging ‘co-operative fishing’ instead of ‘competitive fishing’.

The annual discards of by-catch by multi-day fishing fleet have been considerable over the years. A system should be devised for its effective utilisation. Processing by-catch into value-added products could partially utilize the idle capacity in the fish processing plants.

The seasonal nature of fishing, and the risk and uncertainties associated with it often push the fishermen into poverty. Alternate employment the opportunities are very few and opportunity cost of fishermen is almost zero. The pace of economic development of coastal area is not commensurate with other regions and the overall socio-economic status of fishermen is comparatively lower than that of other sectors. Balanced development of the coastal agro-climatic zone with the integration of capture and culture fisheries combined with agriculture, horticulture, forestry and animal husbandry is essential for providing productive employment and improving the socio-economic condition of the coastal rural communities. Zonation of coastal land with regional prioritization would be helpful.
Census data

A national census of marine fishermen, craft and gear is still the basic data in this field. Data on socio-economic parameters later published by various state governments either through census or periodic updating have a number of discrepancies. A census of craft, gear and other socio-economic parameters of fishermen should be conducted once in five years for providing the much-needed information base for planning fisheries development and coastal zone management. The fishery sector is not taken seriously during census.

Promotion of eco-friendly coastal aquaculture is vital for generating employment and higher income for coastal fishermen. Hence region-wise geographical information system of the coastal agro-climatic zones for coastal zone management and development should be prepared in consultation with experts from capture and culture fisheries. A cautious fish marketing policy for domestic and export marketing should be framed. Periodical dissemination of information on prevailing prices of commercially important varieties of fish in different markets will be much useful to the fishermen, traders and consumers. Only products, which are capable of fetching competitive price, should be exported and the rest should be sold in the domestic market.

Deep-sea fisheries development

The Third United Nations Conference on the Law of the Sea (UNCLOS IX) provides exclusive opportunities for the coastal states to exploit the fisheries resources in their EEZ. Under Article 61 of the UNCLOS IX, a coastal state must determine the allowance catch if the living resources of the EEZ, which according to the Article 62, the state is obliged to utilize at the optimum level and if it does not have the capacity and ability to harvest the allowable catch, it shall, through argument or arrangement, give access to the other state to the surplus of the allowable catch.

The absence of the Indian fleet in the outer shelf will entail other states to give access to the country's EEZ for the exploitation of the un-exploited stocks. Therefore, it is essential that the country urgently formulated a policy for the optimum exploitation of its offshore resources.

The medium sized boats of 23 to 27 m OAL presently trawling for shrimp are reported to be facing in view of the declining yields, resulting in losses and consequent non-repayment of loans. To prevent these losses, a high priority needs to be accorded to diversity the fishing by these boats.
Tuna long liners of 20 m OAL with 80-fish holds and 30 m OAL with 200-fish holds should be introduced either through import or through indigenous construction. In order to diversify their operations, the Indian companies are interested in tuna lining in the international waters or in neighbouring countries' EEZ such as Maldives, Madagascar or Mauritius.

Through the country encourages joint venture in nearly all agricultural and industrial sectors, under the National Environment Policy, such an encouragement is not available for the marine fisheries sector.

**Code of Conduct for Responsible Fisheries**

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

CCRF or simply the Code, as it is popularly known, defines in the general principles that "The right to fish carries with it the obligation to do so in a responsible manner." It sets out principles and standards of behavior for such practicats and aims at effective conservation, management and development of living aquatic resources. The Code covers not merely capture of fish and fishing operations, but the processing and trade of fish and fishery products, aquaculture, fisheries research and the integration of fisheries into coastal area management.

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

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

India needs to adopt all international fishery and related conventions and agreements (e.g. Straddling Stocks Agreement, Compliance Agreement) to which it has been a signatory. In fact, being the largest maritime country in the region we need to set the example. It is also in our strategic interest to do so first. Because of the large marine fisheries resources available to the country, the straddling and migratory nature of many valuable stocks like tuna and emerging issues in sustainable management of these resources, it is important to take the lead to set up regional fisheries bodies, which will help to widen the use of our national research and technical expertise in the region. Our fishery policies have thus far kept us as an future globalising scenario. India is yet to sign the international agreement on straddling stock of fish products, which has been signed by 59 countries.

A sound policy makes a good beginning in our efforts to sustainably and equitably manage our fisheries resources. The renewable fishery resources, if properly managed, can produce long-term sustainable yields and thus support continuous economic activities and employment. The most effective implementation of the National Policy (good interface) can only be through a viable partnership between the government, industry and the civil society as well as internationally.

**Monitoring, Control and Surveillance (MCS)**

MCS problems in the country include the vast size of the EEZ (2.02 million kilometers), the long coastline (8129 km), multiple fleets, participation of foreign-flagged vessels and regional jurisdictional demarcations. (VMS) Vessel Management System is to be adopted for effective surveillance of Indian EEZ. Control of domestic vessels operating largely within the territorial waters is undertaken by coastal State and union territory government. Central Government is responsible for issuing licenses to deep-sea vessels and to foreign-flag vessels. Licenses carry restriction on fishing methods, types of gear, area, depth and cod end mesh size. Other regulatory measures include closed and marine parks.
The existing fisheries policies and programmes in most of the states and union territories revolve around populist welfare measures and a large part of the annual plan budget towards the welfare programme (e.g. housing, saving-cum-relief). Though welfare measures are obligatory to sustain the artisanal sector, parallel development and regulatory measures also need to be implemented.

**WTO Implications**

According to the FAO, the value of world fishery product exports in 1998 stood at US $48 billion. The developing countries contributed to 48% of the total. The export of fish products thus is very important for many maritime developing countries. When about 40% of global fish production enters international trade, only about 6 to 8% of forest products enter international trade. The net foreign exchange earning of developing countries in 1997 from fish and fish products stood at about US $16 billion, which, according to FAO is more significant than the combined net export earning from coffee, tea, rice, and rubber.

However, in the developing international scenario of trade and food security, non-tariff trade barriers are likely to play a major role. In this context, two initiatives can be cited which may have vital bearings on the marine fish export from India. First, the Marine Stewardship Council, a joint initiative of the World Wide Fund for Nature and the multinational giant, and the Fairly Traded Fish and Fish Products initiative of a German organization called the Fair Trade. The former focuses on sustainable fishing and the later on the living and working condition of fish workers in developing countries.

In the light of growing interest in linking environment and labour to international trade, these developments would be seen as an opportunity as well as a matter of concern. While it is still unclear or too early to say how the market will respond to eco-labelled and fairly-traded fish, there is likelihood of controversies in this direction in future.

**Human Resource Development and Welfare Measures**

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

To enable a balanced development of the sector, an All-India Master Plan for HRD and social security in the fisheries sector should be prepared. In the HRD at the organized level where formal education is given, there is need for more sector-oriented education and greater linkage between the formally educated and the industry. There is need for greater emphasis on the role of women in the sector and great care and attention to the health and welfare of the children in the communities.

**Marine Fisheries Laws and Regulations**

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

2. The Wildlife Protection Act, 1973 and various central legislations on environmental protection
3. Indian Coast Guard Act, 1978
4. The Maritime Zones of India (Regulation of Fishing by Foreign Fishing Vessels) Act, 1981

Under the enabling provision of the Indian Fisheries Act, 1897, various States and Union Territories have introduced their fishery regulations. For regulation of fisheries in the territorial waters, all the coastal states and the Union Territory of Lakshadweep (except Gujarat and the remaining union territories) have enacted their MFRA. These acts are based on a model bill provided by the Union Government in 1979.

The MFRA by the maritime provincial governments and the deep-sea fishing schemes as provided under the Maritime Zone of India (Regulation of Foreign Fishing Vessels) Act, 1981, of the Government of India provide for...
prohibition of fishing by foreign vessels in the areas earmarked for the traditional and small motorized craft. For monitoring the fishing activities to be carried out in different assigned fishing zones by respective fleets, patrol boats are provided to the fisheries department of the maritime states. Surveillance beyond the territorial waters is undertaken by the Coast Guards. The resources monitoring surveys conducted by the Fishery Survey of India (FSI) are being linked with the management measures to be evolved and applied for sustainable development of fisheries. However, at present, there is no law to regulate Indian owned deep-sea fishing vessels.

**Aquatic exotics and Quarantine**

India is one of the richest countries in the world in terms of fish genetic wealth. But since the 19th century, there have been imports of over 350 fish species to the country for sport fishery, aquaculture, ornamental fishery and insect control purposes.

Some of the introduced species have added to the production or enhanced the trade but other species proved to be invasive in our open waters, affecting the native species. The potential and real impacts of introducing new species into the aquatic ecosystem have been major issues debated worldwide. The benefits of introduced species are usually immediate and for short duration, whereas the adverse impact of exotics become evident only after a long time. The long-term impacts of the introduced species have not been evaluated till date in our country. It is necessary to provide feasible guidelines for the import of new species on strains depending on the purpose of import. Under the Convention on Biodiversity, India has the moral and legal obligations to conserve its biodiversity. In India, the policy on introduction of exotic aquatic organisms is not clearly defined. Moreover, there is no policy to tackle exotics already introduced both legally and illegally.

CCRF emphasizes the need to minimize the risks of disease transfer and other adverse impacts on the wild and cultured stocks associated with the introduction of non-native species and transport of eggs, larvae or fry, broodstocks, or other live materials. The Code also adopts the principle that international trade in fish and fishery products should be conducted in accordance with the principles, rights and obligations as per international agreements. India is a signatory to a range of trade related agreements under World Trade Organization (WTO). One of the important agreements under WTO is the application of SPS measures. The SPS Agreement specifies that measures should be applied only to the extent necessary to protect human, animal and plant life or health. SPS Agreement uses the standards, guidelines and recommendations developed by
Office (OIE) for animal health and zoo noses as the international benchmark. Each country is, therefore, expected to have acquired facilities for complying with the above conditions and to have evolved appropriate code of practices, either of its own or as a group of nations. The nation needs to strengthen the human capacity and infrastructure capability to support risk analysis, health certification, diagnostics, surveillance and disease reporting. In the light of WTO agreement, these have to be addressed in a time-bound manner.

Quarantine Guidelines and Codes of Practice have been developed and subsequently revised by international agencies. These codes and guidelines have been developed to provide a level of international uniformity and standardization for preventing disease transfers associated with the movement of aquatic organisms. OIE is an international veterinary organization, with 157 member countries. It has a Fish Disease Commission. The principle policy of OIE is to facilitate intentional trade on animals and animal products, including aquatic organisms and products. Keeping this in view, it prepared OIE International Aquatic Animal Health Code and Diagnostic Manual for Aquatic Animal Diseases which needs to be adapted by India.

Existing legally/Illegally introduced Exotics

India has many exotic aquatic organisms, which have been legally or illegally introduced. Among the legally-introduced exotics, which have become established in India and the most widely cited species are Oreochromis mossambicus and Hypophthalmichthys molitrix. Clarias gariepinus is the illegally introduced exotic whose culture has spread rapidly to many parts of India and has been banned by the Ministry of Agriculture. However, not many studies have been carried out on the present and likely impacts of these exotics. The issue of legally and illegally-introduced exotics has to be tackled through scientific, policy and legal mechanisms.

The strategic plan on aquatic exotics and quarantine is to help India protect its aquatic biodiversity from exotic aquatic organisms and pathogens. It is aimed at protecting and promoting India's trade, and it also provides a mechanism to meet India's international obligations and adapt to the changing world scenario in the light of WTO.

Socio-Economic and Legal Implications of Fish Germplasm Distribution

Man has claimed property rights over natural resources based on historical perspective or on territorial basis. These could be included in the national or international legislation. For example, our national right to exploit fish stock
inside the 200 nautical miles in the EEZ is based on territorial foundation. Such legal rights give control and regulate the utilisation of resources or ensure economic benefits. But the question of access to the resource or the terms/conditions of access would influence the socio-economic aspects of human population.

Up-gradation of stackable carps through genetic selection and the selected fish stocks is expected to yield more than 40% better growth as inherent advantage over and above the benefits of better culture operations. We would need protect these stocks for national advantages. Legal status of such germplasm would need to be considered to regulate the utilisation of specific breeding material and their distribution to the identified target groups.

Aquaculture and Environmental Concerns

Again, conservation of genetic resources in situ is critical to aquaculture. Wild stocks of fish are the natural source for gene banks for aquaculture. But wild populations are under threat of irreversible change or loss from habitat disturbances and pollution.

There are several exotic fish species, which are being offered by developed countries to Indian entrepreneurs for better production results. We need assess the long-term effects of such exotic incursions on local fauna and the environment. In fact, there has been indiscriminate 'nods' for such introductions by agencies/entrepreneurs disregarding the national interests with virtually no control in India.

Aquaculture and Socio-economic Aspects

In India, aquaculture has a long-standing tradition as an extensive, low-input production system, practiced by poor farmers. Nevertheless, the introduction of fish farming may have a number of socio-economic effects. Firstly, it may bring on changes in the traditional way of life and resource utilization. Fish farming may lead to an increased need for water and energy, both possibly scarce resources, which may result in conflict over use of land areas, water and other natural resources.

Conflicts may also arise with other sectors, such as agriculture, forestry, pastoral uses and other fisheries already in effect. Furthermore, aquaculture is not necessarily labour-intensive, and this enhances the drift towards changes of traditional land-use and thus potential conflicts over land-use and potential stress on the natural resources of the area. Secondly, the introduction of aquaculture may give rise to change in training and in the division of labour between men...
and women. To consider introduction of aquaculture some of the checkpoints would need to be ensured if the target people have the property rights to land and water resources or only seasonal access to these resources.

**Legal Status of Genetic Resources**

The genetic resources are subject to private or public control or may be regarded as part of the Common Heritage of Mankind. It is traditional in the southern hemisphere, but the elaborate material in the northern part of the globe is often subject to some kind of intellectual property rights.

Common property resources may be held in four categories of rights—common heritage, private property, state property and communal property. These could, however, overlap in practice. But in the southern region, we need to keep the interest of the small farmer super most in mind.

With regard to fish germplasm in an international perspective, there is yet another reason why it would be better to export know-how about breeding than the breeding stock itself.

Exchange and distribution of plants, seeds and seedlings have traditionally been subject to public control, while the transaction of sperm from livestock often has belonged to the private sphere. Fish germplasm seem to constitute a "middle-ground" in this respect, but it is probably more comparable to plant seeds than to livestock.

Hence, lessons may be drawn from the plant genetic resources arena, in the search for an environmentally and socio-economically sound legal approach to control and utilize fish germplasm. Patenting will pose a severe restriction for small-scale enterprises, which lack the means to pay the license fee for elaborated breeding material.

At the same time, the international search for an enhanced patent regime is undermining the traditional property right systems of common heritage and communal property. Hence, a pragmatic approach to the question of small-scale distribution so far, seems to be some kind of national control over germplasm dissemination. Furthermore, this might ease the introduction of and compliance with environmental regulations.
INTRODUCTION

India is the fourth largest producer of fish in the world today. With a production of over 5.8 mmt, it has registered a cumulative growth of over 4.2 percent per annum since 1950-51 being the fastest in the food sector except potatoes, eggs and poultry in the last fifty years. It is also the second largest producer of inland fish where it had achieved an impressive growth of 8.38 percent during the nineties. Indian fisheries is no longer a source of subsistence activity for the poor and the backward but has emerged as a commodity for trade and export, besides being one of the cheapest sources of animal protein of high biological value that ensures nutritional security, it provides income and livelihoods to over seven million fishermen and a large number engaged in the subsidiary industries. Exporting about 450,000 tonnes of live and frozen products valued at Rs.65,500 million, it is an important source of valued forex. The share of the fisheries sector in the GDP is 1.4 per cent that equals to 4.7 per cent of the contribution from agriculture. Fisheries and aquaculture have thus an important role in the socio-economic fabric of the country.

It is unfortunate that the issues, priorities and needs of such an important sector have not been identified so far and no policy laid down by successive governments in the states and center and approved by the legislatures and the Parliament respectively. What is surprising is that the nation that has its entire economy based on agriculture has had its first ever agriculture policy adopted only recently and action on its various provisions is still awaited. Since fisheries are supposed to generate wealth and employment in the agriculture sector, the National Agricultural Policy has itself included certain aspects of fisheries and aquaculture for development. The National Policy on Agriculture seeks to promote technically sound, economically viable, environmentally non-degrading, and socially acceptable use of country’s natural resources – land, water and genetic endowment to promote sustainable development of agriculture that includes fisheries and aquaculture too. However, it is time that policy issues in fisheries and aquaculture are sorted out and a national policy developed.
WHAT IS A POLICY?

A policy is a course of action adopted to achieve one or a set of objectives considering the available opportunities and constraints. It is necessary to deal with a changed situation or public pressure or it could also be proactive when it offers new options. Policy making requires the selection of an option from a set of options based on an objective assessment of their pros and cons. It also requires adequate understanding of the resources, environment, technology and the economic and social aspects of the discipline for which policies are framed, in the present case that of fisheries and aquaculture.

PRESENT STATUS AND CHALLENGE OF THE NEW MILLENIUM

As for marine fisheries, intense fishing activity with larger vessels coupled with expansion of effort and improved fishing technology, establishment of Exclusive Economic Zones (EEZs), extension of fishing limits following UN Convention on the Law of the Sea (UNCLOS) have led to tremendous increase in fish and shellfish production. The International Convention on Biological Diversity has further strengthened the national rights over living resources and increased national responsibilities that require strengthening of resource management capabilities to discharge these rights and responsibilities.

On the other hand, rapid strides in aquaculture technologies with emphasis on increased production and the fast growth in global trade have brought about a significant change in the world scenario. Consumption of high value species of fish and shellfish has increased in the developed countries resulting in increased imports from developing countries while the availability of quality fish for consumption by the poor has decreased as a result of globalisation and free trade that also controls prices and employment. These activities have resulted in overfishing and environmental degradation besides considerable inequality in the distribution of benefits between countries and between various groups within countries. Diminishing natural stocks are threatening the income and livelihood of small-scale producers, who are either wholly or partly dependent on it, bringing about severe conflicts among users and stakeholders. Appropriate fisheries
management is imperative to improve and restore the productivity of natural stocks and while aquaculture is considered an alternative to increase fish production the poor have neither the access to the technology nor the finance to go ahead.

In brief, the challenge of the new millennium is to develop and maintain sustainable fisheries and aquaculture, enhance food security and bring about economic development through networking and information exchange and regional and inter-regional cooperation.

FISHERY POLICY ISSUES

Broadly speaking, the major policy issues of capture fisheries, whether of the sea or inland fisheries, are almost similar the world over though certain specific differences do exist that need appropriate attention. Some of these issues that are specific to our country are discussed in the following pages.

Marine capture fisheries

Deep Sea Fisheries

There is no policy for deep sea fishing with the result that foreign vessels are exploiting the stocks closer to us. Our fishing fleet for the deep sea has plummeted from 190 vessels to 65 which is further compounded by the withdrawal of charter and joint venture scheme. The present level of exploitation of the valuable tuna is much below the potential being only 10% of over 300,000t of harvestable stock and so also that of the cephalopods. A damaging scheme was initiated for the sake of Indianisation through import of used foreign vessels that allowed them to take away the entire catch. Recently, a pilot scheme has been initiated by equipping two Indian trawlers with long lining and the results are awaited with keen interest.

The FAO's Code of Conduct for Responsible Fisheries (CCRF) endorsed by India also requires the development of measures for long term conservation and sustainable use of fishery resources. Violations have to be dealt with adequate severity. It is therefore necessary to enact comprehensive legislation to regulate
the Indian as well as foreign fishing vessels in the EEZ and international waters and enforce it through strict supervision by the Coast Guards.

What needs to be done is to acquire resource specific vessels and develop them on the basis of equity participation and at the same time fix the size of each fleet. Further, adequate support is to be provided thrust establishment of post-harvest infrastructure facilities and marketing. Fishing harbours with adequate and modern facilities are a must along with landing centres where proper attention has to be paid to hygiene and sanitation in the light of the strict regulations imposed by the European Union and other countries to meet the HACCP and ISO 9000 standards.

Coastal fisheries

Indian coasts are endowed with a multi-species and multi-gear fishery of which 50 species of pelagics and 25 species of demersal fishes are commercially important. The contribution of pelagic fisheries has gone down from 70% to 50% in the course of the last four decades (1960-1998). The major stocks are already being exploited to the level of MSY. However, the catfishes are under heavy fishing pressure and so are the penaeid prawns showing a decline of the larger sizes. Sea ranching with hatchery-produced post-larvae of *P. semisulcatus* in the Gulf of Mannar and that of pearl oyster in the Gulf and Palk Bay has been successfully done. Proper management to address the problems of overfishing of the stocks is imperative along with that of overcapacity, i.e. excess labour besides enhancement of stocks through ranching.

While a Marine Fishing Regulation Act (MFRA) was enacted by each maritime state to regulate fishing in the territorial waters within their jurisdiction, there was no uniformity with regard to the reservation of areas for artisanal fishermen or for different types of fishing vessels. This created further problems. Some other measures like ban on monsoon fishing and increasing the number of ring/purse seiners were also proposed to conserve the resources but these could not be effectively implemented on account of lack of suitable manpower and necessary infrastructure such as patrol boats. Whatever be the case,
alternative and supplementary means of livelihood will have to be found for these communities who are being thrown out of employment.

Inland Capture Fisheries

Rivers

The rivers are a source of rich and varied germplasm with 417 species of commercial importance many of which contribute to aquaculture. Hill streams and upland lakes constitute a rich potential for sport fisheries and eco-tourism with indigenous schizothoracids and mahseers besides the exotic trout but these have been adversely affected owing employment of the destructive fishing methods and introduction of exotics such as common carp/mirror carp, tench and crucian carp. The present average yield from the Ganga is 1 t/km ranging from as low as 0.64 to about 1.64 t/km. There is a marked decline in the contribution of high value species from 44% to 8% in the last 40 years. The fisheries of the peninsular rivers have also suffered a similar fate. Floodplain fisheries that provided a significant portion of subsistence supply of fish are almost totally lost and unknown now. Owing highly dispersed and unorganised landing and marketing channels, it has been a problem to develop a proper database on fish yield and fishermen population, boats and nets, landing and marketing centres.

Recently, besides the presence of exotic silver carp and grass carp, the catfishes, *Clarias gariepinus* and *Pangasius sutchi* have also been recorded from various parts of the rivers in the northern states. Are we prepared for the havoc that these may cause to our already declining fisheries and endangered species? Stray attempts at rehabilitating the hilsa, mahseer and the Indian major carps through ranching in the Ganga and Brahmaputra have been made but these require sustainable fingerling supply that appear difficult, though not impossible, in the absence of a proper policy supported by legislation and the means to enforce it. The issue of biodiversity impact would also need necessary attention.

The rivers need to be considered in their entirety and not in segments in different states. The fish do not stay in one place, they move and any disturbance
in one part affects the other. The kind of disputes that are arising for harnessing their waters do not deserve a mention and it would be worthwhile regulating their use by a central authority.

