World Trade Agreement and Indian Fisheries Paradigms: A Policy Outlook

Central Marine Fisheries Research Institute

(Indian Council of Agricultural Research)

Post Box No. 1603, Ernakulam North P.O., Cochin - 682 018, Kerala, India

www.cmfri.org.in.

ICAR funded Short Course

on

World Trade Agreement and Indian Fisheries Paradigms: A Policy Outlook

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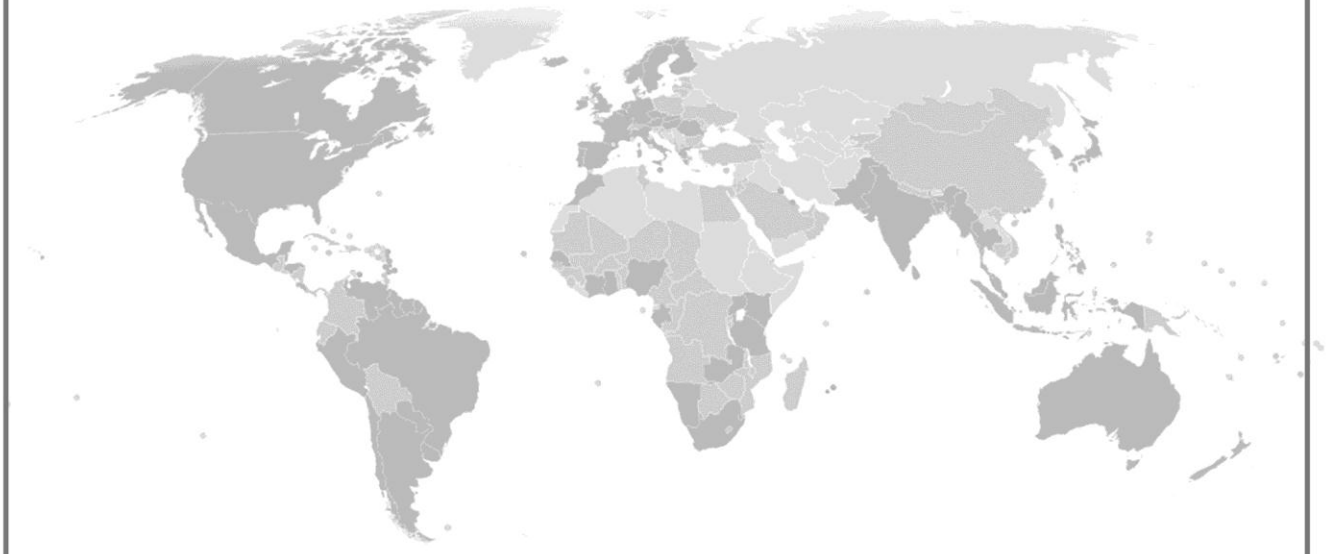

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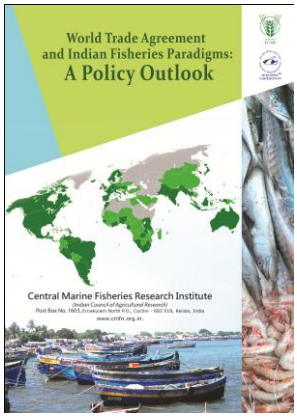

Front Cover

Back Cover

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WORLD TRADE AGREEMENT AND INDIAN FISHERIES PARADIGMS: A POLICY OUTLOOK

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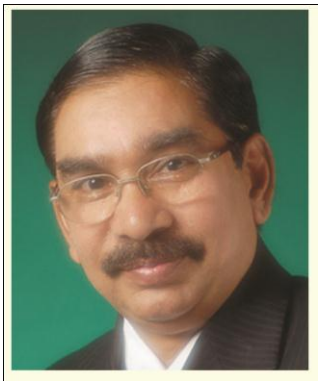
Foreword



International trade is duly called as the "engine of growth" and is inextricably linked with economic development. Nevertheless, trade is also vulnerable to economic slowdown as in the current global environment. Many of the developing countries are getting exposed to declining demand for exports and increased protectionism. Even in times of strong economic growth, trade and its benefits had not been evenly distributed across the developing world and the growth had been asymmetric. The World Trade Organization (WTO) which officially commenced on January 1st, 1995 under the Marrakesh Agreement, replacing the General Agreement on Tariffs and Trade (GATT), intends to supervise and liberalize international trade through negotiations aiming at expansion of rules–based trade and thereby gearing trade policies to support development. When the developing countries were liberalizing their economies, they felt the need for better export opportunities. The establishment of WTO is an important landmark in the history of international trade as it provides opportunities for countries to grow and realize their export potentials, with appropriate domestic policies in place.

The provisions under the various WTO agreements are expected to have impact different dimensions of fisheries sector. The major issues and challenges faced by Indian fisheries trade in relation to the Non Agricultural Market Access, Technical and Non-Technical Barriers to Trade, Subsidies, Anti-dumping, Sanitary and Phyto-Sanitary measures, Domestic trade and Free Trade Agreements was discussed in the various sessions of the training programme. Since Indian fisheries trade is facing a lot of challenges in the recent years this training was timely.

The Socio- Economic Evaluation and Technology Transfer Division is essentially involved in research on socioeconomics which consists of both Fisheries Economics and Fisheries Extension. I am happy that the SEETT Division has taken the lead in organizing this short course funded by ICAR with the main aim of sensitizing and imparting training on the various aspects of WTO agreement and its impact on Indian fisheries. I take this opportunity to congratulate Dr. R. Narayanakumar, Head of the division and the scientific, technical and administrative support that made this programme a grand success. I also compliment Dr. Shyam S. Salim, Senior Scientist and the Course Director for his conceptualization and meticulous planning of the short course and preparation of the manual on "World Trade Agreement and Indian Fisheries Paradigms: A Policy Outlook.

I am sure that the lessons learnt will be beneficial to conduct research on WTO related issues and its implications will be not only in fisheries but also in various related areas including agriculture.

G.Syda Rao

06 .10 .12
Cochin

Preface

In the name of Almighty the most benevolent and merciful

The economic reforms of 1991, the subsequent WTO agreements and the proliferating Regional Trading Agreements (RTAs) have brought challenges as well as opportunities for the Indian fisheries sector. Liberalization of economies coupled with increasing demand for value added products and other product diversifications have resulted in the structural changes of seafood industry in the last decade. Indian seafood exports increased from 2.81 billion US $ in 2010-11 to 3.15 billion US $ during 2011-12. Seafood is high on the global trade agenda and has become particularly relevant in the light of the entry of fisheries into the WTO process in the Non-Agricultural Market Access (NAMA). The varied impacts of trade liberalization policies including the WTO agreements on fisheries trade are manifested on domestic trade and marketing, subsidies, protectionism including tariff and non-tariff barriers like Quantitative Restrictions, Sanitary and Phyto Sanitary (SPS) measures, environment, dumping, negative list and legal rights. Even though the international trading regimes are changing, with more open markets and increased access, the EU, US and other developed countries are taking increasingly stringent measures on seafood safety. Changes in market access are likely to have significant implications for poor producers and costs of implementation of international fisheries agreements such as SPS measures, HACCP standards and market-driven labeling schemes form barriers for participation of poor fisherfolk and thereby reduce their livelihood options. The global attention and the ongoing debates of fisheries subsidies focus mainly upon the twin issues of trade distortion and environment and largely bypass other dimensions like fair play, subsistence livelihood and quality of life.

It was under the above pretext the ICAR Short course on 'The World trade Agreement and Indian Fisheries Paradigm: A Policy Outlook' was conceptualized and funding sought from t ICAR . The response was overwhelming and had to limit the participants to 33. The participants were chosen according to ICAR guidelines and included scientist and faculty from different fisheries and related organization, research and development professionals and middle level managers. The main theme areas covered in the course include WTO and fisheries: A historical perspective , Trade liberalization and Export performance of fisheries sector, Tradeoffs between international trade and domestic trade with Impact on domestic trade, Tariff reduction and bindings to provide market access, Removal of Quantitative Restrictions (QR), Reduction, of domestic and export subsidies, Application of Sanitary and Phyto-Sanitary (SPS) measures, Trade and environment: Eco-labeling, Disputes , Impact of dumping on trade , Trade Related Intellectual Property Rights (TRIPS) and imposition of patent regime , Trade Related Investment Measures (TRIMS) and Regional Trade Agreements (RTA's) and their implications.

We are thankful to the Director, CMFRI who wholeheartedly facilitated the programme along with the administrative and audit staff of the Institute. The support from the faculty members who contributed in delivering the lecture is beyond words. The timely support from the Course Co-ordinators Dr.N.Aswathy, Dr.Vipinkumar .V.P, and Dr.C.Ramchandran , Senior Scientists of the Division deserves special mention .The backbone of the programme had been the unstinted support from the colleagues in the Division which ensured the smooth execution of the programme plan.

The edited manual comprises the different lectures which were delivered during the course of the training .We believe that these lectures could provide an insight into the new horizons of International trade agreements and in analyzing the domain of World Trade Agreements and Indian fisheries for the future.

06.10.12 **Shyam.S.Salim**

Cochin **R.Narayanakumar**

Contents

List of Acronyms ...

A & N	Andaman & Nicobar
AAAS	American Association for the Advancement of Science
ADM	Anti-Dumping Measures
ADO	Anti-Dumping Duty Order
AHL	Animal Health Law
AHNS	Acute Hepatopancreatic Necrosis Syndrome
AIDCP	Agreement on the International Dolphin Conservation Program
AMC	ATMA Management Committee
AMS	Aggregate Measure of Support
ANFACO	National Association of Manufacturers of Canned Seafood
APEC	The Asia Pacific Economic Community
ARCH	Auto Regressive Conditional Heteroskedasticity
ARP	Appellate Review Process
ARIMA	Auto Regressive Moving Average
ARTNeT	Asia -Pacific Research and Training Network on Trade
ASC	Aquaculture Stewardship Council
ASCM	Agreement on Subsidies and Countervailing Measures
ASEAN	Association of South East Nations
ASEAN	Association of South East Asian Nations
ATMA	Agricultural Technology Management Agency
BAP	Best Aquaculture Practices
BOBP	Balance of Payment Problem
BoP	Balance of Payment
BPL	Below Poverty Line
BRC	British Retail Consortium
BSE	Bovine Spongiform Encephalitis
BTT	Back to Top Team
BTT	Block Technology Team
CAC	Codex Alimentarius Commission
CBCRM	Community Based Coastal Resource Management
CBD	Convention on Biological Diversity
CBD	Convention on Biological Diversity
CCF	Code of Conduct for Fisheries
CCR	Changed Circumstances Review
CCRF	Code of Conduct for Responsible Fisheries
CECA	Comprehensive Economic Cooperation Agreements
CECAs	Comprehensive Economic Cooperation Agreements
CEPA	Comprehensive Economic Partnership Agreements
CFH	Collection, Fishing and Holding
CFR	Code of Federal Regulations
CGIAR	Consultative Group on International Agricultural Research
CIEL	Center for International Environmental Law

CIF	Cost Insurance Freight
CIFT	Central Institute of Fisheries Technology
CITES	Convention on International Trade in Endangered Species
CMFP	Comprehensive Marine Fishing Policy
CMFRI	Central Marine Fisheries Research Institute
CMFRI	Central Marine Fisheries Research Institute
COFI	Committee on Fisheries
COP	Cost of Production
CoP	Conference of Parties
CPH	Catch per hour
CPUE	Catch per Unit Effort
CR	Critically Endangered
CSE	Centre for Science and Environment
CSIR	Council of Scientific Research
CSMCRI-	Central Salt and Marine and Chemical Research Institute
CUSAT	Cochin University of Science and Technology
CZMP	Coastal Zone Management Plans
DAHDF	Department of Animal Husbandry, Dairying and Fisheries
DDA-	Doha Developed Agenda
DEA	Data Envelopment Analysis
DEPB	Duty Entitlement Passbook
DGAD	Directorate General of Anti-dumping and Allied Duties
DNA	Deoxyribonucleic acid
DOC	Department of Commerce
DOF	Department of Fisheries
DSB	Dispute Settlement Body
DSU	Dispute Settlement Understanding
EBFM	Ecosystem-Based Fisheries Management
EEZ	Exclusive Economic Zone
EEZ	Exclusive Economic Zone
EFF	European Fisheries Fund
EFM	Ecosystem and Fishery Management
EIA	Export Inspection Agency
EIA	Environmental Impact Assessment
EIC	Export Inspection Council
EIC	Export Inspection Council
EMS	Environmental Management System
EMS	Early Mortality Syndrome
EOU	Export Oriented Unit
EOU	Export Oriented Unit
EPA	Environmental Protection Act
EPA	Environmental Protection Act
ETS	Effluent treatment Systems
EU	European Union

EU-GSP	European Union- General System of Preference
EUS	Epizootoic Ulcerative Syndrome
FAD	Fish Aggregating Devices
FAM	Fisheries Assessment Methodology
FAO	Food and Agricultural Organisation
FAO	Food and Agriculture Organization
FFA	Fish Farmer Association
FFIGs	Fish Farmer Interest Groups
FH	Fishing Harbours
FIFG	Financial instrument for the Fisheries Guidance
FLCs	Fish Landing Centres
FOS	Friend of the Sea
FPAs	Fisheries Partnership Agreements
FRP	Fibreglass-Reinforced Plastic
FSC	Forestry Stewardship Council
FSI	Fishery Survey of India
FSIS	Food Safety and Inspection Service
FTA	Free Trade Agreements
FTAA	Free Trade Area of the Americas
GAA	The Global Aquaculture Alliance
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GB	Governing Board
GCR	Growth Constancy Retention Matrix
GDP	Gross Domestic Product
GDP	Gross Domestic Product
GMAD	Global Marine Aquarium Database
GMM	generalized method of moments
GMOs	Genetically Modified Organisms
GOI	Government of India
GoM	Gulf of Mannar
GPS	Global Positioning System
GRT	Gross Regional Product
GRT	Gross Registered Tonnage
GSP	Generalised System of Preferences
H&L	Hooks and Lines
HACCP	Hazard Analysis and Critical Control Point
HACCP	Hazard Analysis and Critical Control Point
HHT	Handling, Husbandry and Transport
HLL	Hindustan Lever Limited
HSD	Human Systems Development
HTML	Hypertext Mark up language
IATTC	Inter-American-Tropical-Tuna-Commission

IBM	In Board Motor
ICAR	Indian Council of Agricultural Research
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
ICLARM	International Centre for Living Aquatic Resources Management
ICSF	International Collective in Support of Fishworkers
IDP	Inter Departmental Panel
IDRC	International Development Research Centre
IFQS	Individual Fishing Quotas
IHHNV	Infectious hypodermal and hematopoietic necrosis virus
ILO	International Labour Organisation
IMC	Indian Major Carps
IMF	International Monetary Fund
IMNV	Infectious Myonecrosis Virus
IMO	International Maritime Organisations
IOTC	Indian Ocean Tuna Commission
IOTC	Indian Ocean Tuna Commission
IPA	*Indian Pharmaceutical Association*
IPPC	International Plant Protection Convention
IPRs	Intellectual Property Rights
IQF	Individually Quick Frozen
ISBN	International Standard Book Number
ISEAL	International Social and Environmental Accreditation and Labelling Alliance
ISO	International Organisation of Standardization
ISO	International Organization for Standardization
ITA	International Trade Administration
ITC	International Trade Commission
ITC	International Trade Centre
ITO	International Trade Organisation
ITS	Internal Transcribed Spacer
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unregulated or Unreported
KHV	Koi Herpes Virus
KVKs	Krishi Vigyan Kendras
LDCs	Least Developing Countries
LIFDCs	Low-income food-deficit countries
LOA	Length Overall
LOP	Letter of Permit
MAC	Marine Aquarium Council
MAI	Multiple Agreement on Investment
MAI	Multiple Agreement on Investment
MAM	Mariculture and Aquaculture Management
MCS	Monitoring, Control, Surveillance
MEAs	Ministry of External Affairs

MEL	Marine Ecolabel
MEY	Maximum Economic Yield
MFN-	Most-Favoured-nation
MFR-	Marine Fisheries Regulation
MFRA	Marine Fisheries Regulation Act
MFRA	Marine Fishing Regulation Act
MGN-	Mechanized Gillnetters
MMT	Million Metric Tonnes
MNCs	Multi-National Companies
MOEF	Ministry of Environment and Forest
MoEF	Ministry of Environment and Forestry
MPA	Marine Protected Area
MPAS	Marine Protected Areas
MPEDA	Marine Product Export Development Agency
MRAG	Marine Resources & Fisheries Consultants
MRLs	Maximum Residue Levels
MSC	Marine Stewardship Council
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
MTBE	methyl tertiary butyl ether
NACA	Network of Aquaculture Centres in Asia-Pacific
NAFTA	North American Free trade Agreement
NAMA	Non Agricultural Market Access
NASA	National Aeronautics and Space Administration
NBFGR	National Bureau of Fish Genetic Resources
NBPGR	National Bureau of Plant Genetic Resources
NCAAH	National Centre for Aquatic Animal Health
NCBI	National Centre for Biotechnology Information
NCDC	National Cooperative Development Corporation
NDF	Non-Detrimental Findings
NE	North East
NFDB	National Fisheries Development Board
NGO	Non-Governmental Organization
NGOs	Non - Governmental Organisations
NIFPHATT	National Institute of Fisheries Post Harvest Technology and Training
NMFC	National Motor Freight Classification (NMFC)
NTBs	Non-Tariff Barriers
NTMs	Non-Tariff Measures
NW	North West
OAL	Overall Length
OBGN	Outboard Gillnetters
OBM	Out Board Motor
OECD	Organisation for Economic Co-operation and Development
OIE	International Office of Epizootics

PAM	Policy Analysis Matrix
PCFFA	Pacific Coast Federation of Fishermen's Associations
PCR	Polymerase Chain Reaction
PDS	Public Distribution System
PFZ	Potential Fishing Zone
PL	Post Larvae
POI	Period of Investigation
PPMs	Production and Processing Methods
PRIs	Panchayati Raj Institutions
PTA	Preferential Trade Agreements
PTAs	Preferential Trade Agreements
PTC	Pacific Telecommunications Council
QAAD	Quarterly Aquatic Animal Disease
QR	Quantitative Restrictions
R & D	Research and Development
RAPD	Random Amplified Polymorphic DNA
RASFF	Rapid Alert System for Food and Feed
RATS	Regression Analysis of Time Series
RBF	Risk Based Framework
RFMOs	Regional Fisheries Management Organisations (RFMOs)
RFMOs	Regional Fisheries Management Organisations
RILA	Retail Industry Leaders Association
RSW	Refrigerated Sea Water
RTA	Regional Trading Arrangements
RTAs	Regional Trade Agreements
SAARC	South Asian Association for Regional Cooperation
SAARC	South Asian Association for Regional Cooperation
SAFTA	South Asian Free Trade Areas
SAFTA	South Asian Free Trade Agreement
SARS-	Severe Acute Respiratory Syndrome
SAS	Statistical Analysis System
SCM	Subsidies and Countervailing measures
SE	South East
SEAI	Seafood Exporters Association of India
SIC	Standard Industrials Classification
SIL	Special Import Licence
SIP	Special Import Permit
SITC	Standard International Trade Classification
SNPs	Single-nucleotide polymorphism
SPS	Sanitary and Phytosanitary
SPSA	Sanitary and Phytosanitary Agreement
SPSS	Statistical Product and Service Solutions
SQF	Safe Quality Food
SREP	Strategic Research and Extension and Plan

STDF	The Standards and Trade Development Facility
SW	South West
SWOT	Strength Weakness Opportunities and Threats
T & C	Time and Cost
TA	Trade Agreement
TAAD	Transboundary Aquatic Animal Diseases
TAB	Trade Analysis Branch
TAC	Total Allowable Catch
TAC	Total Allowable Catch
TAD	Transboundary Animal Diseases
TAT	Thematic Apperception Test
TBT	Technical Barriers to Trade
TED	Turtle Excluder Device
TEV	Total Economic Value
TRIMS	Trade Related Investment Measures
TRIPS	Trade Related Aspects of Intellectual Property Rights
TRQ	Tariff-rate Quota
TSV	Taura Syndrome Virus
TUSMP	Technology Upgradation Scheme for Marine Products
UN	United Nations
UN-	United Nations
UNCLOS	The United Nations Convention on the Law of the Sea
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNIDO	United Nations Industrial Development Organisations
UPC	Universal Product Code
URI	Uniform Resource Identifier
US-	United States
US $	United States Dollar
USA-	United States of America
USD-	United States Dollar
USPTO	United States Patent and Trademark Office
USTR	United States Trade Representative
UT	Union Territory
VAT	Value Added Tax
VMS	Virtual Memory System
VNN	Viral Nervous Necrosis
WAHID	World Animal Health Information Database
WAHIS	World Animal Health Information System
WCPFC	Western and Central Pacific Fisheries Commission
WFF	World Forum of Fish Harvesters & Fist Workers
WHO	World Health Organisation
WIPO	World Intellectual Properties Organisation

WITS	World Integrated Trade Solutions
WSSV	White Spot Syndrome Virus
WTO	World Trade Organization
WTO-	World Trade Organisation
WWF	World Wide Fund for nature
YHV	Yellow Head Virus
ZENGYOREN	Japan Fisheries Cooperatives

List of Tables…

List of Figures…

1

Marine fisheries in India: The path ahead.....

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Introduction

Fishery sector in India serves as potential source of nutritional and livelihood security for about 40 million people. The fish production in India is now about 7.85 mt out of which, 3.32 is contributed by marine fisheries and the rest by inland fisheries. Marine fisheries in India have been showing a slow pace of growth during the last one decade. Though the production from the seas was stagnating, the annual total marine fish landings exceeded three million tonnes. However, meeting the requirements of the growing population in the years to come is a big challenge. To meet this challenge, we have to look into the seas again as it is the only available alternate food production system, which offers immense potential like sea farming systems. To harness the potential of sea farming / mariculture bio-secured facilities are to be developed on priority basis for brood stock management. Sea farming is an emerging field that requires massive investment to establish. On this line, CMFRI had initiated demonstration of open sea cage farming since 2007 and has nearly standardized the technology and making it available to enthusiastic entrepreneurs.

Marine capture fisheries

The estimated landings from the marine capture fisheries from the peninsular region of the country (excepting Lakshadweep isles and Andaman and Nicobar) stands at 3.32 million tonnes with a quinquennial with a smoothed growth rate of 4.62 per cent. In the past decade the inter-annual growth rate of landings have ranged from -10.7 per cent to 12.8 per cent. The estimated harnessable marine resource potential of the Indian EEZ is 4.4 million tonnes at the present exploitation rates. The most liberal of the exploitation forecasts predicts that by 2030 the landings off Indian shores could reach unto 4.6 million tonnes. The trend based surveys have indicated that in the depth range upto 100 m, which contributes to about 86 per cent of the total exploited resources, have practically no possibility of witnessing quantitative expansion of harvesting. However the depth ranges beyond 100 m have avenues of expansion, albeit more on qualitative terms. In this domain the possibility revolves around oceanic resources like tuna, bill fishes and allied species whose combined potential is pegged at 0.2 million tonnes with the lucrative Yellow Fin Tuna contributing to the tune of 40 per cent to it. Another feature of the decadal trends of landings is that among the various groups the contribution by pelagic and demersal fin fish resources have shown marked increase with while the crustaceans (shrimps) and molluscs are fluctuating around a flat trend. This adds relevance to the argument that quantum increase need not necessarily indicate increase in value of the products in the same vein.

The nine maritime states and two UTs in the peninsular region have retained their distinctive patterns when it comes to the dominance of sectors as well as resources

primarily focused upon. Obviously resources with geographic loyalty like bombay duck, non-peneaid prawns Hilsa etc. are being continued to be exploited in the North West and North East regions of the Indian coast as was in vogue. But at the same time certain other resources like Cat fishes which were quite dominant in the South West region have shown alarming downward slide in the past decade. One stand out factor in the recent past is the thick fast spreading of Oil Sardines in the South East coast which stands at 0.13 million tonnes in 2010. Among the states Maharashtra, Gujarat and Kerala have consistently recorded near total domination of fishing propelled by machines. In fact the out-board sector (motorized) sector which had galvanized the meandering fihseries of Kerala in late 80s has usurped place of prime with a strength of 1.3 units for each mechanized unit. The artisanal crafts, non-mechanised and out-board, dot the east coast more (73 per cent and 60 per cent of national count), whereas around 60 per cent of mechanized crafts including trawlers are recorded against the west coast. Even in the North West region where the penetration of the core mechanized crafts was the least, the past couple of years have shown stark decline in the contribution by non-mechanised vessels. Another interesting feature of the fisheries is that the mechanized operations tend to be more multi-day in operation thereby further paling the demarcation between states' territorial boundaries. In past couple of years, the focus is more on more per trip than more trips per month as even the motorized crafts slugging out for more days. This has a firm indication towards the compulsions of operational constraints. The fishermen families which are around 8.63 lakhs in the main land, have 9.26 lakh active core fishers as per latest figures (2010).

The way ahead in marine capture fisheries management needs to focus on the following issues

(i) Expansion of fishery is no more uni-focal, ie. simple increase in quantity.

(ii) Fast shrinking space for virgin avenues. Oceanic resources and deep sea resources are sure fire possibilities in the coming quinquennium.

(iii) The intra-coastal geographic divide has little bearing on most of the resources exploited and it is in fact the marketing avenues which influence patterns in a telling fashion.

(iv) Significant, sustained spread of not so high valued resources onto unconventional areas is noticeable. The role of environmental upheavals like global warming and climate change needs special flagging.

(v) The trend has been of sustained increase over the past six decades and more interestingly there has been no let down in the last five years or so. This augurs well for the validity of harvestable potential forecasts.

(vi) Crafts tend to be prepared for longer trips and hence the increasing numbers, either as conversions/ upgradations or as new build-ups, have to be seen with national resource availability at the back drop or bifurcated thereafter to local territorialisations.

(vii) Ventures onto relatively unexploited domains like open sea cage culture may come in handy from the sustainability perspective of fishermen.

(viii) Resources like Myctophids and Krills can be focused upon for possible value addition and marketing.

Capture based aquaculture (CBA)

The room for increasing production from marine capture fisheries sector in relation to the growing demand for fish and fishery products is very limited. The marine capture

fisheries production statistics indicates a stage of stagnancy and the current level of exploitation is fast approaching the potential exploitable level. One of the most important factors for aquaculture development is the failure of wild fisheries to meet market demand. Aquaculture. Aquaculture helped increasing the supply of fishes, improving the quality of fishes, developing the new products for consumers which all in turn increased the per capita consumption of seafood.

Capture based aquaculture uses wild seeds or juveniles to stock in aquaculture facilities for on growing purposes. Capture Based Aquaculture accounts for about 20 per cent of the total quantity of food fish production through aquaculture – mainly molluscans and some high valued finfish. Capture-based aquaculture constitutes an alternative livelihood for local coastal communities, and can contribute significant economic returns in those regions with depressed marginal economies. The collection of adult organisms is a special case related to the development of captive broodstock used for breeding in hatcheries.

Conflicts between aquaculture and commercial fisheries have been reported on Space-related issues from various locations around the world. There is general fear that development of open water aquaculture will hinder the fishing activities of the traditional/local fishermen. Despite the potential for conflicts, adequate coastal zoning management can lead to the development of synergies between aquaculture and traditional fisheries. In areas with declining wild catches and increasingly restrictive fishery regulations, aquaculture may help increasing production and providing livelihood opportunities for fishermen. Open-ocean aquaculture may also provide unique opportunities for commercial fishermen either as a new occupation or a business that could complement their fishing practices since they already own vessels and have the maritime skills and knowledge of local oceanic and weather conditions.

Worldwide aquatic wild stocks and their ecosystems are in a fragile state. The growing importance of aquaculture production should be a way to relieve the fishing pressure on wild stocks and foster the maintenance of biodiversity whilst satisfying the growing market demand for aquatic products. Aquaculture can influence fish stocks through its use of wild fish stocks for inputs, such as feed, brood stock or juveniles. Dependence of fish meal for the production of aquaculture feeds is one of the major negative effects of aquaculture on fisheries. Aquaculture can also influence wild fish stocks through intentional releases. It has been used to replenish or enhance fisheries through purposeful release of juvenile or adult fish. Aquaculture can enhance fisheries habitat through development of infrastructure like oyster farms, fish cages and pens, or, in some cases displace wild fish through its use of habitat. Aquaculture may cause the transmission pathogens to wild population and accidental escape of non-native fishes from culture facility may affect the biodiversity of the farming region.

Fisheries Socio economics and welfare

Marine fisheries sector in India provides employment to about three million people comprising 1.3 million of active fishermen, 1.50 million in the secondary sector and the rest in the tertiary sector of fisheries. The sector also supports the livelihood for about 18-20 million people.

The estimated marine fish landings in 2010 was 3.07 million tones (CMFRI, 2011). The gross value of the marine fish landings at the landing centre level is estimated at Rs.19,753 crores and at the retail level at Rs.28,511 crores (SEETTD, 2011). The private capital investment in fishing equipment's has increased from Rs.10,352 crores in 2003-04 to

Rs.15,496 crores in 2009-10. The per capita investment per active estimated at Rs.3,11,799 in the mechanized sector, Rs.38,87 in motorized sector and Rs.17,205 in the non-mechanized sector

Fish & fish products recorded highest increase in price among all food commodities- Transforming from a poor man's food to luxurious food item. The percentage share of fishermen in consumer rupee (PSFCR) ranged from 40 per cent for oil sardines to 80 per cent for seer fish in private marketing channel. Wherever Self-Help Groups (SHG's) or Cooperative fish marketing exists, PSFCR is consistently above 70 per cent for all varieties.

Domestic marketing system requires more attention on modernization including quality control. There exists, inadequate coastal infrastructure for domestic fish marketing, other than the commercial landing centres. This has led to polarization of harbour based infrastructure development and isolation of small centres

High level of occupational risks and also inter and intra sectoral marginalization. There is a lack of positive attitude towards non-fisheries livelihood options. The following aspects of fishery socio economics have to be considered for marching ahead.

- Formulation of a cogent Marine Water Leasing Policy
- Identification of suitable mariculture sites and central sector schemes for community oriented mariculture enterprises (as Open Sea Fishery Estates)
- Biomass augmentation through FADs ,Artificial reefs and Marine parks
- Promotion of export oriented marine ornamental fish culture as a cottage industry and development of Special Fishery Enterprise Development Zones (SFEDZ)
- Empowerment of fisher women through Capacity building interventions through Training programmes
- Incentives for value addition enterprises
- Investment for Coastal infrastructure development (through PPP mode)
- Modernization of domestic fish markets
- Special banking schemes for small scale fishery- related enterprises
- Compulsory registration of craft and optimization of fleet size
- Sea safety measures made mandatory
- Introducing new insurance schemes focusing fishery sector
- Development of bio-shields, installation of early warning systems, and strengthening PFZ delivery.
- Integrated Coastal Zone Development including Responsible Coastal Tourism

Training and capacity building

Great many people are dependent on marine fish as a livelihood source, and the fish resources are being over-exploited. Any natural resource which is continually exploited at such high levels needs administrative and management inputs at sustainable levels.

Management of marine fishery resources is a complex science. The large knowledge base and expertise built up over the years by CMFRI can be used to enlighten the interested stakeholders through short term training course of 1-2 months duration. Short term training courses on topics such as marine fisheries management can be organized. Such courses will benefit fisheries managers and administrators and entrepreneurs in fisheries sector and other stakeholders and will result in the creation of a new generation of fishery managers.

Milestones reached during the eleventh plan (2007-12)

1. **Mariculture through open sea cage culture:**

Open sea culture of finfishes and lobsters was **initiated** at Veraval, Mumbai, Karwar, Mangalore, Cochin, Kanyakumari, Chennai, Kakinada, Visakhapatnam, Srikakulam and Balasore. Very good success was achieved for farming of sea bass at Balasore and for lobster at Vizhinjam. Other experiments with mullets and polyculture are in progress

a. Farming of spiny lobster, a most sought species of shellfish in the international market, was carried out in open sea cages and successfully harvested in February 2010 at Mandapam and Kanyakumari for the first time in the southern coast of the State of Tamil Nadu. The cost of production per crop was Rs.95,000 including Rs.67,000 as the production cost, which included the cost of juveniles, feed, labour and others. The yield of lobsters through a crop could be sold for Rs.2.40 lakh, realizing a net income of Rs.1.46 lakh. It had been proved that cage farming of spiny lobsters could pave the way for the development of commercial level farming ventures in the region through self-help groups. The CMFRI would provide assistance for an economically viable alternate livelihood option for fishermen.

b. The harvest of the integrated fish farming in cage under the NFDB sponsored project was carried out by CMFRI at Moothakunnam near Cochin during June 2010. The seedlings of mullet (*Mugilcephalus*), sea bass (*Latescalcarifer*) and the pearlspot (*Etroplus spp*.) with an average weight of 40-60 g were stocked in 6m dia HDPE cage. The fishes attained 300-600 gm in weight during a period of six months. The harvested fish were handed over to the beneficiaries who auctioned them at the site.

c. CMFRI achieved record growth rate for sea bass at Karwar(June-July 2010) The Asian sea bass *Latescalcarifer* stocked in the cage under the project "Open sea cage farming of finfishes/shell fishes" in the marine cage farm of CMFRI at Karwar achieved a record growth rate with a high FCR which is considered as one of the best FCR obtained anywhere in the world for sea bass culture. 2500 number of seeds introduced in the cage with an average weight of 9 g reached 850 g in weight in 135 days and 2 tonnes of the fish were harvested.

2. At Mandapam Regional Centre of CMFRI a major breakthrough in Cobia breeding and seed production was achieved. Successful broodstock maturation of Cobia was obtained in sea cages for the first time in India by feeding with suitable broodstock diets. Methods for induced breeding were also developed and successful spawning and larval production was achieved. The rearing of larvae is in progress and shortly the techniques for successful seed production will be standardized. The hatchery production of Cobia fingerlings can pave the way for large scale sea-cage farming of Cobia in our country.

3. Pompano brood stock and seed production: This is achieved for the first time in India. It is a rare fish and the World aquaculture production is only 300 tonnes. The species tolerates wide salinity, grows fast and highly suitable for pond farming. Continuous seed production is being carried out and farm trials are going on at different locations.

4. Cobia F_1 :The cobia seed, which were produced during March 2010, attained a size of about 15 kg by September 2011. They also matured and spawned resulting in seed production. Cobia sees are also continuously produced and the farm trials are being carried out at different locations. This is an excellent species for open sea cage culture.

5. CMFRI data base recognized:CMFRI's marine fisheries data base is recognized by the Ministry of Agriculture as the official marine fisheries data of the country. This recognition was regained after a gap of 40 years

6. E-prints@cmfri: CMFRI has established Open Access Institutional Repository, Eprints@CMFRI, for its research publications. Eprints@CMFRI is an open access digital collection containing the research output of CMFRI scientists.
7. Fish Watch: CMFRI has initiated a new system of field information dispensation on a near real time basis. As the first phase of this effort, the fish landing figures and the landing centre price range of important resources at six major fishing harbours of the country are being published as "Fish Watch" in CMFRI website. The landing figures are given in kg starting from 12.00 noon of the first calendar day to 12:00 noon of the subsequent day. These figures are updated at 16.00 hrs on working days.
8. National Marine Fisheries census-2010: The National Marine Fishery Census was commenced on April 16, 2010 across the country and was completed on May 15, 2010
9. Launching of CMFRI Trademark-'Cadalmin': The Central Marine Fisheries Research Institute (CMFRI) has officially registered a trademark entitled 'CADALMIN' for the products and services of the institute
10. CMFRI launched two products namely, Cadalmin TM Green Mussel extract (GMe) and Cadalmin TM Varna-Ornamental Marine Fish Feed. The Cadalmin TM Green Mussel extract (GMe) was launched in March 2010. The product contains 100 per cent natural marine bioactive anti-inflammatory ingredients extracted from green mussel. GMe is an effective green alternative to synthetic non steroidal anti-inflammatory drugs (NSAIDs) to combat Joint pain/arthritis and inflammatory diseases in humans.
11. Hatchery production of the green mussel *Pernaviridis:*
    Nearly one lakh spat of *P.viridis*were produced in the marine hatchery at Regional Centre, Visakhapatnam. This is the first time in India, where large scale spat production in the hatchery has been achieved. This is significant to the mussel farming industry, since farmers are now looking forward to the supply of mussel seed from hatchery to meet the increasing demand of seed for the expanding farming activities especially in northern and central Kerala.
12. Preparation of National Plan of Action on Sharks in collaboration with Bay of Bengal Programme – Inter-governmental Organization with Sri Lanka, Bangladesh and Maldives as other participating countries

The way ahead…..

Marine fisheries, though stagnant now, will continue to be the significant component of the capture fisheries sector in the days to come. In future it will become mandatory to shift from an open access to a regulated regime which in turn demands the establishment of a scientifically informed marine fisheries management system. In the Indian context, management regulations are possible only by considering the socio-economic conditions as well as the intricacies of the multi species tropical ecosystem. There is a need to develop such stock assessment tools that are more sophisticated but sensitive not only to the tropical bio-social reality being manifested both in the inshore and off shore sectors but also the looming effect of climate change. It is also a fact that the major portion of Indian marine fisheries is contributed by the artisanal sector. Providing alternate options of production of fish for the coastal fishermen will be the prime requirement. The orientation of research needs to be on production technologies. A concerted effort by the Institute on development of viable farming methods by taking into account the environmental considerations, biotechnological interventions, biodiversity implications and socio-economics is needed with a vision of enhancing coastal production through sea-farming. The Institute has identified appropriate strategies to overcome these constraints and achieve our goal. The fundamental tenet that guides the envisaged vision is "*Better Science for Better Fisheries*". A networked constituency of informed stakeholders holds the key for future developments in

the sector. Some of our thrust areas to achieve the above development initiatives are given below

- Development of a model for chlorophyll based forecasting of fish and potential yield
- All India Coordinated Research Project on mariculture
- Facilitating a scientifically informed marine fisheries management system. Establishment of a National Fisheries Grid-GIS Platform for strengthening the National Marine Fisheries Information System
- Assessing the health of marine environment and the impact of climate change on marine Fisheries and mariculture
- Developing a comprehensive model on climate change and marine fisheries to build different scenarios and predict fish abundance and fish catches. The impact of climate change on mariculture also needs to be addressed.
- Estimation of biological reference points (or optimum harvesting strategies) for realizing long-term sustainable yields of large pelagics.
- Scaling up sea farming: To establish mariculture as a substantial seafood production sector
- Stock enhancement of depleted finfish and shellfish stock
- Establish a number of bio-secure brood bank to produce seeds of important high value marine fin fishes at a cheaper rate on a large scale to facilitate large scale open sea cage farming
- Conservation of endangered, threatened and vulnerable marine living resource
- Capacity building for process optimization and product development of fish feeds using the state of the art technologies leading to the imitation of nutrigenomics.
- Development of health management packages for the targeted candidate species while formulating viable technology packages for these species.
- Explore and exploit the possibilities in marine bio prospecting
- Developing molecular markers of finfish and shellfish of commercial and mariculture importance
- Valuation of ecosystem services
- Assessing the social cost benefit impacts and the economic performance of fishing methods.
- Constant monitoring of the emerging value chain dynamics, globally as well as regionally
- Policy frame work for marine capture fisheries, deep sea fisheries, island fisheries, coastal mariculture, environmental security, common property resource utilization, sustainability issues, food safety, and WTO commitments for India.

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2

Marine fisheries sector in India-Resource endowments, infrastructure intensities and stakeholder analysis

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World fish production has increased gradually from below 20 million tonnes in 1950 to more than 160 million tonnes in 2009. In a similar fashion the total fish production from India has grown up to around 8 million tonnes in 2010 from below 1 million tonnes in 1950. Marine fish production from India has increased from mere 50,000 tonnes in 1950 to 3.4 million tonnes in 2010. Aquaculture production has reached around 4 million tonnes in 2010 which was almost nil in 1950**.**

The fisheries sector plays an important role in Indian economy and its contribution to the GDP is about one per cent. Export earnings from marine sector have increased from Rs. 3.92 crores in 1961-62 to Rs. 12,901.47 crores in 2010-11 with 11.8 per cent growth during 2009-10. There are 0.99 million active fishermen employed directly and 0.61 million employed indirectly with the marine fisheries sector. The total fisher folk population in the country is 4.00 million and there are about 1,94,490 fishing crafts operated in the country for harvesting marine fishery resources (CMFRI, 2010). Out of this about 72,500 are mechanized crafts, 71,300 are motorized and the rest are non-mechanized. In mechanized sector there are about 35,200 trawlers. Fishing by all these crafts are concentrated in the depth zone up to 100 m. The traditional crafts and motorized crafts are concentrated more in the east coast (72 per cent and 58 per cent) where as the mechanized vessels are more along the west coast (58 per cent).

India is a tropical country with multi-species fishery in the marine sector. Various types of fishing crafts and gears are used for fishing from the seas. The development of fisheries sector in India can be classified into three phases. Prior to 1965-66 is the first phase when landings were mainly by non-mechanized indigenous crafts and gears and the landings remained below one million tonnes during this phase. The second phase is the period upto 1985-86 and the important features of this phase were increased mechanization, improved gear materials, introduction of motorization of country crafts, expansion of export trade etc. The last phase is the period after 1986. This phase featured intensification of mechanization, motorization of country crafts, multi-day voyage fishing etc. The average contribution from west coast is 67 per cent and that from the east coast is 33 per cent. The overall percentage contribution from the four regions are NE 11.4 per cent, SE 22.0 per cent, SW 35.2 per cent and NW 31.4 per cent. Pelagic fin fishes formed 55 per cent, Demersal 26 per cent, Crustaceans 15 per cent and Molluscs 4 per cent. As per the Silas committee (2000), the potential yield of marine fishery resources in the Indian EEZ is 3.93 million tonnes.

There are about 2000 marine species that are caught from the Indian seas. Over years changes have occurred in the type of fishing, crafts and gears used, time spend in

the sea for harvesting the resources, storage and infrastructural facilities, commercial importance, export demand etc. Fish is one of the costliest items of food in the present days. The gross revenue from the marine fish landings during 2009-10 at the point of first sales (landing centre) was estimated at Rs.19,753 crores (CMFRI, 2011). There are more resources that are exported now and from India marine products are exported to nearly 100 countries. Since marine fishery resources are renewable and not in-exhaustible management and conservation of these resources are very much essential for sustained production from the seas. Thus, monitoring the harvest of different marine fishery resources is of great concern. With this view, Central Marine Fisheries Research Institute (CMFRI) has developed a sampling design for collecting the required information and to estimate marine fish landings along with effort expended. The sampling design adopted is based on stratified multi-stage random sampling technique, with stratification over space and time. The harvest potential of each of the commercially important marine fishery resources have to be periodically revalidated along with the optimum size of different types of fleets operating in the fishery.

Table 2.1 Profile of Indian Marine Fisheries

Component		Profile
Physical Component		
	Length of coastline	8129 km
	Exclusive economic zone	2.02 million km2
	Continental shelf	0.50 million km2
	Inshore area (< 50 m depth)	0.18 million km2
	Fishing villages	3288
Human Component		
	Marine fishers population	4.0 million
	Active fishers population	0.99 million
	Fishermen families	0.86 million
Infrastructure Component		
	Landing centers	1511
	Major fishing harbours	6
	Minor fishing harbours	27
	Mechanised vessels	72559
	Motorised vessels	71313
	Non-motorised vessels	50618

Estimation of Marine fish landings in India

India is one among few countries where a system based on sampling theory is used to collect marine fish catch statistics. The sampling design adopted by the CMFRI to estimate marine fish landings is based on stratified multistage random sampling technique, stratification being done over space and time. CMFRI initiated the process of collection of data on marine fish catch, effort, biological parameters etc. based on scientific principles way back in 1947. In 1959 CMFRI initiated collection of marine fish landings data along the west coast of India through a stratified multistage sampling design. The sampling design became operational in 1961 for both East and West coasts.

Table 2.2 Indian Marine Fisheries Statistics

Gross value at landing centre	Rs. 19,753 crores
At retail points	Rs. 28,511 crores
Export earnings	US$ 3.5 billion
Percentage in total exports	3 per cent
Domestic markets	81 per cent fresh; 5 per cent frozen; 6 per cent dry; 5 per cent fish meal
Per capita fish consumption	2.58 kg (range 0.3 – 39)
Share in GDP	1.1 per cent
Share in agricultural GDP	5.4 per cent
Infrastructure Component	
Landing centers	1511
Major fishing harbours	6
Minor fishing harbours	27
Mechanised vessels	72559
Motorised vessels	71313
Non-motorised vessels	50618

Marine Fish Production

Table 2.3 Top-ten Resources by Value (Landing centre prices)

Rank	Resource/ Stock	Rs. Billion	US$ Million
1	Penaeid shrimps	43.4	964.4
2.	Sardines	10.7	237.8
3.	Cephalopods	9.0	200.0
4.	Seer fishes	6.0	133.4
5.	Pomfrets	5.8	128.9
6.	Croakers	4.6	102.2
7.	Carangids	4.6	102.2
8.	Mackerel	3.9	86.7
9.	Perches	3.9	86.7
10.	Bombay duck	2.5	55.6
11.	Others	15.6	346.7
12.	TOTAL	110.1	2446.7

Table 2.4 Top-ten Resources by Quantity (lakh tonnes)

Name of fish	Average landings (2006-2010)	Per centage
Oil sardine	4.48	14.60
Penaeid prawns	2.16	7.05
Indian mackerel	1.87	6.09
Croakers	1.71	5.57
Ribbon fishes	1.64	5.35
Non-penaeid prawns	1.58	5.14
Threadfin breams	1.18	3.86
Bombayduck	1.11	3.62
Other sardines	0.98	3.21
Catfishes	0.81	2.64
Total	30.67	

Table 2.5 State wise contribution in marine fish landings (lakh tonnes)

State	2010		Average (2006-2010)	
	Landings	Per cent	Landings	Per cent
Kerala	6.08	18.31	5.99	18.44
Gujarat	5.86	17.63	5.83	17.96
Tamil Nadu	5.09	15.32	4.90	15.08
Karnataka	3.86	11.61	3.34	10.28
West Bengal	3.59	10.82	3.39	10.43
Orissa	2.91	8.76	2.54	7.83
Andhra Pradesh	2.41	7.27	2.41	7.43
Maharashtra	2.41	7.26	3.04	9.36
Goa	0.89	2.69	0.90	2.79
Pondicherry	0.11	0.33	0.13	0.39
Total	33.22	100.00	32.46	100.00

Table 2.6 Gear wise contribution in marine fish landings (2006-2010 average)

Gear Name	Landings (lakh tonnes)	per cent	CPUE (Kg/unit)	CPUE (Kg/hour)
Mechanized Trawlnet	16.37	49.52	1242	44
Mechanized Dolnet	2.30	6.96	511	53
Mechanized Gillnet	1.99	6.03	463	17
Mechanized Purseine	1.88	5.69	2331	414
Mechanized Ringseine	1.42	4.31	2584	1157
Mechanized Bagnet	0.40	1.21	364	38
Mechanized Hooks & Lines	0.04	0.13	286	12
Mechanized Driftnet	0.03	0.09	167	15
Other mechanized gears	0.18	0.56	2655	27
Outboard Gillnet	3.34	10.09	82	15
Outboard Ringseine	2.13	6.45	1121	589
Outboard Hooks & Lines	0.56	1.71	77	14
Outboard Bagnet	0.33	1.00	259	50
Outboard Boat seine	0.20	0.61	253	84
Outboard Purseine	0.19	0.56	748	255
Other outboard gears	0.36	1.10	134	28
Non-mechanized gears	1.32	4.00	48	13
Total	33.05	100.00		

What do we exploit from the sea?

Marine fisheries in India is a multi-species fishery. Around 1400 finfish species are harvested from the sea of which 263 are commercially important. Apart from this 36 species of penaeid shrimps and 34 species of cephalopods are also harvested in which 15 species of penaeids and 8 species of cephalopods are commercially important.

How the exploitation is carried out?

The marine fishery resources from the Indian seas are harvested using more than 35 different types of craft gear combinations. The major crafts used are of three different categories namely mechanized, motorized and non-motorized. The mechanized sector include trawlers, gill-netters and inboard vessels. Most of the crafts in the mechanized sector use machines for both propulsion and operation of the gear. The motorized sector exclusively consists of crafts fitted with outboard engines. The non-motorized sector consists of traditional vessels made up of wood, fibre glass, thermo coal etc. and do not use any machine power either for propulsion or for operation of the gear. Major gears used in the marine fisheries sector are trawl nets, gill nets, bag nets, hooks & lines and seines.

Trawl fisheries

It is the major gear accounting for 44 per cent of landings. Number of trawlers and engine horse power increased over time. The Deep sea fishing is done upto 400 m depth from 1999. The medium trawlers undertake multi-day voyages. They carry different trawl nets having different cod-end mesh sizes (15 to 35 mm) to target c high value resources. Penaeid shrimps form the main catch. High opening trawls catch squid, cuttle fish and fishes. Finfishes exploited by trawls belong to 21 major groups.

Seine Fisheries

Ring Seine is the most popular seining method for the pelagics along Kerala coast. Purse seiners operated in Kerala, Karnataka, Goa and Maharashtra. Main species - small pelagics such as oil sardine, lesser sardines, anchovies and mackerel.

Gillnet Fisheries

The gillnet catches increased by more than 4 times in recent years (5.8 lakh t in 2008). Share of mechanized gillnetters increased compared to outboard gillnetters. Small meshed gillnets catch clupeids and croakers. Large meshed gill nets catch sharks, seerfish, mackerels, catfishes, pomfrets, tunas and carangids

Bag net Fisheries

Major gear used by artisanal fishers along NW and NE coasts. Gujarat and Maharashtra, a fixed variety of bag nets (Dolnets). Dolnets operate upto 40 m. 80 per cent of the bag net fisheries come from the mechanized dolnetters. Resources caught are non-penaeid shrimps (Acetesindicus), Bombay duck (Harpadonnehereus), golden anchovy (Coiliadussumeiri) as well as penaeid shrimps and ribbonfishes.

Hooks and Line Fisheries

The hooks and lines fisheries contributes to 2 per cent of the all India marine fish catch. They target large pelagic fishes such as sharks, tunas and barracudas. Development schemes promote hooks and lines fisheries particularly the modern version - long line fishing for tunas.

Artisanal Fisheries

It dwindled with the advent of mechanization from 88 per cent in 1960 to 2 per cent recently. Catamaran and plank built boats have been motorised.

Bivalve fishery

Clams and mussels mainly in inland waters and bays; hand picking and by dredge. Kerala leads in the production of clams - 66,000 tons (t) in 2008-09

Marine Fisheries Management in India

In India, fishery in general is open access fishery which is governed by different acts introduced by the government over years

- Indian Fisheries Act, 1897
- The Wild Life (Protection) Act, 1972
- MFR (regulation) Bill, 1978 formulated after the EEZ declaration
- MFRA of maritime states enacted from 1980 in all maritime states
- Maritime Zones of India Act, 1981
- Environment (Protection) Act, 1986

Regulatory Measures

- Closed season
- Closed fishing areas
- Marine Protected Areas (MPAs)
- Protected Species
- Ban on certain destructive fishing gears and methods
- Minimum mesh size regulation
- Minimum legal size at capture
- Use of Turtle Excluder Device (TED) in trawls in Orissa

Table 2.7 Closed Season for Mechanized Sector

State	Months	Days
Gujarat	June - August	45
Maharashtra	June - August	45
Goa	June - August	45
Karnataka	June - August	45
Kerala	June - August	45
Tamil Nadu	April - May	45
Andhra Pradesh	April - May	45
Orissa	April - May	45
West Bengal	April - May	45

Table 2.8 Spatial closures throughout the coastal states

State	Reserved for traditional vessels	Available to mechanized vessels
Goa	Up to 5 km	Beyond 5 km
Kerala	Up to 10 km	<25 GRT: 10-22 km; >25 GRT: beyond 23 km
Karnataka	Up to 6 km	<15m LOA: 6-20 km; >15m LOA: beyond 20 km
Maharashtra	Up to 5-10 fathom	Beyond 10 fathom depth
Tamil Nadu	Up to 3.4 nautical miles	Beyond to 3.4 nautical miles
Andhra Pradesh	Up to 10 km	<20m LOA: 10-23 km; >20m LOA: beyond 23 km
Orissa	Up to 5 km	<15m LOA: 5-10km; >15m LOA: beyond 20 km

Marine Protected Areas (MPAs)

- Currently, there are 31 MPAs (majority in A&N)
- The current area under MPAs is 6.16 per cent of the area in the coastal biogeographic, which is proposed to be expanded to 7.12 per cent
- Oil wells in Bombay High and Godavari Basin also function as MPAs

Table 2.9 Protected Species(under Indian Wildlife Protection Act, 1972)

Species/ Group	Number
Molluscs	24 species
Elasmobranchs	10 species
Grouper fish	1 species
Sea horses	All species
Sea Cucumber	All species
Sponges and seafans	All species
Corals	All species
Turtles	All 5 species
Whales, dolphins, sea cow	All species

Table 2.10 Minimum Legal Sizes

Species	Weight (g)/ Length (mm)
Panuliruspolyphagus	300 g
P. homarus	200 g
P. ornatus	500 g
Thenusorientalis	150 g
Pampusargenteus	200 g
Loligoduvauceli	80 mm
Sepia pharaonis	115 mm
Octopus membranaceous	45 mm

Ban on Destructive Fishing Methods

- Dynamite fishing
- Cyanide poisoning
- Pair trawling in GoM and Palk Bay
- Thalluvalai (minitrawl) in GoM and Palk Bay

Management and conservation of the resources

- Ecosystem-based fisheries management (EBFM) better than single species management ecosystem evaluation and modeling, can predict changes
- Bycatch reduction- BRDs and semi pelagic trawling
- Capacity reduction- limit entry, buyback
- Understanding climate variability and fisheries-improved information on climate and effects made available
- Implementation of CCRF -overexploitation of stocks, damage to ecosystems, trade issues: ecolabelling
- Natural hazards – disaster management plans
- Mariculture- potential mariculture site identification
- Development of Infrastructure- post harvest loss -15 per cent, public investment, VMS, better domestic marketing
- Diversification of vessels and deep sea fishing- 1.3 lakh t of deep sea resources- tuna longliners and squid jiggers
- Diversification of products -value added products
- Utilization of fish waste to useful products
- Marine Protected Areas (MPAs)-area to expand to 7.12 per cent

Habitat degradation

- Water contamination
- Enforcement of standards for water discharge
- Maintaining the quality of river runoff
- Reducing greenhouse gas emissions

Major items of export

Frozen Shrimp continued to be the major export value item accounting for 49.63 per cent of the total US $ earnings. Shrimp exports during the period increased by 24.86 per cent, 42.97 per cent and 37.99 per cent in quantity, rupee value and US$ value respectively. Fish, has retained its position as the principal export item in quantity terms and the second largest export item in value terms, accounted for a share of about 40.27 per cent in quantity and 19.48 per cent in US$ earnings. Frozen Cuttlefish recorded a growth of 21.92 per cent in rupee value and 15.58 per cent in USD terms. Unit value also increased by 25.06 per cent, however, there is a decline in quantity (7.59 per cent). Export of Frozen Squid showed an increase of 21.53 per cent in rupee value and 17.46 per cent in US$ realization. Unit value also increased by 32.95 per cent. However, there is a decrease of 11.65 per cent in terms of quantity. Live items also showed a growth of 8.76 per cent in terms of rupee value and 3.18 per cent in terms of US$ realization compared to the previous year. Dried items showed a drastic decline in quantity, value and US$ terms by 32.05 per cent. 41.08 per cent, and 44.56 per cent respectively. (Figure2.1)

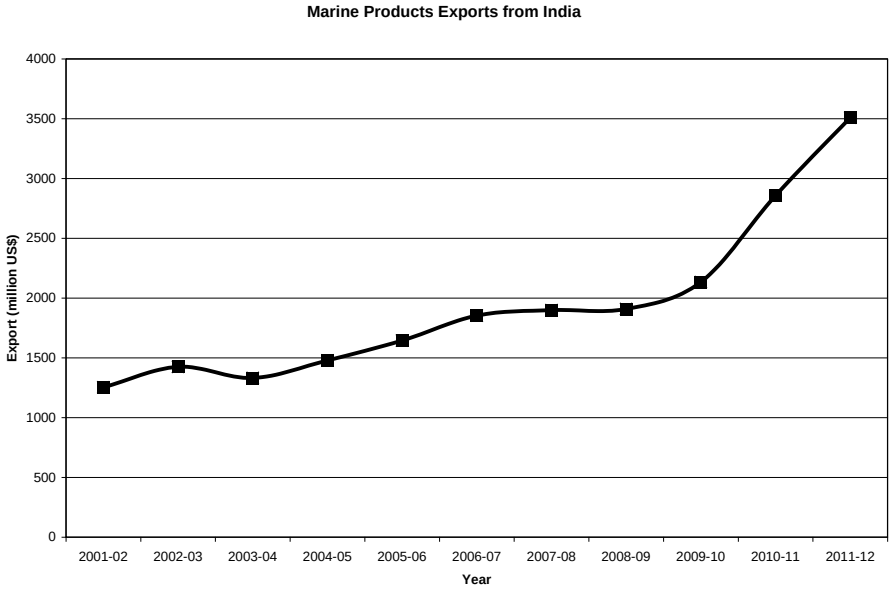

Figure 2.1 Marine Products Exports from India- Total

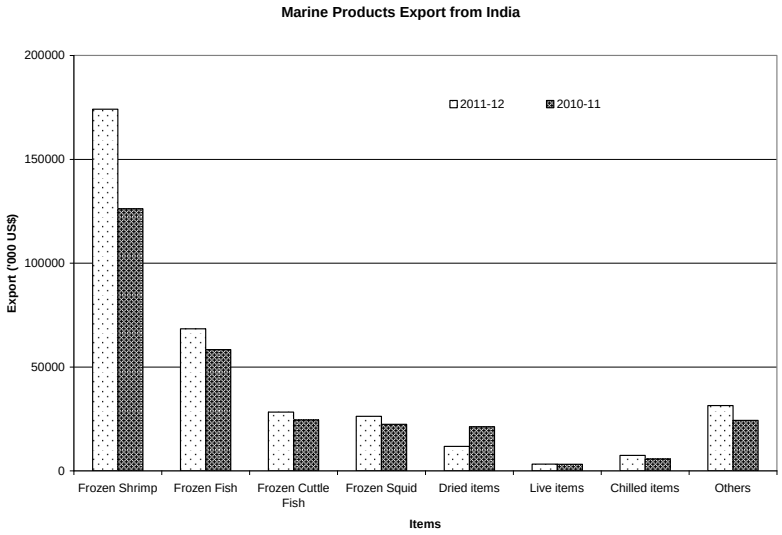

Figure2.2 Marine Products Exports from India –Commodity (Value)

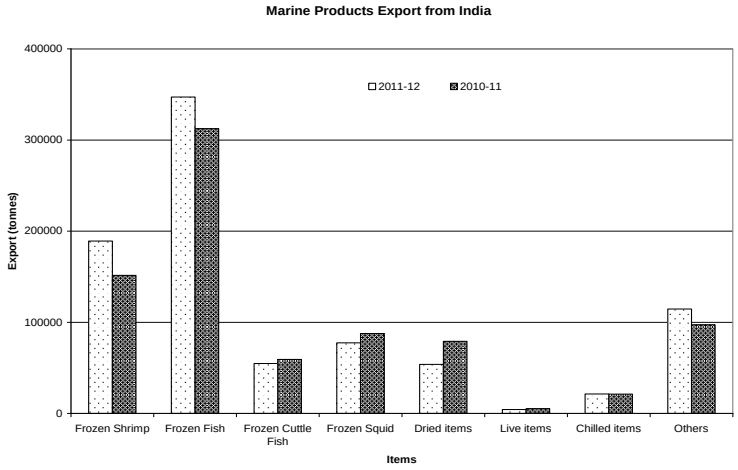

Figure2.3 Marine Products Exports from India –Commodity (Quantity)

Major export markets

As per the current status the largest buyer of Indian marine products is South East Asia with 39.9 per cent share in volume and 25.09 per cent share in value (US$). The next highest buyer is European Union with 22.96 per cent share in volume followed by USA 18.17 per cent, Japan 13.01 per cent, China 7.51 per cent, Middle East 5.33 per cent and 7.5 per cent to other countries. Export to South East Asia recorded a growth of 45.01 per cent in volume and 87.51 per cent in US$ realization. This is mainly due to the increased export of Frozen Shrimp, Frozen Fish and Chilled items. Exports to United States registered a growth of 36.45 per cent in quantity and 45.39 per cent in value (US$ realization) and this is mainly due to increased export of Frozen Shrimp and cephalopods.

Exports of Vannamei shrimp showed a tremendous increase in US market by 212 per cent in quantity and 209 per cent in US $ realization. Export to Japan also registered a positive growth of 21.33 per cent in quantity and 22.35 per cent in US $ terms. Exports of chilled items showed a tremendous increase in Japanese market by 120.12 per cent in quantity and 220.34 per cent in US $ realization. Exports to China showed a drastic decline of 46.89 per cent in quantity and 40.17 per cent in US$ terms. The marine products exports have strengthened India's presence in South East Asia. There is a significant increase in

exports to South East Asian Countries compared to the previous year. Export of Fr. Shrimp to South East Asia has registered a growth of about 222.43 per cent in volume and 356.36 per cent in US$ terms. Export of Fr. Shrimp to USA has also showed a growth of about 47.68 per cent in volume and 47.55 per cent in US$ terms. Export of Vannamei shrimp had also picked up. We have exported about 40787 MT of Vannamei shrimp during this period. Export to Middle East countries showed an increase of 25.98 per cent in US$ realization but declined in quantity by 13.25 per cent. The details are given in the following table.

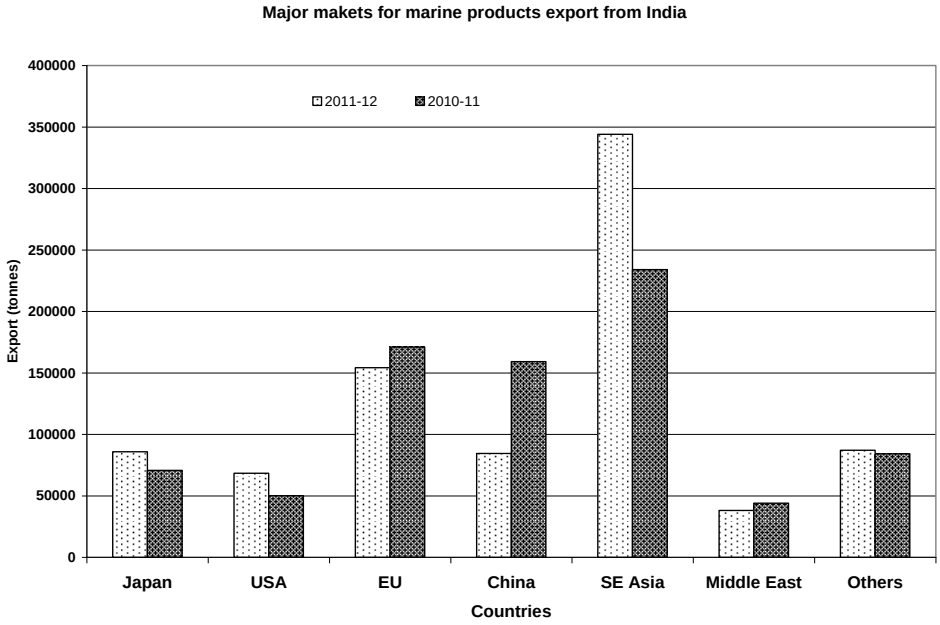

Figure2.4 Major markets for marine products export from in India (Quantity)

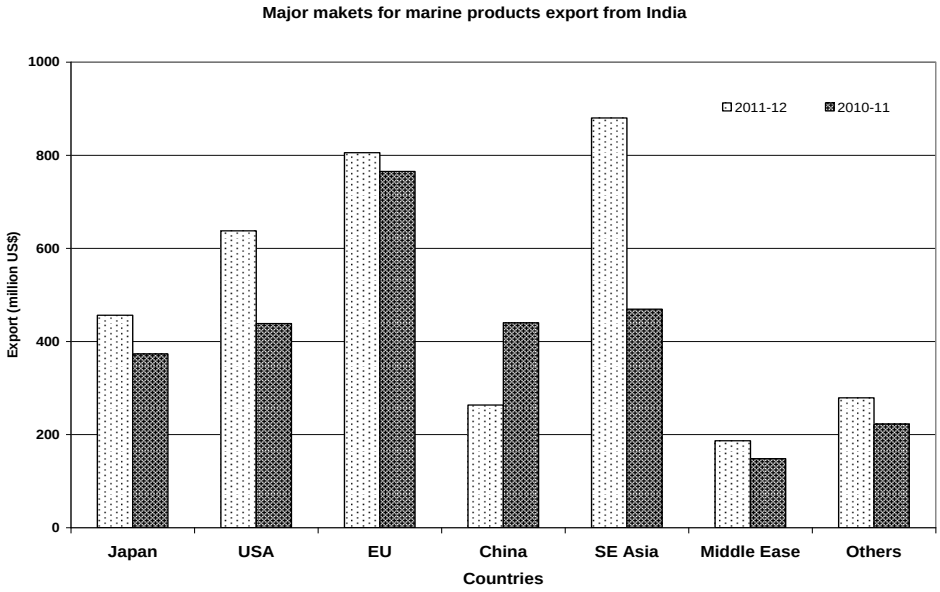

Figure2.5 Major markets for marine products export from in India (Value)

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From GATT to WTO and the way forward /The WTO Agreement: A Historical Perspective

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At the end of the Second World War, alongside the two international financial institutions, the International Monetary Fund and International Bank for Reconstruction and Development (World Bank), the United States and United Kingdom led an effort to create a permanent international institution governing world trade in goods. The original intention was to create a third institution to handle the trade side of international economic cooperation. Over 50 countries participated in negotiations to create an International Trade Organization (ITO) as a specialized agency of the United Nations at a UN Conference on Trade and Employment in Havana, Cuba in 1947.

Meanwhile, 15 countries had begun talks in December 1945 to reduce and bind customs tariffs. With the Second World War only recently ended, they wanted to give an early boost to trade liberalization, and correct the legacy of protectionist measures which remained in place from the early 1930s. This first round of negotiations resulted in a package of trade rules and 45,000 tariff concessions affecting $10 billion of world trade. The group had expanded to 23 by the time the deal was signed on 30 October 1947. And so the new General Agreement on Tariffs and Trade (GATT) was born, with 23 founding members (officially "contracting parties").The Havana conference began on 21 November 1947, less than a month after GATT was signed. The tariff concessions came into effect by 30 June 1948 through a "Protocol of Provisional Application". The 23 signatory nations of GATT were also part of the larger group negotiating the ITO Charter, which was finally agreed in Havana in March 1948. The ratification of this agreement in some national legislatures proved impossible and the most serious opposition was in the US Congress. In 1950, the United States government announced that it would not seek Congressional ratification of the Havana Charter, and the ITO was effectively dead. So, the GATT became the only multilateral instrument governing international trade from 1948 until the WTO was established in 1995.

From 1948 to 1994, the General Agreement on Tariffs and Trade (GATT) provided the rules for much of world trade. The system of rules was developed through a series of trade negotiations, or rounds, held under GATT. Since GATT's creation in 1947-48 there have been eight rounds of trade negotiations. The first rounds dealt mainly with tariff reductions but later negotiations included other areas such as anti-dumping and non-tariff measures. The GATT was a provisional agreement and for almost half a century, the GATT's basic legal principles remained much as they were in 1948. There were additions in the form of a section on development added in the 1960s and "plurilateral" agreements in the 1970s, and efforts to reduce tariffs further continued. Much of this was achieved through the series of multilateral negotiations known as the "trade rounds". In the early years, the GATT trade rounds concentrated on further reduction of tariffs. Then, the Kennedy Round in the

mid-sixties brought about a GATT Anti-Dumping Agreement and a section on development. The Tokyo Round which lasted from 1973-1979, with 102 participating countries was the first major attempt to tackle trade barriers that do not take the form of tariffs. The Tokyo Round failed to come to an agreement with regard to the fundamental problems affecting farm trade and also stopped short of providing a modified agreement on "safeguards" (emergency import measures). Nevertheless, a series of agreements on non-tariff barriers did emerge from the negotiations, either by interpreting existing GATT rules or forming entirely new ones. In most cases, only a relatively small number of (mainly industrialized) GATT members subscribed to these agreements and arrangements. Because they were not accepted by the full GATT membership, they were often informally called "codes". Even though they could not be called as multilateral, they marked a beginning. The eighth trade round, the Uruguay Round of 1986–94, was the last and most extensive of all and it led to the formation of the World Trade Organization (WTO) and a new set of agreements.

GATT was provisional with a limited field of action, but its success over 47 years in promoting and securing the liberalization of much of the world trade is incontestable. Continual reductions in tariffs alone helped spur very high rates of world trade growth during the 1950s and 1960s, on an average at around eight per cent per year. The rush of new members during the Uruguay Round demonstrated that the multilateral trading system was recognized as an anchor for development and an instrument of economic and trade reform. As time passed new problems arose and the Tokyo Round in the 1970s was an attempt to tackle some of these but its achievements were limited. GATT's success in reducing tariffs to such a low level, combined with a series of economic recessions in the 1970s and early 1980s, drove governments to devise other forms of protection for sectors facing increased foreign competition. High rates of unemployment and constant factory closures led governments in Western Europe and North America to seek bilateral market-sharing arrangements with competitors and to embark on a subsidies race to maintain their holds on agricultural trade. Both these changes undermined GATT's credibility and effectiveness. The problem was not just a deteriorating trade policy environment. By the early 1980s the General Agreement was clearly no longer as relevant to the realities of world trade as it had been in the 1940s. For a start, world trade had become far more complex and important than 40 years before: the globalization of the world economy was underway, trade in services, not covered by GATT rules, was of major interest to more and more countries, and international investment had expanded. The expansion of services trade was also closely tied to further increases in world merchandise trade. In other respects, GATT had been found wanting. For instance, in agriculture, loopholes in the multilateral system were heavily exploited, and efforts at liberalizing agricultural trade met with little success. In the textiles and clothing sector, an exception to GATT's normal disciplines was negotiated in the 1960s and early 1970s, leading to the Multi-fibre Arrangement. Even GATT's institutional structure and its dispute settlement system were causing concern. These and other factors convinced GATT members that a new effort to reinforce and extend the multilateral system should be attempted. That effort resulted in the Uruguay Round, the Marrakesh Declaration, and the creation of the WTO.

Table 3.1 The Eight Rounds of GATT

Year	Place/name	Subjects Covered	Participating Countries
1947	Geneva	Tariffs	23
1949	Annecy, France	Tariffs	13
1951	Torquay, England	Tariffs	38
1956	Geneva	Tariffs	26
1960-1961	Geneva- Dillon Round	Tariffs	26
1964-1967	Geneva -Kennedy Round	Tariffs and anti-dumping measures	62
1973-79	Geneva -Tokyo Round	Tariffs, Non-tariff measures, framework agreements	102
1986-1994	Geneva -Uruguay Round	Tariffs, non-tariff measures, rules, services, intellectual property, dispute settlement, textiles, agriculture, creation of WTO, etc	123

The Uruguay Round

It took seven and a half years for the Uruguay round to come to a conclusion. The seeds of the Uruguay Round were sown in November 1982 at a ministerial meeting of GATT members in Geneva. Although the ministers intended to launch a major and new negotiation, the conference stalled on agriculture and was widely regarded as a failure. Nevertheless, it took four more years of exploring, clarifying issues and painstaking consensus-building, before ministers agreed to launch the new round. They did so in September 1986, in Punta del Este, Uruguay. They eventually accepted a negotiating agenda that covered virtually every outstanding trade policy issue. The talks were going to extend the trading system into several new areas, notably trade in services and intellectual property, and to reform trade in the sensitive sectors of agriculture and textiles. Two years later, in December 1988, ministers met again in Montreal, Canada, for what was supposed to be an assessment of progress at the round's half-way point. The purpose was to clarify the agenda for the remaining two years, but the talks ended in a deadlock that was not resolved until officials met more quietly in Geneva the following April. Despite the difficulty, during the Montreal meeting, ministers did agree a package of early results. These included some concessions on market access for tropical products aimed at assisting developing countries, a streamlined dispute settlement system, and the Trade Policy Review Mechanism which provided for the first comprehensive, systematic and regular reviews of national trade policies and practices of GATT members. The round was supposed to end when ministers

met once more in Brussels, in December 1990. But they disagreed on how to reform agricultural trade and decided to extend the talks.

Despite the poor political outlook, a considerable amount of technical work continued, leading to the first draft of a final legal agreement. This draft "Final Act" was compiled by the then GATT director-general, Arthur Dunkel, who chaired the negotiations at officials' level. It was put on the table in Geneva in December 1991. In November 1992, the US and EU settled most of their differences on agriculture in a deal known informally as the "Blair House accord". By July 1993 the "Quad" (US, EU, Japan and Canada) announced significant progress in negotiations on tariffs and related subjects ("market access"). The original Uruguay Round subjects included tariffs, non-tariff barriers, natural resource products, textiles and clothing, agriculture, tropical products, anti-dumping, subsidies, Intellectual property, investment measures, dispute settlement etc. It took until 15 December 1993 for every issue to be finally resolved and for negotiations on market access for goods and services to be concluded. On 15 April 1994, the deal was signed by ministers from most of the 123 participating governments at a meeting in Marrakesh, Morocco.

The World Trade Organization (WTO) is the legal and institutional foundation of the multilateral trading system. It provides the principal contractual obligations determining how governments frame and implement domestic trade legislation and regulations. It also serves as the platform on which trade relations among countries evolve through collective debate, negotiation and adjudication. The WTO was established on 1 January 1995. Governments concluded the Uruguay Round negotiations on 15 December 1993 and Ministers gave their political backing to the results by signing the Final Act in Marrakesh, Morocco, on 14 April 1994. The "Marrakesh Declaration" affirmed that the results of the Uruguay Round would "strengthen the world economy and lead to more trade, investment, employment and income growth throughout the world". The WTO is the embodiment of the Uruguay Round results and the successor to the General Agreement on Tariffs and Trade (GATT). It held its first Ministerial Conference in Singapore from 9 to 13 December 1996.

The GATT versus WTO

The WTO replaced GATT as an international organization, but the General Agreement still exists as the WTO's umbrella treaty for trade in goods, updated as a result of the Uruguay Round negotiations (as GATT 1994). Not only does the WTO have a potentially larger membership than GATT (128 by the end of 1994), it also has a much broader scope in terms of the commercial activity and trade policies to which it applies. The GATT covered trade in goods; the WTO covers trade in goods, trade in services and "trade in ideas" or intellectual property. Prior to establishment of WTO, only trade in goods was subject to multilateral rules. These rules were codified in the General Agreement on Tariffs and Trade (GATT). Upon creation, the WTO subsumed GATT within itself and added to it the General Agreement on Trade in Services (GATS) and the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs). These latter agreements brought trade in services and intellectual property rights, respectively, within the ambit of multilateral rules. While GATT was officially a legal text with contracting parties, WTO is an organisation with members. Unlike GATT which was ad hoc and provisional, WTO is permanent. WTO has sound legal basis as the members have ratified the Agreement in their parliaments while GATT was never ratified in the respective parliaments. The dispute settlement system in WTO was stronger, faster and more automatic and the rulings could not be blocked in WTO.

The **principal functions** of WTO are

(i) Administering and implementing the multilateral and plurilateral trade agreements
(ii) Settling trade disputes
(iii) Conducting trade policy reviews of its members, and
(iv) Acting as a forum for multilateral trade negotiations.
(v) Cooperating with other international institutions involved in global economic policy making.

The Agreement: The WTO Agreement contains 29 individual legal texts which lay out the procedures and rules for trade in services and goods and for enforcing intellectual property rights. The WTO also comprises the GATT 1994 Agreements on trade in goods. The World Trade Organization (WTO) deals with the global rules of trade between nations. Its main function is to ensure that trade flows as smoothly, predictably and freely as possible
Structure of WTO: The structure of the WTO is dominated by its highest authority, the **Ministerial Conference**, composed of representatives of all the WTO Members. It is required to meet at least every two years and can take decisions on all matters under any of the multilateral trade agreements. Below this is the General Council, which meets several times a year in the WTO headquarters at Geneva. The day-to-day work of the WTO falls to a number of subsidiary bodies, principally the **General Council**, composed of all WTO Members and reports to the Ministerial Conference. The General Council is the WTO body entrusted with carrying out the functions of the WTO, and taking action necessary to this effect, in the intervals between meetings of the Ministerial Conference, in addition to carrying out the specific tasks assigned to it by the WTO Agreement by taking up the task of overseeing the operation and implementation of the multilateral trading system embodied in the WTO Agreement. The General Council also convenes in two other forms – as the **Dispute Settlement Body**, to oversee the dispute settlement procedures, and as the **Trade Policy Review Body**, which conducts regular reviews of WTO Members' trade policies and practices. Other main bodies which report to the General Council are the **Council for Trade in Goods**, the **Council for Trade in Services** and the **Council for Trade-Related Aspects of Intellectual Property Rights**. Under these Councils are numerous specialized committees, working groups and working parties dealing with the individual agreements and other areas such as the environment, development, membership applications and Regional Trade Agreements.

Membership: The WTO membership is open to states or customs territories with full autonomy over their external commercial relations. To join the WTO, a government has to bring its economic and trade policies in line with WTO rules and principles, and negotiate with individual trading partners on specific concessions and commitments on goods and services. It can take many years for country to become a WTO member, which requires the full support and consensus of the existing membership. However, the accession process is designed to ensure that new members are able to participate fully in the multilateral trading system from the outset. The WTO currently has 157 members accounting for 97 per cent of global trade.

Timeline of GATT and the WTO
1944: At the Bretton Woods Conference, which created the World Bank and International Monetary Fund (IMF), there is talk of a third organization, the International Trade Organization (ITO).
1947: As support for another international organization wanes in the U.S. Congress, the General Agreement on Tariffs and Trade (GATT) is created. The GATT treaty creates a set of rules to govern trade among 23 member countries rather than a formal institution.
1950: Formal U.S. withdrawal from the ITO concept as the U.S. administration abandons efforts to seek ratification of the ITO at the congress.
1951–86: Periodic negotiating rounds occur, with occasional discussions of reforms of GATT. In the 1980s, serious problems with dispute resolutions arise.
1986–94: The Uruguay Round, a new round of trade negotiations, is launched. This culminates in a 1994 treaty that establishes the World Trade Organization (WTO).
1995: The WTO is created at the end of the Uruguay Round, replacing GATT.
1996: Singapore Ministerial Conference
1998: Seattle Ministerial Conference
2000 January : Negotiations begin on Services
2000 February : Negotiations begin on Agriculture
2001: Doha, Qatar
2003: Cancun Ministerial Conference
2005: Hongkong Ministerial Conference
2009: Geneva Ministerial Conference
2011: Geneva Ministerial Conference
2012: The WTO consists of 157 members, accounting for approximately 97 per cent of world trade.

Philosophy of WTO

(i) Trade contributes to growth and development.
(ii) Trade liberalisation is to be achieved through reduction of tariff and non-tariff barriers.
(iii) Predictability and security of trade through binding commitments increases trade.
(iv) Well-defined rules on all matters relating on trade will have a positive impact on trade.

Principles of WTO

1. Most-Favoured Nation (MFN) Treatment:

The basic idea is "treating other people equally". Under the WTO agreements, countries cannot normally discriminate between their trading partners. If a special favour such as a lower import duty rate for one of the products is granted to one country and the importing country has to do the same for all other WTO members. This principle is known as Most-Favoured Nation (MFN) treatment. It is so important that it is the first article of the General Agreement on Tariffs and Trade (GATT), which governs trade in goods. In general, MFN means that every time a country lowers a trade barrier or opens up a market, it has to do so for the same goods or services from all its trading partners, whether rich or poor, weak or strong.

2. National treatment:

The basic idea behind this principle is "treating foreigners and locals equally". As per this principle, imported and locally produced goods should be treated equally, at least after the foreign goods have entered the market. The same should apply to foreign and domestic services, and to foreign and local trademarks, copyrights and patents. National treatment only applies once a product, service or item of intellectual property has entered the market.

Therefore, charging customs duty on an import is not a violation of national treatment even if locally-produced products are not charged an equivalent tax.

3. Freer trade:

Freer trade is to be promoted "gradually through negotiations". Lowering trade barriers is one of the most obvious means of encouraging trade. The barriers concerned include customs duties (or tariffs) and measures such as import bans or quotas that restrict quantities selectively. From time to time other issues such as red tape and exchange rate policies have also been discussed. The WTO agreements allow countries to introduce changes gradually, through "progressive liberalization". Developing countries are usually given extended time to fulfil their obligations.

4. Predictability:

Predictability in international trade is to be encouraged through "binding and transparency". With stability and predictability on tariffs, investment is encouraged, jobs are created and consumers can fully enjoy the benefits of competition, choice and lower prices. In the WTO, when countries agree to open their markets for goods or services, they "bind" their commitments. For goods, these bindings amount to ceilings on customs tariff rates. One of the achievements of the Uruguay Round of multilateral trade talks was to increase the amount of trade under binding commitments. In agriculture, 100 per cent of products now have bound tariffs. The result of all this: a substantially higher degree of market security for traders and investors. The system tries to improve predictability and stability in other ways as well. One way is to discourage the use of quotas and other measures used to set limits on quantities of imports, administering quotas can lead to more red-tape and accusations of unfair play. Another is to make countries' trade rules as clear and public ("transparent") as possible.

5. Promoting fair competition

The WTO is a system of rules dedicated to open, fair and undistorted competition. The rules on non-discrimination, dumping (exporting at below cost to gain market share) and subsidies are designed to secure fair conditions of trade. The rules try to establish what is fair or unfair, and how governments can respond, in particular by charging additional import duties calculated to compensate for damage caused by unfair trade. Many of the other WTO agreements aim to support fair competition: in agriculture, intellectual property, services etc.

6. Encouraging development and economic reform

The WTO system contributes to development. On the other hand, developing countries need flexibility in the time they take to implement the system's agreements. And the agreements themselves inherit the earlier provisions of GATT that allow for special assistance and trade concessions for developing countries.

The WTO Agreements

The WTO agreements cover goods, services and intellectual property. The current set of agreements was the outcome of the 1986–94 Uruguay Round negotiations which included a major revision of the original General Agreement on Tariffs and Trade (GATT). They spell out the principles of liberalization, and the permitted exceptions. They include individual countries' commitments to lower customs tariffs and other trade barriers on

goods, and to open and keep open services markets. They set procedures for settling disputes and also prescribe special treatment for developing countries. The agreements also require governments to make their trade policies transparent by notifying the WTO about laws in force and measures adopted, and through regular reports by the secretariat on countries' trade policies. Through these agreements, WTO members operate a non-discriminatory trading system that spells out their rights and their obligations. Each country receives guarantees that its exports will be treated fairly and consistently in other countries' markets. Each promises to do the same for imports into its own market. The system also gives developing countries some flexibility in implementing their commitments.

These agreements are often called the WTO's trade rules, and the WTO is often described as "rules-based", a system based on rules. The agreements fall into a simple structure with six main parts: an umbrella agreement (the Marakkesh Agreement Establishing the WTO); agreements for each of the three broad areas of trade that the WTO covers (goods, services and intellectual property); dispute settlement; and reviews of governments' trade policies. The agreements for the two largest areas, goods and services, share a common three-part outline, even though the details are sometimes quite different. They start with broad principles: the General Agreement on Tariffs and Trade (GATT) (for goods), the General Agreement on Trade in Services (GATS) and the Trade-Related Aspects of Intellectual Property Rights (TRIPS**)**. From 1947 to 1994, the GATT was the forum for negotiating lower customs duty rates and other trade barriers for trade in goods; particularly non-discrimination. Since 1995, the updated GATT (GATT 1947 to GATT 1994) has become the WTO's umbrella agreement for trade in goods. It has annexes dealing with specific sectors such as agriculture and textiles, and with specific issues such as state trading, product standards, subsidies and actions taken against dumping. Banks, insurance firms, telecommunications companies, tour operators, hotel chains and transport companies looking to do business abroad can now benefit from the same principles of freer and fairer trade that originally only applied to trade in goods. These principles appear in the new General Agreement on Trade in Services (GATS). WTO members have also made individual commitments under GATS stating which of their services sectors they are willing to open to foreign competition, and how open those markets are. The WTO's intellectual property agreement amounts to rules for trade and investment in ideas and creativity. The rules state how copyrights, patents, trademarks, geographical names used to identify products, industrial designs, integrated circuit layout-designs and undisclosed information such as trade secrets, "intellectual property", should be protected when trade is involved.

Table 3.2 Agreement in Nutshell

Umbrella	Agreement Establishing the World Trade Organization		
	Goods	*Services*	*Intellectual Property*
Basic Principles	General Agreement on Tariff and Trade (GATT)	General Agreement on Trade in Services (GATS)	Trade Related Aspects of Intellectual Property Rights (TRIPS)
Additional Details	Other goods Agreements and Annexes	Services Annexes	-
Market Access Commitments	Countries' Schedule of Commitments	Countries' Schedule of Commitments & Exemptions	-
Dispute Settlement	----------Dispute Settlement----------		
Transparency	----------Trade Policy Reviews----------		

Then there are **extra agreements and annexes** dealing with the special requirements of specific sectors or issues. Finally, there are the detailed and lengthy **schedules (or lists) of commitments** made by individual countries allowing specific foreign products or service-providers access to their markets. For GATT, these take the form ofbinding commitments on tariffs for goods in general, and combinations of tariffs and quotas for some agricultural goods. For GATS, the commitments state how much access foreign service providers are allowed for specific sectors, and they include lists of types of services where individual countries say they are not applying the MFN principle of non-discrimination. Underpinning these is the dispute settlement, which is based on the agreements and commitments, and trade policy reviews, an exercise in transparency. The WTO's procedure for resolving trade quarrels under the "Dispute Settlement Understanding" is vital for enforcing the rules and therefore for ensuring that trade flows smoothly. Countries bring disputes to the WTO if they think their rights under the agreements are being infringed. Judgements by specially appointed independent experts are based on interpretations of the agreements and individual countries' commitments. The system encourages countries to settle their differences through consultation. Failing that, they can follow a carefully mapped out, stage-by-stage procedure that includes the possibility of a ruling by a panel of experts, and the chance to appeal the ruling on legal grounds. The purpose of the Trade Policy Review Mechanism is to improve transparency, to create a greater understanding of the policies that countries are adopting, and to assess their impact. Many members also see the reviews as constructive feedback on their policies. All WTO members must undergo periodic scrutiny, each review containing reports by the country concerned and the WTO Secretariat

Additional agreements: The two "plurilateral" agreements not signed by all members are the civil aircraft and government procurement.

The Doha Development Agenda: The WTO agreements are not static and they are renegotiated from time to time and new agreements can be added to the package. The 2001 Ministerial Conference in Doha set out tasks, including negotiations, for a wide range of issues concerning developing countries and other implementation issues of the present agreements. The entire package is called as the **Doha Development Agenda (DDA)** and the negotiations as the Doha Development Round. The **DDA** is the current trade-negotiation agenda of the World Trade Organization (WTO). Its objective is to lower trade barriers around the world, which will help facilitate the increase of global trade. As of 2008, talks have stalled over a divide on major issues, such as agriculture, industrial tariffs and non-tariff barriers and services. The most significant differences are between developed nations led by the European Union (EU), the United States (USA), and Japan and the major developing countries led and represented mainly by Brazil, China, India, South Korea, and South Africa. There is also considerable contention against and between the EU and the USA over their maintenance of agricultural subsidies.

The Agreement on Agriculture

The three pillars of Agreement on Agriculture (AoA) are market access, domestic support and export competition. In the area of market access, non-tariff border measures are to be replaced by tariffs that provide substantially the same level of protection. Tariffs resulting from this "tariffication" process, as well as other tariffs on agricultural products, are to be reduced by an average 36 per cent in the case of developed countries and 24 per cent in the case of developing countries, with minimum reductions for each tariff line being required. Reductions are to be undertaken over six years in the case of developed countries and over ten years in the case of developing countries. Domestic support measures that

have, at most, a minimal impact on trade ("green box" policies) are excluded from reduction commitments. Such policies include general government services, for example in the areas of research, disease control, and infrastructure and food security. It also includes direct payments to producers, for example certain forms of "decoupled" (from production) income support, structural adjustment assistance, direct payments under environmental programmes and under regional assistance programmes In addition to the green box policies, other policies need not be included in the Total Aggregate Measurement of Support (Total AMS) reduction commitments. These policies are direct payments under production-limiting programmes ("blue box subsidy"), certain government assistance measures to encourage agricultural and rural development in developing countries and other support which makes up only a low proportion (5 per cent in the case of developed countries and 10 per cent in the case of developing countries) of the value of production of individual products or, in the case of non-product-specific support, the value of total agricultural production. The Total AMS covers all support provided on either a product-specific or non-product-specific basis that does not qualify for exemption and is to be reduced by 20 per cent (13.3 per cent for developing countries with no reduction for least-developed countries) during the implementation period. Members are required to reduce the value of mainly direct export subsidies to a level 36 per cent below the 1986-90 base period level over the six-year implementation period, and the quantity of subsidised exports by 21 per cent over the same period. In the case of developing countries, the reductions are two-thirds those of developed countries over a ten-year period (with no reductions applying to the least-developed countries) and subject to certain conditions, there are no commitments on subsidies to reduce the costs of marketing exports of agricultural products or internal transport and freight charges on export shipments.

Agreement on Sanitary and Phyto-Sanitary (SPS) Measures

The agreement on SPS Measures is concerned with the application of sanitary and phyto-sanitary measures or the food safety and animal and plant health regulations. The agreement recognizes that governments have the right to take sanitary and phyto-sanitary measures but that they should be applied only to the extent necessary to protect human, animal or plant life or health and should not arbitrarily or unjustifiably discriminate between Members where identical or similar conditions prevail. In order to harmonize sanitary and phyto-sanitary measures, members are encouraged to base their measures on international standards, guidelines and recommendations where they exist. However, Members may maintain or introduce measures which result in higher standards if there is scientific justification or as a consequence of consistent risk decisions based on an appropriate risk assessment. The Agreement spells out procedures and criteria for the assessment of risk and the determination of appropriate levels of sanitary or phyto-sanitary protection.

Agreement on Technical Barriers to Trade (TBT)

The TBT Agreement seeks to assure that the mandatory product regulations, voluntary product standards, and conformity assessment procedures (procedures designed to test a product's conformity with mandatory regulations or voluntary standards) do not become unnecessary obstacles to international trade and are not employed to obstruct trade.

Agreement on Dumping (Implementation of Anti-dumping duty)

This agreement provides for the right of contracting parties to apply anti-dumping measures, i.e. measures against imports of a product at an export price below its "normal

value" (usually the price of the product in the domestic market of the exporting country or less than the cost of prodcution) if such dumped imports cause injury to a domestic industry in the territory of the importing contracting party. Negotiations in the Uruguay Round have resulted in a revision of the Agreement at the Tokyo Round which addresses many areas in which the earlier Agreement lacked precision and detail. The revised Agreement provides for greater clarity and more detailed rules in relation to the method of determining that a product is dumped, the criteria to be taken into account in a determination that dumped imports cause injury to a domestic industry, the procedures to be followed in initiating and conducting anti-dumping investigations, and the implementation and duration of anti-dumping measures.The agreement strengthens the requirement for the importing country to establish a clear causal relationship between dumped imports and injury to the domestic industry.

Agreement on Safeguards

Under the WTO Agreement on Safeguards, the Government of a member country can impose tariff, non-tariff or a mix of both measures for a temporary period in case increased import is causing serious injury or threat of serious injury to the domestic industry. The main conditions that need to be established to apply safeguard measures are increased imports, serious injury or threat to domestic industry and a causal link between increased imports and injury or threat to the domestic industry.

Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS)

Intellectual Property Rights (IPRs) are rights given to people over the creations of their minds. These rights are given by society through the state as incentive to produce and disseminate ideas and expressions that will benefit society as a whole. The IPRs covered by the TRIPS Agreement are copy rights, trademarks, Geographical Indications, industrial designs, patents, layout-designs and undisclosed information.

Non Agricultural Market Access (NAMA)

NAMA refers to the WTO negotiations on non-agricultural products (industrial products) and other products like fish and fish products, rubber products and wood and wood products. The mandate for the NAMA negotiations have emanated from the Doha and Hong kong ministerial declarations and the July 2004, framework agreement. The key elements of NAMA negotiations are

- Formula for general tariff reductions
- Treatment of unbound tariff lines
- Flexibilities for developing countries including Less than Full Reciprocity
- Sectoral initiatives for elimination or harmonization of tariffs
- Non-tariff barriers

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Implications for WTO Agreement in Fisheries Sector– A Conceptual Framework

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Trade liberalisation by reduction of tariffs or the removal of non-tariff barriers including Quantitative Restrictions will have impact on the economy mainly through the influence on commodity prices. Imposition or reduction of tariffs will affect the relative commodity prices ie, price of each of the commodity in terms of other commodities. This relative change in prices can be for commodities belonging to the same sector like industry or agriculture or fisheries or between categories of commodities, for e.g., agricultural in terms of non-agricultural. The changes in relative prices will in turn have its influence on the relative profitability of taking up different enterprises, which will result in changes in enterprise combinations. Different enterprises will have different input use intensities or factor combinations and at times, the increased profitability of taking up some of these enterprises would make the entrepreneurs to overuse inputs like pesticides and fertilizers, or even over exploit the resources which in turn will have environmental as well as sustainability implications.

On the other hand, decreasing profitability of some of the enterprises for many years will cause the neglect of the enterprise or shift from the enterprise to more profitable ones. The increased risk or vulnerability to market fluctuations can also make the entrepreneurs to diversify their income sources. They may respond to these vulnerabilities either by consumption smoothing or income smoothing strategies or a combination of both. All these coping mechanisms will have implications on the output of the enterprise which in turn will affect or even lead to reduction in income entitlements of the households. Exorbitant prices due to some international phenomenon or higher side of volatile prices give wrong signals to the entrepreneurs to increase the production which ultimately end up in over production, market glut and price crash. All these have implications on the food security as well as poverty at the household, state and country levels. The implications will be varied for the producers and the consumers and also based on factors like whether the commodity is exported or domestically consumed.

The changes in production in turn will have effect on the prices of the enterprise or commodity/ commodities under question as well as the relative prices of other commodities or enterprises. The firm level output changes will also influence the income entitlements of families. The change in prices and income entitlements will have implications on pattern of the demand ultimately causing the trade pattern of the country to change. The trade liberalization policies along with the changes in the export-import pattern of the country would ultimately result in increase or decrease in tariff revenue of the government. The resulting variation in government revenue will affect the real investment in country. The ultimate result of all these changes will be evident as changes in output and growth of the economy. The changes in the revenue pattern of the government will also

affect the spending by the government on household or social welfare activities. All these will have implications in the household welfare. The implications of trade liberalization policies will be varied from country to country based on the policies of liberalization as well as the environment of implementation.

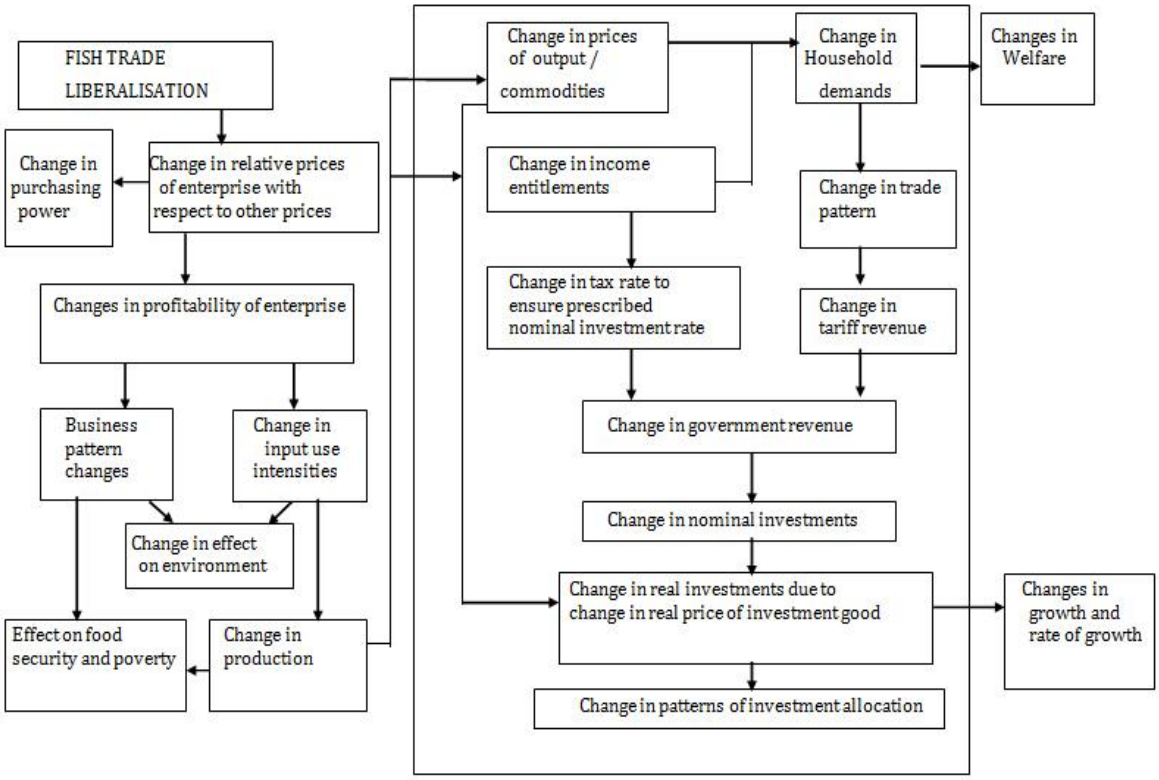

Fig 4.1 Conceptual Frame Work of Trade Liberalization and Its Impact on Fish and Fish Products

The Major WTO Agreements having Implications on Fisheries Sector

- Marakkesh Protocol to the general Agreement on Tariffs and Trade (GATT 1994)
- Agreement on Sanitary and Phyto-Sanitary Measures (SPS)
- Agreement on Technical Barriers to Trade
- Agreement on Implementation of Article VI of the General Agreement on Tariffs and Trade (Anti-dumping)
- Agreement on import Licensing Procedures
- Agreement on Subsidies and Countervailing Measures
- Agreement on Safeguards

The most important ones are

Agreement on Sanitary and Phyto-Sanitary Measures (SPS)

This agreement is intended to safeguard interest of a country in the crucial area of health and hygiene. As per the agreement, the application of the SPS measures should on the basis of scientific justification or on risk assessment so as to prevent using it as an instrument of protection. The signatories are also encouraged to apply internationally recognized standards but are at liberty to apply stricter standards. The agreement is based on the pillars of harmonization, equivalence, transparency, scientific judgment and risk assessment. But there are growing apprehensions about the application of the SPS measures as non-tariff barriers with the purpose of shielding the domestic producers from international competition and also for preventing processed products from developing countries from entering the domestic market, resulting in trade distortion. Even some of the restrictions are introduced just on the basis of public activism from interested parties. Some classic examples of the case are the EU import ban on the pretext of cholera, Australia's ban on the import of salmon, EU import ban of shrimp from Bangladesh, US and EU ban on Indian processed shrimp on grounds of poor sanitary conditions and pre-clearance inspections. Japan and EU have very demanding SPS standards. The costs of compliance to these standards are substantial and even if the exporters or the firms have these compliance mechanisms the payback period will be very high and the scale of operation may not be to the level of recovering these costs. This has severely affected their economic viability and competitiveness in the international market.