The Indian Fisheries Act 1897 that has existed for over 100 years with Rules framed by the different States for regulating mainly the inland capture fisheries was not implemented effectively in most parts. Violation of these rules was a punishable offence but hardly anyone was jailed or fined. None of the problems that we face today were known when the Act was enacted in 1897 and it is time that it is revised to meet the present situation.

**Estuaries**

Another rich resource that has been providing employment to a large population besides nutritional security both for the rich and the poor through high and low value fish and shellfish comprises the Hooghly, Mahanadi, Godavari, Krishna, Cauvery, Tapti and Narmada estuaries and the large lagoons, viz., Chilka, Pulicat and Vernbanad. The destruction of the seed of several species of fish and prawns while collecting the shrimp seed for culture is going on for the past two decades without any control. Destruction of mangroves and estuarine wetlands for construction of housing properties and fish ponds for aquaculture has brought about a tremendous decrease in the nursery areas for the young ones of fish, prawns, crabs and other species that constitute the food chain. A weak legislation in this regard has been the bane of all ills. The hilsa, mullet and prawn fishery of Chilka has suffered heavily and has adversely affected the livelihood of a large number of fishermen who depended on fishing in the lake as also of those who depended on its trade. The ecology of Pulicat is changing owing thermal pollution and flyash deposition. Vernbanad backwaters have already lost the fishery of *Macrobrachium rosenbergii* owing the construction of Thanneermukom.

**Large reservoirs**

India is fortunately gifted with about 3.0 million ha of water area under large reservoirs that is likely to grow further in view of several plans for irrigation
and hydroelectric projects envisaged for the next decade. Fisheries development in the reservoirs has a great potential and it is the most economic production system. It not only makes quality fish available in the interior but also provides jobs to those who inhabit its periphery. With experience gained over the years both through empirical techniques and researches in the field, it is now possible to raise the yield from the present level to at least five to ten times depending upon the ecological conditions and the inherent productivity of the system. The experience with Kerala and Tamilnadu and lately with Himachal Pradesh and other states shows that the exotics have to be avoided totally and at all costs. While it is necessary to build up the stocks initially, provide recruitment support whenever and wherever required before throwing it open for commercial fishing, the effort and mesh sizes of the gear to be used must be regulated based on the results of experimental fishing.

Recent experience has been that provision of cage culture in the reservoirs is one of the means to rehabilitate the oustees of mega projects. Proper training, infrastructure facilities and the inputs will have to be organised for the purpose at least for the first three years.

The reservoirs are the property of the states. However, when these are shared by two or three states there are always problems of poaching and pilferage, improper discharge of responsibilities or sharing the revenue. There is no fisheries policy as such except for some developmental plans since it is a source of food and income. A policy for proper management of large reservoirs has to be developed and the least that can be said in its favour is to privatise the entire management.

**Culture-based capture fisheries**

Beels and lakes, as it is, are capture fisheries resources but small reservoirs constitute a "put and take" fishery and therefore belong to the domain of aquaculture. Unfortunately, it is a known practice in the country - though not based on any principles - to club them along with the beels under the category
of culture-based capture fisheries. There are water bodies that are controlled by Departments of Irrigation, Revenue, Forest, Fisheries or else panchayats, municipalities or corporations. These are normally auctioned for aquaculture or leased to cooperative societies at a nominal amount on a yearly basis. Legislation is necessary to lease them for a period of at least five years and to make it imperative for the lessee to maintain them in good condition and utilise properly for fish production since these are often left uncared for owing politics or vendetta. Beels are a unique resource in Bihar, West Bengal and Assam and, except for a few cases, where and are a source of livelihood for the peripheral fishers. These have been left to the mercy of nature that has been kind enough to infest them with weeds and potential health hazards. With considerable quantities of nutrients locked up in the bottom sediment, these constitute a resource for exploitation through bottom feeders and air-breathers. Certain experiments conducted in the last few years have shown a high production potential even for carps when raised in pens following the principles of aquaculture. The possibility of enhancing the production by 10-15 times has been demonstrated. Corporations and Authorities for the development of heels have long been established in each of these states but no tangible results are seen and the resource remains undeveloped and unexploited despite promises for employment and nutritional security. Policy support regarding access to these resources and security of tenure is required.

Aquaculture

As a follow up of the Code of conduct for Responsible Fisheries, the FAO has also issued guidelines to ensure sustainable production from aquaculture in harmony with the environment. It is assumed that the technologies are technically feasible, economically viable and socially acceptable. Policy alternatives need to look at the possibilities of reducing the cost of aquaculture production. Let it be known that aquaculture will be the mainstay of aquatic food supplies in the new millennium.

Freshwater aquaculture

It is one system that is environment friendly. It does not pollute, rather absorbs pollution. It is unfortunate that it is not considered a source of employment and food in most of the watershed management schemes that are coming up every day in various parts of the country. There has to be a policy to integrate aquaculture in all watershed management measures. It is equally necessary to
protect the resources lying idle and getting infested with weeds or else serving as the dumping grounds of all kinds of dirt and pollutants. Some of the well-maintained water bodies in the cities and towns or even villages suffer when the idols of Ganesh, Durga, Kali and Saraswati are immersed after the celebrations. Since toxic chemicals are used to paint them, these are a health hazard not only to fish but human beings as well. There is no law to prevent it.

Multi-ownership of ponds and community rights for irrigation and bathing are the biggest problems in their proper utilisation. No regard is paid to the fish crop in the pond when the water is drawn for irrigation and even the minimum level for their survival not maintained. If the community uses the pond for bathing or washing purposes, it is just not possible to use fish toxicants for pond preparation or fertilisers to enhance pond productivity. A fresh look at the existing policies is urgently needed to improve the efficiency of water use, its allocation for agriculture and other purposes.

Proper utilisation of seasonal ponds is unknown and so is integrated aquaculture-agri-livestock system that has tremendous scope for production of energy through biogas plants, recycling the wastes and keeping the environment pollution free. The case of Haryana where cattle mortality was rampant about two years ago is a pointer to the dangerous situation that could have been prevented. New systems such as cage culture in canals and reservoirs and running water fish culture should be considered as thrust areas as they have a tremendous potential for increasing fish production in remote areas. However, the present rules do not permit the use of these water bodies for the new systems.

While the entire attention is focussed at production of carps that are in great demand and have a ready market, there is a great shortage of some of the indigenous and low-value fish. Labeo bata, Cirrhinus reba, Amblypharyngodon mola, Puntius sarana and some other species are also great delicacies whose prices are now soaring high. There is a need for development of low-cost culture systems and also for diversification to include the various catfishes and murrels that are reckoned as high value fish in certain areas. Carp hatcheries have
mushroomed but there is no authority to certify the seed quality with the result that the farmers suffer not only on account of a mix of undesirable species but also low survival and poor growth of desirable species produced at farms as a consequence of inbreeding. Though the Government of Assam has recently introduced a policy on ‘Fish Seed Industry’, its impact is yet to be known.

Besides quality seed, other inputs are equally of poor quality and difficult to obtain. Credit is not easy to be obtained without a clout or under-hand-dealings and those who manage to get it never refund with the result that the banks are now hesitant to advance it even to the most genuine. Subsidies, though discouraged in the context of WTO, are a necessary evil in the present circumstances.

Introduction of exotic species has already affected the indigenous fauna in its natural habitats as well as in the culture systems. It is a pity that the government is not able to control illegal introductions despite the existence of a Bureau to regulate such action. Quarantine is unknown and diseases have a free flow. Besides powerful legislation there is a need to have proper infrastructure facilities and expertise too. Presently, there is no need to indulge in the expensive pursuit for Genetically Modified Fish though genetic technologies should certainly be used for reconstructing populations of endangered species. A policy decision needs to be taken.

**Brackish-water aquaculture**

Its sudden death was as fast as its sudden growth - a system that was considered the most lucrative till the other day! The greed of a few has been the bane of many. It has been estimated that it generated employment for eight persons per hectare, benefitting 800,000 people and generating an income of Rs.300,000/ha. The problems identified with the growth of the industry are conversion of agricultural land into shrimp ponds, destruction of mangroves and wetlands, salinisation of land and drinking water, deterioration of water quality owing effluents rich in nutrients, chemicals and antibiotics. The situation led to both social and legal conflicts between the ‘haves’ and ‘have nots’. Shortage of
seed and feed necessitated its import from abroad along with diseases that almost wiped off the local industry. The magnitude of the problem could be realised from the production losses of the order of Rs 3,000 million suffered during 1994-95. Yet there is no indication of sound judgement as *P. vannamei* has been recently introduced in the country and, as usual with anything new, farmers would be mad after it. It is not known who brought it from where, how and when? Was any clearance sought from the Committee on Introduction of Exotics? One does not know what is in store for us? In fact, there is a need to diversify with equally valuable species such as *Penaeus indicus, Penaeus semisulcatus, Peneaus merguinensis, Macrobrachium rosenbergii*, chanos, mullets, seabass and groupers. Establishment of hatcheries with proper and adequate broodstock for supply of quality seed would be the most desirable thing to do. Hatchery technology is available for most of the shrimps. The problem of WSS may be controlled once the domesticated broodstock of *P. monodon* that is being developed is available. Crab fattening now appears to be the most lucrative activity for the small-holder.

Disease diagnostic labs with modern gadgets need to be set up in every state and-in some-states even at the district level. Proper infrastructure, equipment and trained technicians and scientists are needed - an area considered to be the least important till the tragedy be fell but not being given the priority it deserves even now. The farmers and entrepreneurs have to be advised to avoid the use of all prohibited drugs including chloramphenical and, when necessary, make the minimal use of permitted drugs/ antibiotics for disease control. It needs to be appreciated that the Government of India has regulated the import of fish and fishery products through a sanitary import permit from the Department of Animal Husbandry and Dairying.

The notification issued by the Ministry of Environment and Forests in 1991 on Coastal Zone Regulation (CRZ) banning the establishment of any industry within 500 m from the High Tide Line (HTL) has almost put a stop to the growth of shrimp farms. The Supreme Court considered shrimp farming an industry and went even further to suggest that all structures within the CRZ shall be demolished.
except those that practice traditional or improved traditional system of aquaculture. Even those that have to be constructed now outside the CRZ will have to seek the approval of Aquaculture Authority of India. The Aquaculture Authority Bill that would prescribe regulations for construction and operation of aquaculture farms and clarify that aquaculture is not a prohibited activity and grant licenses to take it up is yet to be enacted. An important feature of the new order is that a farm above 5 ha in area would have to have an Effluent Treatment Plant as an in-built component in the design. However, there is an urgent need to avoid delay in licensing so that those who are ready with the programme could take it up without further loss of time. Moreover, a policy is needed to eliminate the negative aspects of shrimp aquaculture through legislation and necessary regulation.

In addition, there is a vast resource of brackishwater in the inland states in the northwest that covers about 150,000 ha of saline wasteland in the Haryana, Punjab, Rajasthan and Uttar Pradesh that needs urgent for its proper exploitation to provide food and employment. Once a policy decision for its development is taken and infrastructure provided, it would be a boon for those who have lost it and suffered so long.

**Mariculture**

Mariculture is rather new to India and its potential and scope therefore not realised by many. It is another food production system that feeds the poor and the very rich. Mussels, clams, pearl oysters, cephalopods, sea cucumbers and the seaweeds that have a direct use in the agar industry are all mariculture candidates. Hatchery technology is available for the seed production of all the candidate species. The techno-economic viability of bivalve farming has been studied and clam culture in Tamilnadu, oyster culture in Andhra Pradesh and mussel culture in Karnataka demonstrated at different sites. Culture technology for the red alga, *Gracilaria edulis*, has also been demonstrated to the women's group in Gulf of Mannar and Palk Bay with a five-fold increase in 90 days. Ranching of *Marcia opima* and *Crassostrea madrasensis* has been done in Tuticorin Bay and Karapad creek. Mussel and oyster farming has picked up in
Kerala just in the last two years. Once the cage culture technology of breams and groupers, high value species, is perfected, it would help raise the economic condition of the poor. While a part of the mariculture produce is likely to be consumed within the country, it has a great export potential. Pearl culture will be a source of great employment and income. The policies for mariculture need to drawn keeping in mind its fast development in the coming few years and the social, economic and territorial problems that it may be breed soon.

Aquaculture is a new and a growing phenomenon and needs to be looked at as such. From traditional and empirical pisciculture meant to supply some protein food to the pregnant or nursing mothers under the UNICEF scheme in the early fifties, it has developed into a science that encompasses biology, aquatic microbiology, biochemistry, nutrition, pathology, genetics, environmental sciences, engineering, economics, social sciences, business management, human resource development and a lot more. Further, it has now spread from the fresh to brackish water and into the sea. It was unknown when the Indian Fisheries Act was enacted and hence there is an urgent need to have a separate aquaculture policy to cover fresh and brackishwater aquaculture as well as mariculture.

ENVIRONMENTAL DEGRADATION

Environmental degradation results in mass mortalities, recruitment failure, obstruction of migratory routes, diseases, changes in water quality and so on that are reflected in a decline in fish catches and yields.

Red tides and El Nino are natural phenomena that cause fish mortalities in the sea. Oil spills cause tremendous damage to the sea and coastal fisheries. The damage due to washings and other activities at all major ports is well known. Discharge of industrial effluents and sewage either directly into the sea at Mumbai or Chennai or Paradip and Haldia or through the estuaries all along the coasts of India is not unknown. Reports on mercury poisoning from Goa have often been reported. Amba, Savitri, Mandovi, Zuari, Godavari. Mahanadi and Hooghly are known for their pollution load. The deterioration of water quality in the Ganga due to the tanneries at Kanpur needs no discussion. Run-off from
the agricultural fields where pesticides, herbicides and insecticides or other chemicals have been used is equally destructive. Thermal pollution, though not so common, takes its own toll. Despite the existence of Pollution Control Boards, both at the Centre and in the States, and "Clean the Ganga" and such other plans, and the Court Orders that are issued every alternate day, the pristine glory of the rivers is continuously deteriorating. What is all the more important now is to prevent further deterioration of the ecological conditions due to polluting industries and domestic sewage that is increasing every day. A strong political will is needed to handle such issues!

Destruction of mangroves and reefs destroys the nursery grounds of a wide variety of fish and shellfish that affects their survival and results in the reduction of numbers that would mature in subsequent years leading finally to a decline in population.

Construction of barrages, weirs and dams for irrigation and power generation cause an obstruction in the migratory route of fishes for feeding or breeding thus affecting their survival or recruitment respectively. Farakka is a glaring example of a barrier in the migration of hilsa that has adversely affected its fisheries in the Ganga from Allahabad to Lalgola. And yet another is Tanneermukom in Kerala that has brought about a decline of the flourishing fishery of the giant freshwater prawn. A reduction in the flow or an increase in its level affects the breeding and feeding grounds as well. Siltation also alters the ecology of such grounds. Recruitment failure due to a change in the ecological conditions at the breeding grounds is now a common phenomenon experienced almost every year due to the vagaries of the monsoon.

Siltation helps weed infestation as is seen in the Chilka Lake that has further suffered owing the decrease in the entry of seawater gradually turning it into a sweet water lake affecting several estuarine species.

One of the negative impacts of brackishwater aquaculture is also a change in water quality that brings about salinisation of not only the drinking water but also of the cultivated land. Though reclamation of saline land is considered an
alternative, its impact on mangroves and the narrowing of the channels affecting the flow of water through the creeks raises other problems.

There is legislation to curb some of these activities but it has no teeth and the environmental changes are having their own impact on the fisheries.

**GENDER ISSUES**

It is not unknown that women constitute about half the country's population. Among the poor especially, they constitute a working force that is employed on a large scale in agriculture and among the fishermen community in marketing and processing of marine fish. They are also getting involved in freshwater aquaculture. It is a good augury that they are organising themselves into small Self Help Groups (SHGs) and the banks are coming forward to provide them credit facilities. However, there is a need for training for empowerment and identification of proper income-generating schemes.

**HUMAN RESOURCE DEVELOPMENT**

The growing sector of fisheries and aquaculture now needs a proper base involving managers, economists and sociologists, extension specialists, technicians in all disciplines related to seed production, disease and culture and scientists specially in nutrition, disease and genetics. Thus there is a strong case for a massive human resource development programme through the training establishments of the Government of India (Central Institute of Fisheries, Nautical and Engineering Training, CIFNET, and the Central Institute of Coastal Engineering for Fisheries, CICEF) in the marine sector. The fisheries research institutes of the Indian Council of Agricultural Research and the Trainers' Training Centre and Krishi Vigyan Kendras (KVKs) have a role to play in developing and training the scientific manpower and the extension personnel besides training the farmers too. The establishments of all the state governments have the entire responsibility for training the extension personnel as well as the farmers. The Central Institute of Fisheries education (CIFE) has initiated a 2-year degree programme in Fisheries Business Management to fill the long-felt gap in the sector.
DATABASE AND INFORMATION TECHNOLOGY

It is now 55 years that we have been independent and functioning but without a complete idea about our resources. There is a need to assess these at the earliest for proper planning and development. Modern tools such as Remote Sensing (RS), Global Positioning System (GPS) and Geographical Information System (GIS) are now available that could be used to locate potential fishing zones (PFZ) besides areas that are either threatened or potential sites for development of fresh and brackishwater aquaculture.

Poor database is the biggest hindrance in proper planning. There is a need to adopt improved system and method of data collection for which proper training is essential. The Central Marine Fisheries Research institute had conducted the census for marine attributes more than two decades ago and the same is being used for all estimates even now which is highly improper. A properly designed frame survey of marine and inland fisheries attributes must be done every five years to have a reliable data for which necessary funds should be made available to the respective institutes who would organise the same uniformly on a country wide basis. There is also a need for a website to provide information on all aspects of fisheries and aquaculture to planners, administrators, managers, entrepreneurs and farmers.

In the absence of quantitative data, planners often tend to assume that inland fisheries activities are insignificant. On the other hand, without data, it is difficult for administrators to promote the sector in comparison to agriculture, industry and commerce, where economic data, forecasts and analyses are, in general, readily available. There is an urgent need to improve basic data on inland fisheries in order to improve prospects for integrated management.

The data officially published in 1996 by the Fisheries Division, Ministry of Agriculture, Government of India, pertains to varying periods. In some cases the latest information is available up to 1990 while in others up to 1994. It is a sorry state of affairs that in these days of information technology no data is available for the last seven years. What can be planned on the basis of data that was probably relevant seven years ago? Further, it must be realised that to be useful
and comparable all information needs to be collected at the same time following the same methodology as otherwise it has no value except for rough estimates. India is said to have progressed in information technology but where do we find it in our own discipline?

Planning requires data on several aspects such as fishery and operations, biology and environment, economic and financial including production, trade and human resource and socio-cultural comprising distribution of income and food, equity and demographics. It is true that collection and analyses of data costs heavily but its importance is realised only when the revenue lost through depleted resources and environmental damage is found to be much greater than the amount that would have been spent on data collection.

RESPONSIBLE FISHERIES AND AQUACULTURE

Sustainable development of fisheries and aquaculture is the ultimate objective of the entire exercise of planning that involves the governments at the Centre and the States and their institutions besides social and natural scientists, the media, financial institutions, special interest groups (NGOs), aquaculture producers, manufacturers and suppliers of inputs, processors and traders of products. Unless all of these varied groups join together and work hand in hand, it is difficult to realise the benefits that the country and its people are looking for.

AQUACULTURE ON PAR WITH AGRICULTURE

There is a bias in the treatment of farmers who practice agriculture and those involved in fresh or brackishwater aquaculture. While the former are provided flood and drought relief when required besides water and power at concessional rates and an insurance cover, none of these facilities is available to the aquafarmer. There is no income tax relief for him and no priority even for booking live fish seed or the highly perishable fish to reach the market.

Both are producers of food and the latter of quality food, then why this disparity? Should he not be treated on par with the agriculturist?
A SEPARATE MINISTRY FOR FISHERIES

Considering the importance of fisheries and aquaculture as a provider of nutritious food, employment and income and foreign exchange, its role in aquatourism and contribution to the national exchequer, it should be given its rightful status in the national perspective. It has so long been an appendage of the Department of Animal Husbandry and Veterinary Sciences in most of the states and continues to be so in some even now. At the Centre, it has been a part of various departments in the Ministry of Agriculture which itself has undergone several changes from time to time. Presently, it is under the Department of Animal Husbandry and Dairying as a small and insignificant Division. The name of the Department does not even indicate that it deals with fisheries too. In UK, it is the Ministry of Agriculture and Fisheries. Within the country, the situation is much better in some states such as Kerala, Tamil Nadu and West Bengal where not only a Secretary heads the Department but there is a separate Minister too. What is now needed is a separate Ministry of Fisheries at the Centre with independent authorities to control the marine, riverine and estuarine fisheries as well as the fisheries of the reservoirs on the pattern of such authorities in the UK and elsewhere with Marine Fisheries Authority, Riverine Fisheries Authority, Reservoir Fisheries Authority, Freshwater Aquaculture Authority and Brackishwater Aquaculture Authority with only one window for each of these authorities to be a panacea for all problems.
POLICY ISSUES IN FISHERIES AND AQUACULTURE

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Fisheries Development and need for regulatory measure

The Fisheries Sector has witnessed an impressive transformation from a traditional activity to one based on a developed and diversified infrastructure with immense potential for industrialisation. During the last five decades fish production has increased with an annual growth rate of 414%. Immediately after the independence, the fisheries developmental programmes assumed greater significance aimed at increased fish production which resulted in a lot of activities through plan schemes both in inland and marine fisheries sector. The share of inland fishery sector which was 29% in 1950-51 has increased to about 50% in 2000-2001. With advancement of new technologies for culture practices the activities increased manifold. In the case of marine fish production introduction of mechanised fishing boats coupled with new fishing gears revolutionized the coastal fishery sector. There was an accelerated growth after the mechanization programme. However, fish production from near shore waters 0-50m has been stagnant for some years after reaching optimum yield levels. Further the rapid industrialization in the country created problems and conflicts in the marine fishery sector. The production oriented programmes had to give room to the concept of sustainability in fisheries giving due weightage to environmental considerations and eco-system management. The need for proper regulatory measures in various sectors of fisheries for sustainable growth has therefore become important. Our objectives of fisheries development are sustainable development with suitable management practices, utilization of resource hitherto unexploited human resource development and building up of reliable database and network based system etc.

Constitutional Provision

Entry 57 of List 1 of Seventh Schedule of the Constitution specifies Fishing and Fisheries beyond Territorial Waters as Union Subject, whereas Entry 21 of List 11 speaks of fisheries within territorial waters as a State Subject.
Reading both the Entries together, it follows that control and regulation of fishing and fisheries within territorial waters (12 nautical miles) is the exclusive province of the State, whereas beyond the territorial waters, it is the exclusive domain of the Union. The Ministry of Agriculture within the purview of its allocated business helps the coastal States and Union Territories in development of the fisheries within the territorial waters, besides attending to the requirements of the sector in the EEZ.