Agreement on Technical Barriers to Trade (TBT)

This agreement divides technical requirements into two categories: technical regulations and technical standards. While both of them are e product technical requirements, compliance with technical regulation is mandatory whereas compliance with technical standards is voluntary. Both are extensively used in fisheries and cause distortions in trade. Some of the examples of the cases involving TBT are labeling disputes over canned sardines between Canada and the EU, the US testing procedures for imported sea food taking more time than the shelf life of the product, the Eco-labelling of fishery products and the obligation that such labeling should not violate TBT requirement

India's Stand on Fisheries Subsidy

India's objective has been to make real the Hong Kong mandate in that "appropriate and effective special and differential treatment for developing countries and least developed countries should be an integral part of the fisheries subsidies negotiations, taking into account the importance of this sector to development priorities, poverty reduction and livelihood and food security concerns. Prohibition of subsidies causing excessive fishing effort and negatively impacting fisheries resources can and shall be reconciled with the important role of fisheries in the economic development of developing countries. Provision of subsidies to low income resource poor or livelihood fishing activities, by fish workers on an individual or family or association basis or micro enterprises or boat owners shall not be prohibited. On the issue of small scale, artisanal fisheries, India along with the like-minded countries brought forward a definition based on the socioeconomic criteria, inspired by the Article 6.2 of the Agreement on Agriculture. In the procedural part India has always questioned the stand of developed countries for not bringing the fishery subsidy part into the general subsidy discussions. The question is whether the original intention of these countries are really to address trade distortions caused by subsidies or to bring in non-related trade issues to subsidy discussions.

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Indian Fisheries Sector in the Wake Of World Trade Agreement: Paradigms and Perspectives

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International trade has become far more significant in the world economy, and over the past two decades world trade has grown faster than world output growth. However, over the 1990s, the value of world trade has fluctuated substantially. The economic environment for trade, specifically fish trade is changing in a remarkable way due to changes in domestic policies as well as international trade arrangements. GATT, the discussion on which started as early as 1947, the most important one, provided an useful forum for discussion and negotiations on international trade issues. Since then several rounds of talks were organized and the Eighth Round of Multilateral Negotiations popularly known as "Uruguay Round" was initiated in September 1986. Finally the Uruguay Round of Multilateral Trade Negotiations as per the Dunkel Text paved the way for formation of WTO which may have serious implications and consequences for India in many sectors of the economy.

The 1994 Agreement establishing the World Trade Organization was developed during the Uruguay Round, a series of trade negotiations among 125 countries spanning seven and a half years. The Agreement specifies the purpose of the WTO, its functions, structure, and legal status, and provides for a Secretariat. The preamble text states that parties to the Agreement recognize that, "their relations in the field of trade and economic endeavor should be conducted with a view to raising standards of living, ensuring full employment and a large and steadily growing volume of real income and effective demand, and expanding the production of and trade in goods and services, while allowing for the optimal use of the world's resources in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and to enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development".

The World Trade Organization (WTO) was born on 1st January 1995 as a result of the Uruguay Round of Trade Negotiations. Apart from setting rules for international trade, the WTO conducts trade policy review of Member Country. The WTO arrangements were negotiated through several rounds of Talks and finally signed by the main trading nations. The objectives of the WTO agreement is for "Raising standards of living of the world people, ensuring full employment, expanding the production and trade in goods and services and using natural resources optimally in accordance with the objective of sustainable development". The consumer sees price of essential drugs and other knowledge based products go up following intellectual property protection. Subsidies are dear to producers who have to face cut throat competition in the global markets. Industry fears competition from imports.

The aim of WTO is to provide a forum for interpreting established international trade laws, for fresh negotiations among member countries and for settlement of trade – related disputes. It lays down a comprehensive set of regulations and guidelines covering all aspects of international trade. Besides, it establishes an open and liberal global environment free from trade restrictions and encourages participation of developed and developing countries in the newly established Multi-lateral Trading System.

Certification and labeling programmes operated by governments, such as the case of certification and labeling stemming from AIDCP would be considered "standards" for the purposes of the **Technical Barriers to Trade** TBT, since they are not mandatory. Other certification programmes operational in the fisheries sector, such as that of the Marine Stewardship Council (MSC), would also be considered as standards.

The most controversial aspect of certification and labeling is whether voluntary initiatives involving "non-product-related production and processing methods" are covered by the TBT Agreement. Non product- related production and processing methods (PPMs) are those PPMs that do not form part of the physical characteristics of the end product. For example, the subject of Principle 3 of the MSC Principles and Criteria would be likely to be considered a non-product-related PPM, since it relates to an intangible aspect of fishery.

It states, "The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable." If non-product-related PPMs are indeed covered by the TBT Agreement, then some of the disciplines in the Code of Good Practice might interfere with voluntary certification and labeling schemes that are based on such PPMs. These disciplines include the non-discrimination in relation to "like products" and the avoidance of unnecessary obstacles to international trade depending on how these terms are interpreted. So far, there is no consensus as to whether such PPMs are indeed covered by the TBT agreement.

The WTO's Doha Agenda For Fisheries

Once again secret deals are being cut in back rooms by corporate-dominated and little known international trade groups that will directly impact the lives of commercial fishermen and our industry for decades to come. In this account we will explain that threat and help guide you through the 'trade-speak' maze as well as tell you what you can do to see that fishermen's concerns are addressed. The outcome of this struggle really matters. What happens in this fight will directly affect your markets, your price and even whether you will still be able to go fishing in the future. In one-way or another, the issue affects us all.

After failing famously in Seattle in November 1999, the World Trade Organization (WTO) finally succeeded in launching a new round of trade talks in November 2001. Two years following the "Battle in Seattle," trade ministers from 140 nations agreed to expand the WTO's scope over fisheries policies worldwide.

As signed in Doha, Qatar, world governments have agreed to begin negotiations in key areas of fisheries policy, making these issues, which have traditionally been decided in local or national arenas, an international trade agenda item. Everything from gear requirements to labeling requirements to fishermen's federal pensions could be impacted. Once again, fishing men and women, and the coastal communities they support, have been shoved out of the rule-making process and currently have no voice at the table (see the November, 1999 FN article "The World Trade Organization (WTO): Flying Under Fishermen's Radar," available on the Internet.

The Pacific Coast Federation of Fishermen's Associations (PCFFA) and the World Forum of Fish Harvesters & Fish workers (WFF) are important voices for sustainable fisheries and for fishing-dependent people worldwide. Like small farmers, fishing communities everywhere are by necessity uniting globally to defend their rights and to protect their traditional livelihoods from potential WTO attack. Global trade rules currently reflect mainly the interests of large multinational businesses who certainly do not have the interests of commercial fishermen in mind. WTO rules now being proposed for the world's fisheries could also seriously restrict national governments' abilities to regulate their own fisheries, and prevent them from protecting those fisheries from rapacious multi-national corporations.

Countless popular movements have roundly criticized the WTO as a threat to democracy and the public interest. By joining the WTO, our government restricts what its own citizens can do to sustain fisheries and fishing communities, as well as set limits on the behavior of large corporations. Thus fisheries policy-making is increasingly moving offshore, to the arena of international trade negotiations between nations. As a result, nearly every national fishery management policy, tool or conservation program that might restrict corporate access to fisheries or seafood markets could, potentially, be classified to be a violation of the rules of global free trade.

WTO and Indian Fisheries

The impact of these agreements on Indian Fisheries is expected to be on the following:

i) Influence the size, composition, competitiveness and direction of India's Fish Exports;
ii) Influence the productivity of Indian fish; the country's food security position, cost of inputs and their use rates are likely to be affected;
iii) The shift towards export oriented production may lead to certain environmental problems;
iv) Domestic prices of fish commodities may change; and
v) Issues of Trade Related Intellectual Property Rights will have considerable implications on fisheries due to the product patent regime

Liberalization of Fish trade in the world has undergone remarkable change since launching of WTO in 1995. WTO commitments in the area of agriculture fall under the following categories viz., Market Access, Domestic Support, Export Competition and Trade Related Intellectual Property Rights (TRIPS). WTO encompasses three major agreements viz., General Agreement on Trade in Goods, General Agreement on Trade in Services and Trade Related Intellectual Property Rights

Non Agricultural Market Access (NAMA)

A key element of the Doha Round of trade negotiations of the World Trade Organisation (WTO) is liberalisation of trade in industrial products, commonly known as non-agricultural market access (NAMA). NAMA refers to all products not covered by the Agreement on Agriculture. In other words, in practice, it includes manufacturing products, fuels and mining products, fish and fish products, and forestry products. They are sometimes referred to as industrial products or manufactured goods. The methodology for Tariff Reduction: at the core of the negotiations over NAMA. However, here too the developed and developing countries are divided over the extent to which tariff reductions will be carried out. At the heart of the debate is the reconciliation of the process of tariff reduction and the need to use tariffs as a policy tool, primarily by developing countries interested in protecting emerging

industries for developmental purposes. A tariff binding is a ceiling above which a member country cannot apply a tariff, thus representing the maximum tariff than can be applied by a member. The NAMA negotiators have opted in favour of a formula approach to tariff reductions rather than a linear approach. The Swiss formula, which has been propounded by the developed countries such as the US, the EC countries, Norway, and Japan, proposes to cut tariffs steeply without taking account of the existing tariff profile of a country. The modified Swiss formula, on the other hand, takes into account the tariff profile of the countries while carrying out tariff reductions. This approach is supported by the developing countries, group of eleven developing countries working toward strengthening NAMA. The group has two main objectives of supporting flexibilities for developing countries and balance between NAMA and other areas under negotiation. The Member countries of NAMA-11 are Argentina, Bolivarian Republic of Venezuela, Brazil, Egypt, India, Indonesia, Namibia, Philippines, South Africa and Tunisia. NAMA products have accounted for almost 90 per cent of the world merchandise exports.

Negotiation under NAMA focus on market access for all products (mostly industrial) that are not covered by negotiations on agriculture and aim to reduce, if not possible to completely eliminate tariff or non-tariff barriers (NTBs) that restrict trade in these products. NAMA negotiation also considers products including natural resources such as fisheries, forests, gems and minerals. The ongoing NAMA negotiations are based on the mandate given in Doha Development Agenda (DDA), agreed at the 4th WTO Ministerial Conference, in November 2001. The Doha mandate states that the negotiation needs to address tariff peaks, tariff escalation and NTBs. The Doha text also states that, there is need for comprehensive product coverage under NAMA and less than full reciprocity i.e. developing countries need to reduce tariff to a lower extent than industrialised countries and spread commitment over a longer time period. Further, the modalities to be agreed under NAMA include appropriate capacity building measures to assist least developed countries to participate effectively in negotiations. July Framework also, as adopted on August 2004, identified NAMA as the priority area along with the other issues of WTO and reaffirmed on what was promised in Doha to reduce the tariffs and NTBs and address tariff peaks and tariff escalation, taking fully into accounts the special needs and interest of developing and least developing countries (LDCs). India wants to gain greater market access in the developed countries, not much through the reduction of their tariffs, which are already low but through the dismantling of NTBs to trade and some GSP [e.g. the proposed EU-GSP on (T&C)]. India will also like to resist sharp reduction in tariffs forced open upon by developed countries. It will reduce tariff autonomously at a pace it judges suitable for the Indian industry. India will accept any tariff reduction formula only on bound rates and will counter any attempt to use applied rates as the base for application of a tariff reduction formula. India wants an equitable tariff reduction formula in the negotiations keeping in view the concerns of the developing countries. India endorses the suggestion put forward by US for using two different coefficients for tariff reductions – one for the developed country and one for the developing countries, but with a lot of fine-tuning, rather than using the Swiss Formula. India is also against the proposal of a mandatory 'zero for zero' reduction on the seven specific products by 2015 as these constitutes the bulk of the India' export basket and are also product reserved for the small-scale sector. A 'zero for zero' regime would spell their doom by granting unmitigated access to large foreign firms in the same market. India also highlights the need to link adoption of tariff reduction formula with concrete time bound progress on eliminating NTBs.

Market Access

Under this, all member countries of WTO are requested to:

i) Replace all types of non-tariff barriers with tariff barriers; and
ii) Reduce the level of tariffs under a time bound programme.

It was agreed in the negotiation that developed countries should reduce their tariff for fish produce by 36 per cent with minimum of 15 per cent for each product over a six year period (1995-2000), while it was 24 per cent with a minimum cut of 10 per cent for each item in 10 years (1995-2000) for developing countries.

Market access also includes special safeguard provisions which permit the country to impose additional duties when import surges above a particular level or low import prices as compared to 1986-88 levels. Besides, a minimum access equal to three per cent of domestic consumption in 1986-88 will have to be established for the year 1995 which must be increased to five per cent at the end of implementation period (2004).t is now made clear that implementation of these measures had no adverse impact on Indian agriculture. Even in case of edible oils, special provisions allow India to maintain restriction till the end of the implementation period (2004).

Domestic Support (Aggregate Measure of Support)

Domestic support deals with reduction commitments of subsidies provided to domestic producers. It stipulates that the total support given in 1986-88 measured as Aggregate Measure of Support should be reduced by 20 per cent in developed countries and 13.3 per cent in developing countries. Besides, it stipulates that the domestic support (both product and non-product) given should be less than five per cent of the total value of fish production in developed countries and less than 10 per cent in developing countries.

Policies which have been excluded from reduction commitments are government spending on research, disease control, and infrastructure and food security. It also includes direct payments under environmental programmes and regional assistance programmes. India need not reduce any kind of subsidies in the country since its Aggregate Measure of Support (AMS) to the agriculture sector is negative.

Export Competition or Export Subsidies

Under this, WTO agreement calls for reducing direct subsidies to a level of 36 per cent below 1986-88 level in case of developed countries in value terms and 21 per cent by volume terms in six years. The percentage reductions are 24 and 14 in equal annual instalments over ten years for developing countries. In India, exporters of fish commodities do not get any direct subsidy. Only subsidies on freight charges and on export shipment of certain fruits, and floricultural products are given.

Trade Related Intellectual Property Rights (TRIPS)

In the post WTO era, the subject of IPR has assumed greater importance in the scientific research and development and is being regarded as more valuable than traditional asset. The establishment of WTO, which now is the administrative and dispute resolving agency for all the matters related to trade related IPRs, has made it obligatory for India to honour all its commitments to safeguard the intellectual property rights of the owners.

There are seven areas of IPR that are covered by the TRIPs, namely Trademarks, Trade Secrets, Industrial Designs, Copyrights, Integrated Circuits, Geographical Indication and Patents. In the first six areas, Indian laws, regulations, administrative procedures and judicial systems are at par with the rest of the world; the norms of enforcement and protection proposed in the WTO are in conformity with the Indian system. In the last area, namely in issues related to Patents, Indian laws are however, substantially different from the provisions of WTO.

The TRIPS agreement states that patents shall be available for any inventions in all fields of technology provided they are new, involve an inventive step and are capable of industrial application. Biotechnology firms will benefit from improved IP protection for a technology having inventive step with commercial utility under such a system. The increased investment in animal biotechnology research and development implies an increased likelihood of finding solutions to some of the fish diseases (like White Spot Syndrome Virus) that currently defy treatments. In this way, consumers and farmers benefit from the improvements in the practices that may take place in aquaculture. But, the patenting of higher animal life forms was left unresolved, with signatories having the option to use or not use patents to protect such intellectual property rights. The US, EU, Japan, Australia and a few other countries have legalized the patenting of animals even though none of them has as yet patented a farm animal. India has decided not to patent farm animal though it adopted *sui generis* system for protection of plant varieties. However, India being a signatory to the GATT is obliged to adopt a patent system for microorganisms that may open up new avenues in this sector.

Trade Related Investment Measures (TRIMS)

The proposals of a Multiple Agreement on Investment (MAI) spell concern for fisheries sector. The provisions of MAI would fundamentally alter the climate for international investment by preventing governments from providing more favourable conditions for their citizens and domestic companies than for other investors. Under new regime, countries would be required to treat foreign investors no less favorably than domestic ones. It allows foreign fishing fleets the same access to domestic waters that local enjoys.

One of the most contentious aspects of fisheries management is the allocation of the total allowable catch (TAC). Most countries give preferential access to their domestic fishermen, only allowing others in for those species which are not fully utilized. If all foreign investors are to be treated at least as favourably as domestic companies it may not be possible to give continuous support to our poor fisher folk. Further, governments and regional management organizations usually set the TAC based upon some variant of Maximum Sustainable Yield as a target. There are many other possible targets, though, based upon other biological or even economic criteria. If, as a conservation measure, a country wishes to maintain fish stocks at somewhat greater abundance, it may not be possible to do so under the provisions of MAI. Thus, WTO has great impact on the global fishing industry, the conservation of fisheries resources and the communities who depend upon them.

The WTO's current rules apply mostly to international trade in goods and services. But the Doha Summit agenda would also expand the WTO's powers to cover foreign investment. If accepted and implemented by WTO member nations, citizens would lose enormous power to regulate foreign capital through their own governments, threatening fisheries resources in a number of ways. Around the world, many state and local governments grant commercial fishing licenses based on various criteria, such as fleet sizes,

standards of gear, and residency requirements ("fish here, live here" policies). Trade negotiators (especially from nations with substantial long-distance fleets looking for new fishing grounds to exploit) view these kinds of measure as "discriminatory" against foreign investors and are trying to use the WTO process to prohibit all WTO member nations from using them.

Individual Fishing Quotas (IFQs) may also be seriously impacted by new WTO investment rules. The capital-rich nations, looking to "liberalize" markets for themselves, want to make it so that any time any member government privatizes a public entity (say, state-owned companies, social services or even concessions to exploit natural resources), they must do so only according to new WTO rules. Thus, conditions imposed on IFQ systems to protect fishermen and fishing communities could be threatened by WTO investment rules.

The investment agenda's worst element, according to many critics, is the "Investor-State Mechanism," which already exists under the North American Free Trade Agreement (NAFTA) and which the U.S. would like to universalize via the Free Trade Area of the Americas (FTAA) Agreement and through the WTO. By establishing new legal protections for foreign investors, this policy allows private corporations to sue a foreign government for enacting measures that reduce the planned profits of the foreign investor. Under NAFTA, for instance, a Canadian chemical manufacturer sued U.S. government for projected profits lost because of California's recent legislative ban on the fuel-additive MTBE. Even though the state's fresh water supply is heavily contaminated by cancer-causing MTBE, and even though the cleanup of that pollution may now cost California billions of dollars, the foreign investor is demanding cash compensation from the U.S. government of nearly one billion dollars for losing its MTBE market because of the state ban on what is clearly a dangerous pollutant.

Allowing "regulatory takings" of this sort would make it impossible to protect our environment from whatever environmental assault some foreign investor figured to make money off of. Among other things, it might make dam removal, watershed restoration and limits on clear-cut logging, all necessary for salmon restoration, nearly impossible, and then only at great cost to the taxpayer. The corporations and their investors, who make money from destroying those watersheds, would thus have to be paid "protection money" not to continue their destruction.

Sanitary and Phytosanitary (SPS) Measures

The SPS agreement confirms the right of WTO member counties to apply measures necessary to protect human, animal and plant life and health. This right was included in original GATT (1947) as a general exclusion from the other provisions of the agreement provided that "such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same condition prevail, or disguised restrictions on international trade". Despite this general conditions for the application of national measures to protect human, animal and plant life and health, it had become apparent that national sanitary and phytosanitary measures had become, whether by design or by accident, effective trade barriers. The SPS agreement therefore sets new rules in an area previously excluded from GATT disciplines.

The purpose of the SPS agreement is to ensure that measures established by government to protect human, animal and plant life and health are consistent with obligations prohibiting arbitrary or unjustifiable discrimination on trade between countries

where the same conditions prevail and are not disguised restrictions on international trade. It requires that, with regard to food safety measures, WTO members base their national measures on international standards, guidelines and other recommendations adopted by the FAO/WHO Codex Alimantarius commission where they exist. This does not prevent a member country from adopting stricter measures if there is a scientific justification of doing so, or if the level of protection offered by the codex standard is inconsistent with the level of protection generally applied when deemed appropriate by the country concerned.

The SPS agreement covers all food hygiene measures and food safety measures such as the control of residues of veterinary drugs, pesticides and other chemical used in meat production. In addition, it also covers animal and plant quarantine measures. The SPS agreement states that any measures taken that conform to international codex standards; guidelines or other recommendations are deemed to be appropriate, necessary and non-discriminatory. Furthermore, the SPS agreement calls for a programme of harmonization of national requirements based on international standards. This work is guided by the WTO committee on sanitary and phytosanitary measures, to which representatives of CAC, the international office of Epizootics (OIE) and the international plant protection convention (IPPC) are invited.

The export market has been rapidly growing. However, it might be affected by the insistence of USA and other developed countries on imports of food products only from those suppliers who have established HACCP system at their plants. India is a signatory to the WTO, SPS and TBT Agreements. With about one hundred sixty two nations being a part of WTO, basic food safety standards as per CODEX Alimentarius becomes mandatory. When the member countries have started implementing HACCP and our industry does not follow the same standard, our goods exported to those countries may be rejected.

In order to have safe food and larger Foreign and Domestic market for the Indian seafood products, and also to challenge any possible threats under SPS measures it will become increasingly necessary for all the seafood processing companies to follow the guidelines of HACCP and get their products and plants HACCP certified. These SPS measures also protect Indian industry from discriminate policies of developed nations and disguised restrictions imposed on Indian seafood exports.

Quantitative Restrictions (QR)

Quantitative Restrictions (QRs) refer to measures other than tariffs or duties taken to restrict imports (or exports). Article XI of the GATT generally prohibits quantitative restrictions on the import or the export of any product. The Quantitative Restrictions are considered to have a greater protective effect than tariff measures and are most likely to distort free trade. When a trading partner uses tariff to restrict imports, it is still possible to increase exports as long as foreign products become price competitive enough to overcome the barriers created by the tariff. When a trading partner uses QRs, however, it is impossible to export in excess of the quota no matter how price competitive products may be. Thus, QRs are considered to have a greater distortional effect on trade than tariffs and their prohibition is one of the fundamental principles of the GATT. Although multilateral trade rules, in general, prohibit QRs on import (or export) of any product, the GATT provides exceptions to this fundamental principle. These exceptional rules permit the imposition of quantitative measures under limited conditions and only if they are taken under policy grounds justifiable under the GATT such as critical shortage of food stuffs (Article XI: 2) and Balance of payment (Article XVIII: B).

Developing countries like India were permitted to maintain Quantitative restrictions (QRs) due to Balance of payment (BoP) position and initially committed to phasing out the QRs in a phased manner. The Government has accordingly phased out these QRs on imports with respect to 714 items. Commodities such as fish and fishery products figure prominently on the list of items that can now be imported freely and such a step is going to have an impact on the Fisheries sector.

The Indian seafood factories, which are mostly idle during the monsoon season due to trawl ban, can process imported raw material in the changed scenario. Due to the low capacity utilization, seafood has become a low profit industry. The new policy would enable the import of tuna. Since tuna prices are high in the Indian market, exporters do not enjoy a comfortable margin. The situation will change dramatically once cheaper tuna is imported into the country.

US based Red Chamber, the largest importer of Indian seafood, is aiming to shift its re-processing base from China to India with an investment of $ 1.3 billion directly in areas like marine product procurement, processing and value addition. Japan is also keen on tie-ups in this sector. This is a welcoming sign and such collaborations will generate more employment in pre-processing facilities and factories and also bring about a general upgradation in qualitative standards.

The significance of international trade in fish and fish products is further enhanced by the fact that the net foreign exchange earnings from seafood exports is one of the highest in India. However, tariff and non-tariff barriers hamper the access to international markets. If the entire member countries remove QR's in compliance with WTO provisions/agreements, Indian seafood products may find new markets which will enable the fish processing industry more vibrant in the coming years. This may lead to many new enterprises coming in this sector by exploiting the available cheap labor and skilled manpower. In case of any possible inflow of fish/ fish products into Indian market due to removal of Quantitative restrictions, the consumers may be benefited to have the taste of cold-water species such as trout and salmon.

MARKET ACCESS: The Global Free-Fishing Agreement

WTO bureaucrats and corporations already consider many of the policies that conserve fisheries (and the communities that depend on the resource) to be “barriers to free trade.” Since conservation measures always imply some restrictions on harvest, the WTO's market access agenda could undermine sustainable fisheries and livelihoods by weakening legal protections that promote natural resource conservation and communities. The forestry, fishing, and farming sectors are particularly likely to be impacted. Ongoing WTO negotiations for wider market access are broken down into two general categories: 1) eliminating tariffs, and; 2) eliminating “Non-Tariff Measures (NTMs)”.

(i) Eliminating Tariffs

In Seattle, trade ministers were pushing to finalize a deal to eliminate tariffs (import taxes) between nations. Critics pointed out that tariff elimination could also expose small-scale fishing communities, whose survival depends on sustaining local fisheries, in a variety of ways. Lowering tariffs in the absence of adequate safeguards for marine ecosystems and for fishermen, for instance, could accelerate the death spiral of the world's fish stocks and fishing communities.

Although the UN Food & Agriculture Organization (FAO) reports increasingly dire news about dwindling worldwide stocks, no assessment has yet been done on the biological health impacts on fish stocks that are being prioritized for tariff elimination. Nor has anyone even consulted the fishing communities themselves about what issues they want addressed. The Pacific Coast Federation of Fishermen's Associations in the US has been unable to even obtain information on the status of these trade talks. Apparently the only ones who are kept aware of the WTO fisheries agenda are the very importers, processors, and distributors who are driving the "full market access" trade agenda via the WTO. Their goal is to be able to dominate local markets everywhere at the expense of local fishermen.

Cutting tariffs reduces prices for consumers, in turn stimulating consumption, especially in the rich nations where tariffs are highest. This could be disastrous for fisheries. In third world nations it creates pressures on government to export fish otherwise intended for local markets or simply sell quotas to foreign fleets to the detriment of local fishing fleets. In turn, these cheap imports hurt fishermen in the wealthy countries by driving their ex-vessel prices down and subjecting them to a type of third world poverty. Also, some of America's oldest fisheries conservation programs (like the 1954 Saltonstall-Kennedy Act) that are financed by tariff revenues could face difficulty in securing continued funding.

(ii) Eliminating Non Tariff Measures (NTMs)

The most dangerous thrust to fishermen of world trade agreements is the covert effort, by some countries who want to flood our markets, to include just about anything that might keep them out as a "non-tariff measure" or "NTM." In trade-speak, NTMs are considered to be any government measure, policy, or practice that has the effect of "distorting" trade. Obviously this definition is wide open to interpretation and abuse.

Proposed lists of fishing NTMs by some countries have included measures such as normal and biologically necessary harvesting restrictions, bans on destructive gear, precautionary measures against the import of species suspected of disease or illness, residency requirements ("fish here, live here" provisions), and even ecolabels. The Asia Pacific Economic Community (or APEC, which includes the U.S.) has already surveyed what it considers the various NTMs in Pacific Rim markets, with a view to using its list as a framework for negotiations on market access in the WTO. Governments have yet to make this NTM report public, however, as it could reveal a laundry list of important fisheries regulatory or conservation measures being targeted for elimination via WTO negotiations. Yet the United States Trade Representative (USTR) plans to also use this still-secret APEC laundry list as a "negotiating framework" for upcoming market access talks in Geneva.

In the forestry sector, the WTO official definition of NTMs already extends to measures that may have a "potential" to impact trade, such as labeling requirements. Although they admittedly have not yet had any impact on trade, eco-labels are also being closely observed under the WTO microscope.

WTO's predecessor, the General Agreement on Tariffs and Trade (GATT), used to lecture "misguided conservationists" not to use trade measures to influence foreign fishing practices. Instead, GATT insisted, informing consumers through labeling would be a more efficient and effective method that would not impede trade. But now that such labeling systems exist, WTO is saying that labels informing consumers are themselves barriers to trade because they might discriminate against imports.

The rising occurrence of genetically modified organisms (GMOs) that are hitting world markets are also of major concern to scientists and the general public. However, the WTO

has already ruled that governments may not "discriminate" against imports based on how something was produced, for instance by traditional and sustainable versus industrial and destructive methods of production. Under this rubric, other nations' initiatives to label genetically engineered species are already being threatened with WTO action.

Eco-labels, such as the Marine Stewardship Council's (MSC) program for sustain ably harvested seafood products, are also directly threatened by WTO's new mandate given in Doha, including the recent certification by MSC of Alaskan salmon as a sustainable fishery. Trade ministers specified in the Doha Summit's final declaration that eco-labels would be closely observed and assessed for their impacts on trade. Some nations have already made clear their intentions to challenge eco-labels as discriminatory under the WTO's free trade rules. However you might feel about such labeling schemes, this attack, if successful, would also eliminate another type of eco-label most fishermen support, the labeling of wild versus farmed seafood products.

The WTO also restrains governments from taking precautionary measures to prevent the entry of invasive species and foreign diseases. Canada has already successfully challenged Tasmania's ban on salmon eggs, imposed because of possible entry of foreign salmon diseases with foreign eggs. The Sanitary & Phyto-Sanitary (or SPS) Agreement of the WTO does not recognize the precautionary principle at all when allowing governments to implement protections at the border. The burden of proof is thus always on the public to prove something is NOT safe, never on the industries to prove that it is.

U.S. Congressman Nick Rahal (D-WV) has proposed the Invasive Species & Coastal Protection Act (H.R. 3558) to set up a comprehensive national program to protect native fish and wildlife from the impacts of invasive species. In drafting such bills, however, lawmakers are discouraged from enacting any meaningfully precautionary measures, on the theory that such measures would impede global trade and thus could be slapped down by the WTO.

In short, the NTM elimination agenda has become the final push by major multi-national corporations to remove all national or regional governmental controls over natural resources like fisheries. If their full agenda is ultimately adopted, any nation's policies or regulations for the conservation of important biological resources, or for the protection of the communities that depend upon those resources, would become subservient to expanding global trade requirements.

ANTI-DUMPING: When Cheap Imports Kill

It is no secret that the international trading system is currently seeing a multitude of complaints about "dumping," which is the practice of exporting a product at a price lower than it can be produced in an effort to drive out competition and eventually monopolize the market. As global recession deepens, nations are intensifying their promotion of exports to keep their economies afloat. In reaction, importing nations are imposing tariffs and quotas (so-called "anti-dumping measures") to control the flood of cheap products that are driving domestic producers out of business. The Bush Administration, for example, recently imposed restrictions on steel imports into the U.S. to protect our own industry from dumping.

However, the WTO sets strict rules on what measures governments can take, and under what conditions, to stem the tide of damaging imports. The Doha Declaration set forth negotiations "aimed at clarifying and improving disciplines" under the WTO Agreements on Subsidies and Countervailing Measures, also known as the "Anti-Dumping Agreement." Although anti-dumping provisions were heavily pushed in Doha by developing nations who

are frustrated with U.S. attempts to block imports from their countries of steel and textiles, small producers in many nations (especially the poorest) will be the ultimate victims of stronger WTO rules that prevent those nations from regulating the flood of cheap imports into their countries from elsewhere.

From fisheries to forestry to farming, millions of people around the world whose survival depends directly on accessing natural resources (for their own subsistence or for small-scale production) are now threatened by cheap imports. Yet compared to mass-produced, industrial, export-oriented production, many of these small-scale producers employ traditional management practices that distribute natural resources more equitably and are far more sustainable.

From Sri Lanka to California, local fishing communities who have long practiced sustainable harvesting methods are threatened by cheap seafood imports. Sri Lankan fishermen can no longer sell their products since import barriers were lifted to allow industrial trawlers from other Asian nations to flood local markets. Salmon fishermen along the Pacific Coast of the U.S. cannot compete with below-cost imports of farmed salmon from Chile, where export aquaculture that damages coastal habitat and requires massive amount of antibiotics is also being fought by local artisanal fishermen, indigenous peoples, workers, and conservationists. These are but two examples of a worldwide problem.

The expansion of global trade and investment overseen by the WTO has created a crisis in rural communities everywhere. Fluctuating global commodity prices have destabilized local communities and made long-term planning for natural resource protections impossible. Trade rules need to give communities and nations the right to do whatever is necessary to protect sustainable resource management practices and the livelihoods those resources support.

SUBSIDIES: The WTO Swings Its Axe Again

WTO's binding powers force member nations to continuously lower tariffs and reducing tariffs on imported fish lowers prices and stimulates consumption, magnifying pressures on dwindling stocks and ecosystems. WTO also predicted that the last round of tariff reductions would increase the trade in fish. But, to date there has been no impact assessment. Many countries have developed extensive programmes of subsidies to support certain parts of the fisheries sector, including unemployment and reconversion schemes, shipbuilding and modernisation support, fuel subsidies and others. But, as per the WTO agreement, developed countries would reduce subsidies and tariff. So, better overseas markets will be available for Indian fish products. It is important to note that the subsidies reduction requirement under WTO is not applicable to India. The countries having less than $1,000 per capita income annually does not fall under this category.

One of the major fisheries problems covered in the Doha Summit was the problem of the world's badly overcapitalized fishing fleets, with several proposals for cutting national subsidies that maintain fleets too large for the available fish resource. This item on the Doha agenda, which at first glance may appear innocuous if not helpful, could easily turn out to be a corporate Trojan horse. Embedded within it are hidden agendas of large corporations for capturing what is left of the planet's fisheries resources. While governments absolutely need to cut subsidies and reduce overcapacity in their fishing industry, the WTO is not the appropriate place to handle this problem. Letting a trade body, whose main constituents are global trading firms and not people tied to the land and sea, decide which subsidies are

allowable almost ensures that what happened to small scale family farmers under the WTO's last round will now be repeated with the world's small scale family fishermen.

Beyond the WTO's well-documented history of cutting subsidies for the poor while further enriching the wealthy, the true WTO agenda for dealing with fisheries subsidies is revealed by who has been at the table in the discussion to date. Attempts by national networks of fishermen's organizations (including PCFFA) to get a seat at the negotiating table have been ignored, while the U.S. trade association of importers, processors, and distributors (the National Fisheries Institute) has long been an official advisor to U.S. trade negotiators. Some environmental organizations involved with the WTO seem to be playing into this strategy as well, despite being informed repeatedly of the concerns of small fishermen's organizations.

The Doha Summit text mentions the subject of fisheries subsidies under the section calling for the strengthening of the Agreements on Subsidies and Countervailing Measures (Anti-Dumping). But the language contains no explicit conservation mandate, nor even an implied one. Indeed, its only specific directive is "taking into account the importance of this sector to developing countries," which likely signals an orientation toward maximizing and industrializing the exports of fish products from poor countries, where, not coincidentally, some wealthy nations are increasingly investing in foreign fishing because they have over-fished their own territories.

It is still not clear how the WTO will be defining "fisheries subsidies." If past negotiations on farming subsidies are any guide, definitions can range as far as the largest multinationals can stretch them. With no clear conservation mandate, it is hard to say how the WTO's Doha Declaration will impact federally financed programs specifically intended to develop more selective/less destructive fisheries, or efforts to restore habitat, or for the buyback of excessive fleet capacity and permits (including through the Capital Construction Fund), to guarantee retirement accounts for fishermen, or to provide marketing assistance (such as Alaska, Oregon and California's seafood marketing commissions). If any of these important programs are deemed "fisheries subsidies" they could ultimately be declared violations of the WTO rules, exposing the U.S. to stiff sanctions.

Apprehension of the developing countries

The major apprehension of the developing countries is that the developed countries did not implement the commitments made in the agreement on market access, provision of subsidies for export and production of fish commodities. Instead of implementation, the developed countries are continuing their subsidies and reducing the market access to developing countries thereby affecting the competitiveness of agriculture of developing countries. First, market access negotiations should cut tariffs and trade-distorting subsidies, particularly in fisheries in developed countries. We need to put an end to a situation where subsidies and other support to agriculture in rich countries are about US $1 billion a day which is more than six times of all development assistance of developing countries.

India is fully justified in asserting that implementation of existing commitments is more important. In this regard it is to be pointed out that India has convinced the rest of the world and Doha Ministerial Conference which had agreed to take up implementation issues.

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World Trade Agreements and Indian Fisheries Sector: Reflections and Upshots

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Seafood is high on the global trade agenda and has become particularly relevant in the light of the entry of fisheries into the WTO process (following WTO Doha Ministerial Conference in December 2002). International trading regimes are changing, with more open market access but with EU, US and other developed countries taking increasingly stringent measures for seafood safety. Changes in market access are likely to have significant implications for poor producers, and costs of implementation of international fisheries agreements, such as WTO sanitary and Phytosanitary (SPS) measures, HACCP standards, and market-driven labeling schemes may reduce livelihood options through barriers for participation of poor people. Liberalization of economies coupled with increasing demand for value added products and other product diversifications has resulted in structural changes of seafood industry in the last decade. Indian seafood exports declined to $1.89 billion from 2.10 billion dollars during 2007-08. The global financial meltdown seems to have taken its toll on the export of marine products from India with the business recording a 10 per cent slump to $1.9 billion for the year 2007-08. The country may even fall short of its target of $2 billion set for 2009, reports which was hit mainly due to economic recession in Europe and America, which are the major importers of marine products from India. The provisions under the various WTO agreements are expected to have an impact on the different dimensions on the Fisheries sector.

Indian fisheries cannot escape from the stark reality of fierce competition emerging in the global scenario. Indian seafood industry, by and large, still remains as a supplier of raw materials to the preprocessors in foreign countries and 90 per cent goes in bulk packs, which is the prime reason for the drastic reduction in the unit value realization. Restrictions and levies imposed by both the exporting and importing nations acts as fiscal controls and hamper exports. The policy constraints often take the form of non- tariff barriers and generally relate to quality specification of the traded goods and also packing materials. India has taken a position that arbitrary as well as restrictive sanitary and phyto-sanitary measures continue to represent a major obstacle to international trade of agricultural products. Developing-country exports are usually affected because the Sanitary and Phyto Sanitary (SPS) measures are often developed in a non-transparent manner and developing countries invariably do not get adequate opportunity to respond to the proposed measures. A number of international standards are thus being developed without the participation of developing countries. As a result, standards are often being adopted without taking into

account the problems and constraints that developing countries face. The export to the European Union still poses serious threats due to the quality aspects raised by the importers and the characteristics of a buyer market. Recently there had been reports of rejections of consignments from the European Union due to the detection of antibiotic microbial and bacterial residues to the tune of 500-600 crores annually. The overall production from export-oriented aquaculture during last year was estimated to be 1.33 lakh tonnes, which was a fall by 41,000 tonnes in quantity and Rs 941 crore in value compared to the previous year. Shrimp production showed a decrease by 26 per cent and scampi production by nine per cent over the previous year. Disease outbreaks and natural calamities were reportedly the prime reasons for the shortfall in aquaculture production. In addition to all these the recent economic slowdown and recession for the last three quarters is for sure take a toll in the balance of payment in the country. Depreciating rupee notwithstanding, global economic turmoil has started taking a toll on the country's robust export growth story.

Economic Recession is "a significant decline in the economic activity spread across the country, lasting more than a few months, normally visible in real GDP growth, real personal income, employment, industrial production, and wholesale-retail sales. In the event of the economic slowdown coupled with the increase in the purchasing power of the consumers it is important to note that some of the high value fishes like the shrimp, seer fish and pomfrets fetches a premium price in the domestic market too. Low demand from the US and the EU - the two economies hit hard by the global crisis - has decelerated the country's export growth sharply in September 2008. Export markets are subject to risk in terms of detention and loss or damage in transit or variation in foreign exchange values. The setbacks experienced now and then in the export front which is imminent under the WTO regime can be supported only if a buffer is created by a well-developed internal marketing system

WTO and Indian fisheries

With the implementation of the New Economic Policy in July 1991, and the subsequent focus on terms of trade and gains from trade, seafood was identified as a major source of foreign exchange earner for the country. The founding of the World Trade Organization (WTO) in January 1995 marked the culmination of a series of complex, arduous and long drawn out negotiations under the Eighth Round of General Agreement on Tariffs and Trade (GATT). It also marked the beginning of a distortion free multilateral trade among the economies of the World as the core principle of the WTO is institutionalization of global framework for deregulated competitions. India, being a founder member of the GATT, is a signatory to the commitments made during the negotiations.

The provisions under the various WTO agreements are to have impact on the different dimensions on the Fisheries sector. The main provisions of WTO agreement that are applicable to fisheries are:

1. Trade related intellectual property right (TRIPS) and imposition of patent regime.
2. Trade related investment measures (TRIMS).
3. Reductions of domestic and export subsidies.
4. Tariff reduction and bindings to provide market access.
5. Removal of quantitative restrictions (QR).
6. Application of sanitary and Phyto-sanitary (SPS) measures.
7. Aggregate Measure of Support (AMS).

The implications are discussed below under the following heads

(a) Export performance over the years
(b) Recession and its impact on India seafood trade
(c) Debate on Subsidy
(d) Sanitary and Phytosanitary measures
(e) Exporters profiling and constraint analysis of exporters
(f) Tradeoffs between domestic marketing and international trade
(g) Trade and resources

A. Export performance over the years

There has been commendable increase in the Indian fisheries export in terms of quantity, value and unit value over the years. The results are given below in the following tables.

Table 6.1 Export growth of marine products – Post and Pre WTO (Commodity)

Year	Pre -WTO (1980-19950)	Post WTO (1995-2010)
Total		
Quantity (tonnes)	3.49*(1.53)	8.29* (2.763)
Value (Rs)	3.33** (1.50)	8.23* (2.58)
Value (US $)	3.31* (1.80)	6.99* (2.12)
Unit Value (Rs)	-0.15 (-0.10)	1.16(0.24)
Frozen Shrimp		
Quantity (tonnes)	0.83 (0.80)	5.35* (2.67)
Value (Rs)	1.95 (0.89)	7.93* (2.36)
Value (US $)	1.92** (1.01)	6.72* (1.99)
Unit Value (Rs)	1.11 (0.68)	2.45* (1.40)
Frozen Lobster		
Quantity (tonnes)	12.88* (2.94)	2.54(0.64)
Value (Rs)	16.05* (2.64)	4.97* * (0.83)
Value (US $)	16.03* (2.98)	3.79(0.65)
Unit Value (Rs)	2.80 (0.83)	2.36* * (0.89)
Frozen Squid		
Quantity (tonnes)	16.26*(2.24)	7.54* * (1.02)
Value (Rs)	16.64* (2.04)	9.37* * (1.02)
Value ($)	6.61* (2.07)	9.14* * (0.92)
Unit Value (Rs)	0.48 (0.15)	2.69* * (0.90)
Frozen Cuttlefish		
Quantity (tones)	16.03* (3.62)	7.62* (1.58)
Value (Rs)	26.64* (2.04)	7.04* * (1.05)
Value (US $)	26.61* (2.07)	4.66(0.68)

Unit Value (Rs)	0.48 (0.06)	-0.53(-0.24)
Fresh and Frozen Fish		
Quantity (tones)	3.49 (0.41)	11.62* (2.29)
Value (Rs)	8.18 *(1.35)	9.59* (1.98)
Value (US $)	8.15* (1.42)	8.36* (1.75)
Unit Value (Rs)	4.52** (1.14)	1.81* (1.66)
Others		
Quantity (tonnes)	-5.45** (-0.90)	13.59* (1.80)
Value (Rs)	-6.23** (-1.03)	27.44* (1.13)
Value (US $)	-6.25** (-1.12)	27.47 (1.08)
Unit Value (Rs)	-0.83 (-0.11)	12.19* (0.77)

Figures in parenthesis the standard errors of the estimates

indicate * one per cent level of significance and ** five per cent level of significance

Table 6.2 Export growth of marine products – Post and Pre WTO (Market wise)

Year	Pre -WTO (1980-19950)	Post WTO (1995-2010)
Total		
Quantity (tonnes)	3.49*(1.53)	8.29* (2.763)
Value (Rs)	3.33** (1.50)	8.23* (2.58)
Value (US $)	3.31* (1.80)	6.99* (2.12)
Unit Value (Rs)	-0.15 (-0.10)	1.16(0.24)
Japan		
Quantity (tonnes)	-0.06 (-0.06)	3.73* (1.00)
Value (Rs)	0.91* (0.45)	5.03* * (1.02)
Value (US $)	0.92* (0.51)	3.90(0.77)
Unit Value (Rs)	0.97 (0.52)	1.25 (0.59)
USA		
Quantity (tonnes)	2.62*** (0.75)	8.17* (3.57)
Value (Rs)	3.36** (0.77)	14.79* (3.49)
Value (US $)	3.38** (0.93)	14.27* (3.59)
Unit Value (Rs)	0.72 (0.51)	14.73* (3.48)
European Union		
Quantity (tonnes)	3.66 *(1.61)	11.66(1.17)
Value (Rs)	1.26* (1.53)	4.64(1.23)
Value (US $)	1.28* (1.62)	4.62* (1.62)
Unit Value	1.11** (1.08)	4.35* (2.06)
South East Asia including China		
Quantity (tonnes)	2.14*	13.86* (2.04)

Value (Rs)	4.23	12.54* (1.38)
Value (US $)	4.38	11.32(1.23)
Unit Value (Rs)	0.48**	1.15(0.31)
Middle East		
Quantity (tonnes)	3.42**	5.19 (0.85)
Value (Rs)	2.13	7.84 (0.82)
Value ($)	2.32*	6.68(0.69)
Unit Value (Rs)	1.24**	2.51(0.45)
Others		
Quantity (tonnes)	2.84 (0.45)	18.18* (1.52)
Value (Rs)	6.07** (1.13)	24.39* (1.58)
Value (US $)	6.09** (1.08)	23.05* (1.51)
Unit Value (Rs)	3.14 (0.63)	5.26* (1.55)

Figures in parenthesis the standard errors of the estimates

indicate ** one per cent level of significance ** five per cent level of significance

Inorder to examine quantitatively the effect of export quantity and the export unit value and their variability on the export value over the year's decomposition analysis was performed. For better understanding the variance of the export value was measured in two-time period *viz*., pre WTO period (1980-1995) and post WTO period (1995-2010). The export quantity and export unit value of Indian fisheries were detrended for further decomposition analysis.

Decomposition analysis was done for decomposing the sources of growth on average export value and variance of export value of Indian marine products

Table 6.3 Decomposition analysis of the components of change in average export value of Indian marine products

Sl. No:	Source of Change	Percent Share
1	Change in Mean Export Unit Value	7.29
2	Change in Mean Export Quantity	81.21
3	Interaction between changes in (1) and (2)	9.42
4	Change in EQ-EUV covariance	2.08

The results indicated that the contribution of change in mean export quantity was the highest among the other components of change i.e. the increase in mean export quantity accounted for 81.21 per cent of the increase in average export value. This was as expected because the export quantity had recorded significant higher growth rates during both the period whereas the export unit value recorded a negative growth rate during the post WTO period. The changes in the covariance between the mean export quantity and mean export unit value accounted 2.08 per cent increase in the mean export value. The changes in the covariances could arise through the changes in the variance of export quantity and export

unit value. With regard to interaction effect the export quantity was benefited to a small extent (9.42 per cent) from both mean export quantity and mean export unit value. Among the various components, the contribution of change in mean export quantity of Indian marine products was the dominant source for the change in average export value followed by the interaction between changes in the mean export quantity and mean export unit value. The components of change that affected the stability of export value are shown in Table 5.9

A. Export performance over the years (recession)

Recession is defined as the significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in production, employment, real income, and other indicators which started in 2007-08 (mostly in developed economies) There exists a lag in recession especially with regard to food demand .The impact has been noticed since first quarter of 2009.

The impact of recession was studied and it was found that recession has not affected India's seafood trade. The major reasons for the same had been India- economic stimulus, strength of banking system, Developed countries - Purchasing power and employment rate decreased by around double digits as the demand for retailing gone up and lower demand for ready to serve and ready to cook .The demand for food stamps (PDS increased in the developed countries including US and EU amidst massive economic stimulus provided. The China - Stronger Yuan and remain unaffected. In the South East Asian countries was countered by more productivities and governmental regulation .The Indian seafood export wasn't affected due to the Increased demand for raw fish rather than value added products from the retail outlets , declining international market arrivals by over 10 per cent globally in the buyer countries .It was found that the quantity and value are on the high and the emergence of newer markets in Latin American, African (3.5 and 4.2 per cent Quantity and Value).However there are concerns of Unit value declining over the period - case of concern and Growing concern of depreciating rupee compared to dollar increased the earnings and the reduction in the import to China (but channeled through Vietnam was a concern)

Recession and India's export trade

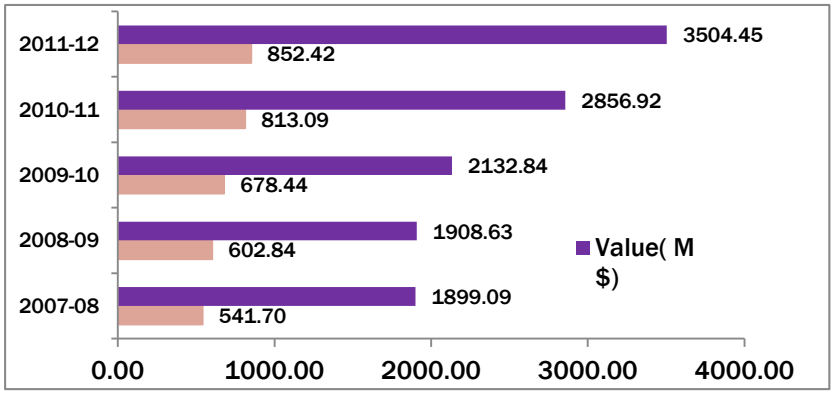

Fig.6.1 Recession and India's export trade

B. Export performance

The export performance was based on a matrix referred to as Growth Constancy Retention matrix (GCR) based on the secondary data collected from secondary data from 1975-2011>the study covered the Geographic concentration of 35 countries and the commodity concentration- species and different forms .The matrix is represented below in Figure 8. The parameters used in the matrix include:

- Growth estimated using compound growth rate HG, MG, LG, MlG
- Constancy - using Stability index- HC, MC, LC, MlC
- Retention- brand loyalty of Indian products estimated using weighted average HR, MR, LR, MlR

The estimation of the parameters are done using G- Growth estimated
using compound growth rate
r =(Anti Ln of b - 1) X 100
C- Constancy done using Stability index
The instability index = (antilog g – 1) x 100 ……. (g)
Where,
Xt = Value of exports in year t or volume of exports in year t
N = Number of years – 1, m =The arithmetic mean of the difference between the logs of Xt and Xt+1 , etc. ,V log = Logarithmic variance of the series
R- Retention- brand loyalty of Indian products estimated using weighted average)

Growth -Constancy -Retention Matrix

Growth / Constancy	High		medium		Low		marginal	
High	HR	MR						
	LR	MLR						
Low								
Medium								
Marginal								

HR,MR,LR and MLR Indcates different levels of retention

Figure 6.2 Growth -Constancy -Retention Matrix

The analysis of the Growth Constancy matrix indicated that there exist stable partners across the export destination with sizeable export quantities

(C) **Antidumping**

Anti-dumping duty had a major impact on shrimp exports to the US which plummeted from $409 million in 2003 before the duty imposition to $142 million in 2008. The exports to US have considerably increased after the reduction in the antidumping duty from 14.29 to 0.79 during 2008-09 (Figure 27A).Subsequent increase from 0.79 to 2.14 per cent(2010-11) hadn't shown any effect on the shrimp exports to United States for now an increased to 452 million $ during 2010-2011.