Marine Fishing Regulation Act (MFRA)

The fast pace of increase in fishing fleet created problems like frequent conflicts between traditional, mechanised and deep sea fishing sectors and also between fishermen of adjacent States over the problem of fishing in certain areas, seasons etc. A Committee appointed by Government of India 1977 (Majumdar Committee) to study these problems recommended that the State Governments should be advised to enact necessary legislation to enable them to regulate fishing in their respective territorial waters (12 nautical miles) as per the constitutional provisions being fishing and fisheries within the territorial waters under States’ List. A Model Bill was circulated by the Ministry of Agriculture in 1979 based on the recommendations of the above Committee advising the States and Union Territories to enact suitable marine fishing regulations by them.

Provisions and Problems in regulation of Coastal Fisheries

The Model Bill in general contains provisions to regulate/restrict or prohibit fishing activities within specified areas, licensing of fishing vessels, prohibition of unlicensed fishing vessels, cancellation/suspension and amendment of licenses and registration of fishing vessels, in addition to provisions for conservation of fishery resources, ecologically sensitive areas, etc. The Marine Fishing Regulation Acts enacted by all States except Gujarat and the UT of Andaman & Nicobar Islands contain all these provisions in addition to provisions for ear-marking fishing areas for different categories of traditional and mechanised fishing.

However, the MFRA enacted by States indicate that there is no uniformity in the regulation of fishing by different Coastal States. The areas exclusively
earmarked for traditional fishing varies from 5 km from shore in Orissa and Goa, 6 km in Karnataka and 10 km in Andhra Pradesh and Kerala. There is thus a need for harmonizing this regulation at least with regard to the adjoining States. The implementation of the marine fishing regulations posed a great challenge to the maritime States in the absence of suitable infrastructure and manpower for its enforcement. Government of India under a Centrally Sponsored Scheme provided assistance to the State Governments to procure patrol boats to supervise and monitor the operation of fishing vessels in the coastal areas. However, most of the States have not put these boats in use effectively due to various reasons.

There is no uniformity in the regulation of fishing by different coastal States especially earmarking of operational areas for different types of fishing vessels. There is need for harmonizing these regulations at least with regard to the adjoining States. The implementation of the Marine Fishing Regulations poses another challenge to the maritime States who do not have suitable infrastructure and manpower for enforcement. There is, therefore, need to introduce Monitoring Control and Surveillance (MCS) system for law enforcement measures. Also the need for conservation of fishery resources through implementation of closed season and ban on monsoon fishing etc. may be necessary. The MFRA therefore, has to be amended through appropriate amendments.

**EEZ Act 1976**

India declared a 200 nautical miles Exclusive Economic Zone (EEZ) on the seas around India by enacting the Territorial Waters, continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976(Act 80 of 1976), thereby earning exclusive rights to exploit the living and non-living resources of this area, comprising of 2.02 million sq. km. Subsequent to acquiring exclusive rights for exploitation of the resources in the EEZ, it has also become obligatory to take necessary steps to exploit deep sea fishery resources. The nodal Ministry for this umbrella Act is the Ministry of External Affairs.
Exploitation of deep sea resources

Consequent upon the introduction of the Charter Policy in 1981 which permitted entry of foreign fishing vessels to fish in the Indian EEZ, the Central Government enacted the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981 and the Rules there under in 1982. The enforcement of this Act is resting with the Ministry of Agriculture. Subsequent to the Charter Policy of 1981, initiatives were taken by the Government from time to time to enable Indian companies to acquire fishing vessels. The New Deep Sea Policy of 1991 permitted Indian companies to enter into Joint Venture arrangements with foreign fishing companies and acquire fishing vessels for fishing in the Indian EEZ, flying the Indian flag. Due to various lacunae in the MZI Act 1981 we could not have adequate control on the operations of these vessels which has necessitated in amending some of the provisions of this Act which is separately under consideration.

Notwithstanding all these developments which enabled setting up of a new fishing regime for Indian owned fishing vessels, there is no legislation to regulate fishing activities of such vessels in the EEZ. In the absence of a legislation, the limited regulation which the Central Government has enforced so far with respect to the wholly Indian owned fishing vessels is through Executive Orders issued from time to time. These Executive Orders have been largely with respect to the enforcement of closed seasons, co-terminus with the closed seasons enforced by some of the coastal states in their territorial waters under their Marine Fishing Regulation Act (MFRA). The application of the Executive Orders issued by the Central Government has been largely restricted to fishing vessels above 20 metre OAL and falling under the deep sea category.

The Technical Committee on Deep Sea Fishing Industry under the chairmanship of Shri T. Murari recommended formulating suitable legislative measures for Indian owned fishing vessels. It is necessary to regulate operation of Indian owned fishing vessels in the EEZ to achieve the major objectives like optimum exploitation of resources at maximum sustainable yield level, preventing over-fishing and conservation of fishery resources, management measures such
as restrictions on area, size of vessels, type of vessels etc. Allocation of total allowable catch and other requirements to comply with international standards and procedures are also to be considered. The guidelines issued by the Ministry of Agriculture on deep sea fishing operations by Indian owned fishing vessels therefore need the requisite legislative support.

CCRF and International Agreements

Subsequent developments in the international arena have made this task more complicated - widening its scope further. The Code of Conduct for Responsible Fisheries (CCRF) evolved by FAO has been endorsed by India which aims at long term sustainable measures for optimal exploitation of fishery resources. The Code also serves as an instrument of preference to establish or to improve the legal and institutional framework required for the exercise of responsible fisheries. Through appropriate policy, legal and institutional framework member countries should adopt measures for the long term conservation and sustainable use of fishery resources. The Code also calls for effective legal and administrative framework for sanctions applicable in respect of violations which are adequate in severity and to allow for the refusal, withdrawal or suspension of authorization to fish in the event of non-compliance with conservation and management measures. Also the member countries should implement effective fisheries Monitoring Control, and Surveillance (MCS) and law enforcement measures wherever appropriate. Further laws and regulations applicable to international trade should be followed in a transparent manner, which are to be reviewed from time to time. The following four international agreements emerging out of the endorsement of the Code are relevant in this context for incorporation under the relevant laws/legislation proposed in this regard for effective implementation by both Indian owned fishing vessels as well as foreign fishing vessels operating the Indian EEZ as well as in the international waters.

(ii) Agreement to promote compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas.

(iii) International Plan of Action to prevent, deter and eliminate, illegal, unreported and unregulated fishing.

(iv) International Plan of Action for Management of Fishing Capacity, Conservation and Management of Sharks, reducing incidental catch of Sea Birds in long line fishing.

AQUACULTURE

Aquaculture is one of the several avenues being considered in the country as a viable means of diversification of agriculture and fisheries. Aquaculture denotes a number of activities that includes traditional, extensive fisheries management in larger bodies of open waters, extensive, semi-intensive and intensive culture in small tanks and ponds in freshwater and brackishwater as well as mariculture activity in coastal waters. The ultimate objectives of aquaculture development are:

• To increase the income and employment of the population.
• Raise the nutritional status
• Maximize economic returns from unit water area
• Increase the availability of fish in domestic market at reasonable price and
• To enhance the foreign exchange earnings.

Shrimp aquaculture is one such activity that has come up in a spectacular manner since the mid-80s. Scientific shrimp farming with selective stocking has been undertaken in the coastal areas in a big way which has contributed significantly to the progress of economy in the coastal regions as well as to the economic upliftment of rural poor.

Problems Encountered in Shrimp Farming

In the wake of its fast growth the aquaculture shrimp farming also posed a number of social, ecological and economical issues mainly on account of
improper planning and unregulated and uncontrolled growth of the enterprise. The experience gained in the Asian countries including India has clearly shown that if this activity is not scientifically managed and judiciously monitored they will not be sustainable and may cause a number of environmental and social problems as well as increased incidence of disease outbreaks. It is, therefore, necessary that the various issues encountered during the past need careful consideration while developing strategies for sustainable development of this sector. The general complaints voiced against this activity include conversion of agricultural land for shrimp aquaculture, salinity ingress affecting drinking water supplies, destruction of mangroves, displacement of labour, outbreak of disease and social conflicts between different user groups etc. Intensive aquaculture practices – a recent transition from the traditional, improved traditional and extensive systems is characterized by the use of high levels of inputs i.e. feeds and fertilizers leading to increases in organic loading which causes stress in the eco-system leading to outbreak of diseases and pollution of adjacent water areas due to improper waste water discharge system. Use of chemicals, antibiotics and chemical fertilizers in some of the areas has resulted in long term adverse conditions. The cumulative effects of all these problems resulted in legal conflicts leading to Government’s direct intervention.

**CRZ Notification of 1991**

The Coastal Zone Regulation (CRZ) Notification issued by the Ministry of Environment & Forests in February 1991 under the Environment (Protection) Act, 1986 specified that the coastal stretches influenced by tidal action up to 500 m from the High Tide Line (HTL) shall be treated as Coastal Regulation Zone where setting up of new industries (except directly relating to water front) are prohibited. Hatcheries have been excluded and drawal of ground water in 200–500-m zone is permitted when done manually through ordinary wells for drinking, horticulture, agriculture and fisheries purposes.
Supreme Court Judgement - December 1996

The unregulated growth of this sector with mushrooming of shrimp farms in coastal areas resulted in the filing of a Writ Petition in the Supreme Court in 1994. The Supreme Court held that aquaculture is an industry and hence covered by the prohibition imposed in the CRZ Notification mentioned above. The salient features of the Supreme Court judgement are:

- No shrimp culture pond can be constructed within CRZ except traditional and improved traditional type ponds.
- Shrimp culture ponds other than traditional and improved traditional set up within CRZ shall be demolished.
- An Authority to be constituted under Environment (Protection) Act, 1986 to deal with the situation.
- Shrimp ponds outside CRZ to be set up with prior approval of the Authority.

The Authority so constituted by the Central Government shall implement the "Precautionary principle" and "Polluter pays principle".

Review Petition

A number of review petitions were filed by the various aquaculture farmers and associations against the Supreme Court's Judgement including the one filed by the Ministry of Agriculture and the Marine Products Export Development Authority in view of the facts that the Supreme Court had interpreted shrimp culture as industrial activity where as it falls under primary productivity sector like agriculture needs water front and dominated by small sector farmers. Three such review petitions filed by private parties were rejected by the Supreme Court in February 1997. The matter is still pending in the Supreme Court.

The Aquaculture Authority Bill floated by the Ministry of Agriculture was formulated with the objective to regulate shrimp farming activity in the coastal areas in an eco friendly manner by setting up an Aquaculture Authority. Besides entrusting the Authority with the job of prescribing regulations for construction and operation of aquaculture farms and to grant licenses for this purpose the Bill also provides for amendments to the CRZ Notification 1991 whereby it would be
clarified that aquaculture is not a prohibited activity within the purview of the Notification. The Bill is still under the consideration of the Government which when enacted would enable the Government to make rules containing general guidelines for regulation of aquaculture to ensure that it is not detrimental to the coastal environment.

Diversification of Cultured Species

At present aquaculture activities are mainly based on culturing a few species. In the case of freshwater aquaculture the thrust is only on the three major Indian carps viz. catla, rohu and mrigal. In the brackishwater side the focus so far is only on *P. monodon*. The aspect regarding potential for diversification has been completely neglected. Diversification is an urgent need and it is high time that domestication of other potential species are also taken up. The diversification should also extend to other types of culture such as mussels, clams, seaweeds, oysters, etc. taking into consideration the suitability of the areas and their conditions. The technology development for seed for these alternate species needs to be streamlined. With the anticipated growth of this sector and the projected requirement of seed, additional hatcheries would be required and at the same time care should be taken to ensure consistent production of high quality seed. Development of healthy brood stock through genetic improvements is another important area that research institutes should take care of to meet the demands of high quality seed. Introduction of any exotic varieties need proper consultation since diseases caused by bacteria, virus and parasites are too often conveyed along with introduced exotic aquatic species. This represents one of the most severe threats that an introduced species may pose to the native community. A national strategic plan evolved by the expert group set up by the Ministry of Agriculture (Department of AH&D) addresses the various issues relating to ecological consequences of exotics, spread of aquatic diseases and the appropriate measures that are to be considered before introduction of any new species. These include details on the purpose and objectives of the introduction of new species in advance, information on all the relevant biological and genetic data of species, the target area likely to be
affected, analysis of potential impacts at the introduction site including potential ecological, genetic and disease impacts and qualitative and wherever possible quantitative risk assessment. Simultaneous efforts should be made for proper quarantine arrangements and a contingency plan to tackle the negative effects of any environment problems on account of such introduction. A National Committee to oversee and regulate the introduction of exotic species in the Indian waters is at present looking into these aspects.

Tackling Disease Outbreak

The sudden spurt in shrimp culture activities in the coastal states of India resulted in shrimp disease outbreak. Overcrowding of farms and unregulated growth of farms led to pressure on the carrying capacity of water bodies. The intake and discharge systems were not properly linked and by virtue of being very close to each other the intake system of some farms became mixed up with the discharge channels of neighbouring farms resulting in deterioration of water quality. The high stocking density and lack of quality control on seeds also contributed to the incidence of disease. The result was a sudden fall in economic returns. The problem was at a maximum during the year 1994-95 when an area of about 23,000 ha were affected resulting in loss of production to the extent of 2500 to 3000 million rupees. In spite of the various scientific studies shrimp farmers today have to contend with the disease problem which can be best controlled through suitable management practices on water quality, stocking density, quality of seed and appropriate use of chemicals. It is found that indiscriminate use of chemicals may cause undesirable consequences in the environment and the responsible use of chemicals that are approved for aquaculture are to be identified and shrimp farmers are to be educated about its use. There is an urgent need for bringing in suitable regulatory measures for manufacture, sale and use of chemicals in aquaculture. Efficient management, increased thrust on sanitation, use of efficient feeds, adoption of partial or complete water re-circulation system, disease diagnostic facilities with sophisticated techniques, adoption of more scientific measures for viral disease management and setting up of effluent treatment plants etc. are the areas to be given due
consideration to find out long lasting solutions to the disease and environment problems.

Use of Chemicals/Antibiotics

The Food and Agriculture Organisation of the United Nations through a press release dated 24.1.2002 has suggested that countries should take steps to stop the use of Chloramphenicol, a broad spectrum anti-biotic used in human and pet animal medicine. It is stated that the studies have shown that this compound is genotoxic, which means it, could cause genetic damages and possibly lead to cancer. It is understood that the European Union has imposed a complete ban on import of all aquaculture marine products from a few countries on account of detection of chloramphenicol in their products. Some of these antibiotics are used in some of the culture system mainly for shrimp culture. Steps are to be taken to discourage the use of these antibiotics in the culture system. The Ministry of Agriculture (Department of AH& Dairying) vide a notification dated 7th July, 2001 has made it mandatory that import of all livestock products shall be allowed only against a sanitary import permit to be issued by this Department. Through another notification issued on the 16th October, 2001 all aquatic animals including fish, crustaceans and molluscs have also been brought under the purview of the earlier notification relating to sanitary import permits. Accordingly all import of fish and fishery products now require a sanitary import permit from the Department of A.H. & Dairying and Committee set up in this Department on Risk Analysis on sanitary imports constituted under the chairmanship of Animal Husbandry Commissioner scrutinizes the import applications and imposes the condition that feed for aquaculture should be free from any chemical residues including antibiotics. The chemical contents of fish and shrimp feed are to be indicated in order to determine its admissibility. The Ministry of Agriculture has already written to all the State Governments to issue suitable orders to impose effective ban on the use of notified drugs, chemicals etc. in aquaculture and educate the shrimp farmers on the implications. The matter has also been taken up with the drug controller through the Ministry of Health for issuing suitable directives to the drug manufacturers to label the
bottles/packets of veterinary grade drugs with "Not for use in shrimp culture". The approval issued by the Aquaculture Authority also makes this a precondition.

**Legislation in Inland Fisheries Sector**

It may be mentioned that no regulatory measures with respect of inland fisheries activities are in force except the legislative measures taken by a few states. The problems in the inland fisheries sector are also multifarious in view of the fact that the administration of the water bodies varies from State to State and are under the control of different agencies such as Departments of Forestry, Revenue, PWD, Fisheries and Panchayat Raj etc. Also from the nature of behavior of fish inhabiting the rivers, it is not possible to regulate or to act single handedly unless with the active cooperation of the adjoining States. Also some of the lakes and reservoirs are under the control of more than one State. It is, therefore, necessary that such private property should have the protection of law and it is essential to have uniform rules and regulations in all the States for safeguarding the inland fishery wealth of common waters.

**Best management practices in Aquaculture**

It is essential for the farming community to have a thorough understanding of the culture practices that need to be adopted for different agro-climatic zones while taking into account the regional preferences. The various government extension agencies should provide the necessary financial support and technical guidance wherever feasible. Besides training of shrimp farmers in the various aspects of the culture it is necessary to organise frequent meetings to bring about awareness to enable them to achieve the envisaged objectives of developing culture systems in the country in an organised and eco friendly manner. The farming community should be informed of the dos and don'ts in such enterprise. In this context the efforts of FAO guidelines on Aquaculture as a follow up to the Code of Conduct for Responsible Fisheries needs to be mentioned which aims at ensuring sustainable exploitation of aquatic living resources in harmony with the environment. Since the fishing/farming communities in most developing countries come from the poorest strata of society with deep roots in traditions...
and customs, the dissemination of information entails enormous amounts of sustained efforts by all the concerned agencies. While the various aspects of conservation, sustainability and management etc. are well recognised the rights of indigenous people and the local community should be fully protected and measures need to be taken judiciously keeping in view the economic interest of the various sections of the society. The present strategy is shifting from management for survival and profits to management for sustainability since sustainable development is the overriding strategic issue and a challenge to all economic sectors especially in aquaculture. All sustainable developmental activities should therefore, be environmentally non-degrading, technically appropriate, economically viable and socially acceptable.

**Sustainability in Aquaculture**

For better sustainability Government needs to recognize aquaculture as a distinct agriculture sector that requires a complex regulatory framework. Aquaculturists must understand the fundamentals of management, economics, marketing and environmentally friendly concepts and not just advanced techniques alone. The effect of neglecting sustainability in aquaculture development has been well illustrated by the dramatic collapse of the shrimp culture industry in Asia during later part of last century. The scarcity of aquaculture regulations and management measures resulted in the aquaculturists to expand the culture areas enormously to make unreasonable increases in stocking density in pursuit of greater profits even beyond environmental capacity. The growing incidence of contagious diseases as a result of environmental deterioration, unreasonable high stocking rates and lack of quarantine systems etc. led to the collapse of this industry which serves as a warning for future aquaculture development. Legislation and regulations must be introduced in order to prevent, reduce and eliminate the risk of various negative aspects that may accrue on account of aquaculture practices. Since aquaculture is highly sensitive to adverse environmental changes it is necessary for the aquaculturists to work towards protection and enhancement of environmental quality in the long term interest. Taking into consideration the need for regulations in maintaining environmental quality, reducing the negative
environmental impacts, allocating natural resources between various economic interests and integration of aquaculture into environmental management, Government is already considering on legislative measures to regulate this activity in an environmental friendly manner.

Future Programmes

The strategies for future development of fisheries and aquaculture should focus attention on both the technique and non-technique aspects. Although in the earlier years it was only the aquaculturists and administrators who were involved in the development of this sector the need for involving expertise in other related disciplines has been well realised as the sector he progressed. A comprehensive regulatory framework for aquaculture has become the need of the hour with the inclusion of other crucial matters such as environmental conservation, public health, legal support, economic incentives, risk insurance, information dissemination, international cooperation and coordination of production, marketing and the management measures. Legislation and regulations are required for prevention, reduction elimination of hazards created by aquaculture with clear cut legal framework on property rights to farm sites and cultured stocks, protection of water quality, prevention of environmental degradation and disease spread. A participatory approach with a harmonious blend of technology, organization development, institution building and human resource development should therefore, be developed in order to streamline the new strategies that a more responsive to the felt needs of this sector. Such an effort would provide the required encouragement to transform the programmes to enable the achievement of sustainable development in fisheries sector with the target group kept in the forefront.

International Seminar on Policy Issues in Fisheries and aquaculture
Section 1: Motivation for the Paper

Although WTO came into being in 1995 to discipline both quantitative (i.e., in the form of tariffs and subsidies) and non-quantitative (in the form of tariff and non-tariff barriers) trade distorting measures in the member nations, fisheries escaped quantitative disciplines till the Doha round of negotiations. However, considering the fact that huge amounts of subsidies are being fed into this sector to distort trading pattern and damage environment not only in the developed nations, but also in many developing countries, it became necessary to bring subsidies under WTO discipline. The Fourth Ministerial Conference of the WTO held at Doha therefore mandated negotiations aimed at clarifying and improving WTO discipline on fisheries subsidies, but taking into account the importance of this sector to the developing countries.

As commonly expected, in anticipation of this WTO ruling, preparations started quite some time ago especially among the developed countries to debate whether or not the regular WTO Agreement on Subsidies and Countervailing Measures (ASCM) should be applied to fisheries, considering certain unique features of this sector. Two key reasons are generally cited in favour of an improved WTO discipline for fisheries. First, because of distinctive association of this sector with depletable type natural resources, fisheries sector subsidies, in addition to the standard market distortions addressed by existing ASCM rules, are likely to distort access to productive resources through negative effects on environmental and developmental perspective. Second, there are significant practical problems in applying existing ASCM rules to the fisheries sector, given heterogeneous nature of fishery products and the economic structure of the fisheries industry. Developing countries quite naturally cite in this context such features as high variability and perish ability of fisheries output, socio-economic backwardness of the fisher folk and complicated environmental implications of fisheries activities over time and space, which their economies and existing infrastructure are simply incapable of handling. It is therefore no surprise that the Doha Declaration agreed to open up the fisheries subsidies issue for negotiations (mandated to be completed by January 1, 2005), but subject to a general caution to members to exercise due restraint with respect to challenging the legitimate developing country goals like regional growth, technology, research and development funding, production diversification, and development and implementation of environmentally sound methods of production, which are generally put under non-actionable subsidies. It is against this background a
number of regional and international bodies like Asia-Pacific Economic Council (APEC), Organization for Economic Cooperation and Development (OECD), United Nations Environmental Project (UNEP), Food and Agricultural Organization (FAO) and also several individual countries have taken initiatives to review and examine the matter and come up with appropriate framework, methodologies and viewpoints to guide and/or influence world opinion. From all these indications it appears that the country can no longer can sidetrack this issue in both domestic and forthcoming international policy discussions. Whether or not we like it or not and whether sufficient homework is done or not, India must provide an immediate policy response to this irreversible process of liberalization and globalization in fisheries, which is underlying the forthcoming WTO negotiations on fisheries subsidies. The present paper makes a modest attempt to provide a perspective to handle this matter.

This paper is organized as follows. The next section makes a brief review of the global initiatives to define or redefine fisheries subsidies. Using FAO's recent initiatives and guide to prepare a broad listing of fisheries subsidies, section 3 attempts a broad classification fisheries subsidy regimes currently prevailing (or proposed during the 10th Five Year Plan) in India. The final section attempts to evolve several principles and strategies to handle and report fisheries subsidies in India before the world community.

The main argument made in this paper is that, given the irreversible process of liberalization and globalization underlying the forthcoming WTO negotiations on fisheries subsidies, the country seems to be better off by taking the bull by its horns — that is, by directly confronting and suitably addressing the issues, rather than doing a poor and half-hearted job on the matter and thus missing the bus, under one plea or the other. Developing countries like India, especially those with versatile and still hugely untapped fisheries resources should not ignore or lightly take the FAO initiative and guide to prepare a comprehensive listing of fisheries subsidies and their measurement. Although the developing countries have a general tendency to suspect and worry about international initiative to publicly share country data and information as a ploy to use the same resource base later to pressurize them in one way or the other, the author argues that these countries cannot simply wish away that possibility irrespective of their possible non-cooperation on this matter. On the other hand, building up a sound data base and sharing it internationally may serve three different purposes to them. First, given the fact that our polity has a tendency to expand the list of inefficient and ill-targeted fisheries subsidies through their self-seeking actions and inactions, a comprehensive listing of subsidies will reveal not only before the global communities, but also to NGOs, environmentalists and friends of the fisher folk for their possible future actions how valuable tax revenues are being misused and squandered and how such leakages should be corrected and stopped. Second, once a broad list of subsidies is prepared, it will include in all
likelihood potential negative subsidies to fisheries and the fishermen from no or faulty government action to safeguard the interests of the fisheries sector and the property rights of the fisher folk, especially in relation to their counterparts in developed countries. Such revelations will not only facilitate creation of fisher folk-friendly property rights in fisheries, but also facilitate international negotiations and demand for support from international donor agencies to overcome the structural deficiencies of developing country fisheries. Third, once such comprehensive data start flowing from the developing countries, the process would force developed nations to share their data too with the global community. Such revelations would then empower the friends of the fisher folk all over the world to undertake educated negotiation process without fear or favour to maximize the value of fishery resources and equitably share the same among all stakeholders. The global village will then usher into a Coasian process of negotiation to achieve maximum value out of fisheries resources at minimum cost. The process seems to be a long-drawn and even a painful one, but it appears there is no short cut to better serve the interests of developing countries like India.

Section 2: Review of Global Initiatives to Define/Redefine Fisheries Subsidies

The Agreement on Subsidies and Countervailing Measures (ASCM) provides the only internationally agreed definition of subsidies with three basic elements: (a) a subsidy must mean a financial contribution, (b) it must come from a government or any public body within the territory of a member country, and (c) it must confer a benefit. This framework also attempts to distinguish actionable subsidies from non-actionable ones, as detailed in the following table.

<table>
<thead>
<tr>
<th>Criteria for Specific and Actionable Subsidies</th>
<th>Criteria for Non-Actionable Subsidies</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Criteria of Specificity (as per Article 2 of ASCM):</td>
<td>A. Subsidies, which are not specific within the meaning of Article 2 of</td>
</tr>
<tr>
<td>A1. If access to subsidy is limited to certain enterprises;</td>
<td>B. Exceptions to General Criteria of Specificity (as per Article 8 of</td>
</tr>
<tr>
<td>A2. If access to subsidy is limited to certain enterprises or industries in designated geographical regions;</td>
<td>ASCM):</td>
</tr>
<tr>
<td>A3. If subsidies are contingent upon performance; and</td>
<td>B1. Assistance for research and to development;</td>
</tr>
<tr>
<td>A4. If subsidies are contingent upon use of domestic over imported goods.</td>
<td>B2. Assistance to disadvantaged export regions; and</td>
</tr>
<tr>
<td></td>
<td>B3. Assistance to promote adaptation of existing facilities to new environmental requirements.</td>
</tr>
</tbody>
</table>

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Based on the above-stated basic definition, the Asia-Pacific Economic Council (APEC) and OPEC have provided a fairly comprehensive listing of fisheries subsidies, as displayed in Table 2 and Table 3, respectively. The focus is obviously on government financial transfers (i.e., monetary value of interventions associated with fisheries policies) and are inclusive of both on-budget and off-budget transfers to the fisheries sector.

So far the most comprehensive and theoretically most prolific classification of fisheries subsidies is provided by FAO. It defines fisheries subsidies as "government actions or inactions that are specific to the fisheries industry and that modifies – by increasing or decreasing – the potential profits by the industry in the short-, medium- or long-term". In its definition "government" includes other governments and public bodies other than the ones in the country under consideration. So, FAO's definition includes contributions from public and international aid and cooperation institutions, besides actions and inactions by non-fishery government agencies and organizations. By "fisheries industry" it refers to all productive sub-sectors of the fisheries and aquaculture sector, i.e., all

Table 2: APEC Categorization of Fisheries Subsidies

<table>
<thead>
<tr>
<th>Categories</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Direct assistance to fishers &amp; fishery workers (all revenue transfers to fishers and fisheries workers from govt. budgets)</td>
<td>Income support programs - payment to supplement the incomes of fisheries and fisheries workers; Unemployment insurance - payment targeted specifically for unemployed fishers and fisheries workers; Other direct payments to fishers.</td>
</tr>
<tr>
<td>2. Lending support programs (all govt.-funded loans, loan guarantees and loans below lending rates to the fisheries sector)</td>
<td>Loan guarantees - including loans provided by private lenders and guaranteed by the government; commercial Subsidised loans - loans at below market rates (calculated as the difference between market interest rates and low interest rates, applied to the total value of the outstanding loans); Loan restructuring; Other lending support programs.</td>
</tr>
<tr>
<td>3. Tax Preferences and Insurance Support Programs (all tax preferences and government-funded insurance programs that benefit the fisheries sector)</td>
<td>Fuel tax exemption - for fishing vessels; Income tax deferral - for fishers; Accelerated depreciation - for taxation of fishing vessels and gear; Favourable tax rates on specific inputs or outputs; Vessel</td>
</tr>
</tbody>
</table>

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4. Capital and Infrastructure Support Programs (all government-funded capital inputs and infrastructure investments to fisheries sector)

- Development grants - for fisheries enterprises; State investment - in state-owned enterprises and cooperatives in the fishing sector; Fleet renewal and the modernization; Foreign access payments - for deep-sea fishing access to foreign fishing waters; Bait services - provided to fishers; Provision of fish auctions or other sales facilities and services; Aid to shipyards - to support fishing boat construction; Fishing port infrastructure enhancement - to provide port improvements for fishing fleets; Harbour facilities and moorage - provided free or at low rates for fishing fleets; Other capital and infrastructure support programs.

5. Marketing and Price Support Programs (all government-funded marketing and price support programs that are designed to reduce capacity and/or enhance the fisheries resource base)

- Export marketing programs - to enhance seafood exports; Fish products promotion programs - including seafood product promotion, labelling, quality enhancement for either domestic or external markets; Market price support - government support to ensure minimum prices or to keep domestic prices above world prices, captured as the gap between domestic price and border price; Other marketing support programs.

6. Fisheries Management, Research, Effort Reduction and Conservation Programs (all government-funded programs that are designed to reduce capacity enhance the fisheries resource base)

- Worker adjustment programs - payments to assist displaced fishers and fisheries workers to find alternative employment; Fisher retraining - to assist fishers and fisheries workers to find alternative and/or employment; Vessel buybacks - payments for the permanent withdrawal of fishing
vessels; Permit buybacks or license retirement (all types) - payment for the permanent withdrawal of fishing permits or licenses; Stock enhancement programs - including fish habitat improvements, release of juveniles, etc.; Fisheries management programs; Fisheries enforcement programs; Programs to assess fish stock; Programs to identify and develop new fisheries; R & D - to develop new fisheries technologies; Other fisheries management, research effort reduction and conservation programs.

Table 3: Examples of Different Categories of Transfers to Marine Capture Fisheries Sector in OECD Countries

<table>
<thead>
<tr>
<th>Types</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Direct payments (transfers from government budgets enhancing revenue of recipients)</td>
<td>Payments to fishers based on level of catches, level of sales, vessel ownership, overall fishing income and/or fishers' historical interest fisheries.</td>
</tr>
<tr>
<td>2. Cost-reducing transfers (payments from government to fishers that reduce costs of fixed capital and variable inputs)</td>
<td>Revenue-enhancing transfers like fuel-tax exemptions, subsidized loans etc. that affect operating decisions of fishers with respect to either output and/or levels and types of inputs used.</td>
</tr>
<tr>
<td>3. General services (government transfers that are not directly received by fishers, but that reduce faced by the sector as a whole)</td>
<td>Expenditures on research, management and enforcement, expenditures to support fisheries prices (e.g., the costs withdrawing from markets) or fisheries infrastructure (e.g., stock enhancement schemes and investments in fishing ports)</td>
</tr>
</tbody>
</table>

Source: Cox and Schmidt (2002)

Types of input industry – including transport and other support services – capture fisheries, aquaculture, processing and marketing. Thus, this definition covers all producers and operators, whether small or large-scale, who are engaged in
recreational, subsistence and commercial fisheries. By "potential profits", the FAO definition implies the overall profitability of the industry as defined earlier. An important aspect of this FAO definition of fisheries subsidies is that it recognizes that such subsidies can also become negative (e.g., in cases of taxes, fees and duties). The FAO categorization of fisheries subsidies is detailed in Table 4 below.

The United Nations Environment Program (UNEP) is also attempting to develop understanding and consensus on policy reforms in the fisheries sector, including subsidy reforms, that will contribute to sustainable development of this sector. It has been striving to "create better understanding, quantification and classification of the economic, environmental and social effects of subsidies to the fisheries sector and explore a variety of approaches to develop policy reforms for the sustainable management of fisheries, which will simultaneously build consensus on the need for reforms". (source: http://www.unep.org)

Table 4: FAO Guide's Categorization of Fisheries Subsidies

<table>
<thead>
<tr>
<th>Categories</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1. Direct financial transfers (all direct payments to the fisheries industry)</td>
<td>(+) investment grants, grants for safety equipment, vessel decommissioning programs, equity infusions, income guarantee schemes, disaster relief payments, price support, direct export incentives, etc. (-) various taxes and fees, import/export duties, etc.</td>
</tr>
<tr>
<td>C2. Services &amp; indirect financial transfers (any active government intervention, which does not involve a direct financial transfer as specified under item 1 above)</td>
<td>(a) non-tariff border measures (e.g., import quotas, export promotion support, direct foreign investment restrictions, etc.) (b) tax and duty exemptions and other reduced charges by govt. (e.g., fuel tax exemptions, investment tax credits, deferred tax programs, special income tax deductions, etc.) (c) services provided by govt. to others as well, but at less than full costs to the fisheries sector (e.g.,...</td>
</tr>
</tbody>
</table>
investment loans on favourable terms, loan guarantees, special insurance schemes for vessel and gear, etc.)
(d) services provided by govt. at less than full costs and only to the fisheries sector (e.g., inspection and certification for exports, specialized training, extension, ports and landing site facilities, payments to foreign governments to secure access to fishing grounds, government funded research and development programs, fisheries management, international cooperation and negotiations, etc.)

| C3. Government non-financial interventions and regulations (with possible short run negative effect and long run positive effect on industry profit) | Environment protection programs, gear regulations, chemical and drugs regulations, etc. |
| C4. Lack of government inaction that allows producers to impose in short and/or long run certain costs of production on others, including on environment and natural resources, and thus having effect on industry profit | Free access to fishing grounds, lack of pollution control, lack of run management measures, non-implementation of existing regulations, etc. |

From a review of the above-stated global initiatives to define or redefine fisheries subsidies, it appears there are four broad options available to the developing countries like India at this stage:

1. To use the existing definition in the ASCM Agreement without modification or clarification;
2. To make more sector-specific modifications and clarifications, for example, by including indirect but explicit government subsidies, and exempting government infrastructure programs in the fisheries sector;
3. To include part or full of the government cost of fisheries management, which the government failed to charge to the industry, over and above the second option; and
4. To include a radically expanded definition of subsidies, which also includes government failure to enforce adequately sustainable fishing practices.

As already pointed out at the beginning, this paper favours starting with the fourth and most comprehensive course, as FAO Guide has been attempting, but then sharpening the arguments for non-actionable subsidies, as already provided in the ASCM Agreement, keeping in mind the spirit of the Doha Declaration on Fisheries to take care of the "legitimate development goals" of developing country fisheries.

Section 3: Proposed Fisheries Subsidies in India during 10th Five Year Plan

A glance at the list of central government schemes proposed for the fisheries sector during the 10th Five Year Plan reveals two broad features. First, the list looks quite comprehensive, but in all probability it will attract a lot of attention at the global level because all the items mentioned therein (summarized in Table 5) correspond to one or the other category of the first three definitions of fisheries subsidies as per FAO classification, unless suitable attempts are made to redefine their purposes. Two options are available in this context: either to separate out the pure public good elements of government actions, and/or to redefine their goals so as to make them look like non-actionable subsidies. Obviously, considerable efforts are needed to separate out the non-actionable components of these subsidies and then to argue before WTO that continuation of the non-actionable category will indeed serve the interests of developing countries, as they are still far behind the developed nations in terms of institutional and infrastructure development. The second crucial observation is that there is hardly any reference made in the 10th Plan document to subsidies arising from inaction of various government departments (e.g., to implement pollution control measures), which seem to be hurting the fisheries sector. So, any careful exercise on fisheries subsidies in the Indian context must address the two above-stated concerns. While Table 5 has attempted to put the various schemes in one or other of the FAO subsidy categories, attempts are being made in the final section to evolve certain first principles to reduce their financial burden and/or to treat them as non-actionable during the next round of WTO negotiations. Obviously, considerable amount of research is needed to improve upon this framework and to implement it through suitable domestic reforms and formal calculations.
Table 5: Likely Subsidy Categorization (as per proposed FAO Guide) of Proposed Central Government Schemes for the Fisheries Sector

<table>
<thead>
<tr>
<th>Schemes</th>
<th>Likely subsidy categorizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Central assistance to fisheries institutes</td>
<td></td>
</tr>
<tr>
<td>1.1 Fisheries Survey of India (FSI):</td>
<td>C2</td>
</tr>
<tr>
<td>(a) surveying and estimating catch of fisheries in territorial waters</td>
<td></td>
</tr>
<tr>
<td>and EEZ, (b) achieving commercial application of data collected and</td>
<td></td>
</tr>
<tr>
<td>compilation at regular intervals, and (c) acting as focal point for</td>
<td></td>
</tr>
<tr>
<td>vessel monitoring system, following notification by Govt. of India</td>
<td></td>
</tr>
<tr>
<td>to make it mandatory for all fishing vessels above 20 m OAL and all</td>
<td></td>
</tr>
<tr>
<td>state machinery (including fishing harbors and landing centers) to</td>
<td></td>
</tr>
<tr>
<td>furnish requisite data to FSI.</td>
<td></td>
</tr>
<tr>
<td>1.2 Central Institute of Fisheries, Nautical and Engineering Training</td>
<td>C2</td>
</tr>
<tr>
<td>(CIFNET): for developing short-term training modules on use of</td>
<td></td>
</tr>
<tr>
<td>communication and navigation equipments; sea safety; engine repairs</td>
<td></td>
</tr>
<tr>
<td>and maintenance; operation of resource-specific gear, their</td>
<td></td>
</tr>
<tr>
<td>fabrication and maintenance; onboard preservation and value-addition;</td>
<td></td>
</tr>
<tr>
<td>etc. with focus on artisanal and small-scale fishers.</td>
<td></td>
</tr>
<tr>
<td>1.3 Central Institute of Coastal Engineering for Fishery (CICEF):</td>
<td>C2</td>
</tr>
<tr>
<td>for conducting pre-feasibility studies for selection of sites for</td>
<td></td>
</tr>
<tr>
<td>fishing harbors and fish landing centers; assisting states and union</td>
<td></td>
</tr>
<tr>
<td>territories in preparation of detailed project reports; subsequent</td>
<td></td>
</tr>
<tr>
<td>monitoring sanctioned projects.</td>
<td></td>
</tr>
<tr>
<td>1.4 Integrated Fisheries Project (IFP):</td>
<td>C2</td>
</tr>
<tr>
<td>(a) commercialization of techniques on value-addition, (b)</td>
<td></td>
</tr>
<tr>
<td>marketing of unconventional fish varieties, (c) development of low</td>
<td></td>
</tr>
<tr>
<td>cost technologies for utilization of by-catch, etc.</td>
<td></td>
</tr>
<tr>
<td>2. Development of inland fisheries and aquaculture</td>
<td>C1 &amp; C2</td>
</tr>
<tr>
<td>2.1 Inland aquaculture: (a) continuing support to fresh water fish</td>
<td></td>
</tr>
<tr>
<td>farmers in 442 FFDAs and shrimp farmers in 39 BFDAs, besides</td>
<td></td>
</tr>
<tr>
<td>providing additional</td>
<td></td>
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</tbody>
</table>
coverage to coldwater, and saline and waterlogged inland areas, (b) construction of raceways for coldwater aquaculture, (c) supplying subsidized inputs (seed, feed, fertilizers, manures, etc.), (c) popularizing integrated fish farming and running water fish culture, especially in North-eastern region and hilly areas, (d) assistance for setting up of hatchery for all commercial species of fish and prawn, (e) assistance for setting up of common effluent treatment plants, especially for small shrimp farmers, (f) a second dose of input subsidy in brackish water segment in cases on natural calamities, (g) strengthening disease diagnostic capabilities through a chain of laboratories, (h) assistance for setting up fish/prawn feed units, (i) assistance for productive utilization of inland waterlogged and saline areas, (j) popularization of ornamental fish culture, breeding and trade, (k) extension of stipends to trainers and trainees along with fishers, and (l) separate package of assistance for North-eastern states.

2.2 Inland capture fisheries: (a) conservation of commercially important fish species in riverine / floodplain stretches through ranching and habitat restoration, (b) stocking of seed and provision of harvest and post-harvest infrastructure, (c) organization of cooperatives for production and marketing, (d) training of fisheries officials, cooperative members and groups of fishers, and (e) awareness programs for local population for conservation of bio-diversity, revival of commercially viable bio-mass productivity and protection of habitat through uniform legislation in inland states (preceded by formulation of a model Bill by the central government).

3. Development of marine fisheries

3.1 Modernization of artisanal and small-scale fishing vessels: (a) replacement of old wooden boats by fishing craft made of FRP/FCB with improved facilities, (b) provision of nets and gears, (c) assistance toward cost of OBM and kerosene, (d)

<table>
<thead>
<tr>
<th>C2</th>
<th>C1 &amp; C2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2 Inland capture fisheries: (a) conservation of commercially important fish species in riverine / floodplain stretches through ranching and habitat restoration, (b) stocking of seed and provision of harvest and post-harvest infrastructure, (c) organization of cooperatives for production and marketing, (d) training of fisheries officials, cooperative members and groups of fishers, and (e) awareness programs for local population for conservation of bio-diversity, revival of commercially viable bio-mass productivity and protection of habitat through uniform legislation in inland states (preceded by formulation of a model Bill by the central government).</td>
<td></td>
</tr>
<tr>
<td>3. Development of marine fisheries</td>
<td></td>
</tr>
<tr>
<td>3.1 Modernization of artisanal and small-scale fishing vessels: (a) replacement of old wooden boats by fishing craft made of FRP/FCB with improved facilities, (b) provision of nets and gears, (c) assistance toward cost of OBM and kerosene, (d)</td>
<td></td>
</tr>
</tbody>
</table>
3.1 Provision of GPS, fish finders, life boats and other
mandatory equipment on board, (e) introduction of
FED and BRD in fishing operation to prevent capture
of juveniles and protect endangered species, (f)
promoting alternate material such as fibre-reinforced
plastic, ferro-cement, steel, etc. to meet requirements
of the boat building industry, material like FRP etc.

3.2 Introduction of intermediate range of fishing craft with
improved design: (a) replacement of aging
mechanized fishing vessels by suitable resource-
specific improved design vessels, (b) financial
package to support group of fishers / cooperatives
acquiring intermediate range fishing vessels.

3.3 Introduction of resource-specific deep sea fishing
vessels like tuna long-liners, purse-seiners, squid-
 jiggers, etc.

3.4 Pilot projects: to develop an All India Coordinated
Research Project on Mariculture for transferring
technologies developed so far, especially with regard
to oysters, mussels, sea bass, groupers, etc.

4. Infrastructure & post-harvest programs

4.1 Subsidizing maintenance dredging of fishing harbors
/ fish landing centers

4.2 Up-gradation of hygienic condition in existing harbors
through incorporation of HACCP and ISO 9000
requirements.

4.3 Programs for augmenting post-harvest & marketing
infrastructure: (a) training in low-cost techniques of
fish products development, (b) input subsidies to
self-help groups of fisherwomen for setting up
processing units, (c) assistance for setting up of
fish vending kiosks and mobile retail marketing units
through three wheelers with refrigerated/ice hold,
(d) setting up model fish markets and establishment
of cold chain at identified sites.

5. Strengthening of data base and information networking

5.1 Inland fisheries statistics: standardization of
methodologies for estimation of catch from diverse
aquatic resources and establishing regular
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2</td>
<td>Use of remote sensing and GIS in estimation of resource size and productivity.</td>
</tr>
<tr>
<td>5.3</td>
<td>Information networking: to organize data and knowledge in a cohesive unit and provide a single window access for end users.</td>
</tr>
<tr>
<td>5.4</td>
<td>Making marine fisheries statistics more informative and accurate</td>
</tr>
<tr>
<td>5.5</td>
<td>National census on important attributes of marine and inland fisheries</td>
</tr>
<tr>
<td>6.1</td>
<td>Continuation and expansion of the provisions of earlier welfare programs: (a) Development of model fisher villages, (b) Group accident insurance scheme for active fishers, (c) Savings-cum-relief scheme for fishers to (i) allow subsidy on housing scheme in hilly areas, (ii) cover seasonal fishers under savings-cum-relief scheme, (iii) include a component for renovation of existing houses, (iv) include platforms for fish drying/trading in fisher villages as community facility</td>
</tr>
<tr>
<td>6.2</td>
<td>Safety at sea: (a) subsidy to fishermen to procure and keep on boat safety equipments, (b) subsidy to state governments on upkeep of patrol boats, (c) supporting responsible movement of live aquatic species and setting up of quarantine infrastructure at major ports following suggestions of National Level Committee on Introduction of Exotic Aquatic Species in Indian Waters.</td>
</tr>
<tr>
<td>6.3</td>
<td>Code of conduct for responsible fisher; (a) translation of Code of Conduct for Responsible Fisheries into vernacular languages, (b) financing workshops for stakeholders for popularizing the Code, (c) appropriate regulation on number of fishing boats/vessels, their operational areas, ban on monsoon fishing, mesh size, use of right type of fishing gear, safety equipments etc.</td>
</tr>
<tr>
<td>6.4</td>
<td>Aquaculture at par with agriculture: income tax relief, power and water supply, loan facilities, insurance</td>
</tr>
</tbody>
</table>
cover, drought and flood relief, subsidy on seed/feed, machinery/equipments, transport, land development and soil conservation, demonstration and training, etc., as available to farmers in agriculture.