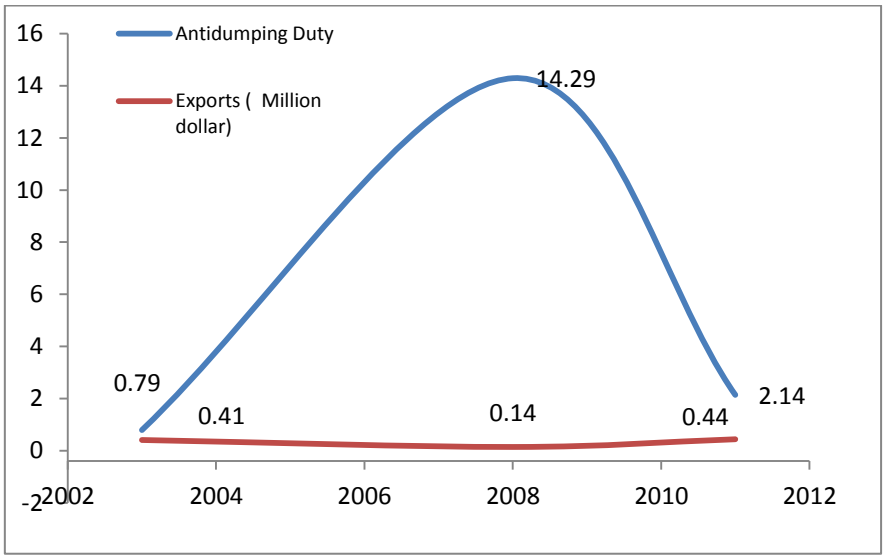

Fig. 6.3 Antidumping duties and changes in export quantum to US

(D)Sanitary and Phyto sanitary measures

The analysis of the short run and long run gains on the SPS and compliance measures by the exporter's analysis indicated that with the huge cost of investment required for the compliance of EU approval and HACCP implementation the gains weren't significant due to non-capacity utilization of the processing plant and lack of raw materials. The processing plants which have implemented the compliance investment for the EU approval are yet to break even their cost of investment even after 8 -10 years on account of processing capacity utilization to the tune of 22-25 per cent.

Nitro furan metabolites, concentration of heavy metals, occurrence of histamine and bacterial inhibitors were the major reasons for the EU rejections of Indian marine products. Belgium, Spain, Greece and UK were the major countries which rejected the consignments during the period the present antibiotic residues level required by the EU for seafood exporters are extremely rigid and beyond the actual requirement of food safety

(E) Fisheries Subsidies

Fuel subsidies, preferential tax treatments, boat construction subsidies comes under the WTO definition of subsidies set forth in WTO Agreement on subsidies and countervailing measures. According to UNEP the different subsidies to fisheries sector consists of fishing infrastructure (construction of harbours and port-facilities, management services (monitoring and surveillance, management related research, subsidies to securing fishing

access, subsidies to decommissioning of vessels, subsidies to capital costs , subsidies to variable costs income supports and price supports. In India the different types of subsides includes, subsides to marine fisheries development (motorization of crafts and reimbursement of excise duty or sales tax exemption on fuel, subsides for kerosene, construction of fishing harbours and other infrastructure, support for domestic marketing ,processing facilities, subsides for promotion of aquaculture , subsidies for different institutions for research and development, and export subsidies. Among the different items, subsidies to marine fisheries development infrastructure and post-harvest operations and export subsidies are considered as harmful subsides. The adverse effect of subsides depend on the existing management regime and the bio economic conditions of the fishery. Subsidies lower the cost of harvest and raise the effective price of fish. As a management tool, cost-reducing or profit-increasing subsidies may result in increased productive efforts and hence considered as harmful through overexploitation of fish resources and unsustainable harvesting (eg. Export promotion subsidies results in targeted fishing and trade diversions).

Classification of Subsidies

The classification of subsidies under the different head *viz.*, Good (Beneficial), ,Bad (Capacity enhancing) and Ugly (Ambiguous)is furnished in Table

Table 6.4 Classification of subsidies

Sl.No:	Type of Subsidies	Details
1.	Good (Beneficial)	Lead to investment in natural capital assets. They enhance the growth of fish stocks through conservation, and the monitoring of catch rates through control and surveillance measures to achieve maximum long-term sustainable net benefits
2.	Bad (Capacity enhancing)	Programs that lead to disinvestments in natural capital assets such that the fishing capacity develops to a point where resource overexploitation makes it impossible to achieve maximum sustainable long-term benefits.
3.	Ugly (Ambiguous)	Programs whose impacts are undetermined, i.e., they may lead to either investment or disinvestment in the fishery resource. These subsidy programs can lead to positive impacts such as resource enhancement programs or to negative impacts such as resource overexploitation.

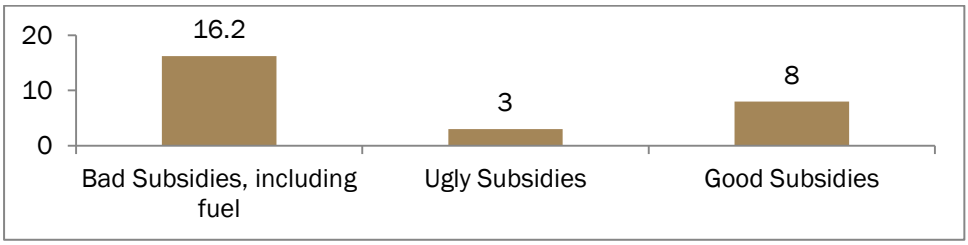

Fig. 6.4 Fisheries Subsidies in the world (Billn $)

Table 6.5 Quantification of subsidies across the world

Type of Subsidies	Total	Share to total value
Bad Subsidies, including fuel	16.20	25.00
Fuel subsidies alone (27 per cent of bad)	6.20	9.57
Ugly Subsidies	3.00	4.63
Good Subsidies	8.00	12.35
Total subsidies	27.20	41.98
Developed (Per county basis – 3 times)	18.50	68
Developing	8.704	32

Table 6.6 Categorisation of fisheries subsidies in the world

Countries	Beneficial - Good	Capacity enhancing - Bad	Ambiguous - Ugly	Total
Japan	0.59	3.39	0.65	4.64
EU	1.26	2.59	0.72	4.57
China	1.23	2.19	0.73	4.14
USA	1.16	0.44	0.20	1.80
Russia	0.32	1.04	0.12	1.48
India	0.18	0.85	0.04	1.07
WORLD	8.00	16.2	3.00	27.2

Table 6.7 Subsidies in select countries - Subsidy per tonne of fish

Sl.NO:	Country	Total	Bad	Fuel subsidy	Landings	Total	Fuel
1 .	Japan	4.64	2.6	56.03	4.21	1102.14	617.58
2 .	EU	4.57	3.4	74.40	5.83	783.88	583.19
3 .	Spain	0.67	0.48	71.32	1.23	547.15	390.24
4 .	France	0.43	0.36	82.57	0.89	489.89	404.49
5 .	China	4.1	3.1	75.61	14.65	279.86	211.60
6 .	US	1.8	1.4	77.78	4.72	381.36	296.61
7 .	Russia	1.48	0.98	66.22	3.45	428.99	284.06
8 .	India	1.07	0.23	21.30	3.10	348.39	74.19

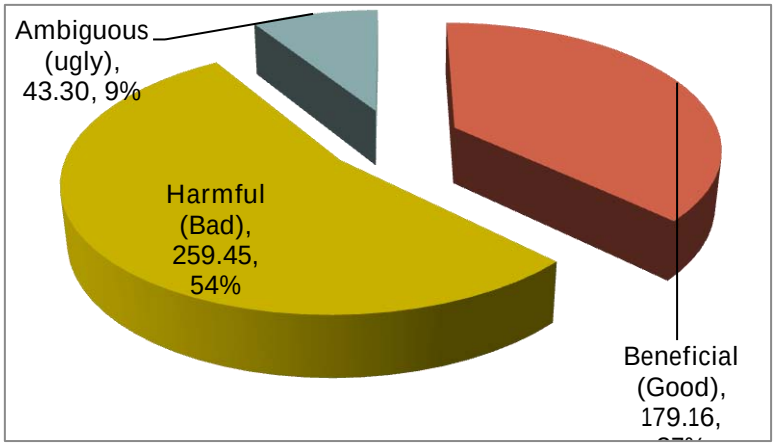

Fig. 6.5 Categorisation of fisheries subsidies in the world

Table 6.8 Quantification of Indian fisheries subsidies

Beneficial (Good)	M$
Fisheries management and services	117.84
Fisheries research and Development	60.00
Maintenance of MPAs.	1.32
Sub total	179.16
Harmful (Bad)	
Boat construction,	27.17
Fishery development and support services	29.14
Fishing port construction and renovation	133.38
Marketing support and storage infrastructure	24.44
Tax exemption	0.31
Foreign access agreements.	0.00
Fuel subsidies (Annual consumption of 1000 million litre)	45.00
Sub total	259.45
Ambiguous (Ugly)	
Fisher assistance	4.15
Vessel buyback	0.00
Rural fisheries community development	39.15
Sub total	43.30
Grand total	481.91

Table 6.9 Fisheries Subsidies

A.	Value of landings at landing centre- crores (Marine Landings -3.12 Million tonnes)	19573	25773
B.	Value of marine landings at landing centre- M $	4893.25	6443.25
C.	Total subsidy breakup		
(i)	Beneficial (Good)	179.16	37.18
(ii)	Harmful (Bad)	259.45	53.84
(iii)	Ambiguous (ugly)	43.30	8.99
(iv)	Grand total	481.91	
D.	Percentage of subsidies	9.85	7.48

- Fishery subsidies greatly impact the sustainability of fishery resources. Subsidies that reduce the cost of fisheries operations and those that enhance revenues make fishing enterprises more profitable than they would be otherwise. The global fisheries subsidies are estimated at 30 billion dollars which comprises of good bad and ugly subsidies on account of their role in investment or disinvestment to the natural capital assets. The global subsidies are valued at 35–40 per cent of the value of total fisheries production. Fuel accounts to more than 27.7 per cent. The good subsidies account to 27 per cent of the total subsidy in terms of fisheries management, research and conservation programmes. Developed countries account for more than 68 per cent of subsidies, and developing countries the remaining 32 per cent. However on a per country basis, developed countries provide more than three times as much subsidy as developing countries.

- In the context of India the amount of subsidies provided is much less with less than 8 per cent of the total value even though challenged internationally .The marine fisheries sector in India is a subsistence fishing and much different from the factory / commercial fishing of developed countries. In addition the fuel subsidy provided contributes to less than 5 per cent of the total value of landings. But on the other side the welfare measures, saving cum relief, housing and other transfer payment adds to the subsidy component in the Indian context. Further it is important that the good subsidies don't feature in Indian fisheries subsidy regime.

- The subsidies to fisheries development, infrastructure and post-harvest infrastructure and export subsidies which were considered as harmful in the WTO definition were Rs. 62.8 crores and Rs.34.22 crores respectively during 2010-11. The total amount of support to fisheries sector was Rs.259 crores only (including both beneficial and harmful subsidies) which was less than one per cent of the fisheries GDP in India

The different items of subsidy in the Indian fisheries sector (Centrally sponsored schemes) are as follows:

Table 6.10 Subsidies in the fisheries sector in India (2010-11)

Items	Amount (Rs.lakhs)
1.Marine fisheries development	
a)Motorization of traditional crafts Central share (50 per cent): State share (50 per cent)	498
b)Rebate on HSD (central share-80 per cent state share 20 per cent)	936
2.Establishment of fishing habours and other infrastructure	5282
3.Welfare measures	746
4.Institutes	4376
5.NFDB	8675
6.Aquaculture	2000
Total	22513

The various fishery development measures like motorization of crafts and rebate on HSD oil and fishing harbor development are included under the subsidy class of WTO as they directly promote fishing operations. The assistance for fishing harbor development is considered as an indirect subsidy in the WTO definition.

Table 6.11 Export subsidies (2010-11)

Export subsidies	Amount (Rs.lakhs)
Sea freight assistance scheme-for import of raw materials for preparation of value added products	
Tuna long lining	100.00
Development of potential farming area	679.00
Organic aquaculture	14.19
Digital data base on aqua farms	37.00
Ornamental fish breeding	209.00
Subsidy for promotion of aqua culture	414.00
Acquisition of processing machinery	1200.00
Technology for up gradation of marine products	105.00
Basic facilities for chilled fish/tuna	148.00
Effluent treatment plant	18.00
Promotion of aquaculture societies	177.00
Labs for quality certification	21.33
Landing centres/ fishing harbours-ice making machines and chill rooms	300.00
PCR lab	40.68
Total	3422.52

NFDB also promotes fisheries through development of fishing harbours, assistance to fish markets and deep sea fishing. The total assistance for marine fisheries development was Rs.998 lakhs in 2010-11. The support to institutes like fishery survey of India, Central institute of fisheries nautical engineering, NIFPHATT, Central coastal engineering institute, integrated fisheries projects etc. are considered as favorable subsides as they promote sustainable fishing practices. Export subsidies are provided through various export promotion schemes of MPEDA. The total export subsidies amounted to Rs.34.22 crores in 2010-11

The expenditure on subsidies for marine fisheries development, infrastructure and post- harvest operations declined from 60.85 crores in 2005-06 to 41.49 crores in 2007-08 and then increased to 62.8 crores in 2010-11. The total amount of subsidies to fisheries sector is 259 crores only which is less than one per cent of the fisheries GDP in India.
Figure 34 Growth in subsidies in marine fisheries development, infrastructure and post-harvest operations

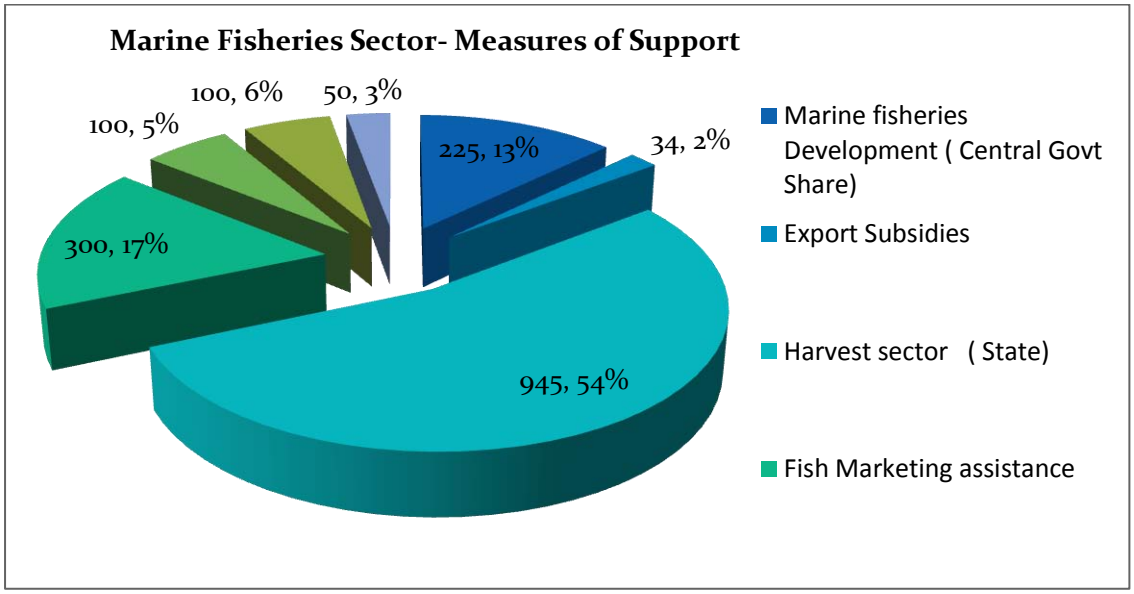

Figure 6.6 Marine Fisheries Sector- Measures of Support

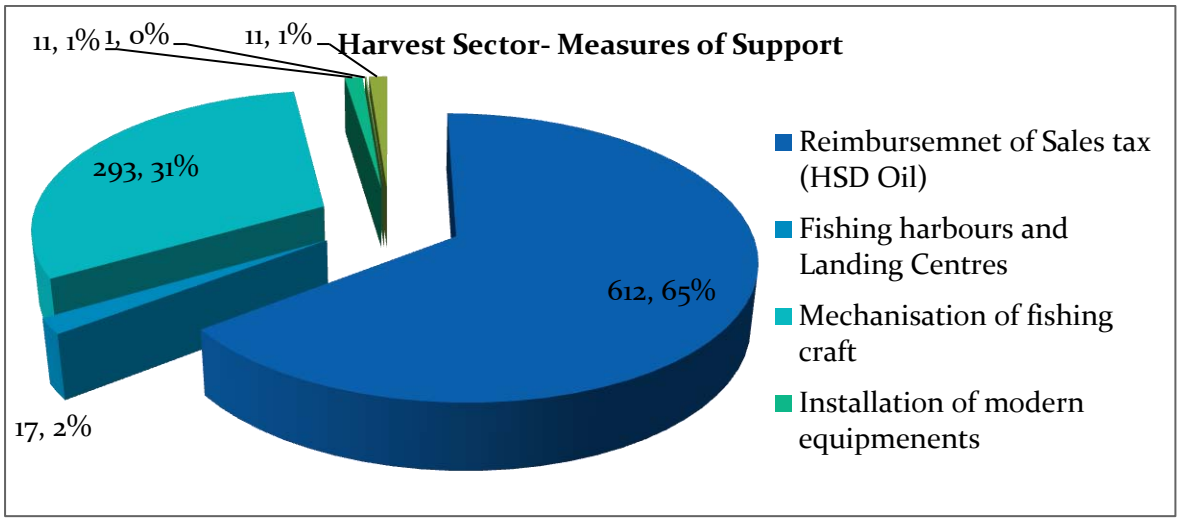

Figure 6.7 Harvest Sector- Measures of Support

Table 6.12 Subsidies in Indian marine fisheries sector

Sl.No:	Parameters	2010	2011
1.	Marine fish landings in India (Qty)	3.32	3.40
2.	Value of marine landings at landing centre- crores	22,648	24,372
3.	Value of marine landings at retail level- crores	36,964	38,152
4.	Total subsidy	1927	1754
5.	Percentage of subsidies	8.51	7.19
6.	Subsidy per tonne of fish (Rs)	5806	5150

The implications on the study of subsidies indicated the following

- The amount of subsidies provided is much less with less than 8 per cent of the total value even though challenged internationally.
- The marine fisheries sector in India is subsistence fishing and much different from the factory / commercial fishing of developed countries.
- In addition the fuel subsidy provided contributes to less than 5 per cent of the total value of landings.
- But on the other side the welfare measures, saving cum relief, housing and other transfer payment adds to the subsidy component in the Indian context.

H. Trade and Resources

The relationship between the landings, export, CPUE were estimated and depicted graphically in the following figures.During 1985-2010, the marine products export has been increasing proportionate to the marine fish landings. The share of export has steeply increased from 2001 onwards compared to the previous period.

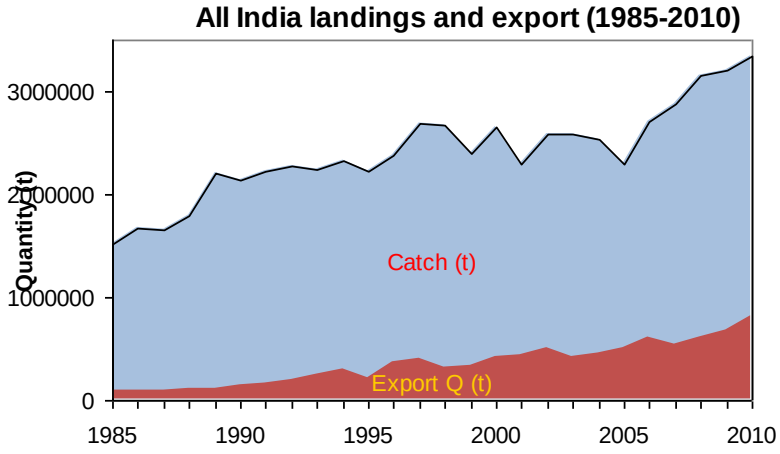

Figure: 6.8 All India landings and export (1985-2010)

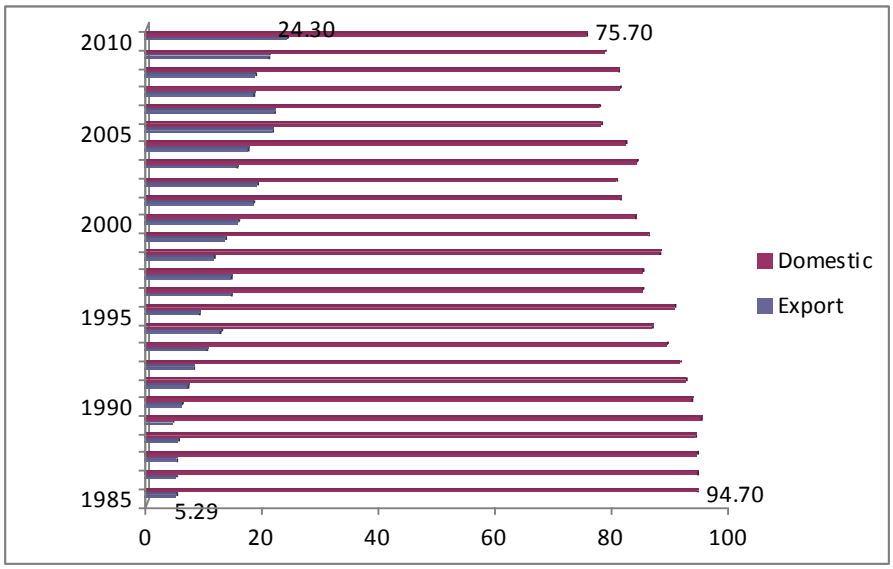

Figure: 6.9 Share of landings to Domestic and Export market (1985 – 2010)

There is positive relationship between quantity exported with that of total CPUE of the vessels. Whenever a landing increases, the CPUE also increases logarithmically.

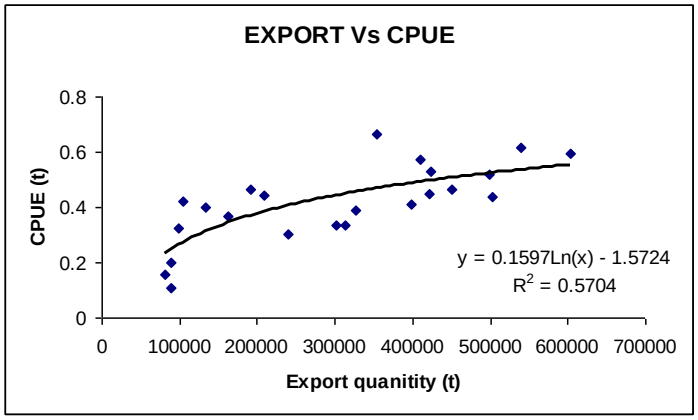

Figure 6.10 Exports vs CPUE

There is a steep increase in CPUE of mechanized vessels of India with the increase in export quantity (Fig.). However, the CPH of mechanized vessels showed a decreasing trend with increase in quantity exported (Fig.). This can be attributed to the induction of more number of multiday mechanized vessels to target the key resources of high demand in export market, which in turn reduced the CPH of vessels.

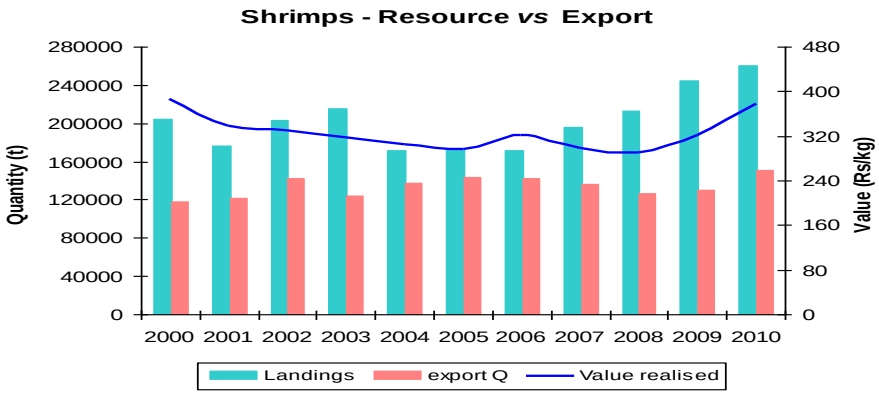

Figure 6.11 Shrimps- Resource vs Export 1985-2010

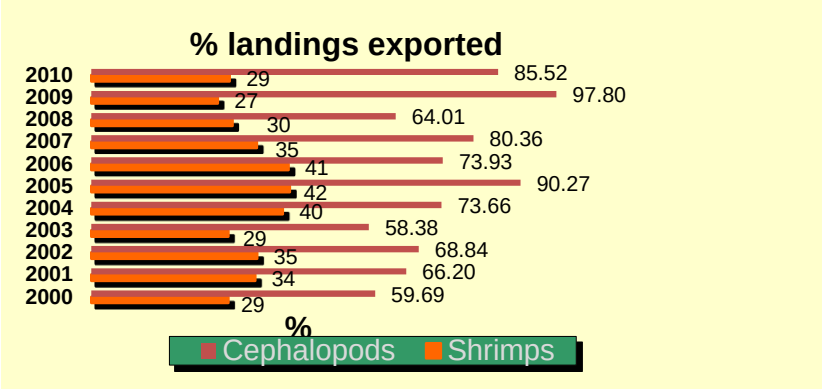

Figure 6.12Percentage landings exported 1985-2010

The value realized for shrimps during the last decade decreased with increase in landings. In the case of cephalopods, there is a marginal increase in the value with the increase in landings. This has resulted in the increase of per cent share of landings of cephalopods during the last five years.

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7

Marine Finfish Resources of India: Distribution, Commercial Exploitation, Utilization Pattern and Trade

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The world's fisheries provide more than 2.6 billion people with at least 20 per cent of their average annual per capita protein intake (FAO, 2007). Globally, fish has been attracting increased attention not only as an item of connoisseur's delight and preferred food for health conscious elite but as a source of employment, livelihood and food security to several millions of poor people in the developing world. Capture fisheries and aquaculture supplied the world with about 142 million tonnes of fish in 2008 (Table 1). Asia contributes to 63.17 per cent of total fish production in the world. However, South Asia's contribution is only 6 per cent. India occupies a prime position amongst South Asian countries in fish production. While Bangladesh (17 per cent), Pakistan (9 per cent), Sri Lanka (3 per cent), Nepal have only small shares, India contributes to 71 per cent in this region (FAO, 2008).

Table 7.1 Fish Production in India and the World and its Per cent contribution to World fish Production (in mmt) Source: handbook on Fisheries and Aquaculture ICAR, New Delhi

Year	Capture fish Production		Aquaculture Production		Total fish Production	
	Global	India	Global	India	Global	India
2005	92.0	3,.691	44.3	2.967	136.3	6.659(4.88 %)
2006	89.7	3.845	47.3	3.180	137.0	7.025(5.13 &)
2007	89.9	3.859	49.9	3.112	139.8	6.971(4.99 %)
2008	89.7	4.105	52.5	3.479	142.2	7.584(5.33 %)
2010	90.0	4.02*	55.1	4.27*	145.1	8.290(5.71 %)

Fisheries sector is an important player in the overall socio-economic development of India. The fisheries sector contributed 76913 crores to the GDP (at current prices) during 2009-10 which is 0.96 per cent of the total GDP at factor cost and 5.4 per cent of the GDP at factor cost from agriculture forestry and fishing. During 2010-11, the export of marine products reached over 8 lakh tonnes valued at Rs 12,901.47 crores and US$ 2.857 billion (Report of the working group, Planning commission, 2011). Indian marine fisheries which existed as a sustenance fishery for years, underwent a series of change with the advent of mechanisation in 1950s, evolving itself into a multi-billion dollar industry. India has earned US$ 2.84 billion mark in the export of marine products from the country (MPEDA, 2011).

India is one of major fish producing countries in the world contributing over 3 per cent of both marine and freshwater fishes to the world production (Srinath and Pillai, 2006) with third position in capture fisheries and second in aquaculture. India has an Exclusive Economic Zone (EEZ) covering a total area of 2.02 million sq. km (fig 1), i.e., 0.86 million sq. km on the west coast including the Lakshadweep Islands and 1.16 million sq. km on the east coast, including the Andaman and Nicobar Islands and a continental shelf of half a million sq. km (Vivekananadan*et al.,* 2003).

The marine fisheries sector has high potential for rural development, domestic nutritional security, employment generation, gender mainstreaming as well as export earnings. The first formal step towards the development and management of marine fisheries in India was the enactment of the Indian Fisheries Act of 1897, delegating various erstwhile provinces with the responsibility of fisheries administration and management (BOBP, 1982; Bensam, 1999). To increase fish production from the seas, the different Five-Year Plans took adequate care by developing the marine fisheries by mechanization of indigenous craft, introduction of mechanized vessels, and improvement of fishing implements, establishment of infrastructure facilities for processing and storage and to establish a strong R & D facility (James and Rao, 1992).

Table 7.2 Indian marine fisheries statistics at a glance

Gross value at landing centre	19,753 crores
At retail point	28,51 crores
Export earnings	US$ 2.84 billion
per cent in export earnings	3 per cent
Domestic markets	81 per cent fresh, 5 per cent frozen, 6 per cent dry, 5 per cent fish meal
Per capita fish consumption	2.85 kg (0.3-39)
Share in GDP	1.1 per cent
Share in agricultural GDP	5.4 per cent

Indian fisheries sector has been witnessing a steady growth since the First Five Year Plan. The marine fish production increased from 0.53 million t in 1950-51 to a maximum of 3.3 million t in 2010-11.

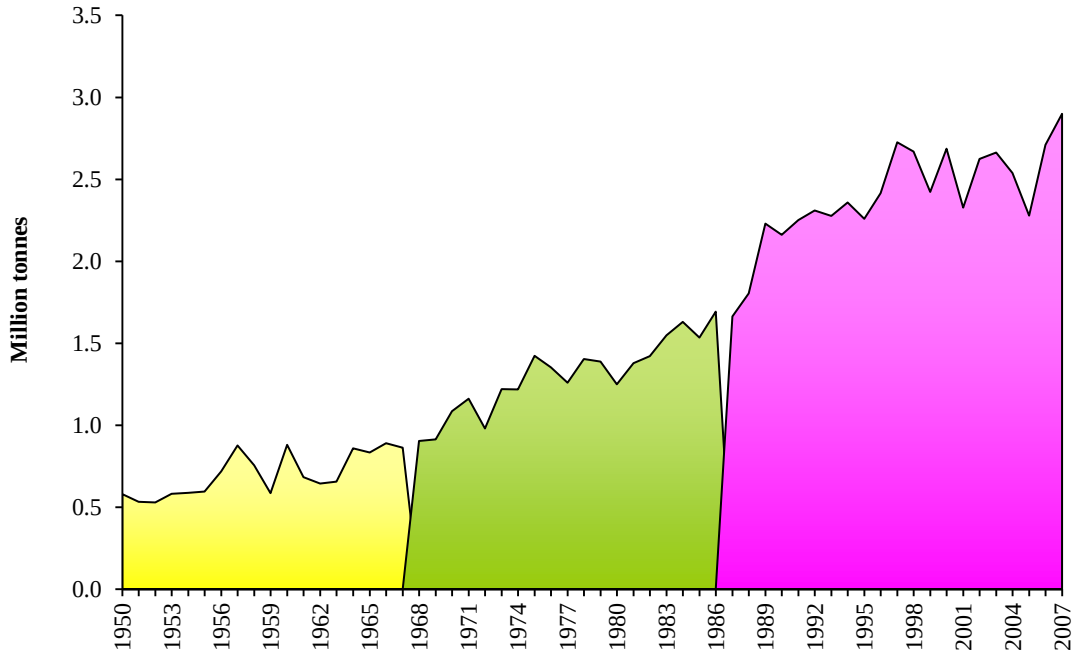

Figure 7.1 Three phases of development of Indian marine fisheries (Source: handbook on Fisheries and Aquaculture ICAR, New Delhi) 2010.

The growth of marine fisheries in India can be demarcated into three phases (Srinath and Pillai, 2006). The **I Phase** which extends from 1950s to late 1960s witnessed a slow, but steady growth in fisheries where non-mechanised craft and gears were operated (Fig 1). **Phase II** (late 1960s-mid 80s) was marked with use of improved gear materials, export trade expansion, increased mechanisation, initiation of motorisation of country craft and intensification of fishery activities. The **III Phase** which extends from mid80s to the present is characterised by intensification of mechanised fishing, growth in motorisation and multiday fishing, extension of fishing grounds, seasonal fishery ban, introduction of molluscan aquaculture, open sea cage farming and breeding and hatchery development of marine finfishes for aquaculture. The developments in fish harvest technology has been in areas of craft technology and mechanization of propulsion, introduction of synthetic gear material, acoustic fish detection and satellite-based remote sensing techniques, advances in electronic navigation, provisions for on-board fish processing and preservation. Thus, the fishing industry in the last five decades has undergone significant developments leading to improvements in the working conditions and reducing the drudgery of fishermen.

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

About 35 per cent of Indian population eats fish. Thus, annual per capita consumption of fish eating population is projected about 16.8 kg in 2010, and would rose to 18.5 kg by 2020. Under the baseline scenario, the additional fish demand from the year

2000 to 2020 would be about 3.21 million tonnes (Ref. Pradumankumar et al-handbook on Fisheries and Aquaculture ICAR, New Delhi). Out of this, 52 per cent would be met from Indian major carps (IMC) followed by other freshwater fish (38 per cent), Pelagic low value sardine mackerel, anchovies etc (14 per cent) and Demersal low value fish like rays, lizard fish, nemipterids, catfish, soles etc (3.3 per cent). The additional consumption of shrimp, Demersal high value (rocks cods, snappers, letherinids, threadfins etc and Molluscs species would decline by 9 per cent. The aquaculture has been found to hold the key for meeting the future demand challenges.

About 0.933 million people are employed in the sector on full-time basis, 1.01 million on part-time basis and 1.39 million are engaged in other ancillary activities. Major fish production comes from the coastal resources. As per the early estimates of NMFC, 2010, there are about 8.63 lakh fisher's families in the mainland and about 9.26 lakh people are engaged as active fishers. The estimated marine resource potential of the Indian EEZ is 4.24 million metric tonnes (mmt) at the present exploitation rates. In marine fisheries, while inshore waters have been almost exploited to the sustainable levels (CMFRI, 2011), contributions from the deep sea have been insignificant. The trend based surveys have indicated that in the depth range up to 100 m, which contributes to about 86 per cent of the total exploited resources; practically there is little possibility of witnessing quantitative increase in production. However, the depth ranges beyond 100 m have avenues of expansion, albeit more in qualitative terms. In this domain, the possibility revolves around oceanic resources like tuna, bill fishes and allied species whose combined potential is pegged at 0.2 mmt with the lucrative yellow fin tuna contributing to the tune of 40 per cent to it.

Present scenario of capture fisheries

The period 1960 -70s saw a gradual increase in fisheries production from 0.63 million t in 1960 to 1 mt in 1970; a twenty year period (1950–1970) was required to raise production by double. Another 20 year period (1970 – 1989) was required to cross the 2 million t mark. During 1989 – 2010, fishery production did not have a smooth sail, but increased by leap and bounds. However, the period 2005 -10 witnessed a meteoric increase in production by over 45 per cent i.e. 1.03 million tonnes (m.t) compared to that of 2005. Production has now touched 3.3 m.t in 2010

State-wise production

Among the coastal states, Kerala, followed by Tamil Nadu, Gujarat, West Bengal and Maharashtra together contribute a major share (59.2 per cent) to the marine fish production of the country. However, considering the production per unit length of coast line, West Bengal has the maximum productivity of 2,259 t/km followed by 953 t/km by Karnataka, 878 t/km by Kerala, 682 t/km by Goa, 496 t/km by Tamil Nadu and 439 t/km by Maharashtra. While the east coast has 57.2 per cent of the total coastline, it contributes only 28.8 per cent of the total marine fish production, with rest 70.2 per cent contributed by west coast.

Table 7.3. State-wise marine fish landings in India in lakh tones (average for 2006-10)

	Average landings	per cent
Kerala	5.99	18.44
Gujarat	5.83	17.96
Tamil nadu	4.90	15.08
West Bengal	3.39	10.43
Karnataka	3.34	10.28
Maharashtra	3.04	9.36
Odisha	2.54	7.83
Andhra Pradesh	2.41	7.43
Goa	0.90	2.79
Puducherry	0.13	0.39

On the East coast, Tamil Nadu was the major contributor followed by West Bengal and Orissa. Marine fish production has shown a steady increase in Tamil Nadu from 1.23 lakh t in 1960 to 5.09 lakh t in 2010. The increase was prominent in West Bengal from 0.9 lakh t in 1960 to 3.6 lakh t in 2010. Marine fish production has been more or less steady in Andhra Pradesh during 1960-2010. In Orissa, the production has increased from 0.3 lakh t in 1976 to 2.9 lakh tin 2010; the production showed a tremendous increase of 2 lakh t during the last five years.

On the west coast, Kerala was the major contributor with an increase in annual landings from 2.68 lakh tonnes in 1960 to 6.08 lakh t in 2010. Highest marine fish production of Kerala was in 1990-91 when it touched 6.62 lakh t. Gujarat on the other hand increased its production to 5.85 lakh t in 2010 from 0.95 lakh t in 1960, showing over a six fold increase during the last 50 years; the increase has been very prominent during the last 14 years. Maharashtra showed a steady increase in production from 1.2 lakh tonnes in 1960 to 2.4 lakh t upto 2002 (4.5 lakh t) after which the production has shown a grave decline and now stands at 2.4 lakh t.

Resource-wise production

The fishery resources of India is constituted by a large variety of species (nearly 1,570 species of finfishes and about 1,000 species of shellfishes) co-existing in the same grounds (Srinath and Pillai, 2009). Among these, only 200 species of finfishes and shellfishes are commercially important. Region-wise studies show that pelagics contribute to the major share of the landings in the southwest (SW) and southeast (SE) and northwest (NW) regions, while landings are poor in the northeast (NE) (Fig.3). On the other hand, demersals are exploited more in the northwest NW and SE and to a lesser extent in SW; however, landings are poor in the NE. Crustacean resources especially the non–penaeids dominate the landings in the NW and to a lesser amount in the SW; landings are less from the SE and NE waters.

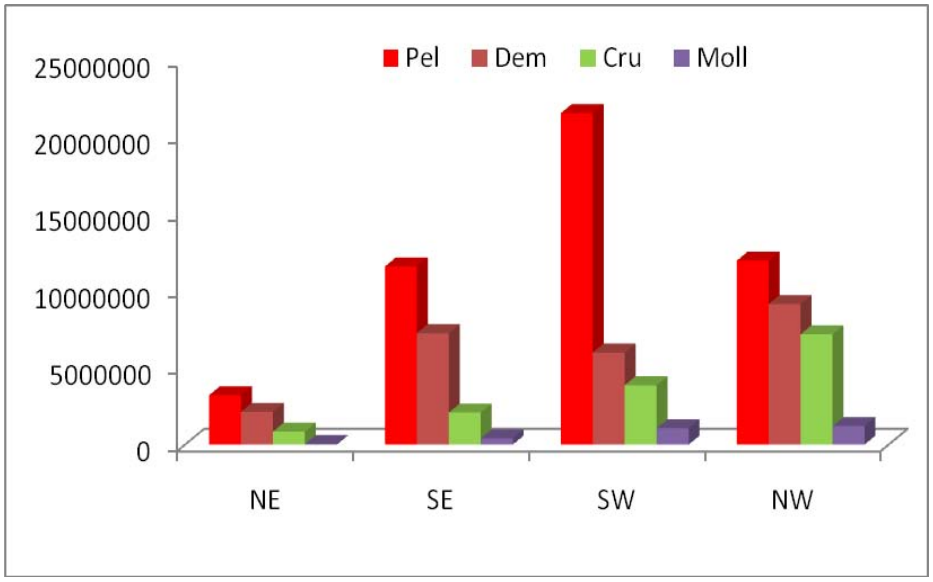

Figure 7.2 Resource-wise region-wise landings during 1961-2010

Important groups of marine fisheries resources of the country and their composition are as follows: (i) Pelagic resources (oil sardine, mackerel, seer fish, tuna, lesser sardine, anchovies and ribbon fishes); (ii) demersal resources (perches, sciaenids, catfishes, polynemids, flat fishes, pomfrets, eels, sharks, skates, rays and fishes which are mainly caught by trawls); (iii) Mid-water resources (Bombay duck, silver-bellies and horse mackerel); (iv) Crustacean resources (prawns, shrimps, lobsters and crabs); (v) Molluscan resources (oysters, mussels, clams, chanks, squids and cuttlefishes); and (vi) Seaweed resources.

Table 7.4 Important species groups (all-India average 2006-10) in lakh tonnes

Name of fish	Avg landings	Per cent
Oil sardine	4.48	14.60
Penaeid prawns	2.16	7.05
Indian mackerel	1.87	6.09
Croakers	1.71	5.57
Ribbon fishes	1.64	5.35
Non-penaeid prawns	1.58	5.14
Threadfin breams	1.18	3.86
Bomaby duck	1.11	3.62
Other sardines	0.98	3.21
Catfish	0.81	2.64

Annual average landings of all major resources have shown considerable increase over the period; however very high change was noticed in oil sardine landings, non–penaeids, pomfrets and cephalopods during the last 5 years (Table 5). No significant increase was noticed for perches, mackerel and ribbonfish, croakers, carangids and penaeid prawns. Contrary to this, landings of apex predators like elasmobranchs, after registering an increase during 2000-04 has shown a decline during 2006-10. Landings of Bombay duck, lesser sardines, silver bellies however, did not show much variation.

Table 7.5 Annual average landings (in 1000 tonnes) for major exploited resources

Species	1985-89	2000-2004	2006-2010
Elasmobranchs	53.5	60.3	48.0
Cat fish	50.6	53.9	80.7
Oil sardine	141.7	353	426.7
Other sardines	75.5	87.4	103.7
Bombay duck	93.2	109.8	106.9
Perches	89.1	197.1	215.2
Croakers	103.3	131.7	163.1
Ribbon fish	79.1	166.7	161.7
Carangids	105.1	122.2	152.3
Silverbellies	60.2	51.3	68.7
Pomfrets	37.1	38.9	144.5
Mackerel	123	114.1	179.5
Seer fish	34.8	47.9	53.1
Tunnies	28.6	42.3	66.6
Flat fish	29.7	43	41.1
Penaeid prawns	144.2	194.2	208.4
Non-Penaeid prawns	58.8	137.6	160.9
Cephalopods	40.3	109.4	137.1

(Source: CMFRI Annual Reports)

Sector-wise landing

Even though the size of the Indian fishing vessels, in general, range from 5 m OAL (overall length) to 30 m OAL, most of the fishing vessels are below 20 m OAL. Fishing vessels of this category would qualify to be called 'small-scale' and this would include all fishing methods that are employed by these vessels including trawling, purse-seining, gill-netting and long-lining. Thus, small-scale fisheries contribute almost the entire marine fish production of India (Mathew, 2003, Vivekanandan and Mohamed, 2009).

While mechanized fishing sector of the country produces 73 per cent of the all India marine landings, motorized and artisanal sectors contribute 25 per cent and 2 per cent respectively. (CMFRI, 2010).The pattern of marine fish landings in India during the past fifty years clearly reveals that the contribution by the artisanal sector to the total production was significant up to the sixties. As a result of the popularization and consequent expansion of mechanized fishing during the subsequent periods along with the motorization of artisanal crafts, the contribution by the artisanal sector declined considerably.

Major fisheries of India

The major fisheries of India is depicted in Table 7.6

Table 7.6 Classification of Indian marine fisheries based on different criteria

Realm-wise	Broad resource group-wise	Major species-wise (exceeding 100,000 tonnes)	Vessel-wise	Gear-wise
Pelagic fisheries [55]	Finfish [80.5]	Oil sardine [15.0]	Non-mechanized [4.8]	Trawl [44.0]
Demersal fisheries [45]	Crustacean [14.9]	Croakers [5.2]	Motorized [24.9]	Seining [19.2]
	Molluscan [4.6]	Bombay duck [4.1]	Mechanized [70.3]	Gillnets [18.4]
		Threadfin breams [3.9]		Hooks and lines [2.0]
		Carangids [7.5]		Bag nets [11.0]
		Ribbonfish [5.6]		Artisanal [4.8]
		Mackerel [5.5]		
		Penaeid shrimp [6.8]		
		Non-penaeid shrimp [5.4]		
		Cephalopods [4.4]		

Trawl Fisheries

Trawling is the major gear used to exploit marine resources from all along India's 8,129 km coastline. While the number of trawlers increased twice, the estimated efficiency (engine horsepower) increased by nearly 4 times, from 951,200 hp (1980) to 3,448,570 hp (1998) (Vivekanandan and Mohamed, 2009). From 1999, the trawlers are also employed for deep sea fishing up to 400 m depth by modifying the winch drum and the trawl net. CMFRI census currently shows that 29,241 trawlers are registered and the states of Gujarat and Tamil Nadu have the maximum number of trawlers.

Penaeid shrimps are the mainstay of the trawl fishery and catches showed more than 5-fold increase between 1960 (32,000 tonnes) and 2005 and at present contributes nearly 7-8 per cent of the all India marine fish production. The introduction of high opening bottom trawls has reduced the dependence of trawlers on shrimps as the chief revenue earner and cuttlefishes and squids have also emerged as principal income earners (Mohamed, 2006). The finfishes exploited by trawls belong to 21 major fish groups, out of which, sciaenids contributed maximum (18.4 per cent) to the demersal landings along the Indian coast, followed by threadfin breams (17.3 per cent). Each region is characterized by dominance of specific finfish groups. Whereas the NE coast is characterized by the dominance of sciaenids, catfish and pomfrets (together contributing 74.0 per cent to the demersal landings), the SE coast is characterized by the dominance of silverbellies and pig

face breams, the SW coast by the threadfin breams and other perches, and the NW coast by the sciaenids, catfish and threadfin breams (Vivekanandan and Mohamed, 2009).

Table 7.7 State-wise detail of fishing vessels in India

SI. No	State/Union Territory	Mechanized Vessels	Motorized Vessels	Non Motorized Vessels	Total
1.	West Bengal	6829	1776	10041	18646
2.	Odisha	3577	4719	15444	23740
3.	Andhra Pradesh	2541	14112	24386	41039
4.	Tamil Nadu	7711	22478	24231	54420
5.	Pondichery	627	2306	1524	4457
6.	Kerala	5504	14151	9522	29177
7.	Karnataka	4373	3705	7577	15655
8.	Goa	1087	932	532	2551
9.	Maharashtra	13053	3382	7073	23508
10.	Gujarat	13047	7367	3729	24152
11.	Daman & Diu	562	654	211	1427
12.	Andaman & Nicobar	165	781	1837	2783
13.	Lakshadweep	667	376	1341	2384
14.	India	59743	76748	107448	243939

Seine Fisheries

With the advent of mechanization during the 1970s, the purse seines with larger nets and power blocks became the method of choice along the SW coast. A modification to the traditional boat seine vessels to make it more efficient was the mini purse seines or locally called as the Ring Seine which has become the most popular seining method for the pelagics along Kerala coast. Currently there are close to 1000 purse seiners mainly in the states of Karnataka (>50 per cent), Goa and Maharashtra and more than 240 ring seiners mainly in the states of Kerala (>70 per cent) and Tamil Nadu. Ring seines continue to be operated from traditional crafts fitted with outboard or inboard engines. The main species harvested by seines are the small pelagics such as oil sardine, lesser sardines, anchovies and mackerel. A fishery for this resource has recently emerged along the SE, NW and NE coast and this has been attributed to the phenomenon of climate change (Vivekanandan and Mohamed, 2009).

Gillnet Fisheries

Gillnets are traditional gears which are being used by fishermen to capture pelagic fishes both large and small. The gillnet catches which ranged from 100,000 to 135,000 t during the 1980s and 1990s, increased by more than 4-times in recent years. Gillnetting has become popular among fishers due to less capital intensive, could be selectively operated depending on availability and demand and can be operated at areas where bottom is not suitable for trawling (Vivekanandan and Mohamed, 2009). Trend in gillnet catch during the last 5 years in India show that the share of mechanized gillnetters (MGN) is increasing as compared to outboard gillnetters (OBGN). As compared to trawls, gillnets exploit only a few species and up to 60 species have been recorded from drift gillnets along the Indian coasts. Clupeids and croakers are mostly exploited by small meshed gillnets and large meshed gillnets exploit mostly sharks, seerfishes, mackerels, catfishes, pomfrets, tunas and carangids. Average productivity of this gear has been estimated as 13.7 kg/h and maximum was observed along the SW followed by NE coasts.