6.5 Strengthening of fisheries division by improving technical manpower to cope with enlarged activities and responsibilities.

6.6 Strengthening resource base of fishery cooperatives through support of FISHCOPFED.

6.7 Revival of mahseer, a declining species, through concerted research and development efforts.

6.8 Establishment of marine parks with basic infrastructure like hatcheries etc. for endangered species of animals, fish, medicinal plants, etc. to preserve bio-diversity.

6.9 Quality and disease-free fish seed production

6.10 Quality fish feed production for all commercial species to ensure supplies in the hinterland.

6.11 Training, extension and empowerment of women through ICR institutes, state governments and NGOs.

<table>
<thead>
<tr>
<th>Section 4: Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A comprehensive listing of fisheries subsidies, as being attempted by FAO, has potentially both advantages and disadvantages for the developing countries, though it may look totally disadvantageous to them at first sight. The apparent disadvantage is that subsidies by the developing countries, which are sometimes quite large, once properly reported, will be monitored by the global community and hence may put them into a tight spot. However, this paper argues that it is an additional advantage to the developing nations. The value of a unit of tax revenue (say, in purchasing power parity) is much higher for a developing country than for a developed one. So, developing countries need to be more careful than their developed counterparts about efficient use of their tax revenues. Unfortunately, this is very often just the opposite in many developing economies. Though subsidy as such is not bad (especially when it has strong net wealth creating potential in a poor economy), given weaker institutional framework and especially weaker civil societies in these countries to effectively</td>
</tr>
</tbody>
</table>
monitor 'rent seeking' politicians and bureaucrats and to demand transparent government functioning, the poor developing nations often misuse their subsidies. This means, if subsidies are comprehensively reported in both developed and developing countries, at least some enlightened group of citizens can start questioning their efficiency and usefulness in both types of countries. The irony of the poor producers in developing countries is that they live in between two fires – excessive subsidies by developed countries, on the one hand, and non-targeted and inefficient subsidies in their own countries, on the other, both of which dilute the competitive strength of their products. Comprehensive reporting of fisheries subsidies, assuming competitive bargaining, can therefore potentially help the producers of developing countries both at national and international levels. This is true as long as (1) the unequal structural features of the fisheries sector across countries is suitably accommodated in WTO negotiations on subsidies to this sector, and (2) efficiency issues involved in designing and implementation of fisheries subsidies are suitably addressed through suitable domestic reforms. These two points are elaborated below.

The WTO framework for free and fair trade is based on the assumption of existence of a complete set of perfect markets across the globe. It is precisely because of general failure of this underlying assumption especially in the context of developing and agriculture-based economies (and even in the developed economies) that provision has been made for various ‘green box’ measures, which are not part of the negotiating process. Not only that, separate provisions are also there for ‘non-actionable’ subsidies under ASCM to pay due consideration to various market failure features in the context of development and underdevelopment. Although the ‘green box’ measures are likely to undergo changes over time, especially in view of the observed trade-distorting features of some of these measures, these are part and parcel of the Agreement on Agriculture. Though fisheries is not a part of the Agreement on Agriculture, the need for such ‘green box’ measures to take care of market failure problems in the process of development and underdevelopment is even stronger in the context of fisheries. So, the following action points are suggested. First, India must argue for continuation of ‘non-actionable’ category of subsidies, but must try to benchmark the limit, instead of asking for blanket coverage of ‘green box’ type measures in view of the observed tendency of developed countries with much superior government resource base to continue to provide various subsidies under this plea. Second, India must suitably screen and redefine the goals and objectives of various government schemes, so that those measures serving the legitimate goals of development can be treated as ‘non-actionable’ subsidies. This means schemes and sub-components of schemes serving needs of research
and development, disadvantaged regions and environment must be separated out and recorded separately for budgetary purposes. Third, the pure public good elements of various schemes must be separated from impure categories, so that the cost of providing such pure public good services can be exempt from the category of 'actionable' subsidies, whereas the government can think of making alternative arrangements (like total privatisation or collecting user charges) with respect the impure elements. Fourth, the category of non-actionable subsidies should include costs of measures aimed at awareness campaigns and people's participation programs, programs for empowerment of women and disadvantaged groups, and schemes to develop 'Responsible Fisheries' as per international agreement. Fifth, through a thorough review of the structure of regulation and legislation across the world, which have direct or indirect bearing on fisheries, India must try to benchmark the system. The implications of absence or imperfect implementation of such a benchmark system of legislations and regulations by appropriate authorities (which may be the Fisheries Department or some other Department in government), which are hurting the interests of fisheries in this country, must be assessed and treated as negative subsidies and highlighted under the fourth category of subsidies as per the framework suggested by the FAO Guide. Enlisting of such negative subsidies will serve at least two important purposes: first, to highlight the need for suitable domestic reforms, and second, to sensitize the global community about the need for immediate and effective international support systems to overcome the structural deficiencies of fisheries business in the developing countries, which constrain free and fair trade by the fishers in these countries. Finally, as mentioned earlier, an upper limit needs to be prescribed to the quantum of non-actionable type subsidies in the fisheries sector through appropriate benchmarking. For example, the countries can be ranked in terms of per capita income measured in terms of purchasing power parity (PPP), which can be taken as a good indicator of overall development of each country. A country falling short of the global average in terms of this measure should be allowed a higher limit to use these 'non-actionable' subsidies, whereas developed countries above the world average in terms of this measure may be allotted a lower limit. Naturally, these limits will undergo automatic changes during the process of development.

On the issue of efficiency in fisheries subsidies, two things need to be done. First, as mentioned in the previous paragraph, all government programs are not in the category of pure public good services, as such services do not conform to the criteria of 'perfect non-excludability' and 'perfect jointness' in consumption, which are usually applied to judge whether a good or service is a pure public good or not. If a good or service provided through the public budget doesn't conform to these criteria, government should start privatising supply of such goods and services, or at least start charging for such provisions. This will
considerably reduce subsidy burden, while evolving a better property rights system in the supply of such goods and services. Second, the subsidies, which are indispensable, can be ranked in terms of their cost-benefit ratios (inclusive of environmental implications) to prioritise on their use, as the developing countries have an acute shortage of government resources to afford the luxury of wastage. A dollar of tax revenue has a much higher PPP value in a developing country as compared to a developed one, and hence involves a much larger amount of sacrifice on the part of the developing country population. This needs to be borne in mind while using the subsidy instrument in public policy.

References:

APEC (2000), Study into the Nature and Extent of Subsidies in the Fisheries Sector of APEC Members' Economies.


Appendix 1: Examples of different categories of transfers to the marine capture fisheries sector in OECD countries

Direct payments
Price support payments to fishers, grants for new vessels, grants for modernization, vessel decommissioning payments, buyouts of licences and permits, buyouts of quota and catch history, income support, unemployment insurance, retirement grants for fisheries, compensation for closed or reduced seasons, compensation for damage from predators on fish stocks, disaster relief payments, grants to purchase second hand vessels, grants for temporary withdrawal of fishing vessels, grants to small fisheries, direct aid to participants in particular fisheries, income guarantee compensation, vacation support payments, grants to set up temporary joint ventures in other countries, payments to set up permanent joint ventures in other countries, temporary grants to fishers and vessels owners, price support payments direct to fishers.

Cost-reducing transfers
Fuel tax exemptions, subsidised loans for vessel construction, subsidised loans for vessel modernisation, payments to reduce accounting costs, provision of bait services, loan guarantees, underwriting of insurance costs, contributions to match private sector investments, low cost loans to young fishers, interest rebates, transport subsidies, low cost insurance, government payment of access to other countries' waters, low cost loans to specific fisheries, income tax deduction for fishers, government funded training of fish processing workers, government funding of the introduction of new gear and technology, support for crew insurance, tax exemptions for deep-sea vessels, support for development of deep-sea fisheries, interest subsidies for the purchase of machines and equipment for fishing vessels, interest subsidy for the purchase of second-hand vessels, support to improve economic efficiency, reduced charges by government agencies, support to build facilities for commercial fishers at ports.

General services
Research expenditure, management expenditure, enforcement expenditure, market intervention schemes, regional development grants, support to build port facilities for commercial fishers, protection of marine areas, grants to local authorities to for retraining of fishers into other activities, payments to producer...
organisations, expenditure on the protection of marine areas, payments to support community based management, fisheries enhancement expenditure, support to enhance the fisheries community environment, expenditure on research and development, expenditure on research of deep-sea fisheries, expenditure to promote international fisheries co-operation, support to improve the management of co-operatives, support to improve fishing villages, expenditure on fisheries policy advice, expenditure on prosecution of fisheries offences, support for artificial reefs, expenditure on exploratory fishing, support to establish producers' organisations, aid for restocking of fish resources, funding of information dissemination, funding for the promotion and development of fisheries, expenditure for information collection and analysis, expenditure on conservation and management.

Source: Cox and Schmidt (2002)

**Appendix 2: More Examples of Possible Subsidies of Different Categories**

<table>
<thead>
<tr>
<th>Category 1</th>
<th>Support to improve economic efficiency</th>
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<tbody>
<tr>
<td>Grants to purchase new or old vessels, or to modernise</td>
<td>Grants for safety equipment</td>
</tr>
<tr>
<td>Income support, unemployment insurance and income guarantee payments</td>
<td>Direct export incentives</td>
</tr>
<tr>
<td>Vessel decommissioning payments</td>
<td>Grants for retraining fishers for other industries</td>
</tr>
<tr>
<td>Licence, permit and quota buyouts and retirement grants</td>
<td>Bad weather unemployment compensation schemes</td>
</tr>
<tr>
<td>Compensation for closed or reduced seasons</td>
<td>Taxes (negative)</td>
</tr>
<tr>
<td>Gear conflict compensation programs</td>
<td>Import/export duties (negative)</td>
</tr>
<tr>
<td>Disaster relief payments to fishers</td>
<td>Compensation for damages</td>
</tr>
<tr>
<td>Equity infusions to fish processing, harvesting or aquaculture firms by governments</td>
<td>Investment grants for pond construction</td>
</tr>
<tr>
<td>Price support payments to fishers</td>
<td>Grants for temporarily withdrawing fishing vessels</td>
</tr>
<tr>
<td>Grants to small fisheries and direct aid to participants in specific fisheries</td>
<td>Vacation support payments</td>
</tr>
<tr>
<td>Grants to establish joint ventures</td>
<td>Payments to reduce accounting costs</td>
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<tr>
<td></td>
<td>Matching contributions for private sector investment</td>
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<td></td>
<td>Transport subsidies</td>
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</tbody>
</table>
Category 2
Government funded health programs specific to fisheries
Payments to foreign governments to secure access to fishing grounds
Fishery-specific infrastructure, e.g. fish markets, landing sites and ports
Provision of bait services
Gear development
Support to community based management, regional development and producer organisations
Fuel tax exemptions for vessel fuel
Sales tax exemptions
Special income tax deductions for fishers
Tax exemptions for deep-sea fisheries
Deferred tax programs
Investment tax credits
Loans made on favourable terms
Government guarantees of bank loans
Fishers' insurance programs or subsidized insurance
Market promotion programs
Input and output regulations
Support to consultative groups and mechanisms
Inspection and certification services
Training and extension services
Provision of seeds and feed for aquaculture

Government funded research and development programs
Reduced charges by government agencies
Sales of commodities to fishers at less than market price
Information collection, analysis and dissemination
Promotion and development of fisheries
Exploratory fishing and gear development
Fisheries enhancement including support for artificial reefs
Research on deep-sea fishing
International fisheries cooperation
Market interventions
Regional development programs
Tariffs and tariff quotas
Import quotas
Waivers of import duties
Price support systems
Landing bans
Prohibitions on foreign direct investment
Fisheries management (unrecovered costs)
Promotion of fish consumption
Free trade zones
Market research
Ownership restrictions
Allocation of catch quotas only to national fishers
<table>
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<tr>
<th>Nationality and residence requirements for company officials/managers and crew</th>
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<tbody>
<tr>
<td><strong>Category 3</strong></td>
</tr>
<tr>
<td>Hatchery and fish habitat programs</td>
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<tr>
<td>Environmental regulations</td>
</tr>
<tr>
<td>Enhancement of the fisheries community environment</td>
</tr>
<tr>
<td>Technology transfers</td>
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<tr>
<td>Protection of marine areas</td>
</tr>
<tr>
<td>Gear regulations (e.g. TEDs)</td>
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<tr>
<td>Food safety and hygiene regulations</td>
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<tr>
<td>Production and feed quota schemes in aquaculture</td>
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<tr>
<td>Licence requirements for fish farming</td>
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<tr>
<td>Veterinary surveillance requirements for aquaculture</td>
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<tr>
<td>Regulations with regard to the escape of fish in aquaculture</td>
</tr>
<tr>
<td>Record keeping and reporting requirements</td>
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<tr>
<td><strong>Category 4</strong></td>
</tr>
<tr>
<td>Free or below market price resource access</td>
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<tr>
<td>Lack of implementation of fish quality standards</td>
</tr>
<tr>
<td>Fisheries registration fees not collected</td>
</tr>
<tr>
<td>Non-enforcement of existing regulations</td>
</tr>
<tr>
<td>Lack of pollution control</td>
</tr>
<tr>
<td>No requirement of certificate of competence or fisherman's licence</td>
</tr>
<tr>
<td>Use of free public services, e.g. water, sewerage services, for fishers</td>
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</table>

*Source: Westlund (2002)*
Overfishing in the territorial water of India is by and large, confined to the demersal zone. Catch per unit effort of mechanized fishing boats from this zone has declined to an alarming level, causing severe economic hardship to the stakeholders. As a measure of providing relief, steps may be taken by way of a pilot project to equip the boats with monofilament long lining equipment to enable them to exploit pelagic fishery resources up to mid-water zone of the territorial waters and possible beyond. The length of the monofilament line can be between 15-20 km can be accommodated on a boat and the purpose will be mainly to target tuna fisheries in the territorial waters and even beyond. Tuna resources of the zone is awaiting explanation up to sustainable level, with the exception of water around Lakshadweep islands. The boats may also be equipped to undertake midwinter trawling for which installation of a winch of higher capacity than at present may be necessary. State wise pilot projects to equip around 20 vessels in each of the coastal states with the needed equipment may be introduced, to be implemented by the state fisheries departments. This project may also included a component of training program, to be entrusted by the state fisheries department to their fisheries institutes, who can be assisted by CIFNET. CIFT can play a major role in the designing of the predation needed for the boats.

The erstwhile DANIDA project in Karnataka succeeded in equipping a trawler of around 18 m OAL for conducting deepsea bottom trawling at depths of 150 m and beyond for harvesting deepsea lobsters, prawn and Cephalopods. The successful demonstration of the operation has led to the introduction of trawlers of similar design, with an engine of higher h.p. and winch of higher capacity than are generally installed, by several entrepreneurs for operation of vessels of similar OAL along Karnataka, Goa, Kerla and Kanyakumari coasts. It is desirable to have a policy for encouraging stakeholder in other coastal states too, through needed incentives, to emulate and adopt the innovative and upgraded system. CIFT can play a major role in this respect.

Fishing Entrepreneurs of Kerla have taken to the operation of gill nets for catching tuna in the pelagic zone along Kerla coast, after the monsoon season. As the pelagic zone of the high sea abounds mostly in yellowfin tuna, highly favored...
among various species of tuna in major importing countries, step may be taken to popularizes gill netting for tuna in the high sea zone of other coastal zones.

Indian "deepsea fishing fleet" has shrunk in strength from around 195 to 65 vessels. The economics of operations of these vessels to are now at a distressing level. In order to improve the economics of operation of these vessels, government has launched a pilot scheme under the auspecece of MPEDA to equip two of such vessels for undertaking monofilament long lining. The operations of these upgraded vessels under the project have revealed a. problems in locating tuna grounds and exploiting them with Indian crew, and b) in achieving integrated post-harvest operations. Indian EEZ is known to have a estimated potential of 640,000 t of tuna resources, with a major component of yellow fin, which has a lucrative export market, particularly in sashimi. Integrated operations form harvest to export on a viable commercial scale are of paramount important to provided a file to the activities. A fishing voyage on these lines for harvesting sashimi grade tuna which has a prime value has to be completed in a duration of 7-10 days. If this duration is exceeded, post-harvest operations to land the fish in fresh chilled condition for air transport to the importing country becomes impossible. With the operation of two vessels under the pilot project as at project as at present, the integrated operations are seen to be difficult to be achieved. And with ought this crucial systems so important to introduce for tuna to add to national marine products export introduce becomes almost impossible. In this situation, in order to utilize the resources of Indian EEZ, the present pilot project has to be enlarged to a viable proportion, to consists of at least 20 upgraded vessels for monofilament tuna long ling, as is now being successfully alive on a regular commercial scale in Indonesia. Groups of tuna vessels fish in Indonesian waters and get back to the port after fishing for a duration of 7-10 days, to facilitate export to harvest tuna by small chartered planes to Japanese market. It is also very important to enlarge the scope of the pilot project further to have a joint venture with a reputed foreign nation or a major company who can provided the need inputs including expertise to established ad operate the enlarged pilot initially on a viable scale.

The guidelines recently issued by the Union Department of Animal Husbandry and Dairying totally ban demersal trawling. The demersal fishery resources of Indian EEZ, beyond 200 m depth and in any case beyond 500 m depth, are totally unexploited by Indian enterprises. It is accordingly necessary to relax the provision to enable demersal trawling by Indian vessel at depths beyond 200 m.
Indian has not made an entry so far into commercial sea cage culture. Steps are needed to be taken in this direction. These can consist of identifying suitable sites and formulating a procedure for leasing them to entrepreneurs to set up and operate batteries of cages, supported by shore based hatcheries and a transport system to take seed to the cage sites and also for transporting inputs such as feed.

Pond cage culture as pioneered in Taiwan for augmenting cultured fish and crustacean production may be encouraged as a system of polyculture. This system is eco-friendly and will provide economic benefits to the farmers, besides augmenting production.
Although these provisions lapsed after 1999, there is a possibility of their revival in view of the Doha Declaration. There are, however, certain clearly spelt out qualifications to the use of each of these provisions. The next footnote captures only one such qualification.

As per Article 8(b) (iii), a disadvantaged region must have an unemployment rate of at least 110% of the average of the territory concerned or per capita income or household income per capita or GDP per capita must not be above 85% of the average for the territory concerned.


Although the above-stated three categories of fisheries subsidies are identified, a fourth category – namely, market price support, is also included in OECD classification scheme, but is not addressed in its study on Transition to Responsible Fisheries. The extent of recovery on government cost of managing fisheries, as practiced in New Zealand, Iceland and Australia, is also included in its classification. A more comprehensive list of examples of OECD’s three major categories of fisheries subsidies is given in Appendix 1.


A more comprehensive list of examples of FAO’s four major categories of fisheries subsidies is given in Appendix 2.
IMPACT OF WTO, IPR AND NEW ECONOMIC POLICIES: CHALLENGES AND OPPORTUNITIES IN FISHERIES SECTOR

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WTO - NEW ECONOMIC ORDER (EXPORT OR PERISH) - KNOWLEDGE WORKERS

In new regime of global marketing under WTO, IPR and associated instruments have changed the scenario in developing countries including India. Developed nations and developed economies have an access to global markets to get benefits by increasing exports. The industries and production systems in the developing countries are facing challenge. Their products are not being marketed and they have either to adopt hi-tech systems and produce goods of global quality at an economic price, which can be marketed in other countries. The markets in the developing countries are flooded with quality products, processes and services which are marketed globally through networking. The developed countries export hi-tech products, processes and services, which have high value; small volume can be transported safely and quickly for global marketing. Their overheads are high. Therefore the developing countries must look to a different scenario in which they use local raw material, local processes, local people to produce low cost and high volume products, which can be marketed locally. The MNCs cannot enter and compete in this small-scale sector because their overheads and transport cost are very high. Thus, the hi-tech small-scale sector for production of food, nutrition and health care consumer products of local taste is their exclusive domain. There challenges in this sector, which can be solved by use of knowledge systems, modern information technology and developing skilled manpower by creating “Knowledge Workers”.

RECYCLING OF SEWAGE/ORGANIC WASTES

Population explosion is the major problem of developing countries, which produces great demand for food, clothing, housing and consumer products. This results in generating large quantities of sewage, domestic industrial and municipal wastes. Therefore, the most major problem in this millennium is degradation of organic material and recycling of organic and industrial wastes. For this purpose, microbiological techniques and consortia of bacteria should be used for breakdown, degradation and recycling of the wastes so that cheap and inexpensive nutrients available from organic wastes can be used to produce foods.
SINGLE CELL PROTEIN - TO ENSURE "NUTRITION SECURITY"

Increase of production from fisheries and aquaculture to meet the nutritional needs of the people is a very difficult challenge. However, culture of single cell protein like spirulina which have already appeared in the market can help in providing nutrition for the growing population. It is therefore proposed that culture of single cell protein which can be produced in large quantities at an economic price should receive high le cell protein can also be used as an additive to make feed for cattle, fish, prawn, dogs and birds for which there is ready market demand.

INCREASE NUMBER OF EXPORTABLE SPECIES INCLUDING MEDICINAL PLANTS

Traditionally, according to FAO Annual Report there are 12 species of prawn and fish which are exported to the international market. There is a scope for adding few more species for exports but this should be white meat products which have good shelf life and meet the taste of target population. In order to increase production, it is also necessary to develop new growth promoters and products for increasing fecundity. Very little work has been done by India in this sector. Traditionally many herbs, medicinal plants are available which had been used by tribals for population control, encouraging pregnancy and control of many diseases. Many of these plants grow in water and can be cultured and processed easily. In Madhya Pradesh, 26 medicinal plants have been identified which grow along the water edge. Research is needed to determine their bio-active compounds and processes for their cultivation and post harvest technology to make products which have long shelf life and can be distributed globally. In this sector, India has made some progress but the opportunities are immense. For isolating bio-active compounds and developing new products, India needs instrumentation of the west and validation of these products through the processes which are acceptable to the developed nations.

SHORT TERM CULTURE FOR 250-300 GMS. TABLE FISH

In aquaculture, carps, cat fishes, feather backs, murrells, lates, mugils are used which need long duration to grow them to marketable size of one and more. It is necessary to change the short-term culture of 60-90 days in which one can produce table size fish and prawn of 250-350 gms. Size which can be processed and served on the table in the western style. This change will help to get higher production, greater market acceptability and higher profitability.
BIOTECH RESEARCH AND CLONING

Recent advances in bio-technology have helped in perfecting the technique of cloning which can be used for improving the quality of fish and prawn in terms of growth, taste and disease prevention. They can also be used for sex in version, etc. Therefore, more researches are needed to use bio-technology for conversion of existing species and making them resistant from different diseases and ensure higher production.