Bag net Fisheries

Bag nets are a major gear used by artisanal fishers along NW and NE coasts. In Gujarat and Maharashtra, the fixed variety of bag nets is called Dolnets. They are operated up to a depth of 40 m by employing mechanized crafts and also outboard engine crafts and currently there are about 8,862 dolnetters. Because the volumes are high (~300,000 t), it also contributes a substantial portion (11 per cent) of the all India catch estimates. The average catch rates are about 72.5kg/h and the catches are principally comprised of non-penaeid shrimps (mainly the Kiddi shrimp *Acetesindicus*), the mid-water carnivore Bombay duck (*Harpadonnehereus*) and the golden anchovy *Coiliadussumeiri*. Other species include penaeid shrimps and ribbonfishes. Being a bag net, the dolnet exploits the resources indiscriminately. The non-penaeid shrimps, which are epipelagic and occurring in high abundance, such as *A. indicus* (length range 20-35 mm) and *Nematopalaemontenuipes* (length range 40-60 mm) constitute the principal by-catch.

Hooks and Line Fisheries

H&L contribute just about 2 per cent of the all India marine fish catch. This gear mainly targets the large pelagic fishes such as sharks, tunas and barracudas. The development of H&L fisheries has been mainly in the motorization of the traditional boats, and this class of vessels still contributes to the bulk of the estimated catches. Several development schemes of the government has targeted promotion of H&L fisheries particularly the modern version of long line fishing for tunas. As long line fishing for yellow fin tunas has been proven to be lucrative the world over, and since these resources are relatively untapped from Indian waters, many idle large shrimp trawlers (>17 m LOA) in the NE coast have been recently converted to long liners. Consequently, the yellow fin tuna catch has increased significantly from 9,086 t in 2007 to 13,206 t in 2008 and many tuna products including loin and sashimi grade are exported to the Far East.

Artisanal Fisheries

The artisanal fisheries sector has dwindled with the advent of mechanization. The contribution to the total catches decreased from an overwhelming 88 per cent in 1960s to about 2 per cent presently and continues to show a decreasing trend. However, the artisanal fishers were instrumental in bringing innovation in their fishing gears, and to withstand competition from the mechanized sector, motorized their crafts, initially with outboard engines and lately with inboard engines as well. The development of the Ring

Seine fishery for small pelagics along the SW coast is a typical example of this innovative spirit.

Bivalve fishery

Fishery exists for clams and mussels mainly in inland waters and bays; collection is by handpicking and by use of hand dredge operated from a dug out canoe. The meat is also sold both in internal markets as well as to export processing plants. The shell is also sold to cement and carbide factories. The State of Kerala leads India in the production of clams with estimated annual landings of about 66,000 tons (t) in 2008-09 (Suja and Mohamed, 2010). The estimated fishery from bivalves is approximately 1 lakh t.

Sea-weed production

The total production of seaweeds in India in 2005 was approximately 1,00,000 tons (wet weight) (Dhargalkar and Pereira, 2005). India produces 110-132 t of dry agar annually utilizing about 880-1100 tons of dry agarophytes. Annual algin production is 360 to 540 t from 3,600 to 5,400 t dry alginophytes. The surveys carried out by Central Salt and Marine and Chemical Research Institute (CSMCRI), Central Marine Fisheries Research Institute (CMFRI) and other research organizations have revealed vast seaweed resources along the coastal belts of South India. On the west coast, especially in the state of Gujarat, abundant seaweed resources are present on the intertidal and subtidal regions. These resources have great potential for the development of seaweed-based industries in India.

Fish processing and marketing

As per available data, approximately 67 per cent of the total fish produced in the country is consumed in fresh form and nearly 6 per cent is used for reduction into fishmeal (Report of the working group, planning commission, 2011). Altogether 23 per cent is consumed in processed and preserved form that includes 16 per cent used for drying, 7 per cent for freezing and less than one-half per cent for canning- almost all of these under medium and small- scale sectors. While over 0.6 million tonnes of fish produce exported from the country are subjected to some form of processing, bulk of the produce for domestic market is consumed fresh. Traditional methods of fish preservation like drying, salting and smoking are in vogue in coastal areas, while freezing, canning and production of *surimi* have been employed for exports. With increasing inter-state movement of fresh fish, chilling and icing have become important preservation methods for domestic marketing of fish produce. Along with battered and breaded products, ready-to-cook, ready-to-eat fish in modified atmosphere packages and fish-incorporated products like condiments and maricream form the range of value added products. The low valued fishes or byproducts are also subjected to processing for several industrial products, *viz*., fishmeal and oil; chitin and chitosan from the exoskeleton of shrimp, lobster, crab or squilla; fish maws from fish bladder; shark fin rays, etc.

Marine finfish exports and utilisation

The export of marine products in India both in terms of quantity and value has been more or less increasing at a steady pace since last five decades. The export in terms of value has increased from a meagre Rs. 3.9 crores in 1961-62 to Rs 10,048 crores in 2010. While frozen shrimp was the prime export commodity earlier, there has been considerable diversification in terms of both products and markets in the recent past. The shares of frozen shrimp and fresh/frozen fish to the total export are presently 21.0 and 40.0 per cent

in terms of quantity and 43.0 and 19.0 per cent in terms of value, respectively. During 2010-11 (April 2010 – March 2011), export earnings for the first time in the history of marine products exports from India touched US $ 2.857 billion mark. In volume terms the exports aggregated to 813 091 mt, valued at Rs. 12 901.47 crores (Fig. 7.3).

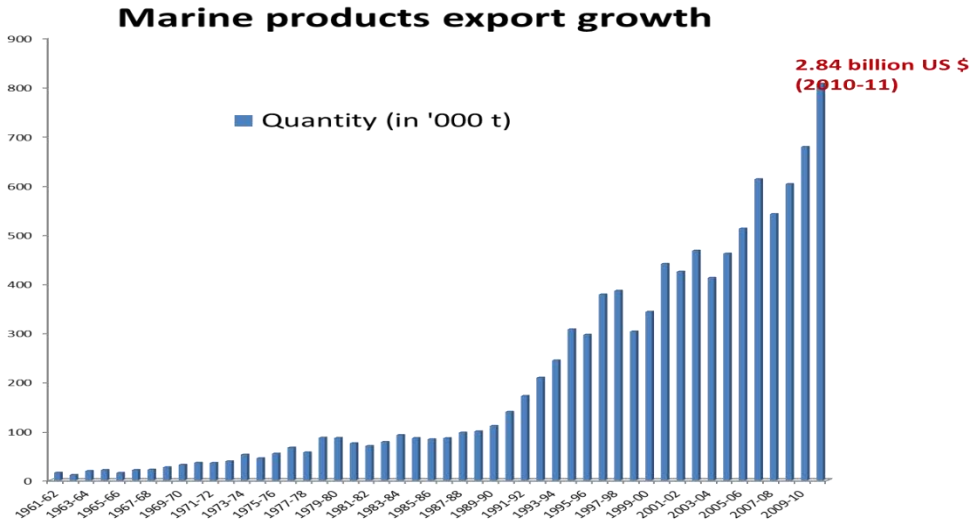

Figure 7.3 Indian marine products export over years

As regards overseas destinations, the European Union, Japan and USA have become important markets for fishery products. While USA has been the top importer of shrimps from India, squid and cuttlefish are two important commodities exported mainly to the EU and south-east Asian countries. In order to realize better export earnings in the coming years the country has to develop appropriate strategies for marketing of ornamental/live fishes and value added fishery better market potentials,

The marine finfish resources of India are marketed both in export and domestic markets (Fig 7.5 and 7.6). The export of marine fishery products from India has made substantial progress over

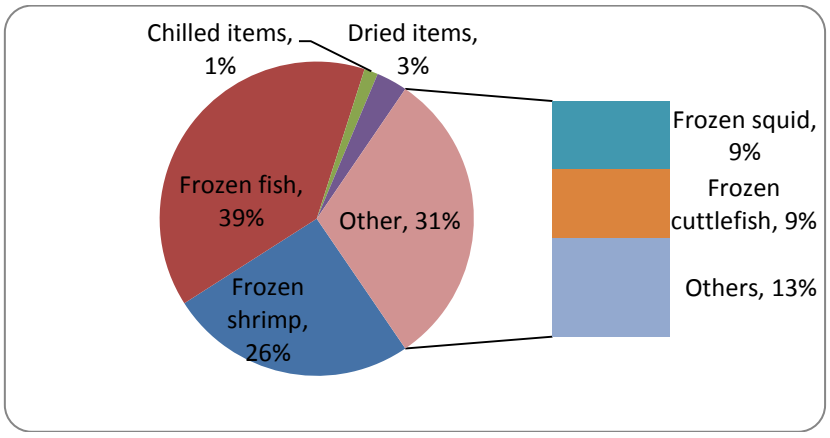

Figure 7.4 Item wise contribution to export quantity (per cent) of marine products from India during 2011-2012the years.

A wide array of processed or value added products from marine finfishes are being exported to various countries. The major items in the marine fishery exports are the frozen products. Among the frozen products (Fig. 7.5), marine finfish is the major contributor in

terms of quantity exported (36 per cent), followed by frozen shrimp (26 per cent), frozen cuttlefish (9 per cent) and frozen squid (9 per cent). However, in terms of value (Fig. 6), frozen shrimp is the major contributor to the export earnings (55 per cent), leaving the frozen finfishes (16 per cent) to the second position, followed by frozen cuttlefish (8 per cent) and frozen squid (7 per cent). The market wise analysis shows that (Fig. 7.) China

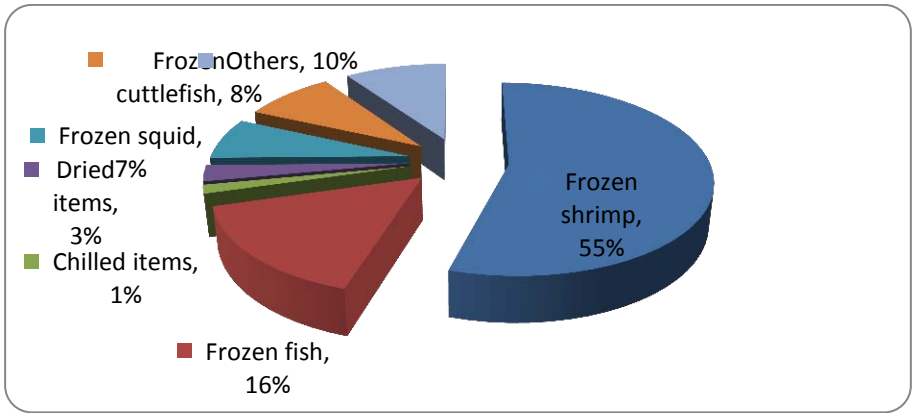

Figure 7.5 Item wise contribution to export value (per cent) of marine products from India during 2011-2012

Leads in the import of finfish from India (40 per cent) followed by Thailand (11 per cent), Tunisia (4 per cent), Malaysia (4 per cent), USA (2 per cent) and Japan (2 per cent). However in term of value, the Chinese market provides only 40 per cent to the total foreign exchange earnings from finfishes. The export of frozen finfishes from the country increased from 1.75 lakh tonnes during 2001-02 to 3.47 lakh tonnes in 2011-12, with an annual average export of 2.26 lakh tonnes worth of Rs. 1436 crores (Fig. 8). During 2011-2012, the foreign earnings from the export of frozen finfishes alone was Rs. 3482 crores.

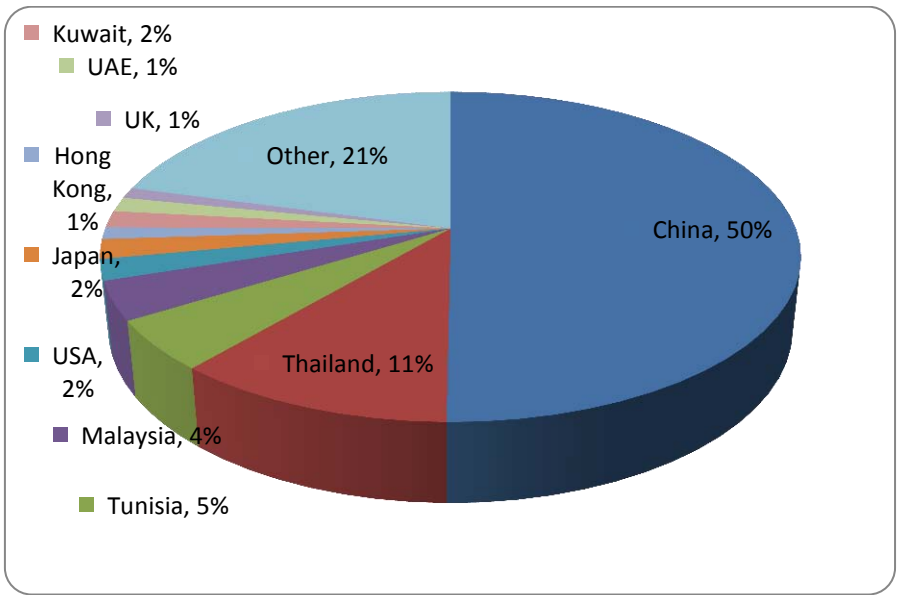

Figure 7.6 Major markets for the finfish export from India by quantity

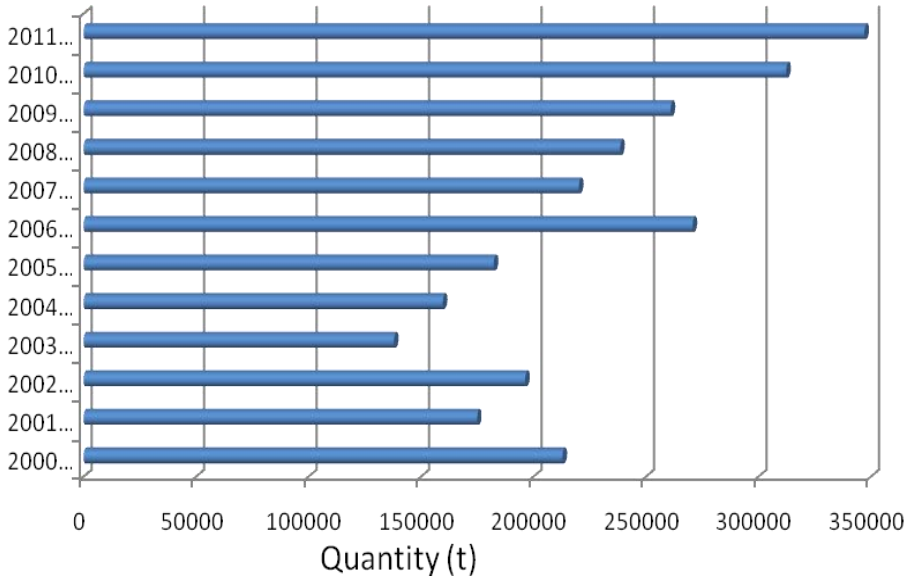

Figure 7.7 Export of frozen finfish from India during the period 2001 - 2012 (t)

About 83 per cent of the dried marine products exported from India were marine finfishes (Table 1). Among chilled items, the marine finfish components were 83 per cent with an average annual export of 5227 tonnes. Frozen finfish is the major form of export from India amounting 2.09 lakh tonnes with a share of 47 per cent to the total frozen products export from India. Item wise export shows that, among marine finfishes, frozen ribbon fish is the major export product with an export of 81,182 t, followed by frozen mackerel (14009 t), fish surimi (11261 t), frozen croaker (10397 t) and dried fish meal (5549 t).

Table 7.8 Contribution of finfish to the various marine products export categories from India

Items	Total export (t)	Finfish export (t)	Share of finfish (per cent)
Frozen	443666	209764	47
Chilled	7631	5227	68
Dried	17178	14220	83
Othes	69751	11274	16
Total	538226	240485	

Table 7.9 Contribution of different resources to the total marine finfish exports from India

Fishery Resource	Quantity (t)	Per cent
Ribbonfish	83507	35
Croakers	27546	11
Tuna	18797	8
Mackerel	14010	6
Pomfrets	11976	5
Total	143860	60

Among the fishery resources, ribbonfish products were the major contributor (Table 10) with a share of 35 per cent to the total marine finfish exports. The other major resources were croakers (11 per cent), Tuna (8 per cent), mackerel (6 per cent) and pomfrets (5 per cent).

Ribbonfishes contributed about 42 per cent of the total frozen marine finfish exports (Fig. 9), followed by Croakers (14 per cent), Tuna (11 per cent), Mackerel (7 per cent) and Lizardfishes (3 per cent). Sardines, king fish and reef codes were contributed 2 per cent each to the frozen marine finfish exports of India. Among the tunas, yellowfin tuna export was 36 per cent, followed by skipjack tuna (27 per cent) (Fig. 7.9)

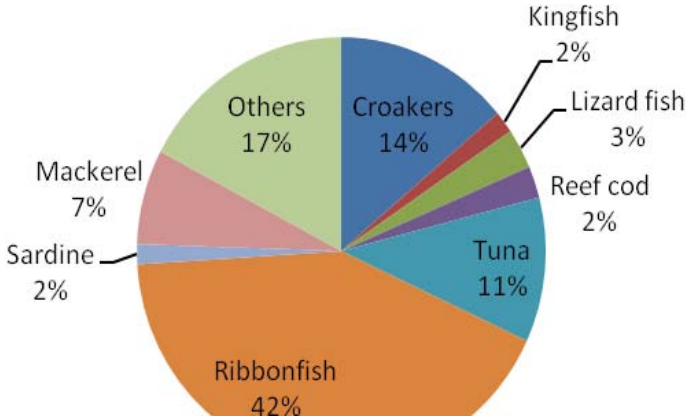

Figure 7.8 Contribution by different fish groups to the total frozen fish exports

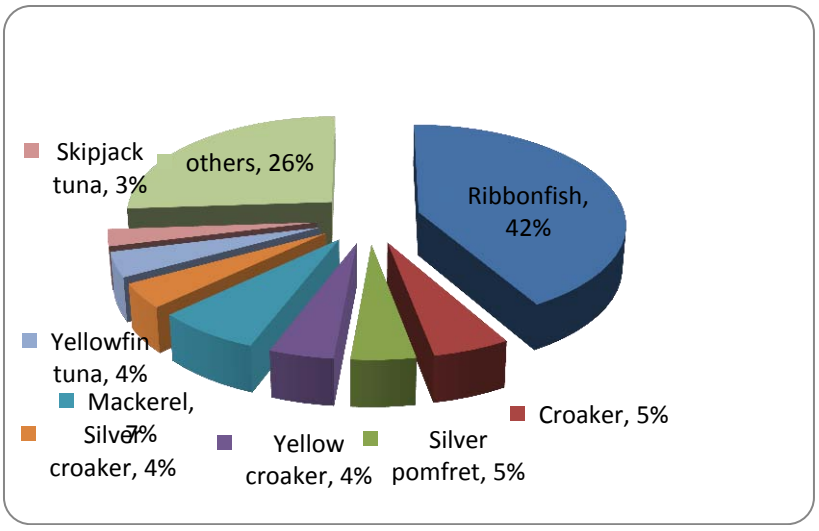

Figure 7.9 Item wise export of frozen marine finfishes in India

Among the chilled products, chilled fish contributed about 39 per cent of the total chilled fish exports (Fig. 11) followed by chilled pomfrets (15.3 per cent), chilled threadfins (13.3 per cent), reef cods (8.8 per cent), kingfish (3.7 per cent), Tuna (2.9 per cent) and Gutted tuna (2.0 per cent)., The dried finfish products (Fig. 12) exported were dominated by

dried fish meal (39 per cent) followed by dried whole fish (38.5 per cent), dried salted fish (9.09 per cent), dried Bombay duck (4.27 per cent) and dried fish maws (4.27 per cent). The major component in the frozen finfish export basket was ribbonfishes (42 per cent) followed by croakers (14 per cent) and Tuna (11 per cent).

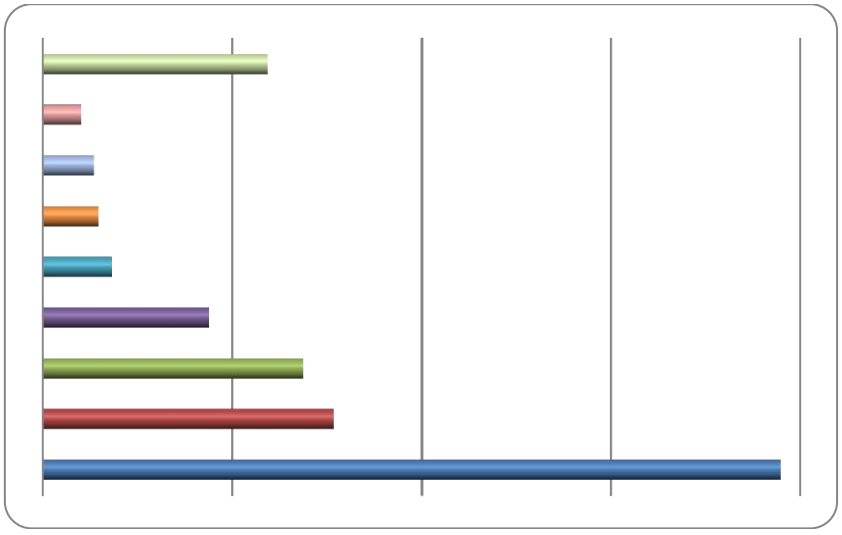

Figure 7.10 Contribution (per cent) of various finfish groups to the export of chilled items in India

There were about 9 products made of ribbon fishes utilised in the export market, with 97 per cent export was in the form of frozen whole fish. Apart from frozen products, minor quantities of this resource are utilised as surimi and chilled and dried products as well. Tuna are exported as 20 different products from India (Table 11), with the highest representation by frozen yellowfin tuna (42 per cent) followed by frozen skipjack tuna (28 per cent), frozen whole tuna (6 per cent) and IQF skipjack tuna (5 per cent). Other than frozen products, small quantities of tuna are exported in the form of chilled products. The other major resource among marine finfishes is the crockers, which are exported as 5 types of products. The major items are frozen products such as frozen croaker (38 per cent), followed by frozen yellow croaker (32 per cent) and frozen silver croaker (29 per cent). Minor quantities of surimi croaker (2 per cent) also exported from India. Pomfrets were exported as 12 products, among which, frozen silver pomfret is the major export item (72 per cent) followed by frozen black pomfret (8.7 per cent), chilled pomfret (6.7 per cent), frozen white pomfret (3.7 per cent) and IQF silver pomfret (3.5 per cent). Mackerels are mainly exported as frozen mackerel (62 per cent) and IQF mackerel (38 per cent).

Table 7.10 Various forms of tuna exported from India

Product	Quantity (t)	per cent
Frozen Yellow fin tuna	7882	41.93
Frozen Skipjack tuna	5336	28.39
Frozen Whole tuna	1179	6.27
Frozen Skipjack IQF	893	4.75
Frozen Yellow fin gutted IQF	731	3.89
Frozen Tuna gutted	629	3.34
Frozen Yellow fin IQF	515	2.74
Frozen longtail tuna	489	2.60

Frozen Skipjack tuna whole round	351	1.87
Chilled tuna	154	0.82
Frozen Tonggol tuna	128	0.68
Frozen Tuna loins	126	0.67
Chilled gutted tuna	105	0.56
Frozen Bigeye tuna	90	0.48
Frozen Yellow fin tuna roe	53	0.28
Chilled Yellow fin tuna loins	40	0.21
Frozen Tuna streaks	39	0.21
Frozen Tuna streak IQF	37	0.20
Frozen Tuna cubes	17	0.09
Frozen Yellow fin tuna chunk	3	0.01
Total	18797	100

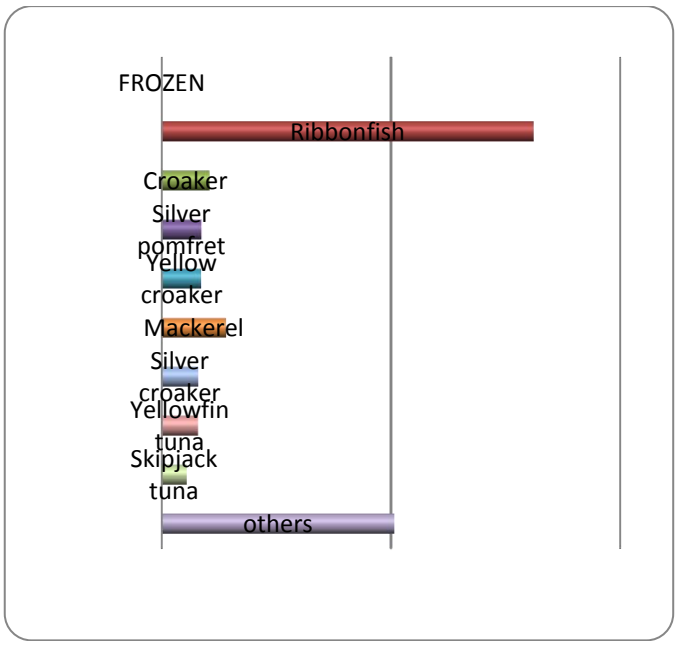

Figure 7.11 Major items in the annual average export of frozen marine finfish (t) from India

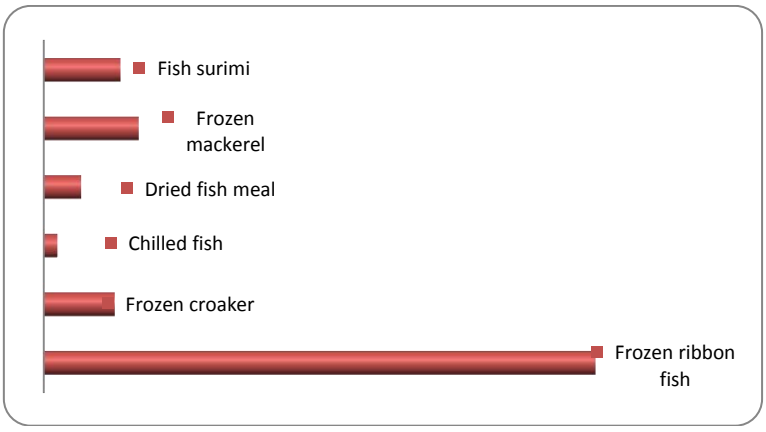

Figure 7.12 Major items (quantity t) in the export of marine finfish from India

Issues in Marketing and Trade

Marketing of fish and fishery products in the country is still unorganised, except in a few towns and cities, with municipalities and other local bodies looking into the marketing aspects (Working group report, Planning commission, 2011). About 75 per cent of fish produced in the country is marketed domestically through wholesale, major and minor retail (including roadside) markets. Majority of domestic markets lack proper fish storing and handling facilities. Other concerns are with regard to transportation system including roads, refrigerated vehicles, availability of potable water, good quality ice, electricity and waste disposal system. There is considerable time lag during the transportation of fish from the landing centre to the interior markets, which results in poor quality of the material leading to high nutritional and post-harvest losses. A study in the Ernakulam District of Kerala and West Godavari District of Andhra Pradesh showed the post-harvest losses in fish to the extent of 15 per cent, amounting to over Rs 2,700 crores annually on a national basis. There exists a cold chain in case of fish production from Kolleru Lake region of Andhra Pradesh (East Godavari and Krishna districts), where fish are transported in insulated trucks with ice to distances of over 2,000 km, with Kolkata being the major market. Hence, public investments to expand access to rural infrastructure and services such as rural roads and transport services, primary and secondary fish markets, telecommunications, and electricity, will be critical to reducing transaction costs and physical losses and to enhancing transparency and competitiveness in traditional fish markets.

Infrastructure development

The infrastructural requirements of the fisheries sector are manifold. Ranging from construction of Fishing Harbours (FH) and Fish Landing Centres (FLCs) to establishment of hygienic domestic markets and setting up of cold chains, the prime objective is to ensure that spoilage is reduced and fish reaches the consumers in the best possible condition. While the PPP concept has picked up in many other infrastructure development sectors, it is yet to take roots in the fisheries sector. Establishment of FH/FLCs and cold chains are some of the areas where PPP mode can work well and the NFDB could facilitate the process.

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Indian Crustacean Resources: Distribution, Commercial Exploitation, Utilization and Trade

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The crustacean fisheries of India have considerable importance in the economy of the country, earning very valuable foreign exchange. Edible marine crustaceans consisting of prawns, lobsters and crabs form the most important constituents of the commercial fish landings of India. In 2009 the total marine crustacean landings were 493356 tonnes of which 83 per cent was constituted by prawns (penaeid and non-penaeid). This chapter discusses the important commercial species of prawns, lobsters and crabs of Indian coast.

Shrimps and prawns

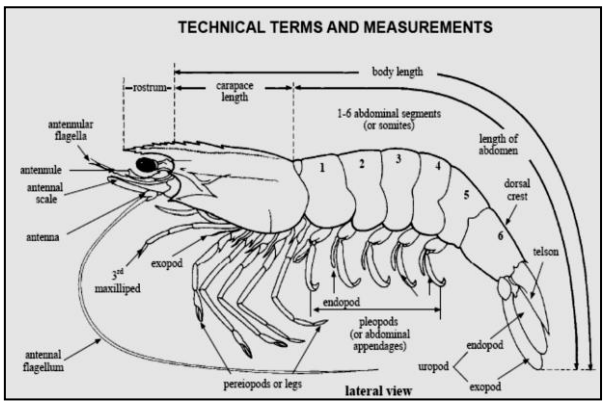
Shrimps and prawns constitute a large group of crustaceans varying in size and are widely distributed in marine, brackish, and freshwater regions from the equator to the Polar Regions. Although the majority of the commercial marine species occupy shallow or moderately deep water areas along the continental shelves at depths of less than 100 m, some are found at depths of nearly 5700 m. Many prawns are pelagic but the majority by far is benthic, living on a large variety of bottoms such as rock, mud, peat, and sand, fragments of shells or mixtures of these materials. At present, only slightly less than 300 species of shrimps and prawns are of economic interest worldwide, and out of these, only about 100 comprises the principal share of the annual world catch.

Most of the commercial species of prawns belong to the **superfamily Penaeoidea**, which is divided into families Solenoceridae, Benthescymidae, Aristeidae, Penaeidae and Sicyoniidae. Among them family **Penaeidae**comprises more species of commercial value prawns.

Superfamily PENAEOIDEA
Penaeoid shrimps
Pelagicprawns

Some of the important penaeid shrimps that support commercial fisheries along the Indian seas are *Fenneropenaeusindicus*(Indian white prawn), *Penaeussemisulcatus*(Green tiger prawn), *P. monodon*(Giant tiger prawn), *F. merguiensis*(Banana prawn), *Marsupenaeusjaponicus*(Kuruma shrimp), *F. penicillatus*(Red-tail prawn), *Metapenaeusdobsoni*(flower-tail prawn), *M. monoceros*(Speckled prawn), *M. affinis*(Jinga prawn), *M. kutchensis*(Ginger shrimp), *M. brevicornis*(Yellow prawn), *Parapenaeopsisstylifera*(Kiddi prawn), *P. hardwickii*(Spear prawn), *P. sculptilis*(Rainbow prawn), *P. uncta*(Uncta prawn), *Trachysalambriacurvirostris*(Rough prawn),

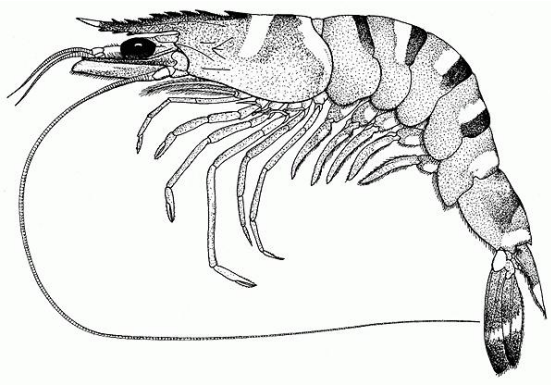
Metapenaeopsisstridulans(Fiddler shrimp), *Parapenaeuslongipes*(Flaming prawn), *Solenoceracrassicornis*(Coastal mud prawn) and *S. choprai*(Coastal mud prawn).



Deep Sea prawns

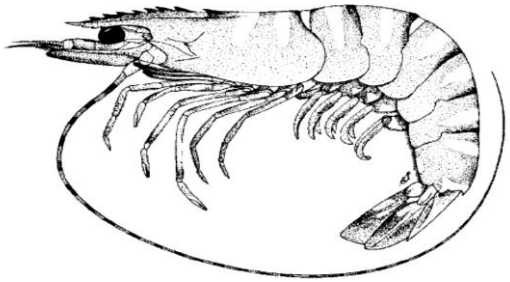
Although about 18 species of penaeid and non-penaeid species were observed in the catches only about 8 species constitute the bulk of the catch. The common deep sea prawns are *Heterocarpuswoodmasoni*, *H. gibbosus*, *Plesionikaspinipes*, *P. martia*, (Non-penaeids -fly. Pandalidae), *Metapenaeopsisandamanensis*, *Penaeopsisjerryi* (fly.Penaeidae), *Solenocerahextii*(fly. Solenoceridae) and *Aristeusalcocki*(fly. Aristidae).
Details of important species are given in the following pages.

Penaeusmonodon (Giant tiger prawn) (Fly. Penaeidae)



Rostrum generally armed with 6 to 8 upper teeth (including those on carapace) and 3 lower teeth; postrostral crest well developed and reaching nearly to posterior margin of carapace, with or without a feeble median groove; adrostral crest extending to just before last postrostral tooth; gastrofrontal crest absent; **hepatic crest almost horizontal** and extending far behind antennal crest. **Fifth pereiopod without exopod**. Colour: body grayish greenish or dark greenish blue; becoming reddish brown in large adults; carapace covered with mud-yellow transverse bands, while abdomen bears dark brown and mud-yellow cross bands.

Distribution and fishery: Throughout the east and west coasts of India and Andaman Islands; depth upto 150 m (usually less than 30 m).

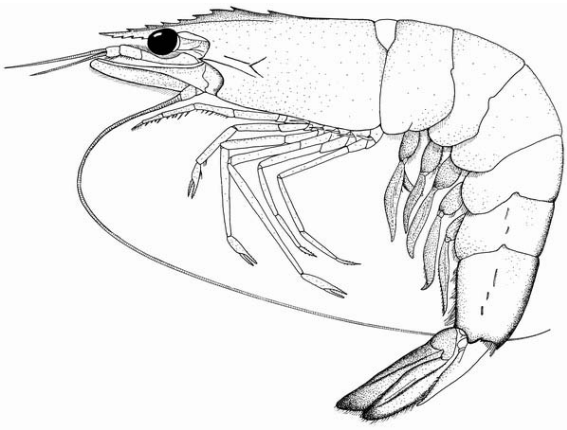


Penaeussemisulcatus (Green tiger prawn) (Fly. Penaeidae)
Rostrum generally armed with 6 to 8 upper teeth (including those on carapace) and 3 lower teeth; postrostral crest well developed and reaching nearly to posterior margin of carapace, with a distinct median groove; adrostral crest extending beyond

last postrostral tooth; gastrofrontal crest absent; hepatic crest long and extending behind antennal crest, **straight but distinctly sloping antero- ventrally.Fifth leg with exopod (somewhat hidden beneath carapace).**Colour: body reddish brown to pale brown or dark green, carapace covered with mud-yellow transverse bands while abdomen including tail fan bears grayish brown yellow cross bands.

Distribution and fishery: Both east and west coasts of India and Andaman waters;depthupto 130 m.

Fenneropenaeusindicus(Indian white prawn) (Fly. Penaeidae)

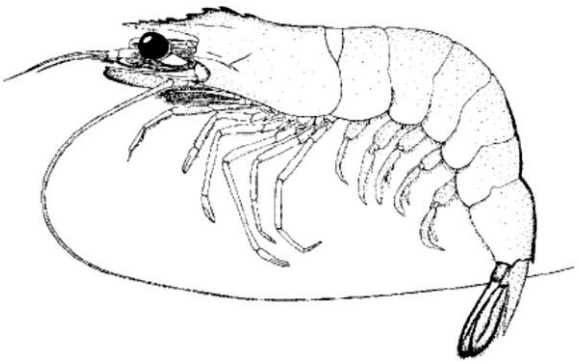


Carapace rather smooth, lacking gastrofrontal and hepatic crests; adrostral crest extending as far as or just before epigastric tooth; **rostrum slightly cruved at tip and sigmoidal-shaped,** usually bearing 7 to 9 upper teeth (including those on carapace) and 3 to 6 lower teeth. **Postrostral crest extending near to posterior margin of carapace.** Colour: Body semi-translucent, Somewhat yellowish white (small specimens) or grayish green and covered with numerous minute dark brown dots.

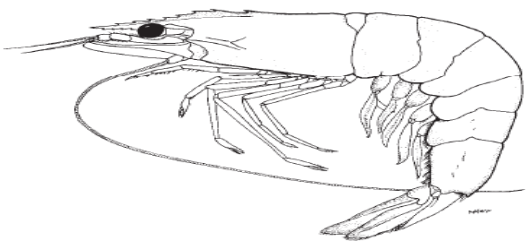
Distribution and fishery: Both east and west coasts of India and Andaman Islands; depth upto 90 m

Fenneropenaeusmerguiensis(Banana prawn)(Fly. Penaeidae)

Carapace rather smooth, lacking gastrofrontal and hepatic crests; adrostral crest extending to, or just before, epigastric tooth; tip of rostrum horizontally straight, and **rostral crest becoming very high and broadly triangular in large specimens (even stronger in females),** generally bearing 6 to 9 upper teeth (including those on carapace) and mostly 3 to 5 lower teeth; postrostral rest extending near to posterior margin of carapace. In adult males, third maxilliped with distal segment only about half as long as second segment this bears **a tuft of dense short hairs** (slightly shorter than distal segment) at tip. Colour: body semi- translucent, some-what yellowish to greenish (in very large specimens) and covered with numerous minute dark brown dots; distal part of uropods yellowish green with red margins; young specimens often with many longitudinal black broken lines on abdomen.



Distribution and fishery: Both east and west coasts of India; depth upto 150 m



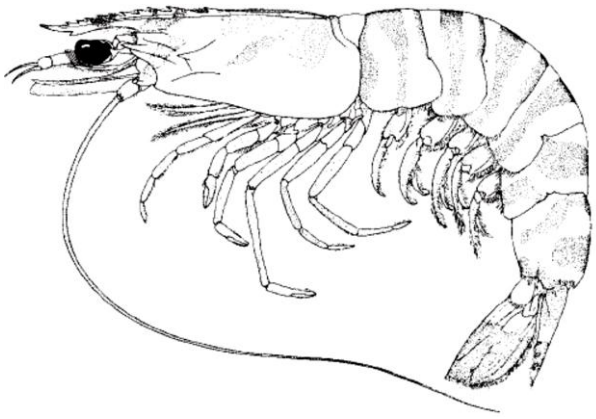
Fenneropenaeuspenicillatus(Red tail prawn) (Fly. Penaeidae)

Carapace rather smooth, **lacking gastrofrontal and hepatic crests**; adrostral crest extending just beyond epigastric tooth; **tip of rostrum horizontally straight, and rostral crest generally slightly elevated in**

youngs and adult males, to moderately high in large females; In **adult males,** third maxilliped with distal segment much longer than second segment which bears **a tuft of dense long hairs** (as long as distal segment) at tip. **Colour:** body semi-translucent, slightly greenish and covered with numerous minute dark brown dots; rostral and abdominal dorsal crests reddish brown to dark brown; **antennal flagella reddish brown**; legs translucent and somewhat whitish; pleopods rather reddish; **distal half of uropods yellowish to greenish but always with reddish tips.**

Distribution and fishery: Gujarat, Maharastra, Orissa and West Bengal; depth upto 90 m

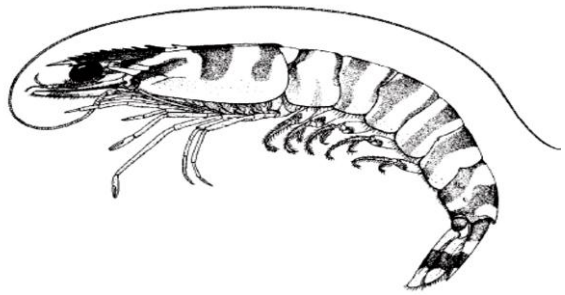
Marsupenaeusjaponicus (Kuruma prawn) (Fly. Penaeidae)



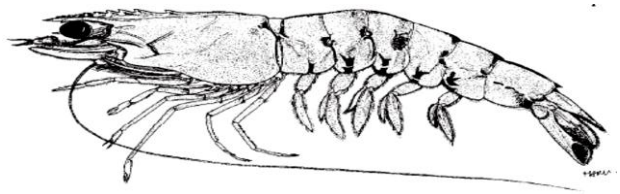
Carapace with grooves and crests very distinct, bearing both gastrofrontal and hepatic crests; **rostrum generally armed with 9 or 10 upper teeth (including those on carapace) and 1 lower tooth,**postrostral crest well developed and with a deep median groove throughout its length; adrostral groove extending near to posterior margin of carapace and almost as wide as postrostral crest; **Telson with 3 pairs of movable lateral spines.** Colour: body pale yellowish and crossed with dark brown transverse bands; those on carapace generally extending to lower half of carapace, **last abdominal band interrupted**.
Distribution and fishery: Gujarat, Tamil Nadu, Maharashtra and West Bengal; depth upto 90 m

Melicertuscanaliculatus (Witch Prawn) (Fly.Penaeidae)

Carapace with grooves and crests very distinct, bearing both gastrofrontal and hepatic crests;



rostrum armed with 10 or 11 upper teeth (including those on carapace) and 1 lower tooth; postrosral crest well developed and with a deep median groove throughout its length; adrostral groove extending almost to posterior margin of carapace and slightly wider than postrostral crest; First leg without ischial spine. **Telson without lateral spines**. Colour: body pale yellowish and crossed with dark brown **transverse bands**; those on carapace note extending over lower half of carapace**while those on last abdominal segment usually continuous to the ventral margin.**
Distribution and fishery: Gujarat, Orissa, West Bengal, Maharashtra, Tamil Nadu, Kerala and Andaman and Nicobar Islands; depth upto 50 m.



***Melicertuslatisulcatus* (**western king prawn) (Fly. Penaeidae)
Carapace with grooves and crests very distinct, bearing both gastrofrontal and hepatic crests; rostrum generally armed with 10 or 11 upper teeth (including those on

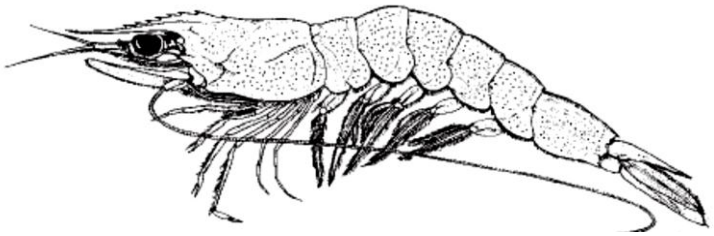
carapace) and 1 lower tooth, lacking distinct accessory crest on the blade; postrostral crest well developed and with a deep median groove throughout its length; adrostral groove extending almost to posterior margin of carapace and distinctly wider than postrostral crest; posterior end of gastrofrontal groove divided into 2. **Telson with 3 pairs of movable lateral spines.**

Colour: body generally yellowish green, becoming slightly reddish inlarge adults; **abdominal segments each with a short vertical black bar on pleuron; hinges on abdomen often bearing dark brown spots** and posterolateral part of carapace also sometimes with 2 black stripes positioned at a right angle.; uropods bright yellow, with distal half and outer margins of exopods bright blue, other margins reddish.

Distribution and fishery: Gujarat, Tamil Nadu, Kerala, Andaman and Nicobar Islands and Lakshadweep; depth upto 90 m.

Metapenaeusdobsoni (Kadal Shrimp) (Fly.Penaeidae)

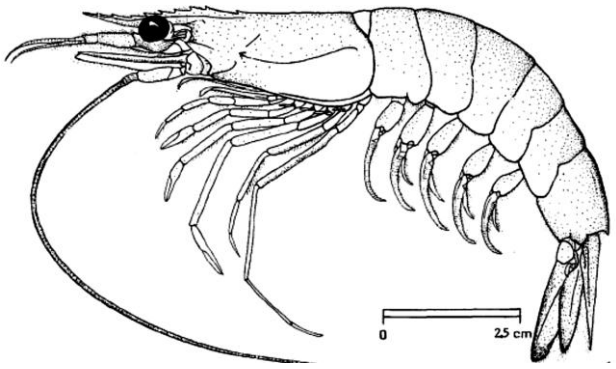
Rostrum long, extending beyond antennular peduncle, slightly sinuous, armed with 7 to 9 dorsal teeth, but toothless on its distal half; postrostral ridge ending near posterior margin of carapace; drostral crest reaching as far as epigastric tooth, adrostral groove a little beyond. **In females, fifth pereopod often reduced to coxa and basis**; thelycum with a long, grooved tongue-like anterior plate partially ensheathed in a horse-shoe-like process formed by the lateral plates; **impregnated (fertilized) specimens with white conjoined pads on thelycum.** Colour: body pale yellow to brownish with red, brownish or greenish specks; antennae red; middorsal abdominal crest and margin of last segment dark brown to red; pereiopods and pleopods white to pinkish; uropods grey-brownish, darker distally with external part of exopods red.



Distribution and fishery: South of Goa on the west coast through southeast coast to south of Visakhapatnam on the east coast; depth 1-40 m .

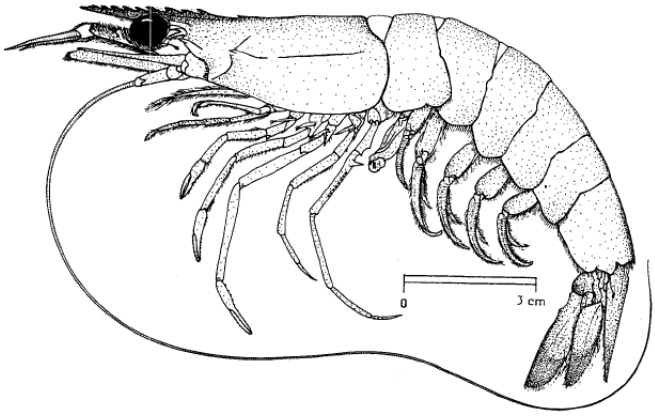
Metapenaeusaffinis(Jinga shrimp) (Fly. Penaeidae)

Generally almost entire body pubescent, rarely partly or completely hairless; rostrum armed with 8 to 11 teeth along entire dorsal margin, slightly sinuous and reaching from proximal to distal margin of third antennular article, or exceeding it; adrostral crest ending behind second rostral tooth, and adrostral groove a little behind epigastric tooth; branchiocardiac ridge slightly sinuous and reaching posterior extension of hepatic spine. **In adult males, merus of fifth pereopod with a proximal notch, followed by a twisted, keeled tubercle; distomedian projections of petasma crescent-shaped,** leaning on distolateral projections and concealing them partly or completely. Colour: body pale green to pale pink, some- times green-bluish or pink- brownish, with green or red-brown specks.



Distribution and fishery: Throughout west and east coasts of India and Andaman waters; major landing from Maharashtra and Kerala; depth 5-90 m.

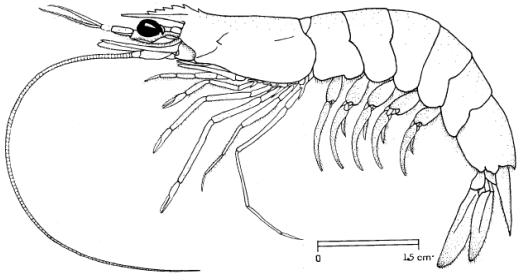
Metapenaeusmonoceros (Speckled shrimp) (Fly. Penaeidae)



Body covered with stiff, very short tomentum. Rostrum nearly straight, uptitted, reaching nearly to, or a little beyond the tip of antennular peduncle.Dorsal carina on first to sixth abdominal terga, blunt and inconspicuous on first to third, very sharp on 4th to 6th. Three terminal joints of 5thpereiopods slender in both sexes, the dactylus rarely reaches much beyond of antennal scale. 5thpereiopod of adult male with proximal end of merus notched on outer side, notch deepened anteriorly by large hood-like spine,No expods on the 5th legs. distomedian projections of **petasma ear-shaped**. Colour: body pink, green-greyish or whitish with brown specks; distal part of uropodspurpleblue.

Distribution and fishery: All along the west and east coasts of India; depth upto 60 m.

Metapenaeusbrevicornis (Yellow shrimp) (Fly. Penaeidae)

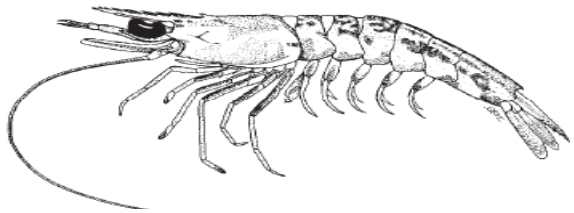


Almost entire body hairless; rostrum armed with 5 to 7 dorsal teeth, toothless on little less than its distal half, reaching from proximal margin of second, to distal margin of third antennular article, **rostral crest high**; postrostral ridge not reaching posterior margin of carapace; adrostral crest and groove reaching as far as second rostral tooth; In adult males, **merus of fifth pereopod with a proximal notch**, followed by a keel-shaped tubercle; each **distomedian projection of petasma with a long and slender apical filament.** Colour: body yellow to white, sometimes greyish, with distinct dark green to bluish-brown specks; pereopods of same colour; pleopods yellowish to pinkish; distal part of uropods brown to rusty red.

Distribution and fishery: Northwest and northeast coasts of India & Andaman waters; supports fishery in the "bheries" of West Bengal; depth 4-90 m.