HI-TECH CULTURE SYSTEM FOR CAT FISHES

Near the large cities like Calcutta, sewage water is being recirculated and this can be effectively used for culture of cat fishes and air breathing fishes. In West Bengal we have Basirhat where about 24 farmers are culturing "Thai Magur" and obtain a production of 70 tons per hectare. They use all kinds of wastes from slaughter houses, vegetable markets, and are able to reduce pollution and market fish at a price of Rs. 30 per Kg. Though culture of "Thai Magur" is illegal but it opens up a new challenge that the culture of cat fishes can be based on the use of organic wastes. This will help in solving the pollution problem and generate animal protein food at a low cost. However, all care must be taken to ensure that fish produced in this process do not cause any direct or indirect health hazards.

AQUACULTURE FOR FOOD AND NUTRITION SECURITY IN HILLS - SPORT FISH AND TOURISM

Provision of food and meat at high altitudes is greatly needed to ensure nutrition and food security of the people living in the hilly region. These areas are very rich in bio-diversity in fish and aquatic organisms. They have very pristine eco-system and should be effectively used for culture of trout's and other Indigenous species and development of sport fish (Mahseer) and angling along with tourism to attract Indian and foreign tourists. In the hilly areas, traditional preparations of fish are very attractive. Through the use of post harvest technology and food processing they can be converted into traditional recipes for serving in expensive tourist resorts and fish fast food parlors.

CLEANING OF RESERVOIR BED OF WOOD AND TREES

During the last few centuries, large number of tanks and reservoirs have been constructed and many more are being added. It is absolutely essential that modern technologies for earth moving machineries and for clearing the wood and trees which come under submergence is developed so that it becomes an economic undertaking. This will make large reservoirs suitable for cage culture, running water fish culture and also use modern techniques of fishing including dredging.
FISH LADDERS FOR MIGRATION SPECIES

Along the most of the irrigation reservoirs, attempts were made to construct fish ladders and fish passes to ensure movement of migratory species of fish and prawn. This has not worked well and research is needed to understand biology and physiology of local fish so that through modeling suitable fish passes and fish ladders can be designed for the species available in the particular aquatic eco-system.

BIO-LEACHING OF HEAVY METALS FROM COASTAL AREAS

Traditionally, civilization has grown around the water edge along the rivers and sea coast. Therefore, major metropolitan cities of the world like Tokyo, New York, London, Rome, Baghdad, Kuwait, Karachi, Mumbai, Calcutta, Singapore and Hong Kong are located along the estuaries of the sea coast. The sea coast is a preferred habitat and more than 10 per cent of the global population particularly in the developed countries are located along the coastline. It is in these areas the heavy industries are also located and more such industries are coming up in developed and developing countries near the coastlines because disposal of the waste is easy and inexpensive. However, this has resulted in accumulation of heavy metals like Lead, Zinc, Mercury, Iron and Manganese in the coastal waters. Their presence has been reported upto a depth of 1 to 1.5 metres. They cause serious health hazards like minimata disease. Therefore, for conservation and protection of the sea coast for health, recreation bathing and swimming needs bio leaching of the heavy metals from the coastal seas. If this does not happen, then like the Black Sea and Mediterranean Sea the areas will become unfit for pleasure, recreation and production of food. It is in this sector research has a major role to play.

DEGRADATION AND RECYCLING OF SEWAGE NEAR METROPOLITAN CITIES

The other important consideration in the developing countries is disposal of untreated or partially treated of sewage in the sea. Though technologies are available for treatment of sewage but they are expensive. Therefore, greater efforts have to be made to develop new processes for degradation and recycling of sewage for increasing productivity of the coastal waters. During 1960s, some experiments were conducted at the Woodshole Oceanography Institution and in a few other areas but a well-tested technology has yet to emerge. Therefore, under WTO provision we should get modern technologies from developed countries to solve location specific problems in developing countries.
CULTIVATION OF SHORT TERM CROPS ALONG BEACHES AND CULTURE OF BI-VALVES AND MOLLUSCS

Beaches near the estuaries receive the nutrients from the land mass and due to wave action they also get nutrients from the near shore areas. This results that the beaches can be very productive and support vegetation of different kinds. In Mumbai, they have been used for culture of Mathi which is grown in 7 days and is very popular. During rainy season along Konkan coast near Ratnagiri and Vengurie in other parts in India Donax, a small bi-valve is produced in large numbers. It is filtered and is used as a soup and food additive along with the rice. Some species of Molluscs and bi-valve are collected by local people along Karwar and Goa beaches. Further research can help them to convert these natural occurring processes into useful and productive aquaculture technologies. It may be mentioned here that in temperate countries like Italy, France, Spain and Portugal culture of Bi-valves Molluscs, and Oysters are a very lucrative and attractive industry. Similar approach should be adopted in tropical countries also.

PEARL CULTURE

The technology of Pearl Culture has been successfully demonstrated and is being commercially used by Japan and China. Pearls both in marine and fresh water have been produced both in India on a very small scale. This industry has very good prospects. Similarly efforts are also needed for culture of Sea Urchins and deep Sea Lobsters etc.

SANCTUARIES AND BROOD STOCK OF PRAWNS

Culture of Tiger Prawn, P. Monodon is very popular and remunerated but obtaining spawners has become difficult. Therefore, declaration of sanctuaries and in large marine fishponds for raising prawn brooders is also desirable.

PROCESSED MARINE FOOD IN ISLANDS

Most of India’s marine fish production used to come from Sardines and Mackerel. Their production has decreased significantly. It is necessary to understand their biology and their coastal eco-systems so that efforts can be made to revive their production. In the open Indian ocean, occurrence of micto hids is dominant but they are not used economically. Along the Gujarat coast some demersal and pelagic fishes are very popular and fetch a good price. However, large quantities of horse mackerel found in this region remain unutilized. Similarly, tuna caught in Lakshwdeep is processed with traditional methods whereas in Maldives tuna has become a modern major industrial enterprise and from where the product is exported. It is desirable to look at the small Islands in Bay of Bengal, Arabian Sea and Indian Ocean to catch and develop hodus
migratory pelagic stocks of Tuna and allied fishes occurring in this region and develop new convenience and ready to eat food products.

AQUACULTURE IN INLAND SALINE SOILS

Due to global warming and changes in the climate, large inland areas in different parts of the world have become unfit for agriculture. Under the new WTO regime, marine and estuarine fishes and prawns with white meat offer extensive aquaculture prospect. Therefore, major efforts are also needed to culture inland and marine fisheries in Inland Saline Salts.

CONTROLLED SYSTEM FOR ENVIRONMENT AND MARINE AQUARIAS

Recent advances in developing control system for hatcheries of prawns and fish of maintaining marine aquaria, culture of ornamental fish under controlled condition have become popular. These technologies can be used by developing countries like India for generating awareness recreation and pleasure in the inland states. As a temporary measure for a period of 3 months marine aquaria was set up by the Department of Ocean Development and CIFE in Pragatimaidan, New Delhi. In this aquaria, anemone with changing colors, sea horse, corals, hydra, hammerhead shark were major attractions. Similarly in Baltimore in USA, Marine Aquaria are a boon for the tourist. Therefore, development of the marine aquaria can become a very useful proposition in which systems and equipments can be imported from the developed countries and the developing countries can use it as a source for eco-tourism which is a great attraction for the foreigners.

VOCATIONAL EDUCATION AND TECHNOLOGY TRANSFER

WTO and IPR have produced many challenges. We have started knowing only a few and many more have yet to come which will effect the local population. The clear indication is that the educated and developing nations will benefit the most. Therefore, technology demonstration and education for in-service personnel from the different states of India and vocational education for the farmers and entrepreneurs supported by large-scale field experimentation is an area of high priority.

EDUCATION AND LIFELIHOOD SECURITY IN RURAL AREAS

WTO and IPR are continuously changing the global scenario in which the developed economies like to market product processes and valuable aquatic food in developing countries. The developing countries have opportunities to use the instrumentation control systems, abatement of pollution control methods, importing of new varieties of fish and prawn with desirable traits, export of
ornamental fish, high value culture system like culture of pearls, mussels and oysters provide new hope and challenge. In order to achieve all this, education and technology is important. Therefore, India in the sector of fisheries and aquaculture should produce knowledge workers who will produce high value products, processes and service, which has an international demand. They should also harness local aquatic nitches in cold and sector of warm waters for culture of aquatic plants like Trapa and other algae and Spirulina algae along with fish prawns and other organisms to provide livelihood, security for the poor living in the rural areas.

WTO OFFER OPPORTUNITIES FOR FOOD, SELF SUFFICIENCY, NUTRITIONAL SECURITY AND DEVELOPING EXPORTS

In the end, it may be said that WTO and IPR clearly indicate that the education, knowledge, information technology, high value health foods which are cholesterol free meat will play an important role in the developing countries. We must face the challenge to create knowledge workers across the country to make the best of the modern technologies available from the developed nations to bring about food and nutrition security and self-employment for the rural people and help entrepreneurs and industries to develop high value exports products.
PRESENT ISSUES IN MARINE FISHERIES OF INDIA

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Introduction

India's present marine fish production is to the tune of 2.8 million tonnes per annum (Anon 2000). The present scenario of marine fisheries is governed by following facts:

(i) The marine fish production has reached a plateau in recent years.
(ii) Whereas the exploitation of marine fishery resources in the present zone of fisheries operation has reached to the level of optimum utilization, deepsea and oceanic resources remain under-utilized.
(iii) There is need for extension of fishing activities to the entire Exclusive Economic Zone in accordance with UN Convention on Law of the Sea (UNCLOS) which has become legal instrument since 1994.
(iv) Exploratory surveys have indicated potential of resources available in the continental shelf and the oceanic waters in the Indian EEZ.

Resources potential

The exploratory surveys conducted in all the sections of the Indian EEZ have revealed availability and abundance of finfish, cephalopod and crustacean resources in the continental shelf, edge and slope, and the oceanic waters. A Committee on revalidation of marine fisheries potential in the Indian EEZ (Anon 2000) based on the trends in fish production, the exploratory survey data for fish stock assessments has revalidated the potential yield of marine fishery resources as 3.93 million tonnes. The main components of these stocks pertain to the groups of coastal and deepsea demersals, pelagic/mid-water and the oceanic fish stocks. Since the production level from the present zone of operation has reached to the optimum level of exploitation, the main resources which portend scope for development and harvest are from the deepsea areas between 100 and 500m depth and the oceanic regime. The resources from these new areas together constitute the balance of the potential (1.13 million tonnes) comprising deepsea demersal fin-fishes, crustaceans (deepsea shrimps, lobsters and crabs), mid-water-fish, coastal tunas and oceanic tuna and allied fishes. Among the oceanic resources are large growing tunas (Yellowfin tuna, Bigeye, Skipjack, Albacore), bill fish (Sail fish, Sword fish and Marlins) and oceanic sharks.
Fishing zones

The fisheries development, monitoring and conservation of fish stocks within the 12 nautical miles territorial waters is the responsibility of Maritime States and Union Territories. In accordance with the Maritime Zones of India Act 1976, the fisheries development, management and conservation of fish stocks in the 12 nautical miles contiguous zone (beyond the 12 nautical miles territorial waters) and upto 200 nautical miles (EEZ) is the responsibility of the Union Government. As the fishing activities within the territorial waters and areas within 100m depth contour have almost reached to the optimum level of exploitation, the resources are to be managed and conservation measures need to be adopted in accordance with the principles enshrined in the UNCLOS and the EEZ Act 1976. Article 21 of Rio Earth Summit. Conventions on Sustainable use of resources and Bio-diversity and FAO's voluntary Code of Conduct for Responsible Fisheries. Thus, the resources in the present operational zone need to be maintained at sustainable level by devising measures required for maintaining long term production and preservation of bio-diversity and marine environment. These measures are to be framed and implemented.

As per the Marine Fishing Regulation Act (MFRA) of various Maritime States, the artisanal fishermen in general operate in in-shore waters upto 5 nautical miles beyond which the motorized and mechanized fleets are operating upto 100m depth contour. The MFRA's will have to be harmonized to give effect to the measures listed in para 4.

In the areas beyond the contiguous zone (beyond 100m depth) the fisheries are to be developed to utilize the fishery potential to its full extent in the Indian EEZ. The new initiatives should aim to exploit the hitherto untapped resources beyond the 100m depth zone in the continental shelf and the oceanic waters upto 200 nautical miles (EEZ).

Technologies

Presently, the indigenous/traditional fishing methods and modern methods such as bottom trawling, purse seining are being generally practiced by coastal fishermen. To encourage these fishermen to venture out to deeper waters to exploit the under-exploited resources upto 100m depth, some of the existing suitable mechanized boats have to be upgraded by installing GPS, echo-sounders, insulated fish holds, life saving appliances etc. It would also be imperative to train these fishermen in the proper use of these equipments and in hygienic handling of fish on board. The use of GPS on board would also save fuel as the fishermen could reach the fishing ground without having to wander. The other management initiatives would be as follows:

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(i) Motorization of the country/traditional crafts to be continued till all existing crafts are motorized.

(ii) Present strength of the mechanized boats to be frozen/maintained and future addition to be permitted on replacement basis.

(iii) New generation intermediatory vessels of less than 20m OAL with suitable fish hold capacity and eco-friendly fishing techniques such as mid-water trawling, long lining, pole and line fishing, squid jiggling needs to be introduced.

(iv) Specialized techniques and suitable fishing vessels larger than 20m OAL for deep sea demersal trawling, mid water trawling, tuna long lining, tuna purse seining, squid jiggling, trap and pot fishing, pole and line fishing to be introduced to optimally harvest the resource potential available within the EEZ. While introducing these vessels, Total Allowable Catch (TAG) and individual catch quota should be taken into consideration. The coastal fishing community may be provided with participatory quota.

(v) The entrepreneurs may be encouraged to participate by constructing the vessels either in indigenous shipyards or shipyards abroad. The fishermen/fishermen co-operative society, their apex bodies and entrepreneurs may be permitted to acquire the vessels under the joint venture agreements.

Infrastructure

Presently, we have six major fishing harbours, thirty minor fishing harbours and 1896 fish landing centers. Besides, continuing the construction of new berthing facilities, it is essential to construct resources and market linked deepsea fishing harbour facilities and infrastructure conforming to the global standards.

Management and conservation of fishery resources

The coastal waters up to 100 m depth contour from where presently the fish stocks are exploited at optimum level have to be focussed for the implementation of management and conservation measures. The management measures such as ban on fishing during breeding season of the fish, ban on use of destructive fishing methods, ban on marketing and export of undersize commercial fish have to be adopted. Similarly appropriate codend mesh size of trawl cod-end, gillnets, ring net, purse seine are to be specified towards conservation of fish stocks and sustainable fisheries. Rehabilitation of overfished and endangered fish stocks/species and restoration of their habitats will help rejuvenate the fishery resources.
Use of Turtle Exclusion Devices (TED) and By-catch Excluder Devices (BED) will go a long way in conservation of non-targeted species. This calls for undertaking awareness drives and training programmes to benefit the fishermen through institutionalized efforts.

Monitoring, control and surveillance (MCS)

Towards full utilisation of fishery potential in the EEZ, deployment of requisite number of various types of fishing fleet, use of diversified fishing technologies will warrant fisheries Monitoring, Control and Surveillance (MCS). These activities being operational, will be implemented through the designated national agencies such as Coast Guard, Fishery Survey of India and State Fisheries Departments by creating necessary co-ordination mechanism. Providing modern systems such as Vessel Monitoring System (VMS) and communication equipment would be integral part of the MCS. These facilities will enable mandatory reporting by the various authorized fishing vessels/operating fishing vessels to provide essential information on their geographic position, catch and effort data to the concerned authority at fixed time intervals. Similarly as and when foreign vessels are permitted in our waters such vessels will comply with FAO guidelines on posting of observers on board for collection of scientific data to study the health of the fish stocks. The safety of fishermen, fishing boats/vessels, defence installations and off-shore platforms will be given priority in the development plan through this initiative.
The process of liberalization and deregulation in the financial sector started since early eighties of the last century has accelerated the pace of reforms in other sectors as well. Privatisation, acceleration of growth rate, increasing per unit area production and value addition became key words in agriculture and allied areas to achieve envisaged target of doubling the agricultural production and commercialization.

While several steps have been initiated in fisheries sector, the pertinent policies at center and state level did not undergo appreciable change. The country is still governed by 100 years old changes, conflicts and constraints. Many areas like conservation of biodiversity, eco-sustainance, introduction of exotic species in Indian Waters, regulating super intensification, environmental damages, quality standards, Food and Nutritional Security, amendments in CRZ Act, development through credit support trade, subsidies etc. remained uncovered in our policy statements.

In view of the hurdles being faced in the development and subsequent commercialization due to obsolete policies, the author suggests that a High level Committee comprising of Scientists, Planners, Financial and Legal experts should be constituted to go into the details of policies and suggest amendments.

**Present Status of Fisheries Policies**

In the last two decades, fisheries has become a world wide business. Catching fishes or raising them confined areas, harvesting, processing, packaging, transporting and marketing have become full fledged industries. As per an estimate, the world trade of fish and fishery products is valued at about US $ 65 billion. Corporate groups, multinational companies, financing institutions, entrepreneurs all over the globe have taken unprecedented interest in commercialisation of the sector. In India also, fisheries and aquaculture are getting maximum attention during the period. Coupled with this, economic scenario of the country also showed signs of change. Winds of changes became visible in progressive liberalisation, deregulation, heightened competition, mechanisation and technological advancement and liberal financial support. It has thrown open new opportunities and challenges as never witnessed in the past. Fisheries in general and aquaculture in particular have made spectacular impact on growth rate and surpassed other agricultural and allied activities. But the development has posed several serious problems of conservation, fish health, sustainability
and environment degradation. Issues which were never heard in the past, like nomadic farmers, economic disparities, social conflicts and disputes over land and water bodies have come into force.

Age old fishery policies being in vague since the year 1897, found wanting in addressing special needs of using modern techniques and intensification. In the last fifty-sixty years, whenever such disputes erupted particularly in marine fisheries sector, special committees were formed to get into the specific areas of problem and resolving the same. These committees gave recommendations and settled issues temporarily, but a comprehensive uniform national fishery policy remained a distant dream.

Various Acts and Legislations at the State level

The fisheries sector being a state subject, local policies were framed as per the geographical, financial and socio-cultural status of the areas. In some states, fisheries was so neglected that authority of framing policies were delegated to different agencies and that too at different levels. This being so there were no definite rules and regulations and no clear cut definitions and each state had its own interpretations. The various acts, from different states, were issued from time to time were as under:

2. The Andaman & Nicobar Islands Fisheries Regulation, 1938
3. The Uttar Pradesh Fisheries Act, 1948
5. The Madhya Pradesh Fisheries Act, 1988
6. The Meghalaya Fisheries Rules, 1980
7. The Nagaland Fisheries Act, 1980
8. The Rajasthan Fisheries Act, 1953
9. The Indian Fisheries Act (Tamilnadu amendment), 1965
10. The Tripura Inland Fisheries Bill, 1986
11. The Indian Fisheries (Pondicherry Amendment), Act, 1965
12. The Tamilnadu Water (Prevention and Control of Pollution), Rules, 1983
13. The Goa (Brackish water) Fish Farming Regulation Act, 1991
14. The Tamilnadu Aquaculture (Regulation) Act, 1995
Non-availability of uniform policies led to unregulated use of water areas and haphazard growth in both marine and inland fisheries and gave reasons for protests from other users. Different policies also became handicap as it could not be defended against the onslaught. So much so that the Tamilnadu Aquaculture (Regulation) Act, 1995 became the basis of the Hon. Supreme Court's judgement on PIL against coastal shrimp farming as there was no firm policy at National level.

Union Government Rules and Acts

At central level, fisheries regulations are mainly concerned with capture fisheries only. "The Indian Fisheries Act - 1897" which is still in force empowers state governments to have their own sets of rules and regulations. Various other legislations of central government issues by different departments governing the water resources are:

1. The Water (Prevention and Control of Pollution) Act, 1974
2. The Water Amendment Act, 1978
3. The Water Cess Act, 1977
5. The Air (Prevention and Control of Pollution) Act, 1981
6. The Environment Protection Act, 1986
7. The Environment Amendment Rules, 1987
8. The Environment (Protection) Second Amendment Rules, 1987
9. The Environment (Protection) Third Amendment Rules, 1987

Eventhough, the above ten acts were framed at national level, Fisheries Development Policies were covered only in the 1986 Act for regulating activities in the CRZ. Till then, entire objective of fisheries development programme at Government of India level was restricted to:

(i) Enhancing production and productivity of fishermen, fish farmer and fishing industry
(ii) Improving the socio-economic condition of traditional fishermen
(iii) Conservation of depleted and endangered species and fishery resources
As could be seen these objectives were mainly considered as the sector was mainly an avocation for fishermen, an activity for conservation of fish fauna and a welfare measure for rural poor. It was never contemplated as commercial activity nor an activity which will endanger environment. The fishery policy also did not cover fish culture, its area and scale of operations. Fish culture which was later coined as aquaculture did not find any place in our fisheries policy. Till such time, it was a small scale operations it did not pose any problem but the moment it became a commercial activity giving very high remunerative returns and taken up by enthusiastic entrepreneurs, it attracted attention of environmentalists. They questioned use of high inputs and effluent discharges of aquacultural activity and its impact on aquatic and terrestrial environment.

The Rio declaration of June 1992 highlighted the issue of environment and sustainability. The principle, four of the declaration says “In order to achieve sustainable development environmental protection shall constitute an integral part of the developmental process and can not be considered in isolation from it “Since surrounding environment was not threatened earlier it was also not included in our fishery policies. The sector had to pay a very heavy price in the last decade for not fine tuning its policies regarding innovation and cost effectiveness. In the quest for excellency and modernisation fisheries did not take proper precaution. But, “as modernisation is not only the process of learning new tools for improving, but also the process of learning to work within the new socio-economic and environmental regimes” (Reddy, 1995). Many regulations introduced time to time were highly complex and vogue and even now many issues have not been adequately addressed. Some of them are enumerated below:

(A) Leasing and Licensing Policy

- Water and soil problems
- Definition of water bodies
- Demarcation of Prohibited areas, Buffer Zones, Sanctuaries, Reservation of aquaculture areas for
  - higher production and social welfare measures
- Area leasing, ownership, mortgaging
- Licensing, Registration of fishing, Culture areas and fishing vessels
- Policy for creating private property in the sea / larger water bodies.
- Prevention of encroachment of water bodies by non-users.
(B) **Definition and Objective**

- Classification/ explanation of different technological terms like fishing, harvesting size
- Technology classification whether it is based on production or area of operation or cost of operation
- Redlining areas of operation
- Optimum sustainable yields of different systems

(C) **Technological**

- Introduction of exotic fish species in Indian waters and conservational measures with norms.
- Effluent management and flushing of sediments
- Regulating dredging in coastal areas, reservoirs, rivers, beels, swamps etc.
- Use of inorganic fertilizers, toxicants, chemicals, feed additives, steroids in Fish Husbandry and Seed production
- Declaring dam heights, fish pathways and mesh size regulations in man-made impoundments
- Lack of policy on Ornamental Fishery Development and quarantine measures

(D) **Environmental Issues**

- Environmental problems faced by entrepreneurs like TED, Miners, explorators etc.
- Impact of non-aquacultural activities in the vicinity
- Chemical discharges in the vicinity of aquaculture
- Effluent management and flushing of sediments
- Ground water use and salinisation

(E) **Social Issues**

- Drinking water availability
- How many permits before operation could commence and its cost
• No single window clearance
• Percentage of total capitalisation expended on the permit process
• Number of state, central, social and environmental agencies/authorities controlling fisheries (Pathak-Palanisamy, 1995)
• Indirect cost on provision of electricity, fuel, drinking water, transportation of men and material, social obligations and services.

(F) Financing

• No uniform models for working out economics
• Mortgaging of public sector lands and collateral available
• No policy for crop loan, insurance of crops
• No linkage between subsidy and loans

It is therefore important that the country decides to frame a Comprehensive National Fisheries Policy immediately. The policy, besides taking care of above identified issues, would accelerate the pace of all round development. It should also identify agencies to take care of several uncovered areas like Establishment of diagnostic centres, Improvement of coastal landing and berthing facilities, Incorporate various guidelines issued by Ministry of Agriculture, Fisheries Department, ICAR Research Institute, MPEDA, Coastal Aquaculture Authority, NABARD, Ministry of Commerce, Ministry of Environment, Revamp weak fish coop. societies; Rehabilitation package for natural calamities accidents; identifying different areas of operation for different agencies etc.

Recommendations

As future of fisheries is at stake and any decision on the subject will have far reaching consequences a broad based committee comprising of scientist, planners, financiers and legal experts should be constituted to go into the details and suggest a long term National Fisheries Development Policy.

Besides, recommending policy framing committee, this AFS forum should also approach government to have a separate Fisheries Ministry at Union Government level.

Aggressive extension programme should also be launched through different strategies to approach different target groups so as to increase awareness about the advantages of fisheries sector.
References


*Opinion expressed in the paper are those of the author and not of the organizations he represents.
Fisheries development in the country has been due to the cumulative effort of the various agencies/institutions/organization. While, there are various institutions providing financial assistance for fisheries, the Nation Cooperative Development Corporation (NCDC) is the unique organization promoting and developing amounts others, the fisheries cooperative. NCDC has been involved in this sector since 1974, providing technical and financial assistant to the cooperatives of fishermen and fisherwomen. Till date NCDC has sanctioned an assistance of Rs. 766.65 crores and released Rs. 493.48 crores for the development of fisheries through cooperatives. The type of projects assisted by NCDC include traditional fishing sector, mechanized fishing boats, processing and preservation infrastructure, marketing activities, inland fisheries including hatcheries, fish culture, ornamental fish culture, reservoir fisheries development, and brackish water aquaculture, etc.

The fisheries scenario of the country has undergone changes in the last few years. The total marine fish landing has increased from 2.30 million tones in 1990-91 to 2.81 million tones in 2000-01 and inland fish landing has increased from 1.54 million tones in 1990-91 to 2.85 million tones in 2000-01. This increased is not uniform across the different states, but rather starkly different. While there has been an increase of over 230% in West Bengal, the increase in Kerla is only 23% with Karnataka and Goa showing a decline. There has been an absolute increase in the number of fishing craft, the composition of different fishing crafts is totally different than what it was a decade ago. While the number of fishing vessel over 20 m OAL has decreased to 90 (180 in 1990), the motorized traditional crafts has doubled to bout 23,000/- (15,000 in 1990). There is no uniformity in licensing of the fishing boats, with different agencies enforcing different control over the boats. While the productivity under the fish culture has been increased substantially due to various development programs, not much attention has been given to the development of reservoir fisheries. The brackish water aquaculture has beset with several problems including environmental issues needing immediate attention of the concerned agencies. Considering the present status of Indian fisheries, some of the policy issues requiring attention are presented below:

a. The data/statistics on fisheries, particularly the fish catch data is the benchmark for planning development programs, used by various agencies including international agencies. Hence, the data needs to be collected and compiled...
with a better degree of accuracy.

b. With a very large number of traditional, motored machines fishing crafts operating mainly in the inshore areas, the fishing efforts has almost reached the sustainable levels of fish production and in some areas, has led to over-exploitation. Considering the large number of people depended on this activity, to maintain a balance approach, there is a need to enforce an effective control on the number of fish crafts operating in the inshore as well as off-shore areas. In this regards, registration/ licensing of all the fishing vessels will have to be made mandatory.

c. The design, type and number of fishing vessels of different sizes to be introduced/ allowed to be constructed in each state in the next 10 years should be assessed and informed to be concerned agencies, in order to keep a check on the fishing effort. This would also help the financial institutions to provided assistance for fishing vessels within these limits.

d. To allow the growth of juveniles and small sized fish, regulation of size of different nets has to be enacted. Wherever such regulations have not been enacted, action should be taken to enact necessary legislative provision/ acts/ law, and enforce the same.

e. Ban on destructive fishing methods is to be enacted and enforced.

f. Considering the loss of life at sea due to natural calamities occurring frequently, installation of basic communication (wireless) system and global positioning systems (GPS) should be made compulsory for all mechanized fishing boats and no new vessel should be licensed for fishing without these systems. It may also be mentioned here that State Governments and other agencies are providing liberal assistance for installing such systems.

g. In many States, small and medium reservoirs (20-1,500 ha) are leased out on annual basis. This system does not encourage the lessee to undertake any development work of the water body. The sole aim of the lessees would therefore be to harvest all the fish in the water body by the end of the lease period. it is, therefore, imperative that the State Governments/ agencies should consider leasing of water bodies for long duration, preferably 5 to 10 years.

h. Even though the cooperative have been considered the best institutions for the management of small and medium reservoirs, unfortunately some States do not have leasing policy for the benefit of the cooperatives. The State Governments / agencies may consider adopting preferential leasing policy in respect of fisheries cooperative for leasing of small and medium reservoirs.
i. Through the viability of reservoir fisheries and the management practices to be adopted in the development of reservoirs have been discussed in details in various workshops, symposiums, seminars, etc. unfortunately, the financial assistance provided by the Central and State Governments for development of reservoir fisheries is negligible. The management cost in the development of reservoirs is high, but benefits a large number of poor fisherman, many of them in the tribal areas, apart from increasing fish production. The Central and State governments should, therefore, provided liberal financial assistance towards the development of reservoir fisheries.

j. A clear-cut policy with regard to the conversion/utilization of agricultural land for aquaculture is to be drawn, to solve the problem faced by the farmers, intending to take up aquaculture lands.

k. Details of policy for responsible coastal aquaculture with reference to the culture practices, use of harmful chemicals/ pharmaceutical preparation in isolation as an ingredient in feed or in any other manner needs to be drawn up.

l. Detailed policy for allotment of water areas in the seas for mariculture operation may also be drawn up.

With the above issues being attended to in a positive framework, planned development of the fisheries sector to meet the challenges, both internal and external, is certain. The individuals, corporate as well as cooperative involved in the fisheries development in the country will certainly be able to fulfill their roles towards achieving the blue revolution.
A DEVELOPMENT AGENDA FOR INDIA'S AQUACULTURE?
DRAWING SOME INDICATIONS FROM THE REGIONAL PROGRAM ON AQUACULTURE AND AQUATIC RESOURCES DEVELOPMENT

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Introduction

Being in the context of a vast nation and a diverse set of social and economic concerns, India's aquaculture is necessarily confronted by diverse issues. Nonetheless, it would be a fair expectation that, as with the rest of the region, the situation of aquaculture sector of India can be described as below:

"Intensified production has begun to stress the land, water and biological resource bases impairing their capacity to continue to support production. More crucially, higher production has not been shown to significantly reduce rural poverty. Conflicts over resource use simmer, occasionally flaring up to strain the management and regulatory capacities to deal with them. Promoting cohesiveness and harmony in the face of diverse interests, with the pool and weak often getting ignored, has begun to expose weaknesses in policy making and governance. Finally, there is need for a clear understanding and strong unified action to better address the difficult issues faced by the production and marketing of products in highly competitive markers where it is essential to assume responsibility not only for the quality of the product but for the actions taken, or not taken, in producing it."

The regional program of NACA, which, along with other members of the Organization, India has helped to shape, is addressing these broad issues. This paper will draw some illustrative examples from the regional program to provide an indication of the directions that India could follow, bearing in mind that there would be issues that are unique to the country, which ranks second in the world in aquaculture output with production of 2 mmt in 2000 (Gopakumar) and population of around 1 billion in 2001. It should be pointed out that India is participating in the regional program and that there are specific country activities addressing such concerns as the participation of poor rural people in remote communities in research and policy formulation, sustainable management of shrimp aquaculture, formulation of an appropriate national fish health management strategy, intensification of food production through aquaculture, raising the standard of and improving access to aquaculture education and sustainable management of coldwater fishery resources.
India registered a good 6.1% growth in GDP in the 1990s; its 1999 GDP was 44.2 billion US dollars. This economic gain however had been negated by a high population growth. The human development index is low in all South Asian countries. One out of five people in South Asia is described as chronically malnourished, and one out of three is living below the poverty line (1US$/day). In India it is 44%, and three-fourths of these are in rural areas. The landless make up 45% of the number of rural poor (Muthunjaya and Pal, 2002).

A regional exercise held in Hyderabad in July 2001 sponsored by APAARI (Asia-Pacific Association of Agricultural Research Institutes) to identify research priorities described the common issues facing agricultural development in South and West Asia as follows: (i) high incidence and concentration of poverty in the region; (ii) prevalence of natural disasters including drought, floods, cyclones; (iii) fragmented and small landholdings (arable land availability in India stood at less than 0.30 hectares per person in 1999 and expected to decrease to around 0.25 ha by 2010); (iv) gender inequities; (v) low urbanization and poor infrastructure; (vi) poor transfer of technology; and (vii) high risks associated with production and marketing of agricultural commodities. Clearly, these social and economic issues need to be addressed urgently.

The opportunities of harnessing the vast potential of the aquatic resources in addressing these pressing social and economic have been identified in recent forums held in India. Two of these are cited here:

A roundtable on fisheries and aquaculture held in New Delhi on 27 September considered the following priorities: utilizing the unexploited resources especially of seas (India has 8000 km of coastline that is described to be largely underutilized); boosting production through intensification at sustainable levels and exploitation of unutilized space; diversification in cultured species; and improving technological base through intensified research and adaptation of technology. The roundtable also saw the need to raise even higher the profile of fisheries and aquaculture in national planning (Kutty, M.N. 2002). The aquaculture resources are vast but the issues here are indeed, as Kutty points out, how to exploit them in a sustainable way and, more important, with the poor actively participating and mainly benefiting from their utilization.

A regional expert consultation conducted by FAO, NACA and India’s Central Institute of Freshwater Aquaculture on the intensification of freshwater aquaculture production in countries of South Asia, held in Bhubaneswar in October 2001, recommended the review of policies, regulatory frameworks and institutional arrangements on water use for aquaculture and culture-based fisheries in medium and large water bodies; screening and mapping of locally available non-
conventional feed sources, with emphasis on replacement of fish meal in aquatic feed; introduction of novel concepts of disease control, particularly of trans-boundary importance to the relevant policy makers and regulators of the Sub-region. The Consultation also saw the need for increased awareness and understanding among policy makers of the issues relating to international trade, particularly required under WTO-SPS agreement.

This broad concern of utilizing aquatic resources (including for aquaculture) to address social issues is the core element of the regional policy on "Aquaculture for Rural Development" which the member governments of NACA have formulated and made as the thrust of the work program for the period 2001-2006. The NACA work program has five major elements: (i) Capacity Building through educational and training programs; (ii) Effective R&D by collaborative networking among centres; (iii) Information and communication, (iv) Policy guidelines and support to policies and institutional capacities, and (v) Aquatic animal health management.

Information and Communications Technology and Strategy for Networking:

Information Technology and Communications Technology (ICTS) is now used to bring into the regional programs more intellectual inputs and resources without spending a lot more money. A large factor in the success so far achieved in regional aquaculture development is the cooperation among governments and the coordinated participation of national institutions in regional activities. Coordination has facilitated numerous and diverse activities enabled the pooling of scarce national resources and a wide and equitable sharing of results.

The resources existing in the region that can be brought to bear on aquaculture development are enormous. Getting this vast reservoir of human and physical resources applied and focused on regional priorities would greatly accelerate the expanded development of aquaculture regionally and within states. Information and Communication Technology would facilitate an effective and economic regional coordination of efforts. The same could be said of India with so many and diverse stakeholders and intellectual resources that could be harnessed efficiently through a knowledge management system based on ICT. The NACA information system now includes databases that support specific projects as well as special and general information packages. It aims to provide three services: (i) One-stop and interactive shop for acquiring and exchanging information as well as for jointly developing information packages, (ii) Gateway to a wide range of sources of information and knowledge, (iii) Forum for focused and systematic interactions to identify, clarify, and resolve urgent and common issues.
ICT complements the traditional means of effecting coordination, delivering information and education, and fostering interactions among people taking part in network activities. It is not a substitute, but it is now the only known option to cost-effectively carry out a people-oriented and project-expertise oriented networking mode. The Information program is also moving to help improve national capacities for accessing and assessing information resources by the knowledge workers and information technologists working in aquaculture and resources management in member countries, particularly the less developed.

Intensifying the use of ICTS for networking draws its rationale from the fact that resource-poor countries can benefit cost-effectively from borrowing and adapting technologies from elsewhere. They need not spend scarce resources reinventing the wheel. Information technology will now allow technologists from poorer countries rapid and economical access to a broader range of information and technology.

The six activity areas described above show that a broad-based participatory multi-institutional collaboration can multiply benefits to people. They demonstrate how cooperation in areas of mutual interests can effectively muster resources, expertise and institutional support to implement regional projects, promoting synergy, avoiding duplication of activities, and expanding the range of beneficiaries.

**Indications for a national strategy**

*Networking and cooperation.* The reason for having a network was that sharing resources and responsibilities among institutions (and countries) is probably the only practical and cost-effective means available (then and now) for identifying and solving the diverse problems arising from a diversity of species, farming systems, and environments. India by itself is a sub-region with diverse species, systems and constraints related to aquaculture development. Cooperation among India's various and numerous players in the sector becomes even more compelling with the limited resources of the government. The complex and many challenges faced in the development of aquaculture, a relatively new food producing and employment generating activity, strongly argue for a collaborative approach to make efficient use of resources and overcome constraints.

*Ownership and participation.* Programs and projects of NACA address the priority issues and needs articulated by stakeholders especially the governments in various forums in which NACA is involved. The needs and priorities are translated and formulated into a regional action plan by a technical advisory committee of NACA, which is adopted into the regional work program by the Governing Council. The same principle of assuring that stakeholders feel they have ownership of development plans and initiatives is just as relevant and even
more urgent in the national context, particularly in a nation like India with diverse and numerous active participants to national and state-level policy development and program implementation.

The strategy would thus result in the program being (i) owned by stakeholders; (ii) a product of multi-stakeholder consultation, and (iii) implemented in a cooperative and coordinated way that builds on the capacities of the various institutions and agencies including NGOs and farmer groups. These attributes make two important conditions happen: the participants commit resources to implement the programs, and take up the results in their policy and programs.

Indications for policy

As with Asia’s, the aquaculture sector in India is now more organized with increasing state support but also greater private sector participation; productivity has increased rapidly largely from the better application of technology and technical and management skills; Increasing levels of production have improved the general availability of food to the population and increased export earnings; it contributed to better health and nutritional well-being of people, and improved their income: and happily, there has been a growing sensitivity to the fact that practicing socially and environmentally responsible aquaculture makes good business sense.

Intensified production does not stress the resource base

- good aquaculture practices
- biodiversity
- water productivity
- diversification
- biotechnology
- fish health management

Higher production translates to less poverty

- equity
- targeting - services, technology development, gender
- institutional strengthening for better targeting and provision of services
- access to resources by the poor
- education and training
Avoidance and resolution of conflicts over resource use

• broader stakeholders' participation in planning and implementation of policies and programs
• co-management arrangements - less emphasis on regulatory measures and more on community participation strategies
• appropriate legislation

Relevance of policy-making and governance to the objectives of the poor

• influencing policy; "voices of the poor" in policy; instituting the livelihood approaches to rural development strategies
• broader participation in research agenda setting and policy formulation grassroots education
• institutional strengthening for livelihood approaches

National information capacity and program serves the needs of policy and sector management (including public education on aquaculture issues and practices)

• capacity building for ICT
• a policy on ICT for fishery development
• networking of experts, schools, information and education providers
• a knowledge management strategy

Better access to markets

• food safety and quality assurance
• good farm management practices
• good manufacturing practices; good feed manufacturing practices
• negotiation skills

International Seminar on Policy Issues in Fisheries and aquaculture
Concluding statement: A recommendation for an immediate and doable project

As this conference is sponsored by the Indian Branch of the Asian Fisheries Society, this concluding remark is addressed to the Society. An immediate activity, which is doable and with a wide-ranging impact, that the Society could initiate is the compilation and development of cases illustrating good (or even bad) management practices in aquaculture and fishery. Such cases could be of single interventions, impact of policies, regulations or other interventions on environmental and resource sustainability, and on poor people’s livelihoods, resolution or avoidance of conflicts in the use of common resources, water management, etc. The immediate purpose of these cases is to inform policy. But they would also serve to identify opportunities for research as well as to provide valuable instructional materials in schools and in seminars and workshops. A sample of cases (to serve as models for developing and writing them) may be found at www.enaca.org/shrimp. Published in this website are a number of the cases on shrimp aquaculture management practices developed under the NACA/FAO/WWF/WB Consortium on Shrimp and the Environment.

References


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FISHERMEN COMMUNITY OF KUAKATA, A REMOTE COASTAL AREA OF BANGLADESH

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Khulna University
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INTRODUCTION

Fisheries provide livelihood to about 12 million people of Bangladesh. But the irony is that the 12 million strong fisherfolk of Bangladesh are the poorest people. Fisheries contribute to 5% GDP, 16.7% national income, 10% foreign exchange earning, 16.8% agricultural production and 60% animal protein to human (Amin, 1998).

A large number of people, especially the poor in the rural coastal regions are engaged in artisan fishing in the sea and estuary of the Bay of Bengal. This research is about such a fishermen community of a remote coastal area of the country situated in Latachapali Union under the district of Patuakhali in the southwestern region of Bangladesh. This union popularly known by many as Kuakata, a beautiful sea beach on the Bay of Bengal and is inhabited by a group of fishermen community both local and ethnic (Rakhain Tribe) in origin. It is located at a distance of 93 kilometers from the district headquarters of Patuakhali and lies between 21° 48' and 22° 05' north latitude and 90° 05' and 90° 20' east longitude.

The investigation focused on the fisheries activities of the fishermen community through field investigation.

MATERIALS AND METHODOLOGY

Preliminary assumptions on the number of total people of the studied villages were done through reconnaissance survey. For the present investigation, 10-12% representative populations of the different fishermen villages have been considered to investigate the various parameters. Participatory Rural Appraisal (PRA) tools were applied with different degrees of effectiveness and slight modification was done on certain tools whenever required. One hundred
respondents were randomly selected from each village on the basis of selected parameters. Interview took place on the boat, field, respondent residence, and fish market and river and canal side. For each respondent, occupation was the primary criteria for taking further information. Those respondents only involved in fisheries activities were included for study purposes.

RESULTS AND DISCUSSION

The study area included Latachapali Union of Kalapara Upazila in the district of Patuakhali under Barisal division situated in the southwestern part of Bangladesh. (Fig 1)

The Latachapali Union is comprised of 33 villages as shown in Fig-1.
The study indicated 11 such fishermen villages out of the 33 villages in the Latachapali Union. Fishermen villages were considered on the basis of occupation of the people of the different villages. Villages having greater than 60% people involved in fisheries activities were considered as fishermen villages.

The processing areas were named as "Shutki Point". The field survey led to 6 "Shutki Points" in the Latachapali Union. Within each Shutki Point, a number of small houses were built to carry out fish processing activities (fish drying, salting, smoking etc.). These were named as "Shutki Mahal". Again, the survey resulted in the finding of 31 such Shutki Mahal. A detailed investigation of the fishermen thriving on "Shrimp Seed Collection" was also under taken (Fig 2). The survey also dealt with Local Fish Market, Fish Landing Centres and Fresh Fish Arots (depot).

More than 50% fishermen were engaged in fishing. Relatively very low percentages of fishermen (0.22%) were engaged in netting. 2.88% fishermen were engaged in fish trading (Table 1). As much as three villages did not have any fish trading activities (Khajura, Goramkhola and Hossainpara). About 10.07% were engaged in shrimp fry collection. Nabinpur and Khajura had highest number of fishermen carrying out such activity (22.08% and 19.78%) respectively. These two villages were situated adjacent to the sea.
Table-1 : Nature of Fishing Activities

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Villages</th>
<th>Ahip</th>
<th>Khijura</th>
<th>Kallapara</th>
<th>Nadapir</th>
<th>Gomphalbadrapar</th>
<th>North Kusitla</th>
<th>West Kusitla</th>
<th>Puripurapar</th>
<th>Mambalapar</th>
<th>Hechipar</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish in the Sea and River</td>
<td>76.54</td>
<td>80.22</td>
<td>83.75</td>
<td>72.73</td>
<td>90.02</td>
<td>84.15</td>
<td>58.06</td>
<td>76.47</td>
<td>70.31</td>
<td>74.88</td>
<td>94.19</td>
<td>79.42</td>
</tr>
<tr>
<td>Fish Trading</td>
<td>8.11</td>
<td>0.00</td>
<td>3.75</td>
<td>6.19</td>
<td>3.17</td>
<td>3.66</td>
<td>2.15</td>
<td>1.18</td>
<td>1.15</td>
<td>6.33</td>
<td>0.00</td>
<td>2.88</td>
</tr>
<tr>
<td>Shrimp Fry Collection</td>
<td>14.81</td>
<td>19.76</td>
<td>5.00</td>
<td>22.08</td>
<td>0.00</td>
<td>12.20</td>
<td>7.53</td>
<td>14.12</td>
<td>3.45</td>
<td>3.50</td>
<td>5.51</td>
<td>10.07</td>
</tr>
<tr>
<td>fishing and fry collection</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>13.85</td>
<td>5.88</td>
<td>12.84</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>3.21</td>
</tr>
<tr>
<td>drying, salting and smoking</td>
<td>0.00</td>
<td>0.00</td>
<td>7.50</td>
<td>0.00</td>
<td>0.00</td>
<td>18.28</td>
<td>2.35</td>
<td>3.45</td>
<td>15.19</td>
<td>0.00</td>
<td>0.00</td>
<td>4.42</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

The result indicated that most of the fisheries activities (69.14%) were done through partnership (Fig-3).