Metapenaeopsisstridulans(Fiddler shrimp)(Fly. Penaeidae)

Body densely pubescent. Rostrum low, usually straight, directed slightly upward, reaching

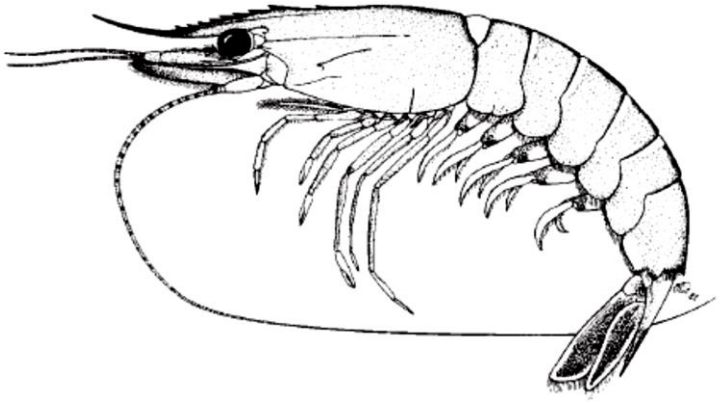


to tip of the antenular peduncle and armed with 7 or 8 dorsal teeth, **the penultimate tooth generally anterior to orbital margin of carapace. Stridulating organ consisting of 5 to 7 very strong ridges on a wide, straight band** at 4/10 of carapace depth. Middorsal crest on third abdominal segment with a usually broad groove. Petasma asymmetrical, right distoventral projection shorter and bearing a few small apical processes, left distoventral projection with 5 to 12 larger apical processes. Thelycal plate subquadrate with rounded corners and slightly wider than long; intermediate broadly trapezoidal, much wider than long , flat or with a shallow median groove; coxal plates of fourth pereopods smaller than thelycal plate. Colour: white to reddish-brown, with red to dark brown mottling; pereopods pinkish to dark red except on

their proximal parts; uropods red to brown except for their proximal third and often their tips.

Distribution and fishery: Maharashtra, Andhra Pradesh, Tamil Nadu and Andamans; depth 90 m.

Parapenaeopsishardwickii (Spear shrimp) (Fly. Penaeidae)

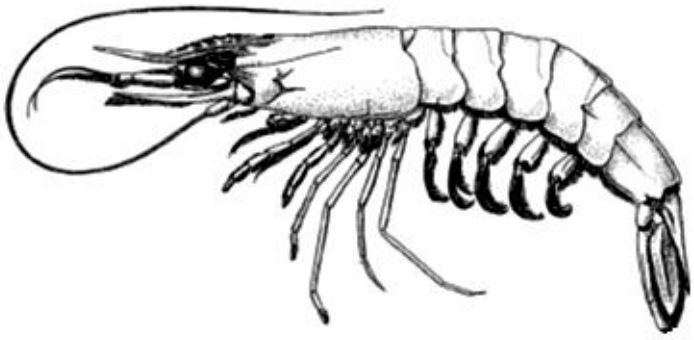


Body naked and smooth, Rostrum armed with 9 to 11 upper teeth; **in females,rostrum very long and of sigmoidal shape**, withdistal 1/3 to1/2 toothless, extending far beyond antennular peduncle; **in adult males, unarmed portion absent and slightly curving downward,** only reaching to middle of second antennular segment. Longitudinal suture extending to about 3/4 or more carapace length.Petasma of males with distomedian projection bluntly protruded and short, somewhat wing-like, anterior margin oftencrenulate; distolateral projection short and directed laterally. Telson bearing only 3 to 5 pairs of minute movable lateral spinules. Colour: body greyish to greenish grey, sometimes pink, and densely covered with dark-coloured dots; rostrum black-brown; basal 1/3 of antennal flagella crossed with brown narrow bands; uropods dark reddish brown with yellowish margins.

Distribution &fishery : Good fishery exists along northwest coast of India (Veraval and Mumbai) and Orissa and Kakinada on the east coast; depth 5-90 m.

Parapenaeopsisstylifera(Kiddi prawn) (Fly. Penaeidae)

Rostrum sigmoid-shaped, strongly upcurved and by far overreaching tip of antennular peduncle (in males somewhat shorter), armed with 7 to 9 dorsal teeth; but **toothless in distal half or more;**

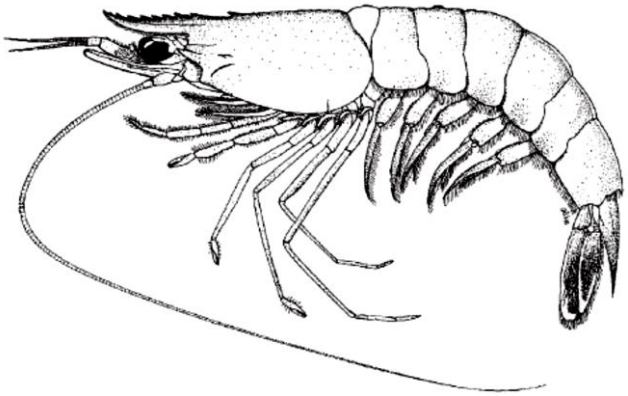


epigastric tooth present; postrostral crest almost reaching posterior margin of carapace; longitudinal suture long, reaching 2/3 of carapace length; **telson armed with 4 pairs of lateral fixed spines;** basis of third pereopod unarmed. In males, distolateral projections of petasma slender, horn-like and straight, directed antero-laterally and with ventro-external openings; distomedian projections small and curved ventrally. In females, anterior plate: of thelycum square, concave, with a slender stem-like posterior process; posterior plate deeply notched arrteromedially. Colour: pale brownish or pinkish white, sometimes greyish; rostrum and abdominal crest darker; pereopods and pleopods yellowish pink to reddish pink; distal part of uropods dark grey, their tips distinctly white.

Distribution & Fishery: All along the Indian coast (good fishery in Kerala, Veraval, Karwar and Mumbai); depth 20-90 m.

Trachysalambriacurvirostris(Rough prawn)(Fly. Penaeidae)

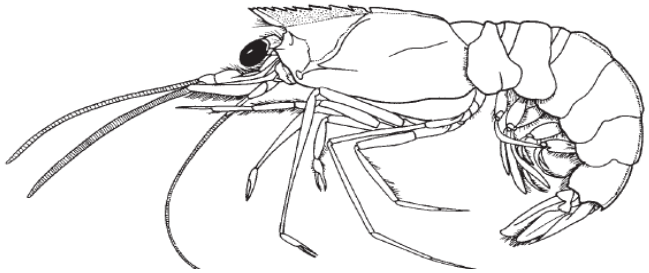
Entire body hairy, with grooves and crests on carapace obscure.**Rostrum slightly upcurved at tip**, armed with 6 to 8 upper teeth (including those on carapace). Longitudinal suture on carapace short.First 3 pairs of legs bearing epipods, first leg additionally armed with a distinct ischial spine, fifth leg not exceeding tip of antennal scale. **Abdomen with a small median tubercle on second segment, last 4 segments with a low dorsal crest, distinctly incised posteriorly. Petasma of malesT-shaped,** distolateral projections broadly wing- like and directed laterally, distomedian projections small. Telson generally armed with 3 or 4 pairs of small movable lateral spines. Colour: body greyish pink to greyish blue, sometimes whitish on sides; antennal flagella reddish; pleopods reddish with white markings on sides; uropods almost entirely reddish, with margins whitish to yellowish.



Distribution and fishery: Gulf of Mannar, Chennai, Visakhapatnam, Kakinada and Kerala; depth 10-150 m.

Solenocerachoprai(Ridge back Shrimp) (Fly: Sloneoceridae)

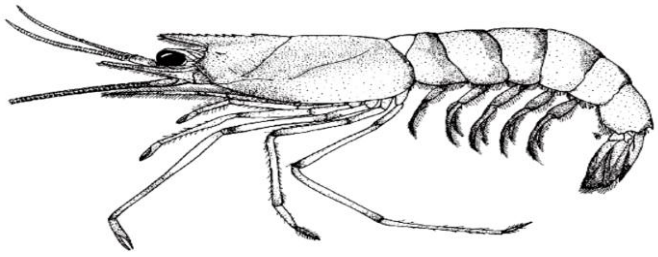
Rostrum short, extending to about 2/3 of eyes; upper border with 8 to 10 teeth (including 4 teeth on carapace); lower border moderately convex.**Postrostral crest markedly elevated and plate-like**, slightly interrupted by a small notch above cervical groove.Carapace with orbital, postorbital, antennal and hepatic spines, but without pterygostomian spines.**Telson with a pair of lateral spines.**Colour: body and legs reddish; antennae banded with dark red and white; uropods dark red, except for some white areas.



Distribution and fishery: West coast and southeast coast of India, major landing in Gujarat, Maharashtra, Karnataka, Kerala and Tamil Nadu; depth 40-300 m.

Solenoceracrassicornis(Coastal mud shrimp)(Fly:Sloneoceridae)

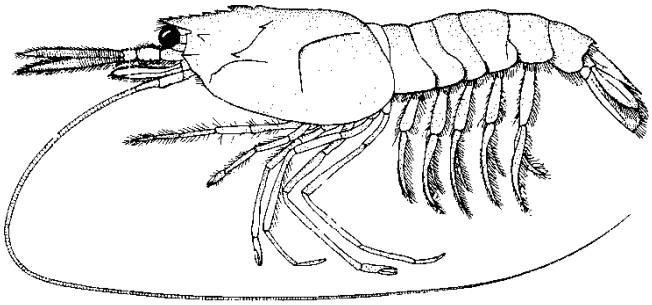
Rostrum short and nearly straight, about as long as eyes; upper border armed with 4 to 7 (mostly 5) teeth; lower border unarmed and somewhat convex. Carapace with 3 postrostral teeth and 1 epigastric tooth, and orbital, postorbital, antennal and hepatic spines, but without pterygostomian spines; **postrostral crest low and rounded**.**Telson unarmed, without lateral spines.** Colour: body pink to pinkish orange; posterior border of each abdominal segment covered with a red cross band; eyes dark brown; antennular flagella and distal part of tail fan reddish.



Distribution and fishery: Northwest and northeast coast of India and Andaman waters, major landing in Gujarat, Maharashtra and Andhra Pradesh; depth 20-85 m.

Solenocerahextii(Deep-sea mudshrimp) (Fly:Sloneoceridae)

Rostrum short, reaching to about distal margin of eye, armed with 6 to 8 dorsal teeth, its ventral margin nearly straight; **postrostral crest elevated and laminose**, reaching posterior margin of carapace and **interrupted by a notch just in front of cervical groove**, cervical groove deep, reaching to, or almost, to dorsal midline; Postorbital and suprahepatic spines present;branchiostegal and pterygostomian spines absent; hepatic crest curved ventrally on its anterior part, with a sharp bending near its anterior end; **branchiocardiac crest very distinct and L-shaped**, telson with a fair of fixed distal lateral spines (trifurcate); fifth pereopod with a coxal spine. Colour: bright pink.



Distribution and fishery: West coast and Bay of Bengal, minor fishery in Kerala and Tamil Nadu; depth 120 - 500m.

Products & export

Shrimps contribute the major share (by value) in the export market and exported to several countries and the major markets for the shrimp are given below.

Japan
USA
Belgium
UK
UAE
France
Netherlands
Germany
Italy
Canada

Products

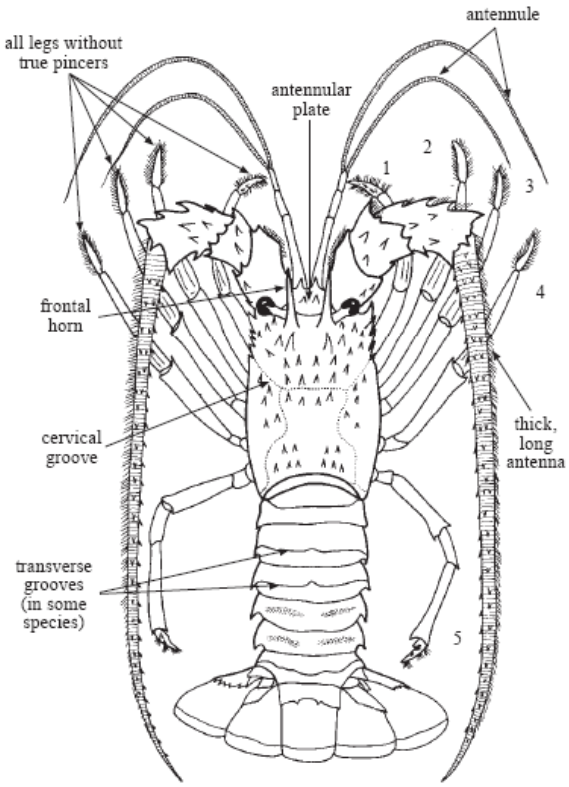
Frozen shrimp and Cultured shrimp
Block frozen shrimp
IQF shrimp
AFD shrimp
Chilled shrimp/prawn
Chilled shrimp (scampi)
Chilled shrimp (tiger)
Chilled shrimp n(brown)
Prawn curry
AFD shrimp powder and Block frozen

Lobsters

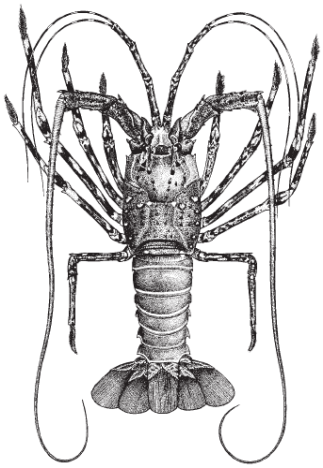
Order : Decapoda
Suborder : MacruraReptantia

Infraorder : Palinuridea
Superfamily : Palinuroidea
Family : PalinuridaeFamily :Scyllaridae
Genus : *Panulirus*Genus :*Thenus*

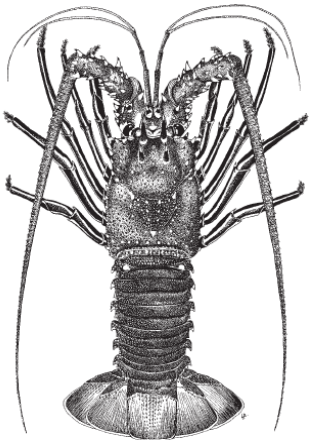
Lobsters are one of the highly priced crustaceans in India and are in great demand as a delicacy in the internal market and as a foreign exchange earner in export market. Fishing of lobsters from Indian seas by traditional fishermen is known since 1950s. The fishery, which has remained as a subsistence fishery until 1957, flourished into a commercial fishery due to the importance of this resource as a potential foreign exchange earner. Twenty five species of lobsters have been so far reported from Indian coast of which only few are commercially important belonging to two families Palinuridae (3 genera- *Panulirus, Puerulus and Linuparus*) and Scyllaridae (*Thenus*). They are *Panulirushomarus*(Scalloped spiny lobster), *P. polyphagus* (Mud spiny lobster), *P. ornatus* (Ornate spiny lobster), *P. versicolor (*Painted spiny lobster), *P. longipes*(Long legged lobster), *P. penicillatus*(Pronghorn spiny lobster), *Linuparussomniosus* (Arabian spear lobster), deep sea lobster *Puerulussewelli (* Arabian whip lobster) and *Thenusunimaculatus*(Flathead lobster) (figures are given in the following pages).



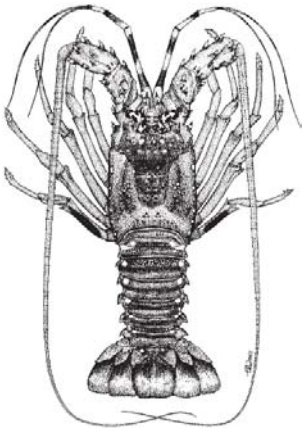
Dorsal view (*Panulirus)*



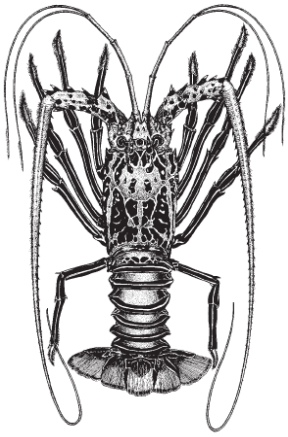
Panulirus polyphagus



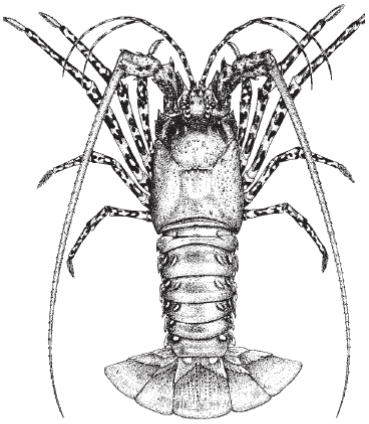
Panulirus penicillatus



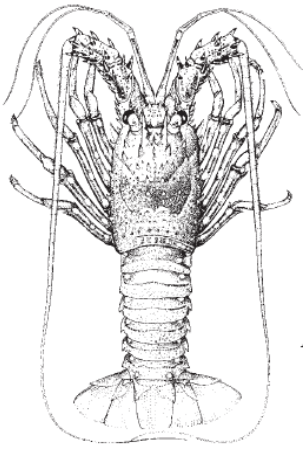
Panulirus homarus



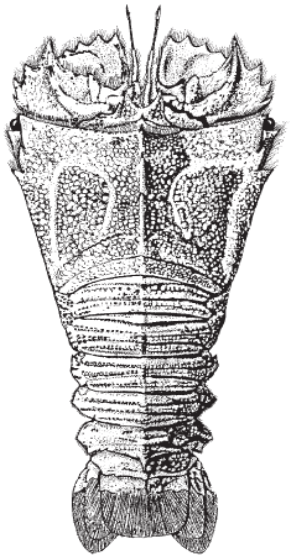
Panulirus versicolor



Panulirus ornatus



Panulirus longipes



Thenusunimaculatus

Panulirushomarus(Scalloped spiny lobster)

Body greenish to brownish.Anterior carapace and region between eyestalks with bright orange and blue markings.Antennular flagella alternated with brown and white bands. Abdomen covered with tiny white spots. Antennular plate at bases of antennae bearing 2 pairs of well-separated principal spines and some spinules.Abdominal segments with a slightly crenate transverse groove sometimes interrupted at the middle.

Panuliruspolyphagus (Mud spiny lobster)

Body dull green.Antennularpeduncle alternated with yellowish white and pale green bands, flagella banded with yellowish white and dark brown. Legs light brown with yellowish white blotches. Abdomen with tiny pale dots; a yellowish white band with brown margins near posterior border of each segment, abdomen naked and smooth, without transverse grooves or sunken pubescent areas.

Panulirusornatus(Ornate spiny lobster)

Body greenish with carapace slightly bluish.Frontal horns intricately banded with yellowish white and brown markings. Antennules and legs conspicuously ringed with pale yellow and black. Abdomen naked and smooth, without transverse grooves or sunken pubescent areas.

Panulirusversicolor (Painted spiny lobster)

Body of adults generally blue and green; more greenish in large individuals. Carapace, including frontal horns, with a mosaic pattern of green, white and blue. Antenna with inner surface pink and outer surface blue; inner surface of antennular peduncle white, outer surface blue; flagella whitish. Legs blue, distinctly striped with white lines.Abdomen greenish, having white lines with blue margins along posterior margin of each segment.

Panuliruslongipes(Long legged lobster)

Body dark brown to indigo and covered with numerous white spots and markings. Inner surfaces of antennae and antennular plate brown to purple and with stridulating pad bright blue; antennules dark brown and alternated with conspicuous white bands. Legs covered with prominent white spots connected by orange lines, or only striped with white or pale lines. Abdomen covered with numerous small to medium-sized white spots.

Panuliruspenicillatus(Pronghorn spiny lobster)

Body dark blue and brown; males usually darker than females.Antennular peduncle striped with white lines, flagella uniformly brownish; membranous areas at outer base of antenna light blue. Legs conspicuously striped with white lines. Abdomen with tiny pale dots.Abdominal segments with a transverse groove, not continuous with pleural groove; anterior margins of pleura spinous.

Thenusunimaculatus(Flat head Lobster)

Body markedly depressed, carapace trapezoid, narrowing posteriorly; anterior part of lateral margin with only 2 teeth, posterior 3/4 without teeth.Eyes small and subspherical; orbits situated at anterolateral angles of carapace. Antennae broad, flattened and plate-like.All legs without pincers and similar in size.Body brownish with reddish brown granules, ventral surface somewhat yellowish white.

Products and Export

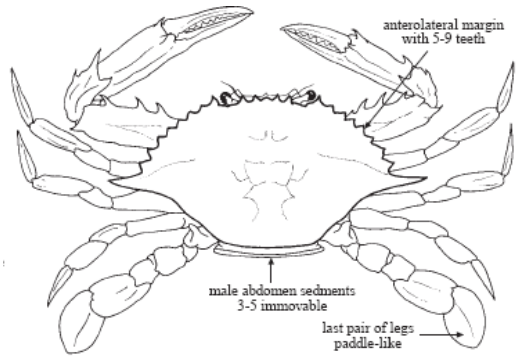
Lobsters are exported in live condition as well as different products, and the following list gives the details of exported products.

Frozen Lobster
Frozen rock lobster tail
Frozen sand/slipper tail
Frozen whole cooked lobster
Frozen lobster meat
Frozen rock lobster whole
Frozen sand lobster whole
IQF sand/rock lobster
Frozen head-on lobster
Frozen lobster whole round
Lobster head-on (IQF)
IQF whole cooked lobster
IQF lobster round
IQF rock lobster tail
IQF head on deep sea lobster
Slipper lobster meat
Sipper lobster whole
IQF raw/rock lobster whole

Crabs

Most of the edible crabs caught from marine and brackish water environments belong to the family Portunidae. In the Indian Ocean, the crab fauna of Portunidae family is included under sub families, Podophthalmidae (Borradaile), Catoptrinae (Sakai), Portuninae (Rafinesque), Caphyrinae (Alcock), Carcininae (Macleay) and Polybiinae (Ortmann). Most of the edible crabs caught from marine and brackishwater environments belong to the sub family Portuninae. In the seas around India, five genera of Portuninae have been reported by various authors. They are *Scylla,Portunus*, *Charybdis, Lupocyclus* and *Thalamita*. Among them the first three genera contribute to the commercial crab fishery Commercially important species are *Scylla* spp. (Mud crabs), *Portunuspelagicus (blue swimmer crab)*, *P. sanguinolentus (three spotted crab), Charybdis feriatus (crucifix crab), C. lucifera*(Yellowish brown crab)*, C.natator*(line crab)and *Podophthalmus vigil* (long eye-stalk crab; sub fly.,Podophthalmidae).

Portunidae



Carapace hexagonal, transversely ovate to transversely hexagonal, sometimes circular; dorsal surface relatively flat to gently convex, usually ridged or granulose; front broad, margin usually multidentate; usually 5 to 9 teeth on each anterolateral margin, posterolateral margins usually distinctly converging.Endopodite of second maxillipeds with strongly developed lobe on inner margin. Legs laterally flattened to varying degrees, last 2 segments of last pair paddle-like. Male abdominal segments 3 to 5 completely fused, immovable.

Portunuspelagicus(Linnaeus, 1758) (Flower crab).

Carapace rough to granulose, front with 4 acutely triangular teeth; 9 teeth on each anterolateral margin, the last tooth 2 to 4 times larger than preceding teeth. Chelae elongate in males; larger chela with conical tooth at base of fingers. Colour:males with blue markings, females dull green/greenish brown.

Portunussanguinolentus(Herbst, 1783)(Three-spot swimming crab).

Carapace finely granulose, regions just discernible; 9 teeth on each anterolateral margin, the last tooth 2 to 3 times larger than preceding teeth. Chelae elongated in males; larger chela with conical tooth at base of fingers; pollex ridged. Colour**:** olive to dark green, with 3 prominent maroon to red spots on posterior 1/3 of carapace.

Charybdis feriatus(Linnaeus, 1758) (Crucifix crab)

Carapace ovate; 5 distinct teeth on each anterolateral margin.Colour:distinctive pattern of longitudinal stripes of maroon and white, usually with distinct white cross on median part of gastric region; legs and pincers with numerous scattered white spots.

Charybdis natator(Herbst, 1789) (Ridged swimmimg crab)

Carapace with densely covered with very short pubescence which is absent on several distinct transverse granulated ridges in anterior half. Colour:orangish red overall, with ridges on carapace and legs dark reddish brown.

Podophthalmus vigil (Fabricius, 1798)

Carapace distinctly broader than long; anterior margin much broader than posterior margin, with posterolateral margins converging strongly towards narrow posterior carapace margin; orbits very broad. Eyes very long, reaching to or extending beyond edge of carapace.Colour:carapace green; chelipeds and parts of legs violet to maroon in adults.

***Scylla* spp.**

The taxonomy of the genus *Scylla* has been terribly confused and is still difficult. Recent research in Australia (Keenan et al., 1998) has clearly shown, using morphological, DNA, and allozyme data, that there are 4 species of *Scylla*.

Scylla serrata(Forsskål, 1775) (Giant mud crab)

Carapace smooth, with strong transverse ridges; H-shaped gastric groove deep; relatively broad frontal lobes, all more or less in line with each other; broad anterolateral teeth, projecting obliquely outwards, colour green to greenish black; legs may be marbled. Well- developed spines present on outer surface of chelipedal carpus and anterior and posterior dorsal parts of palm.

Scyllatranquebarica(Fabricius, 1798) (Purplemudcrab)

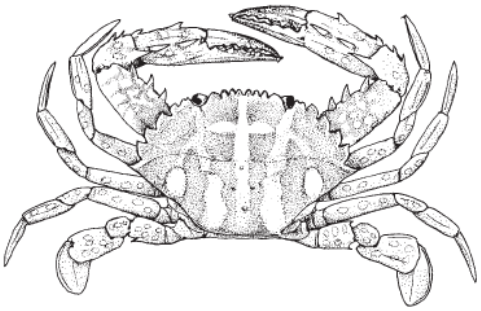
Colour varies from brown to almost black in coloration, and has very well-developed spines on the outer surfaces of the chelipedal carpus and the palm (as seen in *S. serrata*). It differs from *S. serrata*, however, by having the frontal teeth more acutely triangular, the median pair projecting slightly forwards of the lateral pair, and the anterolateral teeth gently curving anteriorly, giving the carapace a less transverse appearance.

Scylla olivacea(Herbst, 1796) (Orange mud crab)

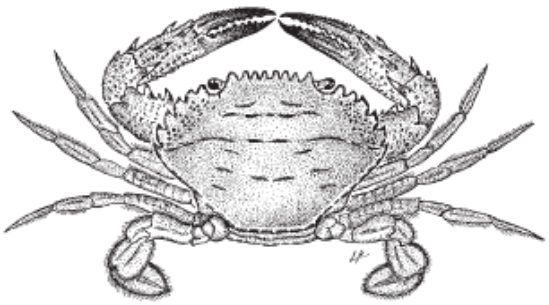
Carapace brownish to brownish green in colour (sometimes orangish), palm orange to yellow. It has a smoother, more evenly convex carapace with very low transverse ridges, a shallow H-shaped gastric groove, the median pair of the frontal lobes more rounded and projecting slightly forwards of the lateral ones, the anterolateral teeth gently curving anteriorly, giving the carapace a less transverse appearance. It also has very low spines on both the outer surface of the chelipedal carpus and the dorsal surface of palm.

ScyllaparamamosainEstampador, 1949 (Greenmudcrab)

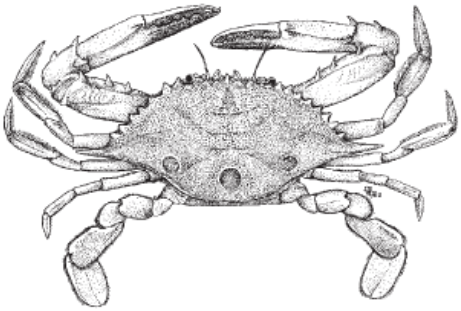
Carapace usually green to light green, palm green to greenish blue with lower surface and base of fingers usually pale yellow to yellowish orange. Frontal margin usually with sharp teeth, palm usually with distinct, sharp spines.



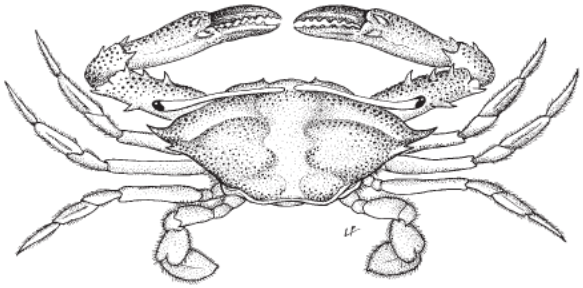
Charybdis feriatus(Linnaeus, 1758)



Charybdis natator(Herbst, 1789)



Portunussanguinolentus(Herbst, 1783)



Podophthalmusvigil(Fabricius, 1798)

Portunuspelagicus(Linnaeus, 1758)

Scyllaserrata(Forsskål, 177

Scyllatranquebarica(Fabricius, 1798)

Scyllaolivacea(Herbst, 1796)

ScyllaparamamosainEstampador, 1949

Products and Export

Among crabs, only *Scylla* spp. is exported in live condition and the following list gives the details of other exported products.

Products

Frozen crab meat
Frozen stuffed crab
Frozen mud crab
Frozen cut swimming crab
Frozen dressed crab
IQF whole crab
Frozen whole crab
Frozen soft shell crab
Frozen pasteurised crab
Frozen crab cutlets
Frozen crab claws
Frozen cut crab with claws
Frozen cut crab
Frozen swimming cut crab without claw
Frozen pasteurised crab meat
Frozen crab meat with shell/crab chunks
Frozen crab stick
IQF cut crab (Red/green)
IQF cut crab (3 spot)
Crab(3 spot crab)
IQF blue swimming cut crab
Frozen blue swimming cut crab
IQF blue swimming crab (whole)

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9

Indian Cephalopod Resources: Distribution, Commercial Exploitation, Utilization and Trade

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Cephalopods are purely marine in habitat, and there are about 600 living species. They are considered as the fastest marine invertebrates. The cuttlefishes come under the order Sepioidea and are characterized by the presence of a shell (chitinous or calcareous), 10 circum oral appendages and the tentacles are retractile into pockets. Suckers have chitinous rings. Posterior fin lobes are free and not connected at midline. The cuttlebone is internal and located dorsally underneath the skin.

The squids come under the order Teuthoidea. The shell is internal and is known as gladius or pen. It is chitinous and feather or rod shaped. There are 8 sessile arms and 2 tentacular arms which are contractile but not retractile. Suckers are stalked, and with or without hooks. Fin lobes are fused posteriorly. Eyes are without lids and either (1) covered with a transparent membrane, with a minute pore (Myopsida) or (2) completely open to the sea, without a pore (Oegopsida).

Octopuses are members of the order Octopoda. There are 8 circumoral arms and tentacles are absent. Fins are sub-terminal (on sides of mantle), widely separated or absent. Shell is reduced, vestigial, "cartilaginous", or absent. Suckers are without chitinous rings and are set directly on the arms without stalks.

Cephalopods are by far the most important group with an average annual production of about 1,12,000 tonnes and in 2008, the production has touched an all-time high of 1,54,000 t. They are landed as by-catch and as a targeted fishery mostly in mechanized trawlers operating up to 200 m depth, and beyond in some areas. The dominant species occurring in commercial catches are *Uroteuthis (P) duvauceli, Sepia pharaonis, S. aculeata* and *Amphioctopusnegelectus*. A list of neretic species commercially exploited is given in Table below.

Table 9.1 List of commercially exploited cephalopods from Indian Seas

Species	Common Name	Distribution
Squids		
Uroteuthis (Photololigo) duvauceli	Indian squid	All along Indian coast
Loliolus (Nipponlologo) uyii	Little squid	Madras & Visakhapatnam
U. (P) edulis	Needle squid	SW and SW coast
Loliolus (Loliolus) hardwickei	Investigator squid	All along Indian coast
Sepioteuthislessoniana	Palkbay squid	Palk bay & Gulf of Mannar
Sthenoteuthisoualaniensis	Oceanic squid	Oceanic Indian EEZ
Thysanoteuthis rhombus	Diamond squid	Oceanic Indian EEZ
Cuttlefishes		
Sepia pharaonis	Pharaoh cuttlefish	All along Indian coast
S. aculeata	Needle cuttlefish	All along Indian coast
S. elliptica	Golden cuttlefish	Veraval & Cochin
S. prashadi	Hooded cuttlefish	SW & SE coast
S. brevimana	Shortclub cuttlefish	Madras & Visakhapatnam
Sepiellainermis	Spineless cuttlefish	All along Indian coast
Octopuses		
Amphioctopusneglectus	Webfoot octopus	SW & SE coast and islands
A. marginatus	Veined Octopus	SW & SE coast and islands
A. aegina	Marbled octopus	SW & SE coast and islands
Octopus vulgaris	Common octopus	SW & SE coast and islands
Cistopusindicus	Old woman octopus	SW & SE coast and islands

Methods of Exploitation

Although about 40 per cent of the world's cephalopod catches are taken by squid jigging and 25 per cent by trawling, in India, cephalopods are principally caught by bottom trawlers operating upto 200m depth zones. While most of the catch is brought in as by-catch from the shrimp and fish trawls employed by the trawlers, of late, there is a targeted fishery for cuttlefishes during the post monsoon period (Sep-Dec) using off bottom high opening trawls along the SW and NW coast. Prior to the seventies traditional gears like shore seines, boat seines, hooks and lines and spearing were the principal gear employed to capture cephalopods. These traditional gears continue to be used especially for cuttlefishes at Vizhinjam, where there is no trawl fishery. Experimental squid jigging has been tried with Japanese expertise along the west coast by GOI vessels with considerable success (Nair et al., 1992a). However, commercial squid jigging is not practised in India.

Cephalopod Production

Cephalopod production, which remained at very low level upto the early seventies, has shown a remarkable increase crossing the 100,000 tonne mark in 1994. From 1973 onwards the commencement of export of frozen cephalopod products to several countries saw the transition of the resource from a discard to a quality resource fetching high foreign exchange (Silas, 1985). Thereafter its production showed a steep increase. The west coast

maritime states, Gujarat (GUJ), Maharashtra (MAH), Goa (GOA), Karnataka (KAR) and Kerala (KER) contribute to the bulk (86 per cent) of the production. While the production from the east coast amounts to only 14 per cent, of which, Tamil Nadu (TN) contributes the maximum followed by Andhra Pradesh (AP). The states of West Bengal (WB), Orissa (OR) and Pondicherry (PON) contribute only a small percentage. Overall, KER ranks first contributing a third of the all India production followed by MAH, GUJ and KAR. The cephalopod production ($t.km^{-2}$) in different maritime states indirectly this indicates the relative abundance in the continental shelf and level of exploitation of cephalopods in the different maritime states. Maximum productivity (0.699 t/km^2) was observed in Kerala, followed by Tamil Nadu, Karnataka, Maharashtra and Goa.

At the national level, Jan-Mar and Oct-Dec were the most productive period. Along the upper east and west coast, the above months were the most productive, while in KAR, KER, TN and AP Jul-Sep was also equally productive.

Species-wise Production

The neretic squid *U. duvauceli* followed by the pharaoh cuttlefish *S. pharaonis* and the needle cuttlefish S. aculeata together contribute to 84 per cent of the total cephalopod production from India. Along the west coast, *U. duvauceli* contributes to more than 50 per cent of the landings, followed closely by *S. pharaonis* and *S. aculeata* (47 per cent). Among squids, *U. edulis* and among cuttlefishes, *S. elliptica* form significant part of the catch from Kerala and Gujarat respectively. A number of octopus species, chiefly, *A. neglectus* forms 5-6 per cent of the catch mainly from Kerala.

The dominant species in landings from the east coast is *S. pharaonis*, followed by *U. duvauceli* and *S. aculeata*. The diversity of squid and cuttlefish species exploited in commercial quantities is more along east coast as compared to west coast. *U. edulis* and *S. lessoniana* are also caught in considerable quantities from TN and AP. Octopus species, which were formerly discarded, has gained importance in recent years. The major production is from Kerala State. Their proportions in the landings from both the coasts are increasing considering the export value of the same.

Utilization and Marketing

About 15-20 per cent (Rs 1,393 Crores) of our marine products export earnings (Rs. 8,608 Cr.) is from cephalopods, comprising of coastal squids, cuttlefishes and octopuses in 2008-09. The squid export from India increased from 34,172 tons in 2007-08 to 57,125 tons in 2008-09 registering an increase of 67 per cent. Existing destination markets for the currently exploited squids from India are in EU, US, Japan and Mediterranean countries such as Spain, Greece, Italy and Portugal.

The squids products presently exported from India are presented in the below figure. Among the 44 varieties, the frozen (Fr.) squid (SQ.) whole (W.) and frozen squid whole cleaned (W.C.) contributed more than 60 per cent to the exports.

In spite of upsurge in the demand for ready-to-eat and ready-to-cook products in international and domestic markets, our export of value-added squid product such as frozen squid rings breaded (Fr. SQ. Rings (breaded)) and frozen squid stuffed is less than 1 per cent.

Table 9.2 Unit value realized for squid products exported from India

ITEM	Product Form	Grade	Price (US $)	Market	Origin
Coastal Squid	Fillet	2/4 5/7 8/12 13/20	8.90 8.50 6.60 5.90	JAPAN	Tuticorin
	Wings	U/10 10/20 20/up	1.85 1.85 1.85	JAPAN	Tuticorin
	Whole, cleaned	10/20 20/40	2.20 1.65	USA	Kollam
	Whole	3/6 6/10 10/20	1.85 (Euro) 1.70 (Euro) 1.35 (Euro)	SPAIN	Kollam
	Whole Cleaned	6/10 10/20 20/40	3.00 2.60 2.50	EU	Veraval
	WC Tray pack	20/40	2.65	ITALY	Mumbai
	Rings blanched IQF	40/60 60/up	2.50 2.80	ITALY	Kochi
	Tentacles blanched IQF	60/up	2.15	ITALY	Kochi
	Rings blanched IQF	60/up	2.30	FRANCE	Kochi
	Tentacles blanched IQF	60/up Broken	2.20 1.80	FRANCE	Kochi
	Whole	10/20 20/40 40/60	1.95 1.35 0.90	UAE	Mangalore

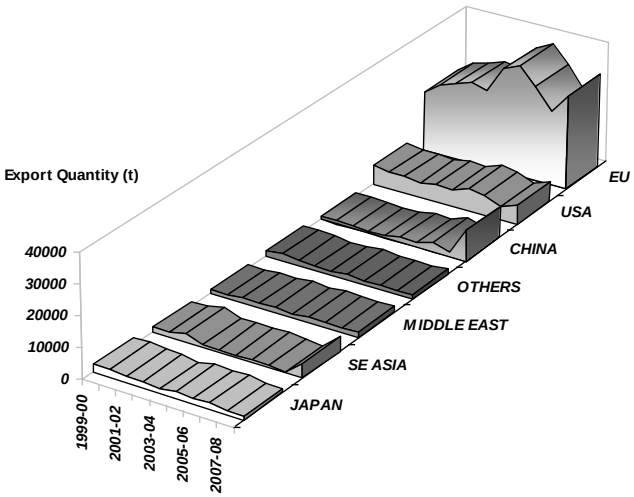

Fig 9.1 Quantity of neretic squid exported to different international destinations from India

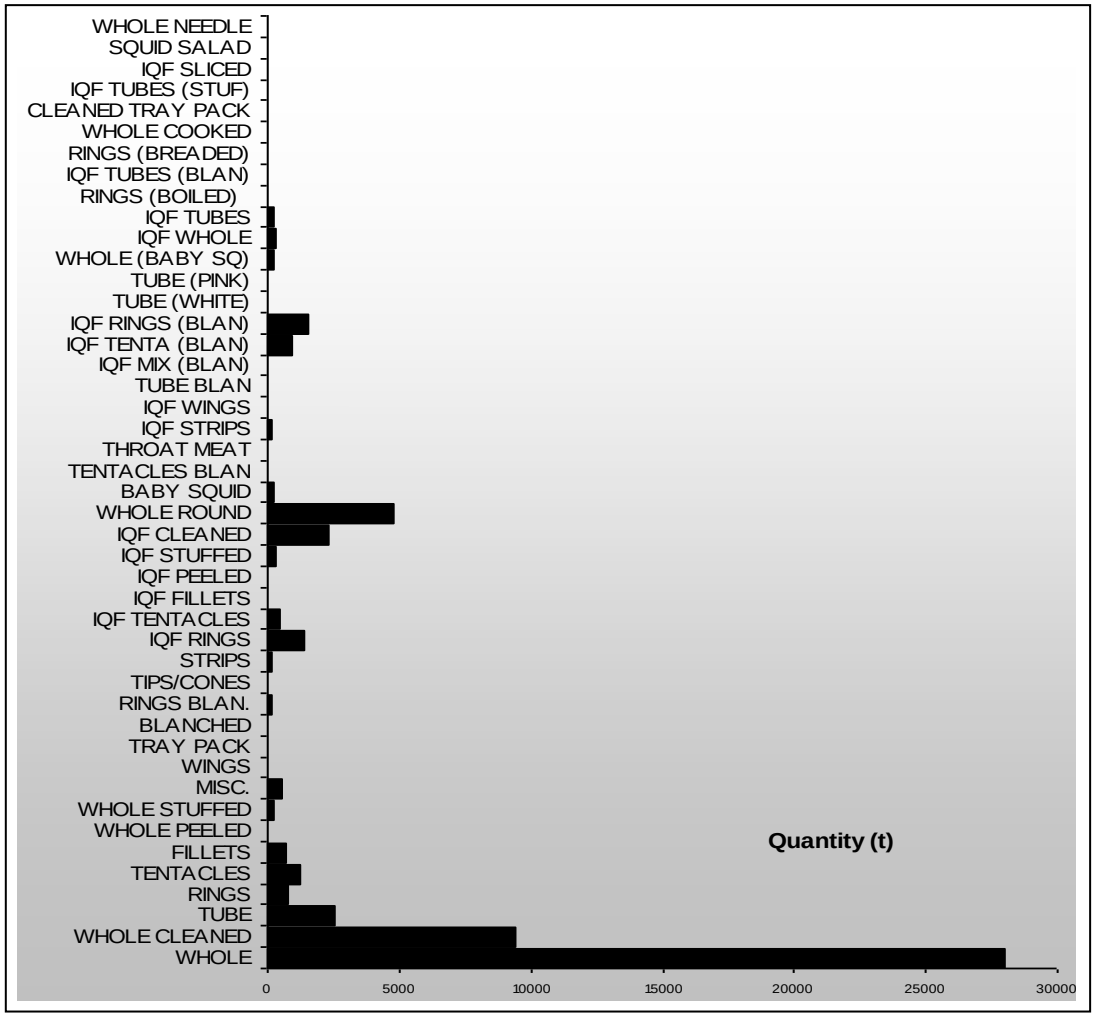

Figure 9.2. Coastal Squid products exported from India

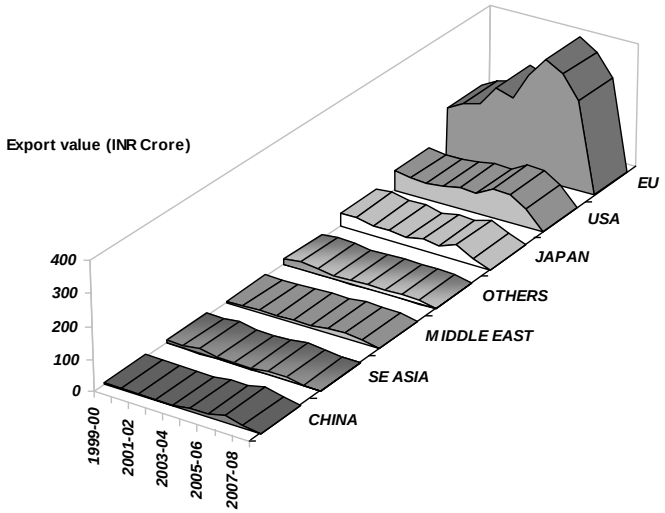

Figure 9.3 Export value realized from neretic squid exports

Oceanic Squids

The purpleback flying squid *Sthenoteuthis oualaniensis* (Lesson, 1830) is distributed in the tropical and sub-tropical areas of the Pacific and Indian Oceans. The Arabian Sea is considered as one of the richest regions for these oceanic squids in the Indian Ocean. These squids are pelagic animals living in the open ocean, usually absent over the continental shelves (<200 m), and first appear over continental slopes at depths above 250-300 m. The species has been called as the master of the Arabian Sea due to its high abundance, large size, short life-span, fast growth and near monopoly of the higher trophic niche. The estimated squid stock in the Arabian Sea varies in the range 0.9-1.6 million t. In recent years, the species has been found to occur in hook and line and gillnet catches in Cochin (Mohamed et al., 2006) and Veraval (Moorthy et al., 2009) and Mohamed et al. (2006) has worked out its population characteristics as $L\infty$ = 49.1 cm; K = 0.83 yr^{-1} and t0 = -0.06 yr. A major programme is currently underway to exploit this resource using squid jigging [official website of the project: www.oceanicsquids.naip.org.in]

The emergence of cephalopods as an important marine fishery resource of the country with almost cent per cent export potential warrants careful monitoring and appropriate management particularly because we are exploiting above the revalidated potential yield. Several gaps exist in our knowledge of these valuable resources, especially on the life histories of our species, and these need to be addressed on a priority basis.

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10

Indian Tuna Resources: Distribution, Commercial Exploitation, Utilization and Trade

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Tuna and tuna-like fishes are important both from global demand and economic view points. They include 40 species occurring in the Atlantic, Indo-Pacific Oceans and in the Mediterranean Sea. Archaeological evidence showed that, tunas being harvested by early Europeans in the area around Sweden, by Native Americans near British Columbia and by the peoples of the Joman culture near Japan. However, industrial fishing for tunas began in the 1950's and global production has tended to increase continuously from 0.6 million tons in 1950 to over 6 million tons in 2008. Catch of principal market tuna species was estimated as four million tons in 2008, which represented about 67 per cent of the total catch of all tuna and tuna-like fishes. Most of these catches were taken from the Pacific Ocean (70.2 per cent), with the Indian Ocean contributing 20.4 per cent with an estimated catch of 870,000 tonnes and the rest by Atlantic Ocean and the Mediterranean Sea (9.5 per cent). Major contributors to the global tuna production are skipjack tuna (57.5 per cent), followed by yellowfin tuna (27.1 per cent), bigeye tuna (9.6 per cent), albacore tuna (4.7 per cent) and the rest (10.7 per cent) by other species. According to assessments carried out during 2010 by ICCAT, IOTC, IATTC and WCPFC the international organizations responsible for management of the tuna stocks of in the world Oceans, many tuna stocks are heavily exploited, some unsustainably, and the catches in many cases are declining.

Tunas have been exploited along the Indian coast since time immemorial with neritic tunas being the mainstay of the tuna fishery till recently. Tunas in Indian waters are represented by nine species belonging to five genera, *Auxis, Euthynnus, Sarda, Katsuwonus* and *Thunnus.* Coastal/neritic tunas are represented by five species and are being exploited as an incidental catch in many commercial coastal fishery. Increased demand for Sashimi grade tuna from export markets, improved harvesting methods, expansion of transportation and storage facilities and development of value added products provided an impetus for fishermen to harvest all commercially important resources including hitherto non-targeted oceanic resources. Modernization and adoption of innovative fishing methods, increased endurance of the fishing crafts and improved fishing efficiency encouraged extension of fishing activities beyond territorial waters, resulting in overall increase in production from few centres.

Though tuna fishery gained importance in recent years, only limited information is available on the recent developments in the tuna fishery, production trends, stock characteristics and potential in the Indian EEZ including Island territories.

Developmental history

Tuna fishery in India has a long history as that of the marine fisheries of the country. Tuna fishery involved coastal based fleets of varying specifications with different craft-gear combinations and large LOP vessels. Until eighties tuna remained as an incidental catch in many fisheries except in Laksahdweep, parts of Kerala and Tamilnadu, where targeted fishery for tunas were in vogue. In Lakshadweep well organised targeted fishery for skipjack tuna has been in vogue using pole and lines and trolllines. At Vizhinjam along the coast of Kerala bullet tuna enjoy considerable local demand and targeted exploitation carried out using hand line, small longlines and gillnets. At Tuticorin along the coast of Tamilnadu tunas and large pelagics were targeted by traditional fishermen using gillnets, trolllines and longlines from traditional crafts. Encouraged by the catch made by traditional fishermen, several trawlers were modified for gillnetting at Tuticorin for tuna and other large pelagics from deeper waters in eighties.

Commercial longliningunder charter scheme by "letter of permit" (LOP) vessels as a prelude to joint venture for oceanic tunas was initiated in mid-eighties and witnessed phenomenal growth over the years. They undertake long duration fishing trips, operate large long lines and gillnets, stay at sea for extended periods of time and rarely return to registered port. They fish both in the EEZ and international waters and the catch is not landed nor reported properly, but is believed to be transshipped in the mid-sea.

During the beginning of this decade, hundred's of traditional fishermen from the southeast coast ventured specifically for exploiting oceanic tunas and associated resources with great success. They operate small longlines/handlines/trolllines/pole & lines/gillnets from artisanal crafts in the outer shelf areas. Encouraged by their success and also following the policy decision of the Government to tap oceanic resources, several commercial trawlers were modified for longlining, mainly to exploit yellowfin tunas during 2005-'06. These fleets based at several major and minor harbours of the country, operate multiple gears, along with longlines mostly in shelf edge and adjacent oceanic waters. But, later, driven by economic benefits several of these units diverted their main target from tunas to billfishes and elasmobranchs. The latest development in this line is the introduction of multiple pole and line with single hook fishery for medium sized yellowfin tunas in Lakshadweep waters.

Tuna resources and potential

Nine species representing coastal/neritic and oceanic species supported the resources and fishery. Little tuna (*Euthynnusaffinis*), frigate tuna (*Auxisthazard*), bullet tunas (*Auxisrochei*), longtail tuna (*Thunnustonggol*) and bonito (*Sarda orientalis*t) represent the coastal/netritic species. Oceanic species were represented by Yellowfin tuna (*Thunnusalbacares*), skipjack tuna (*Katsuwonuspelamis),* dogtooth tuna (*Gymnosarda unicolor*) and bigeye tuna (*Thunnusobesus*).

Little tuna/Kawakawa

Most dominant commercial species, widely distributed along the Indian coast including island territories with large concentration along the southern coasts, especially southwest coast of India.Epipelagic and mainly neritic in habitat and form multispecies shoals in association with skipjack, frigate tuna and yellowfin tuna. Occurs in open waters but young remain close to near-shore areas and often enter bays and harbors. Grows to over one meter.

Bullet tuna

The bullet tunas are distributed along the west and east coast of India, with large concentration along the southern coasts, especially along the coasts of Kerala and Tamilnadu. Epipelagic fish, found in neritic and oceanic waters with large abundance in deeper waters associated with knolls and oceanic ridges and often form large schools. Adults are caught from deeper waters around knolls, sea ridges and Islands. They grow to a maximum size of 50 cm.

Frigate tuna

The second dominant coastal species, distributed along the along the west and east coast of India with major abundance towards southern coasts. Epipelagic fish, distributed in neritic and oceanic waters with large abundance in deeper waters associated with knolls and oceanic ridges. Large abundance was observed along the Indian side of Chagos-Laccadive ridge. They exhibit strong shoaling behavior and supported round the year commercial fishery.

Striped bonito

Neritic species distributed along the coasts of mainland and island territories and show close association with coral reefs and knolls. Major areas of abundance are coasts of Kerala, Andaman & Nicobar and Gujarat. Exhibit schooling behavior and often found along with other small tunas. Support occasional fishery along with other tunas.

Longtail tuna

Distributed mainly along the west coast and Andaman waters with major abundance in northwest coast comprising Maharashtra and Gujarat. Epipelagic species, aggregate in large numbers over knolls and sea mounts. They are observed in appreciable numbers over knolls and seamounts of Chagos-Laccadive and Andaman ridges. Generally avoid turbid and low saline waters. Attain a maximum size of 145 cm and weight of around 36 kg.

Skipjack tuna

Epipelagic species, strictly oceanic in distribution.Distributed along the coast of mainland and island territories. They used to aggregate in areas of convergence, boundaries between cold and warm water masses, upwelling region and other hydrographical peculiarities showing any type of discontinuity. Exhibit a strong tendency to school in surface waters with birds, drifting objects, sharks, whales and may show a characteristic behavior like jumping, foaming, etc. They remain in surface waters during night and move to deeper waters during day. Large shoals were generally observed around oceanic Islands, over seamounts and along the shelf beak areas of east and west coast of the mainland.

Yellowfin tuna

Most dominant oceanic species in oceanic waters.Epipelagic in habitat with oceanic in distribution.Major areas of their aggregation are oceanic waters around island territories seamounts and shelf break areas of mainland coasts.Young and sub-adults forms large aggregations along the shelf-break area and over seamounts. They school primarily by size, either in mono-species or multi-species groups. Larger fish frequently school with porpoises, also associated with floating debris and other objects in oceanic waters.

Big-eye tuna

A typical oceanic species found only in deeper waters and enjoy wide distribution throughout most of the world's oceans. They occurs mostly in waters below the thermocline. Big eye make extensive vertical movements and often observed in depths deeper than other tunas. Among their unique adaptations to life at greater depth is a layer of subcutaneous fat which insulates them from the cold.

Dogtooth tuna

Enjoy restricted distribution in the seas around Andaman-Nicobar, Lakshadweep and oceanic ridges and associated seamounts. In the Indian waters, their rich abundance was observed in Andaman seas.

Tuna potential

The expert committee set up for estimating marine fishery potential of Indian EEZ estimated a potential of 277,972 t for tunas. The potential of coastal/neritic tuna is 65,472 t and that of oceanic tuna is 212,500 t. The potential of important oceanic species, yellowfin tuna is 114,800 t, skipjack tuna 85,200 t and bigeye 12,500 t.

Fishing methods

Tunas were exploited by a variety of gears like, gillnets, longlines, handlines, pole and lines, troll lines, purse seines, ring seines and even by trawls based on the fishing ground and targeted species.

Gillneting:

Drift gillnets are generally used to capture tunas in the open ocean, consist of a series of individual nets connected together. Because of the high incidental capture of other species, the use of drift gillnets longer than 2.5 km. was banned on the high seas by the United Nations. Only a small per centageof the world catch of tunas is taken with gillnets. Only a small per centageof the world catch of tunas is taken with gillnets.

Longlining:

Longlines arepassive and non-selective to the extent that it can capture several species of tunas along with other types of fishes particularly swordfish and marlins. The gear fishes mostly below 100 m depth, where temperatures are cool and the largest tunas frequented. The longline vessels target yellowfin tuna, bigeye tuna and bluefin tuna. The largest long line fleets are those of Japan followed by those of Taiwan and Republic of Korea. In terms of tonnage of tuna captured long lining captures about 14 per cent of the world catch of tunas.

Purse-seining:

Purse seiners target mostly yellowfin tuna and skipjack and on a world scale account for roughly 60 per cent of all the tuna landed. In recent years the purse-seine catch of Bigeyetuna has been increasing rapidly, mostly due to the increased use of FADs. Scientists have urged caution regarding expansion of fishing effort in the surface fisheries and have expressed concern over the fact that the increased use of FADs has increased the catch of juveniles of large tuna species, which could be reducing the yield per recruit and hence the total potential yield.

Pole and lining:

Pole-and-line fishing is a two-mode type of fishing targeting mainly skipjack and yellowfin tunas. The live bait was used to attract the tuna to the vessel where they were caught by pole-and-line gear. If good aggregation of tunas attracted towards the liove bait, several tonnes could be captured in a short time. Though pole-and-line fishing was at one time the major type of tuna fishing in terms of catch, because of improvements in purse-seining and other methods it has diminished in importance.

Trolling:

Trolling consists of towing several lines with bait or lures attached from vessels, generally less than 20 meters in length. Most troll fisheries target albacore tuna *(Thunnusalalunga),* but several other species are also taken. Trolling accounts for only a very small percent of the world catch of tunas.

Fish Aggregating Devices (FADs):

Fish Aggregating Devices are structures located at surface or at midwater depths to take advantage of attraction of pelagic fish to floating objects. FADs anchored in depths beyond 500 m are generally more successful in attracting schools of skipjack *(Katsuwonuspelamis),* yellowfin (Thunnus*albacares)* and bigeye*(T. obesus)* tunas. Smaller tunas (skipjack and immature yellowfin) at the surface and larger tunas (mature yellowfin and bigeye) at depths of 300-400 m. More than 50 per cent of the world catch of tropical tunas come from fishing under FADs

Tuna production

Following modernization of the fishing practices along with the diversification, intensification and extension of fishing to new grounds, status of tuna fishery changed from incidental bycatch to targeted commercial fishery. Landings registered steady increase from 848 ton in I951 t to 129,801 t in 2008. During 2006-'10, the average tuna landings was 112,365 t. The landing thereafter registered a decline. The average catch by LOP vessels during the same period was 87,239 t with peak (100,268 t) in 2008. Their catch also showed a declining trend since 2008.

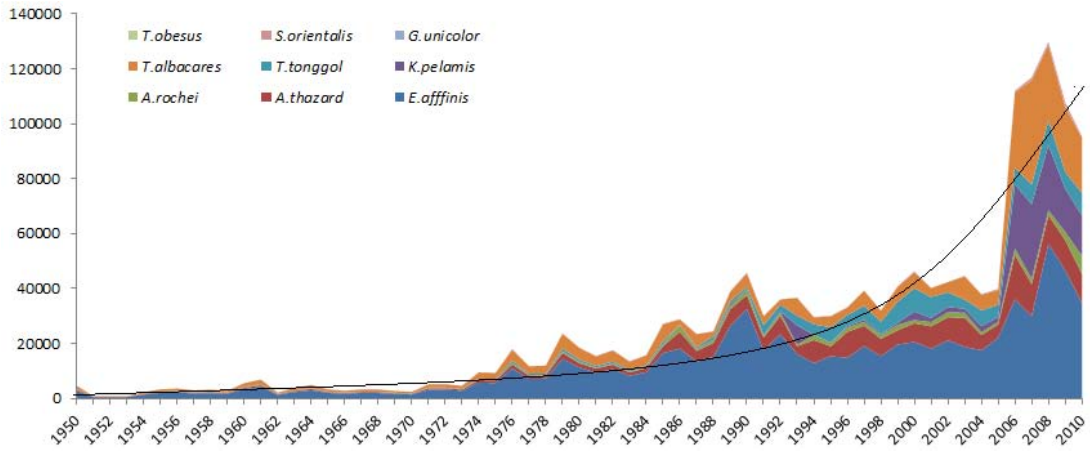

Figure 10.1 Growth in tuna landings in tons by coastal based fishery
(**landings by Island territories included from 2006 onwards*).

Catch composition

The tuna fishery was supported by nine species, five coastal & neritic species and four oceanic species. Coastal & neritic tunas represent 57 per cent of the total tuna catch with an average landing of 64,039 ton. Fishery was supported by little tuna (36.3 per cent), frigate tuna (10.7 per cent), bullet tunas (2.8 per cent), longtail tuna (6.5 per cent) and bonito (0.8 per cent). Among the oceanic species, yellowfin tuna represent 24.3 per cent, skipjack ,18.6 per cent and dogtooth and bigeye tunas of the total tuna catch. Catch by LOP vessels was supported by three species; yellowfin tuna (94.6 per cent) and small proportion of dogtooth (1.5 per cent) and big-eye tuna (3.9 per cent).

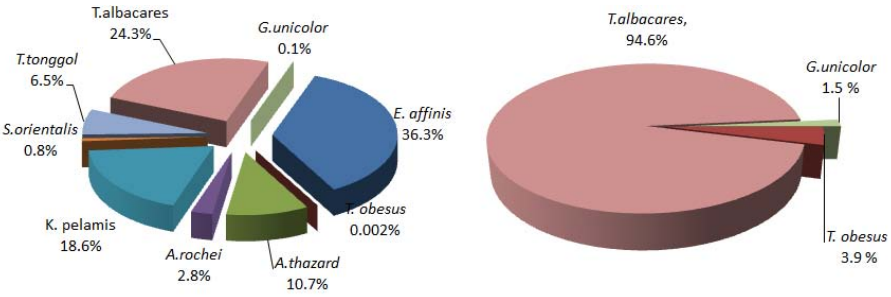

Figure 10.2 Component species in the tuna catch (per cent) in coastal and LOP fishery during 2006-'10

Production by gear

Tunas were caught both as incidental and targeted catch in many gears. Major share of the catch was realized in gillnets (51.7 per cent) and hooks and line (24.8 per cent). Other gears, which land tunas are pole & line, purseseines, ringseines, trawls and bagnets. Considerable variation was also observed in the catch composition by different gears. Major share of the landings by trawl was small yellowfin tunas followed by little tunas. Little tunas formed the major share of the catch in gillnets, hooks and line, bagnets, ringseines, purseseines and artisanal gears and skipjack tunas in pole and line. Yellowfin tunas formed the second dominant component in gillnets, hook and line and in artisanal gears.

Production by region

Tunas are landed along the coast of mainland and Island territories and supported fishing at varying levels from different region.Almost 90.5 per cent of the total tuna landings of the country is from the mainland coast with 47.3 per cent of the landings from west coast and 43.2 per cent from east coast. The major share of the catch, 41.3 per cent is from southeast coast, followed by 28.4 per cent from southwest and 18.9 per cent from northwest coast. Contribution by northeast is only nominal (1.9 per cent). Lakshadweep contributed 7.3 per cent and Andaman & Nicobar 2.2 per cent to the national tuna landings.

Production by group
Coastal/neritic tunas

Average annual production was 64,074 t. After a peak (78,680 t) in 2008, production registered continuous decline. Major share of the landing was from southwest coast (43 per cent), followed by southeast coast (28 per cent) and northwest (20 per cent) coast. Present production was very close to the estimated potential (65,472 t) and had only limited scope for improved production from present grounds. Considerable scope exists for increasing the

production from selected areas like northeast coast, coast of Karnataka, Maharashtra and Andaman-Nicobar Islands, where the present level of production remains low.

Little tuna/Kawakawa

They are the most dominant species abundantly available in Indian waters. They are exploited mainly by gillnets, hooks and lines, ringseines and purseseines. Their average annual production was 40,780 t and the major share (79.5 per cent) was contributed by southern coasts. Only limited scope remains for increasing their yield from these grounds. However, considerable scope exists for increasing the production from waters of Karnataka, Maharashtra, Orissa and West Bengal. They support fishery round the year with peak during June-October. 14-78 cm fishes support the fishery with 34-58 cm as the commercial size.

Frigate tuna

Frigate tuna are the second dominant species available among coastal tunas, with fishery mainly from southern coast, contributing 86.4 per cent in the landings. Exploited by gillnets, hooks and line, ring seines, trawl and purseseines (13.8 per cent). Average annual landing was 11,970 t. Fishery was supported by 14 to 50 cm fishes. Fishery occurred round the year with peak during June to September. There exists only limited scope for enhancing yield from the present grounds. Considerable scope is available for improving their yield from the Indian side of Chagos-Laccadive ridges and from coastal waters of northeast region, Karnataka, Maharashtra and Andaman-Nicobar.

Bullet tuna

Major fishery is restricted to the southernmost part of Indian waters with nearly 75 per cent of the landings from Kerala alone and 21 per cent from Tamilnadu. Average annual production was 3,132 t. Target fishing for bullet tuna by longlines and handlines, driven by local demands, prevails only along the southern districts of Kerala. They are also landed trawls, purse seines and ring seines Fishery occurred round the year with peak during June to Septemberand the fishery was supported by 15 to 38 cm fishes Considerable scopes were available for improving their yield by target exploitation from other areas.

Long tail tuna

Fishery is mainly along the west coast and Andaman waters with major abundance and fishery (96 per cent) from northwest coast comprising Maharashtra and Gujarat. Several gears landed the species, with the major share by gillnet and hooks and lines. Fishery maintaining an uptrend with an average annual production of 7,340 t. Pattern of distribution, abundance and fishery indicated scope for improving production from less exploited areas like knolls, Chagos-Laccadive ridge and associated seamounts of west coast and Andaman and Nicobar waters. Fishery was supported by 26-112 cm fishes.

Oriental bonito

Fishery is highly seasonal from and major share of the catch was from coasts of Kerala, Andaman & Nicobar and Gujarat coast. They are exploited by hooks and line and gillnets. Yield exhibiting an uptrend with average annual landings of 853 t. The resource is at its initial phase of exploitation, had scope for improving production. Fishery was supported by 18-55 cm fishes.

Oceanic tunas

Oceanic tuna landings over the years exhibited a general increasing trend till 2007 and thereafter registered a downtrend. Annual average landings during 2008-10 was 48,335 t and the catch by LOP was 87,240 t. Production exhibited a general increasing trend till 2007 and thereafter registered a downtrend.

Yellow fin tuna

The most dominant oceanic tuna species exploited from Indian waters. Landings exhibited a general increasing trend till 2007 and thereafter registered a continuous downtrend. Average annual landings during 2006-'10 was 27,269 t and the catch by LOP vessels was 82,526 ton. Major contribution was from southeast and southwest coast. Exploited by gillnet and hooks and lines. The exploitation range by the coastal based fishing fleets are very limited and fishery is mainly by small surface tunas. Catch was supported by 24-202 cm fishes. Considerable scope remains for improving production from deeper oceanic areas. Exploited by long lines and drift gillnets.

Skipjack tuna

The second dominant component of oceanic tuna landings of the country and the landings exhibited increasing trend till 2007 and thereafter registered downtrend. Average annual landing was 20,924 t. Exploited mainly by gillnets, pole and lines and hooks and lines. They formed targeted fishery only along the Lakshadweep coast. Exploitation range of this species is also very limited and considerable scope for expanding the fishery. Fishery occurred round the year. Catch was supported by 24-78 cm fishes.

Big-eye tuna

They were not caught by the coast based fishery, except stray numbers from the Andaman waters and the entire potential remain untapped. Average catch by LOP vessels during the period was 3,402 ton. Catch after the peak in 2008, registered decline. Increased production of this species is possible through extension of fishery to deeper waters using long lines.

Dogtooth tuna

Average annual landings was low, 173 t with major share of the catch from Andaman waters. Average catch by LOP vessels during the period was 1,311 ton. Catch after peak in 2008, registered decline. Fishery is at its initial phase and had considerable scope for increasing their production.

Conclusion

Coastal tunas have been exploited from Indian waters both as incidental bye-catch and also as targeted catch since very long and the production reached very close to their estimated potential. Coasts of Kerala, Andhra Prradesh, Tamilnadu, Goa and Gujarat are intensely exploited. Considerable scope remains for increasing the production from less exploited coastal areas including Andaman-Nicobar.

Oceanic tunas were being exploited as targeted fishery at some part and as incidental catch in several coastal fishery. The operational areas limited to outer continental

shelf, adjacent oceanic waters, knolls and seamounts where these resources congregate. Yield can be improved by extending fishery to un-exploited areas.

Utilization

The internationally traded tuna are raw material for canning (*sashimi&loins*- fresh, frozen and frozen pre-cooked loins) tuna for direct consumption (fresh/chilled and frozen) and canned (solid pack. chunks, flakes, grated). Other tuna commodities include dried and smoked tuna, tunasteaks. tuna burgers. Tuna sausage and tuna roe. Animal feed and pet foodre produced from processing waste of tuna canneries

Domestically tunas were considered a low value fish, below sardines and mackerel util recently, when production of oceanic increased anddemand from export markets picked up. During these periods they were consumed mainly as salt dried forms and small portion afresh. Recent days they are being consumed mainly afresh and part in different dried forms or exported to several destinations.. During in 2009/'10, 75 per cent of the total tuna landings, were sold in internal markets. About 97 per cent of the coastal and neritic tuna and 64 per cent of oceanic tunas landed were sold in domestic market. Among coastal/neritic tunas only longtail tuna (23.2 per centof the production) and a samll portion of little tunas find place in overseas markets. The oceanic species exported were skipjack (71 per cent), yellowfin (59 per cent) and bigeye (67 per cent).

The tuna exported from the country in various forms as whole tuna, tuna gutted, gilled and gutted, HL gutted tail off, fillets, chunks, chunks in brine, loins, smoked loins, steak, cubes, belly flaps and tuna roe either in chilled, frozen or IQF forms. Considerable quantity was also exported in canned and smoked dried products. Japan and US are the main market for Indian tuna products. It was also exported to Sri Lanka, Malaysia and several Gulf countries in different forms.

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11

Introduction to Exotics and Trans-Boundary Movement of Aquatic Organisms: Policy Requirements and Relevance to Indian Aquaculture in the Post-WTO Scenario

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Aquaculture is one of the fastest growing industries with an annual growth rate of more than 11 per cent for the past 10 years, producing about 16 per cent of the world supply of animal protein, primarily for human consumption. FAO (2007) has estimated the production from aquaculture at 47.8 million tonnes in 2005 and the global aquaculture production in comparison has overtaken the global production of meat from bovine, ovine, porcine and poultry. Global aquaculture production has jumped from a mere 3.9 per cent of the food produced in 1970 to an impressive 47 per cent in 2006, which indicates a 10 per cent per annum growth. The Indian aquaculture sector led by shrimp and carp farming has recorded an impressive growth during the past decades, raising itself to the status of an industry and a major source of foreign exchange to the country to the tune of @15000 crores/year. The strength of Indian aquaculture lies in (a) large water bodies suitable for aquaculture, (b) tropical Climate, (c) species diversity and (d) availability of cheap labour. While the weakness include (a) unregulated development, (b) disease problems and (c) lack of scientific approaches and (d) non-compliance with guidelines and regulations.

World over, mortality due to diseases or decreased growth rates and/or decreased feed efficiency due to infections are major factors responsible for economic losses in aquaculture. The development and expansion of aquaculture has, to a significant extent, depended on exotic or non-native species and of the 230 plus aquatic species farmed today, majority are non-native in nature. As aquaculture production expands, diversifies, and becomes more intensive, the risks and effects associated with pathogen introduction, transfer, disease outbreaks, and pathogen spread are bound to be enhanced (Subasinghe et al (2001).

Aquaculture in post WTO regime

Subsequent to the introduction of World Trade organization (WTO) rules and associated regulations in 1995, especially the Agreements on the Application of Sanitary and Phytosanitary Measures (SPS) and Technical Barriers to Trade (TBT) agreement much changes have been brought about in aquaculture sector. These agreements have liberated the international trade in aquaculture from various barriers/restrictions imposed by importing countries at the same time retaining the rights of the member countries to protect themselves from risks to human, animal or plant health through the introduction of exotics and pathogens.

Trans boundary movements and the role of exotics in aquaculture

An exotic species is a non-native plant or animal deliberately or accidentally introduced into a new habitat beyond their natural geographical range. Many of these species are able to reproduce and survive outside their natural habitats and integrate with the natural flora and fauna and are referred to as alien, introduced, invasive, non-native, or non-indigenous species. The most common routes for exotic species to arrive in aquatic habitats are through deliberate introduction for sport, aquaculture/ aquariculture activity or unintentional introductions (shipping, ballast waters, biofouling on ship/vessel hull, as live food, escapes or intentional release of pets/aquarium animals, cultured organisms and even from research facilities).

The economics of introductions

The interest and objectives behind the deliberate use of exotics is mostly commercial in nature. The commercial/economic reasons for species introductions in aquaculture include (a) cost-efficient species in terms of production costs to output revenues, (b) high growth potential, (c) resistance to environmental stressors and pathogens, (d) good market opportunities, (e) pre-existing knowledge of rearing methodologies/ technologies etc. Other reasons for the introduction of exotics are connected with trade of species for recreational reasons (stocking, sport fishing), ornamental (species for public and private aquaria), biocontrol, and research and social/religious reasons.

Impacts of introductions

Exotic species can have many negative impacts on the environment, economy and human health, and introductions, either intentional or accidental, carry the same risks. When species are introduced into an area, they may cause increased predation and competition, diseases, habitat destruction, genetic stock alterations, and even extinction (Bondad-Reantaso, 2004). Besides competing with the native species for food and other requirements, these exotic animals bring with them a variety of pathogens (sub-clinical infections/carriers) which may pose serious threats and even decline of the native populations. The risk of pathogen transfer is generally considered greater for the movement of live aquatic animals when compared to the movement of processed and dead products. Approximately 68 per cent of fish species lost in North America over the last century were caused by an invasion of exotic species. Besides, change in fishing patterns due to a newly-established fishery or through changes in land use and resource access can also lead to socio economic disturbances.

The expansion and diversification of aquaculture, coupled with globalisation and liberal trade policies in the wake of WTO policies, witnessed a rapid movement (both regulated and clandestine) of aquatic animals and animal products across the world. The sector has contributed to the introductions of many species of exotic fish, seaweeds and invertebrates. Approximately 17 per cent of the world's finfish production is due to alien species, introduced salmonids account for about 20 per cent of the world's farmed salmon in Chile while the production of the African cichlid tilapia is much higher in Asia (>700 000 tonnes) when compared to Africa (about 40000 tonnes). In Asia pacific, China has moved far ahead with the introduction of 129 aquatic species and the total production of introduced species increased from 780,000 tonnes in 1998 to 2.5 million tonnes in 2006 (FAO, 2010). Other examples of non-native species used in aquaculture include the rainbow trout (*Oncorhynchusmykiss*) which are farmed across the globe, Pacific oysters (*Crassostreagigas*) dominate shellfish production in Europe and many species of shrimp (e.g. *Penaeus vannamei*) are farmed outside their native ranges. Out of a total of 3141 new introductions

recorded by FAO, 1386 (38.7 per cent) resulted from this activity (Bartley and Casal, 1998). The introduction of the brine shrimp, *Artemiafranciscana* as a larval feed into the Indian aquaculture facilities during the 1980s and its subsequent establishment in the Indian hypersaline habitats is a typical example of an exotic organism believed to have replaced a native species *(Artemiaparthenogenetica*) from its natural habitat. (Vikas et al, Vijayan& Syda Rao). Thus aquaculture has become a leading vector of aquatic invasive species worldwide and without proper care, the rapid expansion of this sector will result in the spread of even more pests.

Transboundary movements and diseases

In nature, various barriers (geographical, physical and biological) restrict the movement of animals from one region to another. Each species of animal and each geographic region are potentially associated with their own native pathogen populations which have evolved over years to adjust and adapt to their particular environments and more or less live in equilibrium with their natural hosts.But once they are allowed to cross over to another environment having different physico-chemical and biological components, they may behave in totally weird and unexpected ways. Many pathogens that probably cause sub-clinical disease in their native habitats alter their virulence and cause major disease outbreaks when they enters a new habitat, region or naive/susceptible host populations. Similarly, farmed/introduced fish can be exposed to native pathogens, leading to totally unexpected results. Further, practices like poly/mixed culture provide the opportunity for pathogens to jump across host barriers, infect and establish in new host species. FAO has defined Transboundary Animal Diseases (TAD) as *"Those that are of significant economic, trade and/or food security importance for a considerable number of countries; which can easily spread to other countries and reach epidemic proportions; and where control/ management, including exclusion, requires cooperation between several countries"* (Otte et al, 2004).Increased movements of people and goods have facilitated the emergence and spreading of many transboundary animal diseases – Bovine Spongiform Encephalitis (BSE) in cattle in Europe and Severe acute respiratory syndrome (SARS) in humans in East Asia being notable examples.

Transboundary Aquatic Animal Diseases (TAAD)

Translocation of aquatic animals has been frequently identified as an event that has preceded major outbreaks of a disease that was previously unknown in the affected region or species. Furunculosis in European trout, Whirling disease in US, Crayfish Plague in Europe, viral nervous necrosis (VNN) in marine fish, and many molluscan diseases are typical examples. Epizootoic Ulcerative Syndrome (EUS)epidemiccaused by the fungus, *Aphanomycesinvadans* in Asian freshwater and estuarine fishes has spread throughout Asia, Australia and has even reached the African continent. The recent outbreaks of Koi herpes virus (KHV), in the neighbouring South-East Asian countries is a cause of worry for India. The potential sources of introduction of a pathogen into the habitat include live fish, eggs, larvae, contaminated water, wrappings or packaging etc. Factors like pathogenicity, host-pathogen interactions, vectors, climatic conditions, susceptibility and resistance of the hosts etc. play an important role in deciding/modifying the outcome of pathogen introductions. Open aquatic farming systems favouring easy dispersal of the pathogens along with their ability for long-term survival outside the host further complicates the issue (Rodgers et al. 2011) The 230 plus, mostly non-native, aquatic species farmed, along with diverse culture systems and practices, may enhance the emergence and spread of transboundary pathogens in totally unpredictable ways. Rivers and water bodies shared by adjacent countries can also act as channels for pathogen transfer between countries.

White Spot Syndrome Virus (WSSV) an example

Outbreaks of WSSV, the most virulent virus known to affect cultured shrimps were first reported in *Penaeusjaponicus*in Taiwan and China in 1992.In 1993, it has spread to other species of shrimp and resulted in outbreaks in Japan and Korea. In 1994 it was reported from Thailand, India and Malaysia and by 1996 has spread over the entire Asian continent. In 1995, it was also reported in the USA, entered the central and South Americas in 1998 and Mexico in 1999. Entered Europe during 1995-2001, Iran in 2002 and Saudia

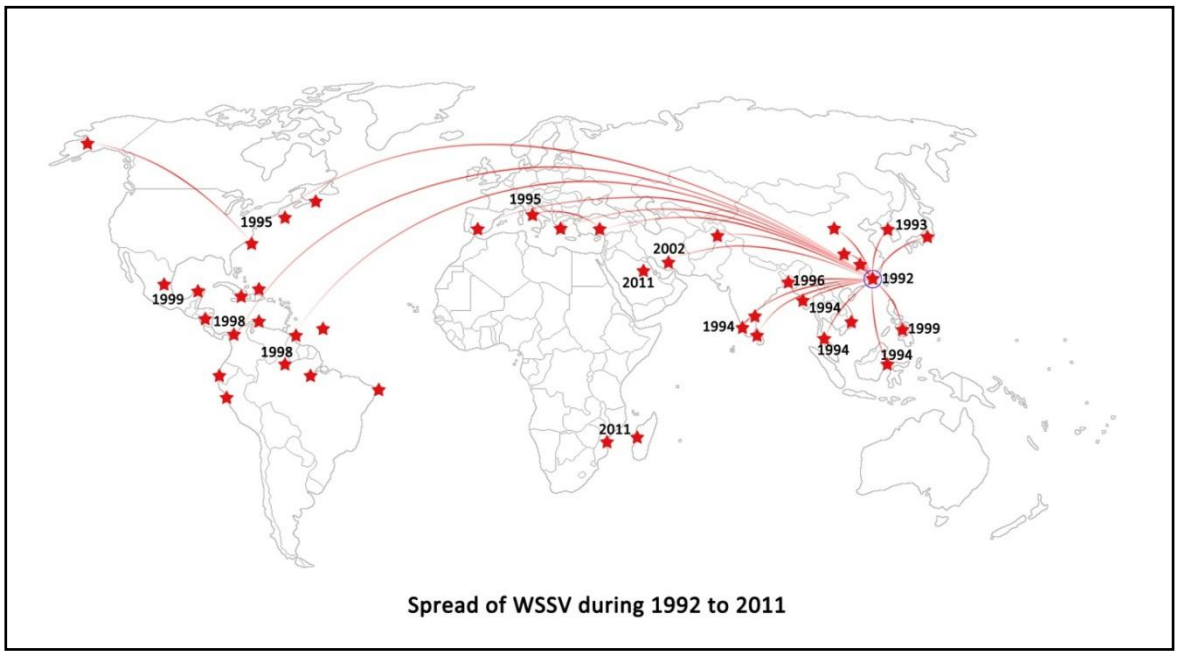


Fig 11.1 Spatial distribution of WSSV during 1992-2011

Arabia and Mozambique in 2011 (WAHID, 2012). Currently, WSSV is known to be present in all shrimp-growing regions except Australia. The practice of moving grossly normal brood stock and post larvae (PL) freely amongst countries was probably the most rapid and effective means of its spread throughout Asia (Flegel, 2006). Movement of frozen shrimp products from eastern to western hemisphere for trade and aquaculture has resulted in the transfer of WSSV from Asia to Americas, and Taura Syndrome Virus (TSV) from Americas to Asia (Lightner, 2005).

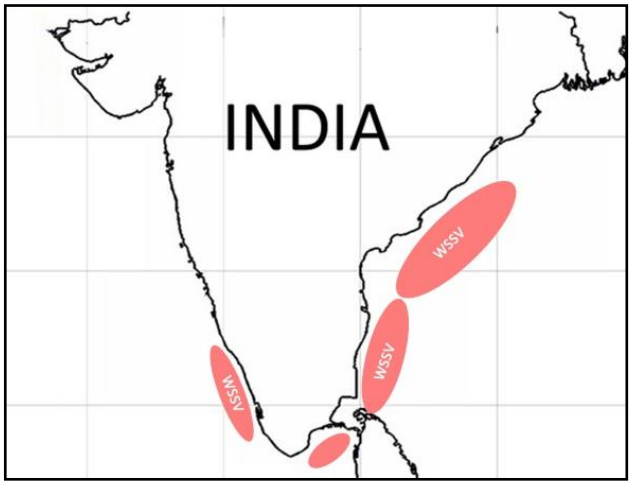


Figure 11.2 Post-WSSV shrimp farming in India

Carp and shrimp culture formed the face of Indian aquaculture and the predominant shrimp species cultured included *Penaeusmonodon* and *Penaeusindicus.* In the wake of the havoc

created by the WSSV pandemic, the shrimp culture industry tried its level best to restore the production to the "previrus" years, but did not succeed. Movement of WSSV infected larvae (both knowingly and unknowingly) from infected regions to uninfected ones have accelerated the countrywide spread of the pathogen, a typical example of "biological magnification of pathogen". WSSV has now crossed species barriers, making almost all decapod crustaceans carriers, thereby widening the reservoir base. Even the brood stock collected from the wild cannot be assumed to be free of the virus. In this scenario, several farmers switched over to the culture of the giant freshwater prawn (*Macrobrachiumrosenberghii),* but white tail disease that emerged sooner resulted in heavy mortalities forcing the farmers to abandon freshwater prawn culture in many states. Efforts to make up the lost production resulted in the introduction of *Penaeus vannamei,* but the culture is presently threatened by the emerging infectious myonecrosis virus (IMNV) disease. Incidences of Early Mortality Syndrome (EMS) or Acute Hepatopancreatic Necrosis Syndrome (AHNS), another emerging disease of unknown etiology showing high mortalities in the early growout stages of both *P. vannamei* and *P. monodon* in many Southeast Asian countries indicate that the future of *P.vannamei* culture is also under threat (NACA 2012). All these examples indicate that as aquaculture develops, new species are cultured and new host-pathogen-environment interactions gets tested, biosecurity risks will go on increasing.

The economic fallout

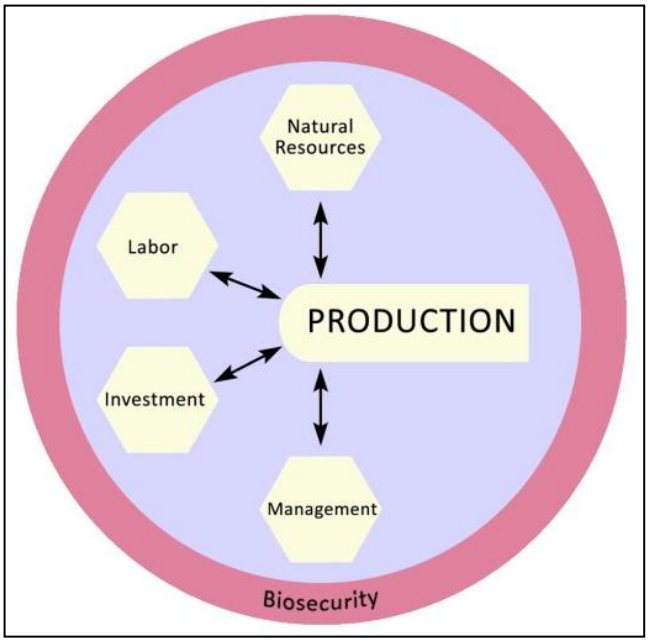
Very often, disease problems act as the major limiting factor in determining the economic viability in rearing systems including agriculture, animal husbandry and aquaculture. The damage due to diseases can be multifold, it includes direct losses to the farmer by way of loss of output, income and investment and indirect losses in terms of lost employment in the culture and associated/allied fields drop in foreign exchange earned etc. Combating diseases is a necessity for farmers. Though a farmer's decision to control the diseases or not is a private one, the presence of an infectious disease in a farm poses a threat to adjacent and even distant farms and can even affect other animal species and develop into an epidemic. This situation where high stakes are involved demand the intervention and action from public agencies or governments (Otte et al 2004). Transboundary diseases in aquatic systems have major economic implications (a) private and public costs of the outbreak (b) costs of the measures taken at individual, collective and international levels in order to prevent or control the infections and disease outbreaks.

Economic losses from aquatic animal diseases still remains a grey area and authentic information from many parts of the world is hard to obtain. The largest economic losses reported so far have been from shrimp farming and the figures given in Table 1, provide a rough indication. The total collapse of the Shrimp farming Industries in Taiwan in 1987, China in 1992, and India in 1995 were due to infectious viral diseases, causing billions of dollars in lost revenue for the industry. Between 1995 and 1996, disease accounted for 71 per cent of the total losses to trout farming in the U.S., part of a continuing trend of a $ 3.02 billion loss to aquaculture from disease worldwide (Leong, 2001). It was estimated that loss from diseases accounted for 30 per cent of the operating costs in aquaculture (Lee and Bullis, 2003).

Table 11.1 Estimated losses from aquatic animal diseases. Most losses are from the introduction and spread of crustacean diseases (from Scarfe,. 2003)

Area	Year	Estimated losses (US $ million)
Thailand	1983-93	100
China	1993	400
India	1994	17.60
Thailand	1996	600
Ecuador	1999	280
Global	1997	300

Lessons from the shrimp farming sector



The most important diseases of cultured penaeid shrimp, in terms of economic impact, in Asia, the Indo-Pacific, and the Americas have infectious etiologies. Since 1993, diseases, especially those of viral etiology have emerged as the major constraint to the sustainability and growth of shrimp aquaculture. The pandemics due to the penaeid viruses, WSSV (White spot), TSV (Taura Syndrome) and YHV (Yellow Head), have cost the penaeid shrimp industry billions of dollars in lost crops, jobs, and export revenue (Table 11.2). The global loss caused by WSSV in 2000 is estimated to be 200,000 metric tons, valued at $ 1 billion (Rosenberry, 2001). While Indian shrimp farming losses due to WSSV is estimated to be 200-300 crores annually, from 1994, with an accumulated loss of about 3000 crores during the last ten years (Vijayan, 2007). The WSSV epizootic has resulted in heavy production losses with a negative impact on different aspects of the production system. Production in any system is closely related to various inputs like natural resources, investment, trade, employment, environment and management costs etc. and whenever production fails, these related areas are also affected indirectly.

Fig.11.3 Different facets of shrimp production

Table11. 2 Estimated economic losses since the emergence of WSSV, TSV, YHV and IHHNV (Adapted from Lee and O'Bryen, 2003).

Virus	Year of emergence	Production loss
WSSV	Asia 1992	$ 4-6 billion
WSSV	Americas 1999	$ > 1 billion
TSV	1991-92, Americas & South East Asia	$ 1-2 billion
YHV	1991, South East Asia	$ 0.1-0.5 billion
IHHNV	1981, South East Asia	$ 0.5 1.0 billion

The practice of using species outside their natural range to increase production or profitability can be expected to continue, legally or illegally and the spread of aquatic animal diseases through these movements of animals and their products remains a serious issue. Though blocking the introduction of exotic species may seem to be an attractive option, in the present global scenario, production and economic reasons prevents a total ban on introductions. Introduction of exotics have become a "necessary evil" in aquaculture and the solution is not to ban introductions or to abandon regulation of their movement, but rather to assess the associated risks and benefits and then, if appropriate, develop and implement a plan for their responsible use.

Legislations – the present scenario

The majority of countries possess basic animal health legislation of different levels. In most countries, there is no clear distinction between terrestrial and aquatic animal health legislation. In cases where specific regulations for aquaculture exist, their enforcement is applied mostly as an emergency procedure to deal with a specific problem, and not as the result of an established program for surveillance and monitoring of the health status of cultured organisms. Several countries have specific legislations to regulate the import and export of live aquatic organisms and their products for use in aquaculture, for human consumption, or other purposes. Generally, these laws and regulations are in conformity with the rules of the World Organization for Animal Health (OIE) and WTO-SPS. (Kalaimani and Ponniah, 2007).

Role of International agreements and policies

Several procedures and guidelines developed by different agencies, organisations or nations deal with the components of biosecurity issues and strategies. The common objectives include aspects of protecting animal populations, environment, food and the humans itself. Many instruments falling under the terms such as policies, codes, agreements, plans, conventions, regulations and treaties has been made to achieve the objectives of biosecurity (Table 11.3).

Table 11.3 International or multinational policy instruments containing elements pertinent to aquaculture biosecurity. Dates are years of initial adoption (from Scarfe, 2003)

Lead Organization	Title
World Trade organization (WTO)	• Agreement on the application of Sanitary and Phytosanitary Measures (SPS Agreement), 1995 • Convention on Biological Diversity (CBD), 1992, and its Cartegena Protocol on Biosafety, 2000
Food and Agricultural Organization of the United Nations (FAO)	• Organization of the United Nations (FAO) • Codex Alimentarius (Codes of Hygienic Practice for the Products of Aquaculture), 1981-1999 • Code of Conduct for Responsible Fisheries, 1995 • Code of Conduct for the Import and Release of Exotic Biological Control Agents, 1995 • International Plant Protection Convention (IPPC), 1997 • International Council for the Exploration of the Sea (ICES)
International Council for the Explorations of the Sea (ICES)	• Code of Practice on Introduction and Transfer of Marine Organisms, 1994
International Maritime Organizations (IMO)	• Guidelines for Control and Management of Ships' ballast Water to Minimize the Transfer of Harmful Organisms and Pathogens, 1997
United Nations (UN)	• Biological Weapons and Toxins Convention, 1972
International Union for the Conservation of Nature	• Guide to Designing Legal and Institutional Frameworks on Alien Invasive Species, 1999

WTO and after

With the liberalization of international trade through the General Agreement on Tariffs and Trade (GATT), the establishment of the World Trade Organization (WTO) and its Agreement on the Application of Sanitary and Phytosanitary Measures(SPS Agreement), WTO member countries are required to use widely accepted scientific procedures including risk analysis as a means to justify any restrictions on international trade based on risks to human, animal or plant health (WTO 2012). The Uruguay Round (the eighth GATT round - 1986 to 1994) which transformed the GATT into the WTO and came into existence in 1995 with 123 signatories, was termed the biggest reform of the world's trading system since GATT was created at the end of the Second World War.

Two agreements negotiated during the Uruguay Round, having significant impacts on aquaculture and trade are The Agreement on the Application of Sanitary and Phytosanitary Measures - also known as the SPS Agreement which deals with food safety and animal and plant health standards andThe Technical Barriers to Trade Agreement (TBT) which ensure that regulations, standards, testing and certification procedures do not create unnecessary obstacles. Key SPS principles include Harmonization; Scientific risk assessment; Appropriate level of protection; Equivalence; and Transparency. Technical Barriers to Trade Agreement provides guidelines to ensure that standards are genuinely useful and not arbitrary or an excuse for protectionism in trade.

Exotics Vs biodiversity

Under the 1992 **Convention on Biological Diversity**under the United Nations Environment Programme (UNEP), signatory nations are committed to developing national strategies, plans or programs for the conservation and sustainable use of biological diversity (CBD 1992). While **The Cartagena Protocol on Biosafety**, a supplementary agreement to the CBD adopted in 2000, seeks to protect biodiversity from the potential risk posed by Genetically Modified Organisms (GMOs) (UNEP 2009).

World Organisation for Animal Health (*Office International des Epizootices*- OIE) and the Network of Aquaculture Centres in Asia-Pacific (NACA)

The OIE with 178 member Countries in 2011 is the intergovernmental organisation responsible for improving animal health worldwide. Issues regarding aquatic animal health are usually referred to the OIE, whose mission is to inform governments of the occurrence and course of diseases throughout the world and of ways to control these diseases, to co-ordinate studies devoted to the surveillance and control of animal disease, and to harmonize regulations for trade in animals and animal products among its member countries (OIE, 2012). World Animal Health Information Database (WAHID) interface provides access to all data held within OIE's World Animal Health Information System (WAHIS). It provides information on the country-wise animal health situation, complete information on various diseases, disease control measures, assessment of sanitary situation including potential trade hazards in various countries along with notifications and alerts on diseases. The OIE***Aquatic Animal Health Code***(OIE. 2011) sets the standard and outlines the necessary basic steps that should be followed. Similarly, guidelines for preventing accidental introductions and transfers of live aquatic organisms through ballast water of ships or on their hulls has been given by ICES, the International Maritime Organization (IMO) and others.

NACA is an intergovernmental organisation with 18 member countries in the Asia-Pacific aimed at promoting rural development in the region through sustainable aquaculture. NACA conducts development assistance projects throughout the region in partnership with governments, donor foundations, development agencies, universities and a range of non-government organisations and farmers (NACA 2012).

FAO Code of conduct for responsible fisheries (1995) sets out the principles and international standards of behaviour for responsible practices with a view to ensure effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. Article 9.3.3 while dealing with aquaculture development says that – "States should, in order to minimize risks of disease transfer and other adverse effects on wild and cultured stocks, encourage adoption of appropriate practices in the genetic improvement of broodstocks, the introduction of non-native species, and in the production, sale and transport of eggs, larvae or fry, broodstock or other live materials. States should facilitate the preparation and implementation of appropriate

national codes of practice and procedures to this effect"(FAO, 1995).

ICES Code of Practices addresses the issues and concerns related to global translocation of species. The Code of Practice on the movement and translocation of non-native species for fisheries enhancement and mariculture purposes (1973) was subsequently revised/upgraded in 1979, 1990 and 1994. The present ICES Code of Practice on the 'Introductions and Transfers of Marine Organisms' 2005 (ICES, 2005) follows the precautionary approach adopted from the FAO principles (FAO, 1995), with the goal of reducing the spread of exotic species.

Biosecurity & HACCP

Biosecurity principles serve as the cornerstone in the implementation of SPS agreement and OIE guidelines and provide an overall management strategy for aquatic animal health. **HACCP (**Hazard Analysis and Critical Control Point) is a systematic and preventive mechanism presently used for the assurance of quality and food safety to the consumer. It functions as a preventive system which would require control over the raw materials, processes, environment, personnel, storage, and distribution early in the system. Presently HACCP plans are increasingly being applied in aquaculture rearing systems to ensure the quality and traceability right from the aquaculture produce to the processor and finally the consumer.

Rights and obligations under WTO

All these international agreements require that signatories should be aware of their rights and obligations and act responsibly when considering the international movement of aquatic organisms and their products and every member country is bound to abide by these agreements. The "zero risk" approach by prohibiting the total movement of aquatic animals and their products is no longer practicable in the current era of globalisation.

Importance of regional co-operation

Many countries in a region can share common social, economic, industrial, environmental, biological and geographical characteristics, and in this situation a regionally adopted health management programme is considered a practical approach. An Asia-Pacific Regional Strategy better known as "Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals" has been developed through an FAO/NACA initiative involving the participation and agreement of 21 regional countries (FAO/NACA. 2001; Subasinghe and Bondad-Reantaso, 2008). It outlines an agreed-upon general approach and framework that countries in the region should use in developing and implementing programmes to reduce the risk of pathogen spread via movements of live aquatic animals and their products. It contain a set of fifteen guiding principles pertaining to the movement of live aquatic animals, the role and scope of health management, importance of risk assessment, implementation of the guidelines, harmonization of procedures, transparency in reporting, technical cooperation, collaboration among all stakeholders and sharing of responsibilities and benefits. The regional Quarterly Aquatic Animal Disease (QAAD) reporting system, a joint activity between NACA, FAO and OIE, provides an excellent mechanism for sharing aquatic animal disease information between the participating countries in the Asia-Pacific region.

Similarly the European Union (EU) has a comprehensive programme for the region to assure health standards for aquatic animals traded between EU Member Countries. The Animal Health Law (AHL) proposed by the EU will provide rules for the movement of

animals and products, requirements for their introduction into the Union, provisions for identification and registration of animals, traceability of germinal products, surveillance and other disease control measures, thereby bringing the animal health rules for terrestrial and aquatic animals under one roof (Europa 2012).

Strategies for aquatic animal health Management at national level

Each country should develop a national strategy which includes short, medium and long-term action plans, for the implementation of the guidelines. Strong national coordination, good leadership, involvement of stakeholders and appropriate monitoring and review systems are essential for its successful implementation (Subasinghe&Bondad-Reantaso 2006).

Legislation has an important role in enhancing responses to aquatic animal health emergencies. It should enable and guide those involved in fish health related activities and should clearly define the duties of various authorities involved at the national, provincial and district levels and promote effective coordination, power-sharing and communication between all those involved. Australia has developed and implemented a health management system (AQUAPLAN) which has successfully protected its waters from most of the disease epidemics which have created havoc in aquaculture world over and the country was able to translate its efforts into economic benefits.

Legislation with respect to the Indian Fisheries sector - Where do we stand now

According to the Indian constitution, the power to make laws and regulations with respect to fisheries is vested with the states and hence regulations and control of exotic organisms and diseases have to be enforced by the respective states. At the central level, the Indian Fisheries Act (1897) which is a century-old is still in existence. A draft legislation on "Live aquatic organisms importation Act 2006" has been proposed (Lakra*et al* 2006). Based on the existing international agreements and codes of practices for the trans-boundary movement of aquatic animals, the recommendations made in various consultations on invasiveness, disease diagnostics, risk analysis, emergency preparedness, capacity building etc., and existing legal provisions adopted by different countries, an act becomes inevitable to strictly implement the provisions needed in safeguarding the existing conservation and management of aquatic animal diseases and biodiversity in Indian fisheries (Kalaimani and Ponniah, 2007).

Way forward

What is required is an integrated plan for maintaining aquatic animal biosecurity and health, where all levels from border to the farm, including the environment need to be developed and implemented through a central – state mechanism. Such a working system would enable us to promote aquaculture in a sustainable and economically viable mode in tune with the international frame work.

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DNA Barcoding in Support of Fish Product Traceability

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The authentication of fish and seafood species has become an important issue within the seafood industry. Increases in international trade, rising worldwide fish and seafood consumption and varying levels of supply and demand of certain species have led to many cases of economic fraud, in which one seafood species is illegally substituted for another. Regulatory organizations such as the European Union have established labelling laws for fish and aquaculture products requiring traceability information such as species identification, origin of fish, and production method (Martinsohn, 2011). Seafood substitution has been prohibited in the United States according to the Federal Food Drug and Cosmetic Act Section 403(b): 'Misbranded Food'. In addition, recent food scares (*e.g*., Bovine Spongiform Encephalopathy (BSE), avian flu, foot-and-mouth disease, etc.), religious reasons, food allergies and genetically modified organisms (GMOs) have tremendously reinforced public awareness regarding the composition of food products. Enforcement of labelling regulations becomes complicated in processed foods such as frozen fillets and precooked seafoods because the original identifying morphological characteristics are absent. However, because labels do not provide sufficient guarantee about the true contents of a product, there is a need for sensitive analytical methods that can be used to determine the species of a seafood product with no detectable external features, thus protecting both consumers and producers from illegal substitutions. Furthermore, to enforce laws against poaching and trade of overexploited and endangered species, reliable methods for species diagnosis are essential

Research into methods for the identification of seafood species presents several challenges that must be overcome. Current methods for species recognition are based on the discovery of polymorphism in protein or deoxyribonucleic acid (DNA) characteristics that are unique to each species. Therefore, the analytical techniques used to establish the unique fingerprint must first be optimized for the specific product under investigation and then they must be able to provide undeniable and repeatable results that prove species identification. A number of diagnostic techniques have been developed and optimized for the differentiation of fish and seafood species in a variety of product types (Martinsohn, 2011). This paper discusses the principle and use of the well known *DNA Barcoding* technique in the authentication of fish and seafood species and future trends in this field.