**Working Days (Yearly)**
Most of the fishermen in all the villages worked throughout the year (85.51%). Comparatively small number of fishermen (14.49%) carried out their fisheries activities seasonally (Fig-4). Again this is attributed to seasonal fry collection, availability of catch, seasonal fish processing activities etc.
Major fish catch

Twenty-eight species of fish were found to be available in the studied site. Each species are illustrated in the Table-2.

<table>
<thead>
<tr>
<th>No.</th>
<th>Scientific Name</th>
<th>English Name</th>
<th>Local Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Hilsa ilisha</em></td>
<td>Hilsh fish</td>
<td><em>Hilsh</em></td>
</tr>
<tr>
<td>2</td>
<td><em>Mugil cephalus</em></td>
<td>Mullet</td>
<td><em>Parshe</em></td>
</tr>
<tr>
<td>3</td>
<td><em>Himantura walga</em></td>
<td>Stingray</td>
<td><em>Shaplapata</em></td>
</tr>
<tr>
<td>4</td>
<td><em>Scoliodon shorrakowah</em></td>
<td>Shark</td>
<td><em>Kamot</em></td>
</tr>
<tr>
<td>5</td>
<td><em>Pama pama</em></td>
<td>Drum</td>
<td><em>Poah</em></td>
</tr>
<tr>
<td>6</td>
<td><em>Polynemus paradiseus</em></td>
<td>Thread fin</td>
<td><em>Tapashi</em></td>
</tr>
<tr>
<td>7</td>
<td><em>Pampus chinensis</em></td>
<td>Chinese pompret</td>
<td><em>Rupchanda</em></td>
</tr>
<tr>
<td>8</td>
<td><em>Euthynnus affinis</em></td>
<td>Kawakawa</td>
<td><em>Kak fish</em></td>
</tr>
<tr>
<td>9</td>
<td><em>Murineosox bagio</em></td>
<td>Common pike conger</td>
<td><em>Samudrik Bain</em></td>
</tr>
<tr>
<td>10</td>
<td><em>Pristis cuspidatus</em></td>
<td>Sawfishes</td>
<td><em>Karati Hangor</em></td>
</tr>
<tr>
<td>11</td>
<td><em>Harpodon neheurus</em></td>
<td>Bombay duck</td>
<td><em>Loytta</em></td>
</tr>
<tr>
<td>12</td>
<td><em>Setipinna phasa</em></td>
<td>Anchovy</td>
<td><em>Phasa</em></td>
</tr>
<tr>
<td>13</td>
<td><em>Epinephelus lanceolatus</em></td>
<td>Sea bass</td>
<td><em>Bole</em></td>
</tr>
<tr>
<td>14</td>
<td><em>Chorinemus lyssa</em></td>
<td>Pompano</td>
<td><em>Chapa</em></td>
</tr>
<tr>
<td>15</td>
<td><em>Trichurus haumela</em></td>
<td>Cutlass fish</td>
<td><em>Churi</em></td>
</tr>
<tr>
<td>16</td>
<td><em>Tetraodon patoka</em></td>
<td>Box fish</td>
<td><em>Potka</em></td>
</tr>
<tr>
<td>17</td>
<td><em>Cynoglossus bengalensis</em></td>
<td>Tongue fish</td>
<td><em>kukurjib</em></td>
</tr>
<tr>
<td>18</td>
<td><em>Hilsa kanagurta</em></td>
<td>Herring</td>
<td><em>Noorilish</em></td>
</tr>
<tr>
<td>19</td>
<td><em>Hilsa toll</em></td>
<td>Herring</td>
<td><em>Chandailish</em></td>
</tr>
<tr>
<td>20</td>
<td><em>Hemiramphus xanthopterus</em></td>
<td>Half beaks</td>
<td><em>Ekhtute</em></td>
</tr>
<tr>
<td>21</td>
<td><em>Mugil speigleri</em></td>
<td>Mullet</td>
<td><em>Bhangon</em></td>
</tr>
<tr>
<td>22</td>
<td><em>Lates calcarifer</em></td>
<td>Sea bass</td>
<td><em>Velki</em></td>
</tr>
<tr>
<td>23</td>
<td><em>Pomadasys hasta</em></td>
<td>Pompano</td>
<td><em>Sada Datina</em></td>
</tr>
<tr>
<td>24</td>
<td><em>Argyrops spinifer</em></td>
<td>Silver bream</td>
<td><em>Laldatina</em></td>
</tr>
<tr>
<td>25</td>
<td><em>Sparus dina</em></td>
<td>Silver bream</td>
<td><em>Datina</em></td>
</tr>
<tr>
<td>26</td>
<td><em>Scatophagus argus</em></td>
<td>Skates</td>
<td><em>Bistara</em></td>
</tr>
<tr>
<td>27</td>
<td><em>Penaeus indicus</em></td>
<td>Shrimp</td>
<td><em>Chaka chintang</em></td>
</tr>
<tr>
<td>28</td>
<td><em>Metapenaeus monoceros</em></td>
<td>Shrimp</td>
<td><em>Harina chingry</em></td>
</tr>
</tbody>
</table>

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Fishermen used four types of fishing crafts such as Dingi (small wooden boat), Bachari (Relatively large wooden boat), Engine boat and Trawler (Table 1). All fishermen of the eleven villages used Engine boat and Trawler. 89.60% fishermen did not own any fishing craft. The number of crafts for each owner ranged from 1-3.

Fishermen used five types of fishing gears such as Hilsa net, Behundi jal, Khuta jal, Long line and Tana jal. All fishermen of the eleven villages used Hilsa net and long line for fishing. The study also showed that no fishermen in any villages used all types of fishing gears.

**Fish preservation and Processing**

The investigation resulted that the fishermen practiced four types of preservation and processing techniques namely icing, drying, salted-drying and smoking. Icing was used in fresh fish arot business, in the sea during fish harvesting and in the shutki mahal (drying house).

**Packaging Materials**

Jute sacks, bamboo baskets and polythene sheets were used for packaging. While for marketing, fish were placed in the jute sacks and sealed; fish were placed in bamboo baskets and sealed with the jute mats; fish were packed with polythene sheets or polythene bags.

**Fish Fresh Fish Arot (Depot), Fish Landing Center and Local Fish Market**

Most of the fresh fish arots (depot), fish landing centers and local fish markets were located nearby the river, sea and or road and were connected with the high ways. The location of arots (depot) depended on fresh fish-landing centers. The identified landing centers, fresh fish arots (depot) and local fish markets were located in two villages namely Alipur and West Kuakata.

In terms of construction materials, the arots were categorized into Katcha (made of bamboo, bamboo-fence, and by Nypa-leafs with earthen floor), Semi-pacca (made of bamboo, wood and tin roof with concrete floor), and Pacca (made of bricks, RCC and concrete). The number of Katcha, Semi-pacca and Pacca fresh fish arots in study area was estimated to be 1, 9 and 3 respectively. There were two fish landing centers, two local fish markets and thirteen fresh fish arots (depot). The study resulted that a landing center and a local fish market were located in Alipur and in West Kuakata. It was also observed that
out of thirteen fresh fish arot (depot), eleven were located in the village of Alipur while only two in West Kuakata. The number of manpower in each fresh fish arot (depot) varied between three and five. Maximum number of fishermen (47) was engaged in fresh fish arots (depot) of the village Alipur. But in West Kuakata, there were ten fishermen. Both fresh fish arots (depot) of West Kuakata had same number of fishermen (5) working. The total production of fresh fish in the studied area was 6,95,475 kg. (Table-3)

Table-3 : Monthly production of fresh fish (kg).

<table>
<thead>
<tr>
<th>Month</th>
<th>Shrimp Fish</th>
<th>Mahseer Fish</th>
<th>Paturghata Fish</th>
<th>Arowana Fish</th>
<th>Bacchu Fish</th>
<th>Redfin Fish</th>
<th>Triton Fish</th>
<th>Minor Fish</th>
<th>Moyla Fish</th>
<th>Mousturi Fish</th>
<th>Narman Fish</th>
<th>Kuakata Fish</th>
<th>Red Fish</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>4220</td>
<td>3127</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2430</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4790</td>
<td>4320</td>
<td>20447</td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>4100</td>
<td>2674</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1225</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2524</td>
<td>1962</td>
<td>12685</td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>1064</td>
<td>850</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>2365</td>
<td>1855</td>
<td>6164</td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>2035</td>
<td>1875</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>720</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1564</td>
<td>1220</td>
<td>7214</td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>8790</td>
<td>7908</td>
<td>1600</td>
<td>1835</td>
<td>2790</td>
<td>3227</td>
<td>1862</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1560</td>
<td>1220</td>
<td>7214</td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>11375</td>
<td>10775</td>
<td>5240</td>
<td>5672</td>
<td>5965</td>
<td>7016</td>
<td>5465</td>
<td>1342</td>
<td>1168</td>
<td>6876</td>
<td>2156</td>
<td>2060</td>
<td>2458</td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>21300</td>
<td>18206</td>
<td>7138</td>
<td>8215</td>
<td>10770</td>
<td>14400</td>
<td>6225</td>
<td>3225</td>
<td>3295</td>
<td>9542</td>
<td>5942</td>
<td>17420</td>
<td>14570</td>
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</tr>
<tr>
<td>August</td>
<td>25377</td>
<td>23445</td>
<td>7570</td>
<td>8730</td>
<td>11450</td>
<td>13268</td>
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<td>3747</td>
<td>8765</td>
<td>6948</td>
<td>19666</td>
<td>15445</td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>19246</td>
<td>19110</td>
<td>6420</td>
<td>7100</td>
<td>10285</td>
<td>11340</td>
<td>8480</td>
<td>3680</td>
<td>3842</td>
<td>3222</td>
<td>5364</td>
<td>15452</td>
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</tr>
<tr>
<td>October</td>
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<td>3220</td>
<td>4430</td>
<td>5220</td>
<td>5965</td>
<td>5955</td>
<td>1381</td>
<td>2275</td>
<td>2163</td>
<td>0</td>
<td>5840</td>
<td>4255</td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>6900</td>
<td>4162</td>
<td>2828</td>
<td>3146</td>
<td>2688</td>
<td>3086</td>
<td>3046</td>
<td>0</td>
<td>1938</td>
<td>800</td>
<td>0</td>
<td>3245</td>
<td>3864</td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>6704</td>
<td>3867</td>
<td>2363</td>
<td>2673</td>
<td>2300</td>
<td>3073</td>
<td>2514</td>
<td>0</td>
<td>1730</td>
<td>0</td>
<td>0</td>
<td>2995</td>
<td>2828</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>117300</td>
<td>102032</td>
<td>39891</td>
<td>42000</td>
<td>51072</td>
<td>65920</td>
<td>46420</td>
<td>12962</td>
<td>17955</td>
<td>22928</td>
<td>19410</td>
<td>80640</td>
<td>67945</td>
<td></td>
</tr>
</tbody>
</table>

Shrimp Seed Collection

Kuakata sea beach area and the estuary of Shibbaria River near the Khajura and Gorakhali were identified as the seed collection zone in the investigated area. Fishermen collected seed in these areas and generally preserved shrimp seed in earthen pots with salt water for storage.

Prices of Fresh Fish.

Price analysis of different fresh fish (monthly and average) is provided in Fig-5. The investigation revealed that the maximum monthly average price was found to be highest for Pampus chinensis and lowest for Tetraodon patoka. (172.50 ± 12.34 and 24 ± 1.48 taka) respectively. The prices of fish varied from month to month and were high during January, November and December. Hilsa ilisha, the
national fish of the country indicated a maximum price of 110 Tk/kg and minimum price of 85 Tk/kg in December, June and September respectively. The average price of Hilasa ilisha were 91.67 ± 7.49 Tk/kg. The fluctuation of the prices depended largely on the market demand and supply.

![Fig-5 : Prices of fresh fish](image)

Daily Fish Consumption

40% fishermen of ten villages consumed 1-500 gm fish whereas only 5.75% consumed 1500-2000 gm daily. Fishermen of these ten villages were relatively poorer and sold their fish to the market for earning extra money. Most of the fishermen families (53.16%) of Islampur consumed 500-1000 gm fish daily since the income of fishermen of this village was relatively higher. The observation revealed that a few fishermen families (5.75%) of the studied area consumed 1500-2000 gm fish daily (Fig. 6).

![Fig-6 : Daily Fish Consumption](image)
Level of Income

The present investigation found out that the fishermen in eleven villages were amongst the poorest of the poor. Level of income of the fishermen community is shown in Table-4. Most of fishermen earned Tk. 500-1000 (25.88%) and Tk. 1000-1500 (38.38%) per month respectively. Only 1.77-% fishermen had earned higher than 4000 taka per month. Here, the fishermen belonged to the processing zone and fish trading business particularly Islampur, which represented 15.19%.

Table-4 : Level of Income (Tk)

<table>
<thead>
<tr>
<th>Villages</th>
<th>500-1000</th>
<th>1000-1500</th>
<th>1500-2000</th>
<th>2000-2500</th>
<th>2500-3000</th>
<th>3000-3500</th>
<th>3500-4000</th>
<th>&gt;4000</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alyapur</td>
<td>28.40</td>
<td>46.91</td>
<td>6.17</td>
<td>1.23</td>
<td>1.23</td>
<td>13.58</td>
<td>1.23</td>
<td>1.23</td>
<td>100.00</td>
</tr>
<tr>
<td>Kholapur</td>
<td>34.07</td>
<td>46.15</td>
<td>8.79</td>
<td>3.30</td>
<td>4.40</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
<td>100.00</td>
</tr>
<tr>
<td>Miahpur</td>
<td>27.50</td>
<td>36.25</td>
<td>13.75</td>
<td>6.25</td>
<td>10.00</td>
<td>2.50</td>
<td>3.75</td>
<td>1.10</td>
<td>100.00</td>
</tr>
<tr>
<td>Kaliakua</td>
<td>18.18</td>
<td>29.67</td>
<td>11.69</td>
<td>16.68</td>
<td>11.59</td>
<td>8.49</td>
<td>3.90</td>
<td>0.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Garmuakhola</td>
<td>0.00</td>
<td>52.38</td>
<td>19.05</td>
<td>17.46</td>
<td>4.76</td>
<td>4.33</td>
<td>0.00</td>
<td>0.00</td>
<td>100.00</td>
</tr>
<tr>
<td>North Kaliakua</td>
<td>0.00</td>
<td>47.50</td>
<td>6.54</td>
<td>3.66</td>
<td>1.22</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>100.00</td>
</tr>
<tr>
<td>West Kaliakua</td>
<td>31.19</td>
<td>33.33</td>
<td>23.66</td>
<td>6.60</td>
<td>9.41</td>
<td>8.24</td>
<td>2.33</td>
<td>1.10</td>
<td>100.00</td>
</tr>
<tr>
<td>Padipora</td>
<td>30.62</td>
<td>34.12</td>
<td>8.24</td>
<td>6.60</td>
<td>9.41</td>
<td>8.24</td>
<td>4.05</td>
<td>5.06</td>
<td>100.00</td>
</tr>
<tr>
<td>Namosipora</td>
<td>27.69</td>
<td>37.93</td>
<td>10.34</td>
<td>12.64</td>
<td>3.45</td>
<td>4.60</td>
<td>2.53</td>
<td>4.65</td>
<td>100.00</td>
</tr>
<tr>
<td>Islampur</td>
<td>8.66</td>
<td>37.93</td>
<td>6.33</td>
<td>34.18</td>
<td>7.59</td>
<td>4.60</td>
<td>2.53</td>
<td>3.49</td>
<td>100.00</td>
</tr>
<tr>
<td>Nazirpur</td>
<td>31.40</td>
<td>20.25</td>
<td>17.44</td>
<td>14.07</td>
<td>7.59</td>
<td>5.06</td>
<td>4.05</td>
<td>1.77</td>
<td>100.00</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Credit Sources

Credit was provided to the poor fishermen of the eleven fishermen villages either through NGOs or Arotders (Depot owners). Some of the fishermen did not take any credit. 37.28% fishermen were engaged with the NGO’s for obtaining credit while rest received credit either from arotders or did their business by themselves. It was also observed that arotders had the maximum contribution in fisheries business.

Fig-8 Credit Sources

International Seminar on Policy Issues in Fisheries and aquaculture
While 21.90% fishermen carried out their fisheries business with their own capital. Also, generally NGO's were interested to provide loan only to the harvesters.

Discussion

Research findings of the present investigation regarding fisheries activities of the fishermen community indicated that more than 50% were directly involved in fishing in the sea and river whereas only 0.22% were fish traders. This result was not in agreement with the findings of Department of Fisheries (DOF, 1993) which revealed that there were 22% professional and 74% non-professional fishermen in Chanda beel. The higher percentage of fishermen found in this investigation was because the study area was situated in the coastal belt and the availability of fish in the sea encouraged the fishermen to fish.

Majority of fishermen carried out fisheries activities in partnership pattern whereas only 7.63% fishermen did their work individually. Almost similar results were found by a survey of DOF (1990). However, other researchers found different results (Mannu, 1999; CPP, 1996; and DOF, 1993). Mannu (1999) studied the socio-economic conditions of the sea going fishermen at Kuakata and reported that no fishermen caught fish individually. DOF (1993) in a study on the fishermen community of Chanda beel reported 85% fishermen carried out their activities individually. A survey on the professional fishermen was done in Tangail district under the Compartmentalisation Pilot Project (CPP, 1996) which indicated that 69% fishermen fish individually. Most fishermen of the study area went fishing far away from the coast. In addition, fry collections in the coastline were not carried out individually.

Findings of the present investigation indicated that 85.31% fishermen worked throughout the year. Ahmed (1996) found almost similar result stating that 81% carried out fishing throughout the year. However, Mannu (1999) reported that 72% were full time fishermen.

The present investigation revealed that 89.60% and 76.99% fishermen had no craft and gear of their own. While Mahabubullah (1986) reported that 64% had no boats and 61% had no gears. Most fishermen in the study area were poorest of the poor and worked as a day labour in other fishing boat.

This investigation found that fishermen in the study area practised four different types of preservation and processing techniques, which were very traditional. Fishermen did not maintain hygiene and sanitation and open latrines were the common phenomenon in the studied area. Johnson and Esser (2000) reported similar observations. Icing procedure practised by the fishermen of the study area was similar to the proposed method of Clucas and Ward (1996).
It was also found that fishermen used bamboo baskets and jute bags as packaging materials. Rubbi, et. al., (1982) reported two types of packages for marketing of dried product i.e. fish wrapped inside gunny bag only and wrapped with polythene inside the gunny bag.

Most fishermen (45.58%) families consumed 1-500gm fish daily whereas only 5.75% consumed 1500-2000gm. Muhit (2000) reported in his study that 46% fishermen took fish as their meal per month.

The present investigation found out that the fishermen were amongst poorest of the poor. Most fishermen earned Tk. 500-1000 (25.88%) and Tk. 1000-1500 (38.38%) per month respectively. These findings of the present investigation were similar to the findings of Bailey (1994) who noted that fishermen and their families in South and Southeast Asia often are considered to be the poorest in the society. Mahabubullah (1986) reported that 71% earned 400 taka or above per month. DOF (1993) stated that average income of majority of the fishermen were 15000 Tk/year. DOF (1990) reported that 70% of the fishermen had an average daily income of Tk.20-25, while rest 30% earned Tk 25-40. CPP (1996) found that 54% fisherman had income of 50 taka daily. Mannu (1999) reported that 89% earned an average of 25000 taka per year. Ahmed (1999) observed that 73.33% had their daily income above Tk. 50 while other fishermen (26.67%) earned less than Tk. 50 during the fry catching season. Rabbani and Sarker (1997) noted that income of the majority of the fishermen ranged from 2000-3500 taka per month.

This investigation revealed that 37.28% fishermen were engaged with the NGO’s for obtaining credit while rest received credit either from the arotder or did their business on their own. Arotder had maximum contribution in fisheries business in the study area. This amounted to 40.82% while 21.90% fishermen carried out fisheries business with their own investment. CPP (1996) reported that 70% took loan from moneylender. Ahmed (1996) found out that 92% of fishermen were member of some associations, clubs and co-operatives. A similar study was conducted by DOF (1993) revealed that 5% fishermen were members of co-operatives and 34% aware of NGO programs.
1. Government should take a long-term strategy for providing loan to fishermen community at the minimum interest level. A new micro credit service system for fishermen should be set up. The credit system should also be easy for illiterate fishermen to get loan within the shortage period of time.

2. Efforts must be made to improve the marketing networks. These improvements should aim to reduce the power of the trader in particular the ‘DADONDER’ and give the fisherfolk a greater share of the price paid by the final consumer. The fisherfolk would then work harder to increase their levels of income. They could then use some of the extra money to invest in their own vessels and achieve financial independence.

3. Dissemination of appropriate techniques for fish preservation and processing should be provided to the poor fishermen through different organizations (NGOs and GOs). This will earn greater profit and will improve the livelihood of fishermen community.

4. Income generation from fisheries activities is highly unpredictable particularly for the coastal fishermen of the studied area. Thus it is essential that alternative income generating sources should be created.

5. Use of destructive gear was a common feature in the study area. Hence, enforcing law should strictly prohibit the use of destructive gears to the target people.

6. Fishermen communities were more susceptible to weather conditions and the fisheries activities depended on both weather and season. During the rough weather, fisherman could not come back quickly to the shore due to absence of motorized boats in most cases. Thus fishing was very risky. Government should take appropriate steps under such situations.

7. Robbery was a very crucial problem in deep-sea fishing and many fishermen lost every thing. Government should provide necessary security facilities.

8. In rainy season, huge amount of fish was lost due to lack of appropriate techniques in preservation and marketing. In particular, the number of ice plants in the study area was limited. Thus, it is suggested that more ice plants should be established immediately in the study area.
9. Seed collection caused enormous loss to other organisms. Therefore, appropriate measures should be taken by the Government to use proper gears/nets. Besides this, seed collection was carried out seasonally and the fisherman became unemployed during off-season. Under such circumstances, alternative sources of income should be provided.

10. Fresh fish is highly perishable product, which needed subsequent preservation for marketing. Thus, quick marketing facilities should be established.

11. Local organizations like village clubs, cultural groups, schools, colleges, local NGOs, local self government bodies etc. should be meaningfully involved in both the planning and implementation phases of any development projects in fisheries that affect the social, economic and livelihood pattern of the fishermen.

12. Problem identification and approaches by the Government and or NGOs should be carried out in consultation with fisherman, local people and village heads. Decision for solution of problems should be developed by group discussion with all concerned.

13. Extension work is important to ensure that there is awareness from all parties (from producers to consumers) on handling procedures and quality regulations to ensure a reduction in losses and quality of product to market.

14. Government and Non-Government agencies, research organizations, universities, local administration, law enforcing agencies should co-operate together to formulate an integrated policy to intelligently manage the poor fishermen communities of the studied area and other coastal region.

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