DNA Barcoding: DNA sequence analysis of a uniform target gene to enable species identification has been referred to as **DNA barcoding**, by analogy with the *UPC barcodes* used to identify manufactured goods. The Universal Product Code system developed by the industrial sector to brand retail items employs 10 options at each of 11 positions to create 100 billion alternates. Just like UPC barcodes, the DNA sequences within each species are unique. A run of 15 nucleotides, with 4 options at each position, creates the possibility of 1 billion codes, a hundred-fold excess over the estimated number of animal species. Of course,

specific nucleotides are fixed at some positions by selection. However, this constraint can be overcome by focusing on protein-coding genes, where every third position is generally free to vary because of the degeneracy of the genetic code. As a result, by examining a stretch of 45 nucleotides in these genes, one has the prospect of close to 1 billion alternates.

Since Linnaeus, biologists have used distinguishing features in taxonomic keys to apply binomial species names, such as *Homo sapiens.* Then, as a master key opens all the rooms in a building, the binomial species name accesses all knowledge about a species. From insects to birds, evidence now shows that short DNA sequences from a uniform locality on genomes can also be a distinguishing feature. As a Linnaean binomial is an abbreviated label for the morphology of a species, the short sequence is an abbreviated label for the genome of the species. The barcode of life thus provides an additional master key to knowledge about a species. Compiling a public library of sequences linked to named specimens, plus faster and cheaper sequencing, will make this new barcode key increasingly practical and useful.

A remarkably short DNA sequence should contain more than enough information to distinguish 10 or even 100 million species. For example, a 600-nucleotide segment of a protein-coding gene contains 200 codon third nucleotide positions. At these sites, substitutions are (usually) selectively neutral and mutations accumulate through random drift. An appropriate target gene for DNA barcoding is conserved enough to be amplified with broad-range primers and divergent enough to allow species discrimination.

In practice, there is no need to constrain analysis to such short stretches of DNA, because sequence information is easily obtained for DNA fragments 10 times as large. This ability to inspect longer sequence arrays is desirable because the likelihood of detecting diagnostic differences between species rises with the number of nucleotide positions examined. Moreover, since the incidence of diagnostic characters depends upon species age and rates of evolution, there is no simple prescription as to the number of nucleotides that must be examined to ensure species recognition. However, given a modest rate (2 per cent per million years) of sequence change, one expects to discover 12 diagnostic differences in a 600bp comparison between species with a million year history of reproductive isolation. It is certain that most species possess much longer histories of evolutionary independence than this. In fact, it is true that even the most closely allied species, those belonging to a single genus; usually have longer histories of reproductive isolation than this. As a result, it follows that the sequence analysis of a 600 bp segment of the genome will permit the reliable diagnosis of most species.

Why do we need a molecular species identification tool? An increasingly accepted view is that traditional taxonomic practices are insufficient on their own to cope with the growing need for accurate and accessible taxonomic information. Although approximately 1.7 million species have been described and named under the Linnaean system (Newmaster *et al*., 2006), the total number of species on earth remains unknown and estimates vary widely, ranging from 10 million to more than 100 million (http: //www.barcodinglife.com//). Even using conservative estimates, it is recognized that the number of species remaining to be discovered far outstrips the current resources of descriptive taxonomists and systematists.

The task of recognizing new species has certain urgency; the diversity of our biosphere so large that the methodical cataloguing of new species by traditional methods is being outpaced by losses from human impacts. In the face of such mounting losses to biodiversity, the need to catalogue and describe life is greater than ever, and there is a growing realization that it will be critical to seek technological assistance for a species' initial recognition and its subsequent identification.

Additionally, barcoding clearly has enormous potential to relieve taxonomists of routine identifications, providing more time to focus on new taxonomic hypotheses and to concentrate on rare, poorly characterized, and new species. Embracing the molecular biology tool to identify species can turn taxonomists into 'a high tech community'. The ability to quickly to put a name to an unknown specimen benefits not only conservationists, but is also a tremendous tool for a ecologists as well (Newmaster *et al*., 2006). The use of barcoding will readily allow the identification of small plant fragments or sterile material, eggs and larvae of marine species and forensic materials which previously would have been extraordinarily difficult or impossible to identify.

Ten reasons for identifying species by DNA Barcodes:

1. **Works with fragments**: Barcoding can identify a species from bits and pieces. When established, barcoding will quickly identify undesirable animal or plant material in processed foodstuffs and detect commercial products derived from regulated species. Barcoding will help reconstruct food cycles by identifying fragments in stomachs and assist plant science by identifying roots sampled from soil layers.
2. **Works for all stages of life**: Barcoding can identify a species in its many forms, from eggs and seed, through larvae and seedlings, to adults and flowers.
3. **Unmasks look-alikes**: Barcoding can distinguish among species that look alike, uncovering dangerous organisms masquerading as harmless ones and enabling a more accurate view of biodiversity.
4. **Reduces ambiguity**: Written as a sequence of four discrete nucleotides - CATG – along a uniform locality on genomes, a barcode of life provides a digital identifying feature, supplementing the more analog gradations of words, shapes and colors. A library of digital barcodes will provide an unambiguous reference that will facilitate identifying species invading and retreating across the globe and through centuries.
5. **Makes expertise go further**: The bewildering diversity of about 2 million species already known confines even an expert to morphological identification of only a small part of the plant and animal kingdoms. Foreseeing millions more species to go, scientists can equip themselves with barcoding to speed identification of known organisms and facilitate rapid recognition of new species.
6. **Democratizes access**: A standardized library of barcodes will empower many more people to call by name the species around them. It will make possible identification of species whether abundant or rare, native or invasive, engendering appreciation of biodiversity locally and globally.
7. **Opens the way for an electronic handheld field guide, the Life Barcoder**: Barcoding links biological identification to advancing frontiers in DNA sequencing, miniaturization in electronics, and computerized information storage. Integrating those links will lead to portable desktop devices and ultimately to hand-held barcoders (Fig. 2).
8. **Sprouts new leaves on the tree of life**: Since Darwin, biologists seeking a natural system of classification have drawn genealogical trees to represent evolutionary history. Barcoding the similarities and differences among the nearly 2 million species already named will provide a wealth of genetic detail, helping to draw the tree of life on Earth. Barcoding newly discovered species will help show where they belong among known species, sprouting new leaves on the tree of life.
9. **Demonstrates value of collections**: Compiling the library of barcodes begins with the multimillions of specimens in museums, herbaria, zoos and gardens, and other biological

repositories. The spotlight that barcoding shines on these institutions and their collections will strengthen their ongoing efforts to preserve Earth's biodiversity.

10. **Speeds writing the encyclopedia of life**: Compiling a library of barcodes linked to vouchered specimens and their binomial names will enhance public access to biological knowledge, helping to create an on-line encyclopedia of life on Earth, with a web page for every species of plant and animal.

Cytochrome c oxidase **subunit** I (COI or **COX I**) of Mitochondrial DNA: Selection of an appropriate gene is a critical strategic and practical decision, with significant consequences for the overall success of DNA barcoding. A number of genes may be likely to meet one or more goals (discrimination and identification of species, discovery of new and cryptic species, scoring genetic divergence at intra-specific level, reconstruction of evolutionary relationships among species and higher taxa). Past phylogenetic work has often focused on mitochondrial genes encoding ribosomal (12S, 16S) DNA, but their utility is constrained by the prevalence of insertions and deletions (indels) that complicate sequence alignments. The 13 protein-coding genes in the animal mt genome are a better target because indels are rare since most lead to a shift in the reading frame. There is no compelling *a priori* reason to focus on generating partial sequences of a specific gene, but the **mitochondrial** cytochrome c oxidase **subunit** I gene (COI or **COX I**) does have two important advantages. Firstly, the universal primers for this gene are very robust, enabling recovery of its 5' end from the representatives of most, if not all, animal phyla. As well, COI likely possesses a greater range in phylogenetic signal than any other mitochondrial gene. In common with other protein-coding genes, its third position nucleotides show a high incidence of base substitutions. However, changes in its amino acid sequence occur more slowly than those in any other mitochondrial gene. The selection of COI as a target gene for DNA barcoding is supported by published and ongoing work, which demonstrates that barcoding via COI, will meet the goals for a wide diversity of animal taxa. Proof of principle for DNA barcoding has been provided by comparison of COIpartial sequences among closely related species and across diverse phyla in the animal kingdom. An important outcome of DNA barcoding will be to identify the groups in which alternate targets are needed and to define what those targets should be. Cnidarians (hard corals, and some jellyfish) for example, have little mitochondrial sequence diversity, perhaps due to a supplemental mitochondrial DNA repair system, and a nuclear gene target will likely be needed. Recently diverged species and species that have arisen through hybridization may not be resolved by COI sequencing.

DNA barcoding has the potential to be a practical method for identification of the estimated 10 million species of eukaryotic life on earth. As a uniform method for species identification, DNA barcoding will have broad scientific applications. It will be of great utility in conservation biology, including biodiversity surveys. It could also be applied where traditional methods are unrevealing, for instance identification of eggs and immature forms, and analysis of stomach contents or excreta to determine food webs. In addition to enabling species identification, DNA barcoding will aid phylogenetic analysis and help reveal the evolutionary history of life on earth.

COI versus Cyt b: Based on their large sizes and slow rates of molecular evolution, COI and cytochrome *b* (cyt *b*) are the mitochondrial genes best suited to serve as the basis for a DNA- identification system. COI does have two important advantages over cyt *b*, both linked to its slower rate of molecular evolution. Firstly, the universal primers for this gene are very robust, enabling the recovery of its 5' end from most animal species. Furthermore, COI has a greater taxonomic signal range than cyt *b*. Both genes do show a high incidence of base substitutions at third position nucleotides, allowing the discrimination of closely allied

species. However, COI provides better resolution of deeper taxonomic affinities because its amino acid sequence changes more slowly than that of cyt *b*.

Protocol: This protocol addresses DNA barcoding of animal species. Alternate targets or protocols will likely be needed for DNA barcoding of other eukaryotes. Plants have too little mitochondrial sequence diversity; probably due to hybridization and introgression (potential targets include matK, a chloroplast gene, and ITS (internal transcribed spacer), a nuclear gene). The mitochondrial DNA of fungi contains introns, which can complicate DNA amplification (this could be circumvented by applying RT-PCR). For protists and planktonic organisms, the utility of COI sequencing has not been explored in depth. The essential points are (a) specimen preservation in 95 per cent ethanol (not formalin) to facilitate DNA isolation, (b) amplification and sequencing of uniform target gene(s), and (c) data basing of DNA sequences linked to specimens including ancillary data (Fig 1).

1. Specimen Preservation: Tissue samples include fin-clips of fishes, appendages of crustaceans, and small pieces of muscle tissue, leaf etc. To allow DNA isolation, 95 per cent ethanol should be used—from formalin-preserved specimens, it is difficult to extract DNA. The ethanol should generally be poured off and replaced with new 95 per cent ethanol within a few days of collection to optimize DNA preservation. Though, DNA has been successfully extracted from formalin-preserved tissue, including relatively ancient samples, its quantity and quality appear to be very poor and alternative techniques may be important in examining previously archived specimens.

2. Specimen labeling: The usefulness of DNA barcoding depends on linking the sequence to a specimen and its associated data (collector, taxonomic confirmation, date, collection site and its geo-reference coordinates, *etc*.).

3. DNA isolation: In addition to standard methods, there are commercial kits that have high success in recovering DNA.

Table 12.1. PCR Steps for COI amplification:

Steps	Temperature	Time	Cycles
Initial step denaturation	95°C	2 min	1
Denaturation	94°C	30 sec	35cycles
Annealing	54° C	30 sec	
Extension	72°C	1 min	
Elongated extension	72°C	10 min	1
Soak	4°C	--	--

5. Databasing results: Barcode sequences are generally submitted to a Barcode of Life database (BOLD) under the auspices of the Hebert laboratory that integrates sequence data with taxonomic and specimen information or NCBI GenBank. The BOLD is an informatics workbench aiding the acquisition, storage, analysis and publication of DNA barcode records. By assembling molecular, morphological and distributional data, it bridges a traditional bioinformatics chasm (fig 3,4,5). BOLD is freely available to any researcher with interest in DNA barcoding. By providing specialized services, it aids the assembly of records that meet the standards needed to gain BARCODE designation in the global sequence databases. Because of its web-based delivery and flexible data security model, it is

also well positioned to support projects that involve broad research alliances (Ratnasingham and Hebert, 2007).

Barcoding Elective: Other genes

If COI-5' is not sufficient for species discrimination, other rapidly evolving gene(s) may need to be analyzed as potential barcoding targets. Possible supplementary sequences include the complete COI gene, other mitochondrial genes (e.g. **16S rRNA, cytochrome b**), and/or **ITS** (internal transcribed spacer), which is a nuclear DNA segment located between rRNA genes. Small subunit nuclear ribosomal RNA (**SSU rRNA**) also referred to as **18S rRNA**, is a slowly evolving gene useful for deeper phylogenetic analysis. In addition to the analysis of COI-5', it will be ideal to determine SSU rRNA sequences from specimens. SSU rRNA is the basis for the Tree of Life and other comprehensive examinations of evolution of life.

Partial sequences of other nuclear genes useful in DNA Barcoding of animals are **RAG-2** (Recombination Activation gene2, associated with the immune system); **Rhodopsin** (460 bp; Sevilla et al., 2007); an anonymous DNA fragment in fish **(TMO M27)** and **aldolase** gene fragment The introns-less fish rhodopsin gene provides quantitatively equal interspecies identification labels of targeted nuclear polymerase chain reaction (PCR) amplification products throughout its coding sequence. This gene has been successfully used in vertebrate phylogenetic studies. The utility of two nuclear protein-coding genes, **phosphoenolpyruvate carboxykinase (*PEPCK*)** and **sodium–potassium ATPase a-subunit (*NaK*)**, as molecular markers for phylogenetics of decapods, insects and bilateral metazoans has been demonstrated (Maa *et al.,* 2009). These two genes participate in fundamental cellular functions in the animal kingdom and are well-conserved throughout evolution. Presumably, these genes only exist as single-copy in most of the crustaceans.

DNA Barcoding of Plants:

Those involved in initiating efforts in plant barcoding have focused on the search for a candidate locus for identifying species. These efforts are inspired by the success of the mitochondrial gene Cytochrome *c* oxidase I (*COI)* as the core of the global bioidentification system for animals. An optimal barcoding locus for plants will naturally have similar characteristics: sufficient variation between species such that species level discrimination can be achieved, but minimal variation within species. Unlike barcoding in animals, however, the mitochondrial *COI* gene is not good candidate for land plants as plant mitochondrial genes typically exhibit lower nucleotide substitution rates than plastid or nuclear genes (meaning that there is often no sequence variation among species within a genus) and often exchange of DNA has been reported between mitochondrial and nuclear genome. The substitution rate in plastid genes, however, is also not great, with rates about one quarter the rate observed in nuclear DNA and 10- to 20-fold less than mammalian mitochondrial DNA.

Even if the "perfect" plant barcoding locus were to be found, it is recognized that reliance on a single (usually) maternally inherited gene will be problematic in groups that exhibit hybridization and introgression. In species complexes that exhibit extensive introgression, incorporation of multiple nuclear regions will be a necessity to make confident identifications .The suggestion to include multiple loci in barcoding systems was welcomed by critics of barcoding. While the use of multiple loci is a straightforward response to the challenges for barcoding plants, the system must retain a minimal complement of loci for it to remain a fast and efficient tool. One obvious choice for evaluation as a potential standard core coding region is ***rbcL*** **(ribulose bisphosphate**

carboxylase – large subunit) of the chloroplast DNA, given its universality and ease of amplification and alignment. While *rbcL,* seems to be a reasonable candidate for a first tier barcoding locus, there are other regions that may prove to be greater utility. Regions in cpDNA especially ***matK*** **(maturase K gene-** involved in group II intron splicing and usually located within the intron of another plastid gene – lysine coding tRNA - *trnK***)** and*trH-psbA* spacer, *rpoC*1, *rpoB*, *accD* and *YCF*5 are identified as the most promising regions in the cpDNA for DNA barcoding in plants and universal primer pairs for these regions have been developed (barcoding@kew.org). These loci meets the criteria necessary for a barcode locus: (i) significant species level genetic variability and divergence, (ii) an appropriately short sequence length so as to facilitate DNA extraction and amplification, and (iii) the presence of conserved flanking sites for developing universal primers. The plastid gene ***matK***, for examples, has a substitution rate that is 2-3 times greater than ***rbcL*** in angiosperms, however there is only a small amount of data available for the bryophytes or ferns, precluding a quick evaluation. The plastid *trnH- psbA* spacer has also been identified as suitable single copy gene locus for DNA barcoding, but falls short of an additional criterion namely, ease of alignment and analysis. While ease of alignment is not a strictly necessary criterion for DNA identification, it is a critical requirement for developing bioinformatics tool. The presence of multiple indels that overlap (as in *trnH-psbA*)makes homology assessment and therefore accurate alignment difficult or impossible (Newmaster *et al*., 2006).

DNA Barcoding of Indian Fishes

India is blessed with huge inland water resources with 29,000 km of rivers, 0.3 million ha of estuaries, 0.9 million ha of backwaters and lagoons, 3.15 million ha of reservoirs, 0.2 million ha of floodplain wetlands and 0.72 million ha of upland lakes. It has been estimated that about 0.8 million tonnes of inland fish is contributed by different types of inland open water systems. The 14 major rivers, 44 medium rivers and innumerable small rivers of the country provide one of the richest fish faunistic resources (765 species of finfishes) of the world. The bounty of marine biodiversity, which is exploited from 2.02 million sq. km of the exclusive economic zone (EEZ) constitutes one of the largest heritage resources of India. There are nearly 1650 species of finfishes known from our seas. However, taxonomic ambiguity exists in several groups of Indian finfishes and shellfishes and many are insufficiently identified. Indian seas also have many unexplored habitats like the mesopelegic zone and deep waters that may harbour many species of finfishes yet to be documented. Although much of the finfish research at present depends upon species diagnoses based on morphological characters and meristic counts, taxonomic expertise has been collapsing in recent years. The limitations inherent in morphology based identification system and dwindling pool of taxonomists signal the need for new approach to document Indian marine finfish diversity. DNA based approaches to taxon identification which exploit diversity among DNA sequences, can be used to identity marine fishes and resolve taxonomic ambiguity including discovery of new / cryptic species.

The National Bureau of Fish Genetic Resources (NBFGR), Lucknow has been identified as the lead center in South Asia to generate DNA Barcodes of marine and freshwater finfish and shellfish species of the region in collaboration with the *International Consortium for the Barcode of Life (iBOL) – Fish BOL*. The NBFGR has initiated a mega programme on DNA Barcoding of Indian marine and freshwater fishes and 2066 samples have been collected covering 553 marine and freshwater finfish and shellfish species from the mainland and island ecosystems. The DNA Barcodes (DNA sequence profile of 655 bp fragment of cytochrome c oxidase I) of 550 species has been completed for the first time in India and taxonomic ambiguity of many species has been resolved (Silas *et al*., 2005; Lakra

et al., 2009, 2010, 2011; Divya *et al*., 2009, 2010; Singh *et al*., 2011). This could be of great utility in sustainable exploitation, management and conservation of Indian marine and freshwater fish species.

Forensic identification of meat of endangered aquatic species:

Whale shark (*Rhincodon typus*) is the largest shark in the ocean, reaching lengths of 20 meters and a weight of 20 tonnes. With very few defences, it has become susceptible to exploitation and has a global conservation status of 'vulnerable to extinction' as listed by World Conservation Union in the Red list of threatened species. To enable trade in whale shark products to be adequately regulated, *Rhincodon typus* was nominated in Appendix II of Convention on International Trade in Endangered Species (CITES) in April 2000. To conserve the species in Indian waters, it is enlisted as one of the protected species and its fishing prohibited under Schedule I of the Indian Wildlife Protection Act, 1972, according to the Order No.1-2/2001 WL1 dated 28.05.2001, Govt. of India. Flesh suspected as that of whale shark was seized from fishermen by the Forest Range Officer (Govt. of Kerala), Kannur, Kerala. A case was filed and the Judicial First Class Magistrate, Thalassery, Kannur, Kerala approached NBFGR Cochin Unit (Case No. R.P.330/08, dated 29. Sept. 2008) to analyze the meat sample for confirmation of the species using DNA markers. Based on DNA sequencing of COI (660bp), 16SrRNA (595bp), cyt B(601bp) and RAG2 (981bp) genes and comparing with the sequences earlier generated by NBFGR (NCBI Genbank DNA sequence accession numbers FJ375724, FJ375725, FJ375726; DNA sample collected from a stranded whale shark along North Kerala on 30 October 2006), the seized meat sample was confirmed as that of endangered whale shark (*Rhincodon typus*) and the result was communicated to the court. This was the first case in India in which scientific evidence was sought to identify the meat of a fish enlisted in the Wildlife Protection Act, 1972 and the DNA markers reiterated their ability to reliably identify product/meat sample of a species, thus helping in curtailing illegal trade of the endangered organisms (Sajeela *et al*., 2010). In another case, identity of cooked fish (pomfret - *Pampus chinensis*) from a restaurant in Mumbai was also confirmed at NBFGR through DNA barcoding.

Perspective:

Despite these technical and conceptual challenges, molecular species identification in food products and forensic samples is likely to increase exponentially. Indeed, DNA barcoding has already produced significant and interesting results, for example in gourmet food (such as species identification in canned tuna or cooked pomfret) and on forensic samples made from endangered species (*e.g.,* whale shark). Molecular identification has already proven useful in court [Sajeela *et al*., 2010]. However, reliable reference barcodes are yet to be developed for many other commercially important aquatic groups and this calls for concerted, joint efforts of molecular biologists and traditional taxonomists to generate accurate baseline information. The protocol/software to convert the DNA sequence information into digital vertical barcodes is still not available in public domain and this can lead to innovations in bioinformatics, electronics and devices such as handheld barcoders. Another option is to utilize the DNA barcode data for identification of species-specific SNPs that can lead to development of DNA chip for much faster and precise identification of many species and hybrids and detection of fish product adulteration.

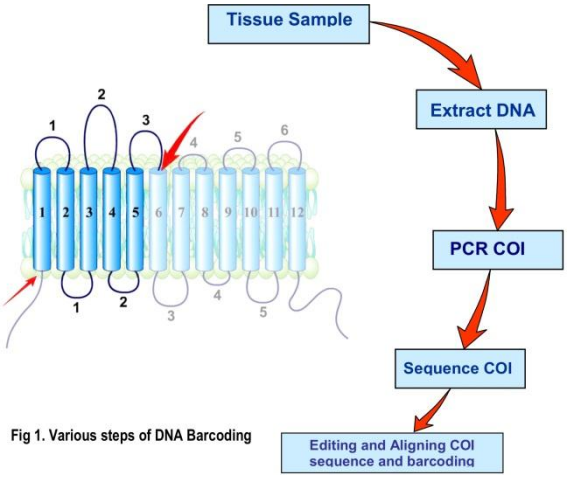

Fig 12.1 Various steps of DNA Barcoding

Fig 12. 2. Two prototypes of hand-held DNA Barcoder (by 2015?).
(Source: http://www.barcodinglife.org/views/login.php)

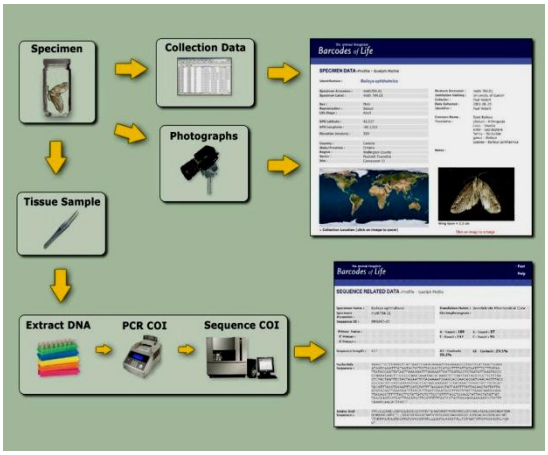

Fig 12.3 Barcoding: Process & database

(Source: http://www.barcodinglife.org/views/login.php)

Fig 12.4 Specimen page for an individual
of *Macroglossus mininus* (Chiroptera).
1, voucher information; 2, full taxonomy;
3, collection location;
4, collection site maps; 5, specimen images.
(Source:http://www.barcodinglife.org/views/login.php)

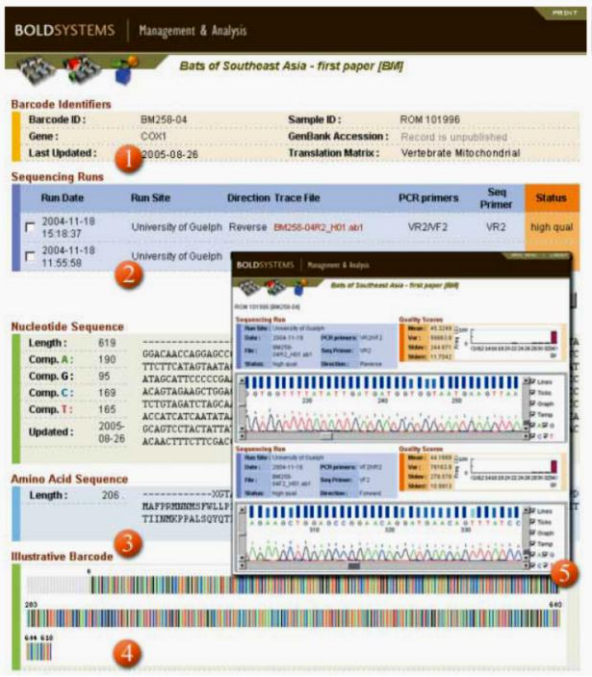

Figure 12.5 Sequence page for the same individual of Macroglossus mininus (Chiroptera).
1, specimen details;
2, sequencing details including links to trace files;
3, amino acid translation of sequence;
4, colourized barcode representation;
5, trace viewer and detailed stats on trace quality.
(Source: http://www.barcodinglife.org/views/login.php)

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13

Marine Fisheries Management in India : Policy Initiatives

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Introduction

Fishing has been considered as a primary livelihood option since time immemorial, for the occupants of the coastal belt in India, stretching along 8129 kms. Fisheries play a predominant strategic role in the economic activity of our country by its contribution to national income, food and employment. It supports the deprived coastal community and serves as an important foreign exchange earner contributing sustainably to food and nutritional security. It is also a principal source of livelihood to people in coastal areas. Fisheries contribute about 1 per cent of India's GDP, which forms about 4.12 per cent of the agricultural GDP (2003-04). The total fish production during the four decades (1950-51 to 1990-91) showed an annual average compound growth rate that varied between 3.35 to 4.62 per cent. About 12.2 lakh fisherfolk operate diverse types of craft-gear combinations with regional and seasonal variations all along the Indian coastline. The secondary sector provides employment to more than 15 lakh people and another one lakh people is employed in the tertiary sector.

Increasing fishing pressure has led to over exploitation of inshore resources - out of 47 commercially important species 30 per cent have been over exploited and 55 per cent have reached an optimum level. Depletion of marine fisheries is further aggravated with the increasing catch of juveniles and discards. Decline in catch rates coupled with increasing domestic and international demand of high value species has resulted into more conflicts in sharing of resources, increase in migration of fishing units and labourers, emergence of multiday fishing even extending beyond 15 days and consequent socioeconomic disturbances like increase in burden of women in household management. Fisherfolk all along the Indian coast as well as Inland hamlets are similar in their socio economic backwardness. About 47 per cent of coastal fisherfolk is living Below Poverty Line (BPL) with a monthly per capita income of Rs. 1000. Housing is one of the most important indicators- about 35 per cent are living in huts, 40 per cent in *kutcha* houses and 25 per cent in *pucca* houses. More than 50 per cent of total fisher population lives within the CRZ-1 and half of them are devoid of title deeds. Inequitable distribution of income is the greatest challenge by our fisherfolk. With the increasing capital intensity of fishing units, the extent of ownership of means of production (crafts and gears) by fisherfolk declined from 27 in 1970 to 14 per cent in 2004, which indicates growth of dispossessed labour class, like landless labourers in agriculture. With the unbridled capital penetration inter and intra sectoral marginalisation is taking place. It is ironical to note that one third of active fishermen (that is the mechanised sector) corners about 70 per cent of the earnings generated at the primary level and the other one third involved in non mechanised sector gets only 7 per cent of the common property resources. Policy interventions in the

production, distribution and marketing segments are highly essential for the rational utilisation and sustainable development of open access marine fisheries.

Materials and methods

Comprehensive usage of data, both secondary and primary is attempted in this paper. Primary data gathered by the Socio Economic Evaluation and Technology Transfer Division (SEETTD) of CMFRI is used for comparative assessment of different aspects of various craft and gear combinations. Exhaustive usage of secondary data from various publications cited herein is also used in the preparation of this paper.

Fisheries Legislation in India

The backdrop of fisheries legislations enacted in India traces back to 1857, when The Indian Fisheries Act was endorsed. It was meant to regulate riverine fisheries and fisheries in inshore waters, to prohibit the use of poisons and dynamite in fishing, and to protect fish resources in selected waters through regulation of, among other things, the erection and use of fixed engines (the reference is to nets, cages, traps, etc.), the construction of weirs, the use of nets of certain types and dimensions, etc.

The present day scenario is governed by various sets of enactments essentially having bearing on the marine fisheries sector. These legislations include Maritime Zones Act (1976) which recognizes the sovereign rights to conservation and management of living resources in the Indian EEZ, in addition to their exploration and exploitation. Another important regulation governing the marine fisheries is Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act (1981) and Rules (1982). Fisheries within the 12-mile territorial limits are managed under the Marine Fishing Regulation Acts (MFRAS) of the maritime States of India. The main emphasis of MFRAS is on regulating fishing vessels in the12-nautical mile territorial sea, mainly to protect the interests of fishermen on board traditional fishing vessels. Thus, the Act has been mainly used for the purpose of maintaining law and order at sea. The MFRAS were first implemented in the States of Kerala and Goa in 1980. They were subsequently enacted in other States, the latest being in 2003, in Gujarat. While the earliest MFRAS were enacted only for regulation of fishing vessels along the coastline of the State, the Gujarat MFRA provides for protection, conservation and development of fisheries in inland and territorial waters of the State of Gujarat and for regulation of fishing in the inland and territorial waters along the coastline of the State. The Coastal Regulation Zone Protection Act, (1986) outlines a zoning scheme to regulate development in a defined coastal strip. The Notification defines the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action in the landward side, up to 500 m from the high-tide line (HTL) and the land between the low-tide line (LTL) and the HTL, as the CRZ. The Environment Protection Act, (2002) authorizes the Central government to protect and improve environmental quality, control and reduce pollution from all sources, and prohibit or restrict the setting and/or operation of any industrial facility on environmental grounds. The Biological Diversity Act (2002) provides for the conservation of biological diversity, the sustainable use of its components and, significantly, the fair and equitable sharing of the benefits arising out of the use of biological resources, knowledge and related matters.

Marine Fishing policy enables sustainable and responsible fisheries in addition to tapping the opportunities in domestic and export market. The Marine Fishing Policy of2004 delineates 'Territorial Waters' as the subject of maritime states. Fisheries beyond this limit falls under the purview of the central Government and is termed as the 'Exclusive Economic

Zone'. The central Government provides financial assistance under the central sector schemes and sponsored schemes for fisheries sector.

Overcapitalisation of fishing fleets

At present (2003-04) there are 2251 traditional landing centres, 33 minor and 6 major fishing harbours in the marine fisheries sector of India. About 1.77 lakh of fishing crafts are in operation comprising 76596 traditional non-mechanised fishing crafts, 50922 motorized crafts and 49070 mechanized crafts operating different gears as shown in Table 1.

Table 13.1 Growth rate of marine fishing fleets in India
(1961-62 to 2003-04)

Year	Sector							
	Non-mechanised		Motorised		Mechanised		Total	
	Number	Growth Rate (%)	Number	Growth Rate (%)	Number	Growth Rate (%)	Number	Growth Rate (%t)
1961-62	90424	---	---	---	---	---	90424	---
1973-77	106480	18	---	---	8086	---	---	---
1980	1,37,000	29	0	0	19,013	135	1,56,013	73
1998	1,60,000	17	32,000	0	47,000	147	2,39,000	53
2003	76,596	-52	50,922	59	49,070	4	1,76,588	-26
2005	1,04,270	36	75,591	136	58,911	25	2,38,772	35
2010	50,618	-51	71,313	-6.0	72,559	23	1,94,490	-19

There is a definite trend of decline in the number of non-mechanised boats in recent years. As non-mechanised fleets are decreasing, there is a clear increase in motorized and mechanized boats due to their better technical efficiency and comparative economic advantage. In mechanized sector itself, growth rate of trawlers is increasing at a faster rate, especially boats with 15 m and more OAL, which are capable for multi-day fishing. Many of our existing mechanized boats have now started operating even beyond 100 m depth resorting to multi-day fishing and the current trend is to go for higher OAL fitted with engines of higher horsepower. The trends in the growth rate of fishing units indicate the possible phasing out of non-mechanised Canoes at least in certain regions, which ultimately reflected a negative growth of 52 per cent by them during 1997-98 to 2003-04. This downtrend is compensated in the motorised sector implying large-scale motorisation of existing traditional crafts. Mechanised crafts displayed a major boom during 1980s and 1990s. The growth rates were 135 and 147 per cents respectively in 1980 and 1997, due to diversification and extended area of operation.

While mechanized trawlers and gillnetters are common all over Indian coast, dolnetters are popular in Gujarat and Maharashtra coasts, purseseines in Goa, Karnataka and Kerala coasts, pair trawling in Tamil Nadu and sona boats in Orissa coasts, depending on the regional and seasonal abundance of resources. When the technical efficiency of a particular gear is better than the other, the lesser efficient gears gradually disappear from the operation (Sathiadhas, 1998).

Sectoral Capital Investment and Fishing Intensity: There are many fishing crafts, which are older up to 20 years, operating along the Indian coasts. The gross investment ranges from about Rs.5, 000 for a small non-mechanised catamaran unit to Rs.35 lakh for a trawler in the small-scale fisheries sector. There is drastic structural change in fishing fleets and capital

investment in mechanised, motorised and non-mechanised sector of marine fisheries in 2003 (Table 2). The fishing fleets as well as capital investment witnessed significant growth rates in mechanised and motorised sectors. The capital investment has increased more than proportionate to the increase in fleet size not only due to increase in price level and consequent increase in capital requirements but also diversification of fishing units opting for bigger OAL boats with high HP and other accessories. The gross capital investment on fishing units in Indian marine fisheries sector during 2003-04 works out at Rs.10,532crore in which mechanised sector constitutes about Rs.9,049 crore, more than a three-fold increase from 1997-98. The increase in investment on mechanised trawlers and gill-netters are comparatively higher than other sectors. The capital investment on motorised sector also almost doubled from Rs.456 crore during 1996-97 to Rs.861 crore during 2003-04. However, as expected, the non-motorised sector has shown a decline in investment from Rs.923 crore during 1996-97 to Rs.622 crore during 2003-04 in tune with their decline in production and diminishing returns. Further, substantial numbers of these units were converted into motorised units.

Table 13.2 Estimated capital investment inCrafts and Gears (1997-98 & 2003-04)

Particulars	1997-98	2004-05	2008-09	2009-10
a) Mechanized sector				
Trawlers	1879	8289	9751	4951
Purse-seiners	134	189	222	171
Gillnetters	255	725	853	5694
Dolnetters	49	258	304	2068
Others	72	263	309	746
Sub total	2388	9724	11439	13630
per cent of mechanised sector to total investment	58	85.84	85.41	89.89
b) Motorised sector				
Dugout canoes	31	13	16	18
Catamarans	48	89	112	120
Plank-built boats	188	455	570	618
Others	188	452	567	614
Sub total	456	1009	1265	1370
per cent of motorised sector				
Total investment	11.08	8.91	9.45	9.04
c) Non-mechanised				
Dugout canoes	218	46	53	22
Catamarans	236	141	163	55
Plank Built Boats	420	396	458	39
Others	49	12	14	47
Sub total	923	595	688	163
per cent of Non-mechanised				
sector to total investment	22.42	5.25	5.14	1.08
Deep sea fishing				
vessels	350	N.A.	N.A.	
per cent of to Deep sea fishing				
vessels to total investment	8.5	N.A.	N.A.	
Total	4117	11328	13392	15163

The estimated gross capital investment on fishing equipments alone works out to Rs.4,117 crore at 1997 price level (Sathiadhas, 1998), in which 58 per cent is in the small scale mechanized sector, 9 per cent in deep-sea vessels, 11 per cent in motorized sector and 22 per cent in non-mechanized sector. It may be noted that out of the total capital investments on fishing equipments, during 2003, 86 per cent is constituted by mechanised sector, 8 and 6 per cents respectively by motorised and non-mechanised sectors.

The overall per capita investments of an active fisherman in 2003-04 was Rs.86,290 ranging from Rs.17,024 in the non-mechanised sector to Rs. 2,19,319 in the mechanised sector. During 1997, the overall per capita investment was Rs.40,363, where the investment per head in mechanised sector was Rs.1,25,689, motorised and non-mechanised sectors invested Rs.26,835 and Rs.13,979 respectively per active fisherman in India (Table 3). Further, fishing intensity is directly related with capital investment *vis-à-vis* number and type of nets they are possessing. A catamaran owner having different types of nets can have more number of fishing days. If he is having only one type of net, he will be having only lesser number of fishing days. In India, most of the non-mechanised fishermen are having one or two fishing nets, which are not sufficient for efficient operation for the whole year.

Table 13.3 Per capita investment on fishing equipments per active fishermen in India – 1997-98 & 2003-04 (Rs.)

Sector	1997-98*	2003-04
Mechanised	1,25,689	2,19,319
Motorised	26,835	19,454
Non-mechanised	13,979	17,024
Overall	40,363	86,290

*Sathiadhas, *et.al.,* (1998)

In the open access marine fisheries, mode of ownership on means of production by fisherfolk greatly influences the occupational pattern and socio-economic status. The type and number of fishing implements owned is the yardstick to measure the economic well being of a fisher household. In India, hardly 13 per cent of the active fishermen in the marine fisheries sector have ownership on craft and gear in 2003 and another 3 per cent possess only gears. The proportion of owner operators in marine fisheries declined over the years with the increasing capital requirement for possessing motorized and mechanized fishing units. In the mechanised sector, 12 per cent, motorised sector 9 per cent and traditional sector 21 per cent have ownership on crafts and gears. Most of the non-motorised units are operating as family enterprises not even realizing the operating cost of the labourers. Lack of finance and credit facilities does not allow these fishermen to go for modernization and come out of the vicious circle of poverty and low-income trap.

Capital intensive technologies and disguised unemployment: Every 100 kg of fish produced from marine fisheries provide full-time employment for 20 persons in the harvesting sector and another 24 persons in post-harvest sector and one person in the tertiary sector. Earlier studies (Sathiadhas, et.al., 1997) confirmed that altogether 10.2 lakh people are involved in active fishing and 12 lakh people are involved in pre and post-harvest sector of marine fisheries during 1995. During 2003-04, 12.20 lakh people are employed in active fishing in the primary sector and another 15 lakh in the pre and post-harvest sector in the secondary sector and one lakh people employed in the tertiary sector. Thus it is estimated that about 18 to 20 million people in India are depending on marine fisheries

sector for their livelihood.

The proportion of catch by mechanised sector as a whole increased from 40 per cent during 1980 to 68 per cent in 1997 and again declined to 66 per cent in 2003. At the same time, the number of active fishermen depending on mechanised fisheries increased from 1.14 lakh to 2 lakh and again increased to 4.1 lakh respectively during the same period. It should be noted that the annual per capita production of active fisherman during the period has increased from 5260kg in 1980 to 8130 kg in 1997 and drastically declined to 4175 kg in 2003 (Table 4). This clearly indicates the high prevalence of disguised unemployment in the mechanised fisheries sector.

The pressure for employment in active fishing is increasing more than proportionate to the harvestable yield in the open access marine fisheries. The fishermen involved in active fishing is more than the absorbing capacity of the fisheries sector and has led to lower per capita production, increased pressure on fishing which results in juvenile fishing, large level discards and thus ultimately causing serious threats to resource sustainability and environmental stability.

Employment in fisheries sector has undergone rapid structural changes during the last few decades. Among those engaged in the mechanized sector, 75 per cent work in trawl fisheries and the rest 25 per cent in other sectors. In the case of motorized sector, 50 per cent are engaged in ring seine fishery alone. There is a wide disparity in income between those engaged in different sectors. It may be noted that still non-mechanized sector is providing about 30 per cent of the employment in active fishing, yet harvesting hardly 7 per cent of the annual landings. Marginalisation of the indigenous non-motorised sector by the motorized and mechanized sectors frequently creates conflicts among fishers. The number of annual fishing days per worker reveals that the level of employment for hired labourers as well as those not having sufficient equipment is low and they are very much underemployed. The seasonal nature of fishery and the risk and uncertainties associated with marine fishing entangled the fishermen in the low-income trap. The alternate employment opportunities are very meagre .The poor economic condition coupled with the less availability of finance from the institutional agencies compel them to sustain with less equipped fishing implements which in turn results in diminishing returns. Several studies have highlighted the micro and macro level socio-economic conditions of fishermen in our country (Desai and Baichwal, 1960; Gurtner, 1960; Sen, 1973; Prakasam, 1974; George, 1974; Selvaraj, 1975; Amarasiri Desilva, 1977; Lawson, 1977; Panikkar, 1980; Sathiadhas and Venkitaraman, 1981; Shanbhu Dayal, 1981; Pietersz, 1983; Platteau, 1984; Prasada Rao and Kumar, 1984; Subbarao, 1986; Krishna Srinath, 1987; Sathiadhas and Panikkar, 1988; Korakkandy Ramakrishnan, 1994)

Table13. 4 Structural changes in socio-economic parameters in non-mechanised, motorised and mechanised sector (1980-81 to 2003-04)

Item	1980-81	1997-98	2003-04
Mechanised			
Marine fish production (per cent)	40	68	66
Average annual production (in tonnes)	32	33	35
Annual per capita production / active fishermen (in Kg)	5260	8130	4175
Ownership of means of production by active fishermen (per cent)	17	24	12
Active fishermen	114000	200000	412596
Motorised			
Marine fish production (per cent)	---	19	27
Average annual production (in tonnes)	---	13	14
Annual per capita production / active fishermen (in Kg)	---	2390	1592
Ownership of means of production by active fishermen (per cent)	---	19	12
Active fishermen	---	170000	442581
Non Mechanised			
Marine fish production (per cent)	60	13	7
Average annual production (in tonnes)	6.57	1.7	2.4
Annual per capita production / active fishermen (Kg)	2590	420	500
Ownership of means of production by active fishermen (per cent)	39	25	21
Active fishermen	348000	650000	365360
Total			
Average annual production (in tonnes)	9.6	9.6	14.8
Annual per capita production / active fishermen (in Kg)	3247	2254	2138
Ownership of means of production by active fishermen (per cent)	34	23	14
Active fishermen	462000	1020000	1220577

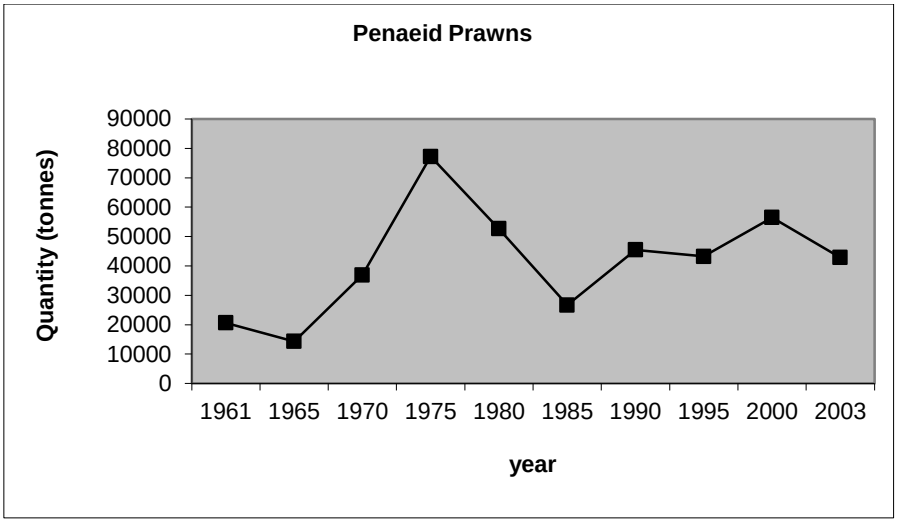
The current scenario of marine fisheries in terms of fishing fleets clearly indicates a situation "too many boats chasing too few fishes". Overcapitalisation in the mechanized sector and under employment in non-mechanised sector is rampant issues, which creates regulatory, and conservatory problems for sustainable production on one hand and socio-economic problems on the other. There are lots of variations among the fishing units in mechanized, motorized, and non-mechanised fishing units. The continuous changes and up gradation of existing fishing technologies not only increase the efficiency of craft and gears but also marginalize the fisherfolk who are not able to cope up with the changes. The craft-gear combinations in the non-mechanised sector have undergone rapid changes. Many of the fishing technologies prominent in past years are even not visible in our coastal villages. Shore seine and low cost cotton nets are almost vanished. Bigger catamarans/canoes/plank-built boats with variety of fishing gears alone are capable to withstand the mounting competition from the motorized and mechanized sector. The non-mechanised sector, as a

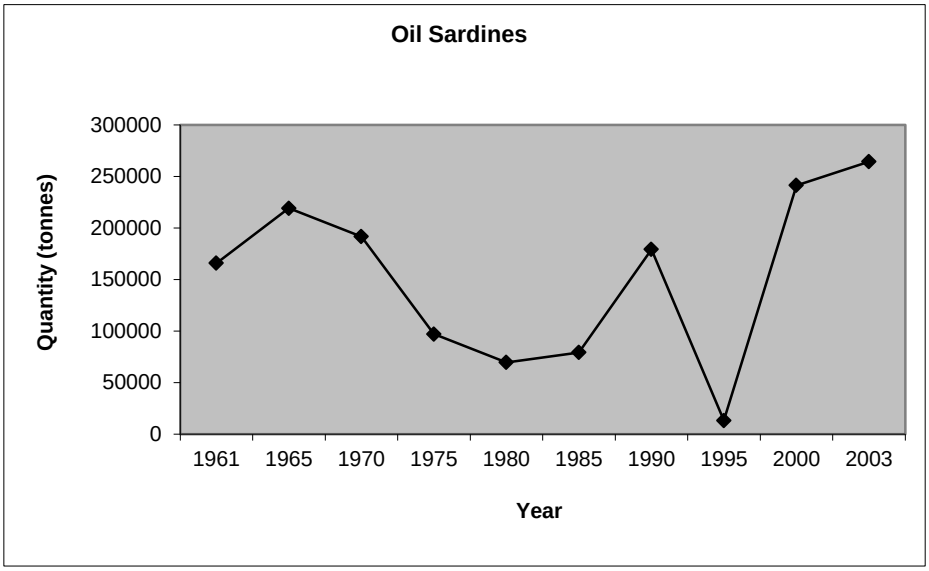
whole, is sustaining only as a family enterprise. Similarly in motorized sector technological upgradation in the form of size of the net and boat has increased over the years. Boats fitted with 2-3 OB engines are very common which enhanced their mobility and fishing capabilities. In the mechanized sector expanded fishing activities with extended fishing days of even more than five days per trip is very common. With this acute competition, both inter and intra sectoral level has marginalized a number of fishermen who are depending on labour intensive technologies for their livelihood.

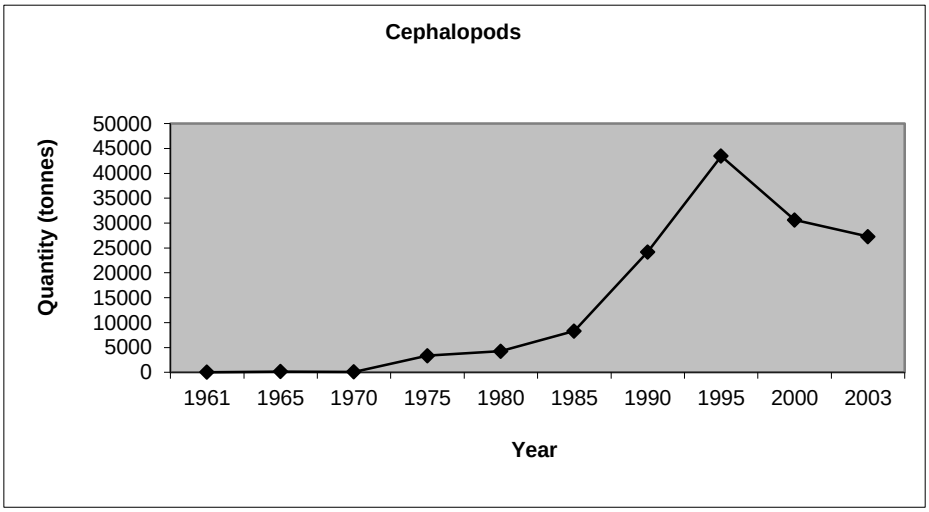
Table 13.5 - Annual Landings of Selected Resources *(tonnes)*

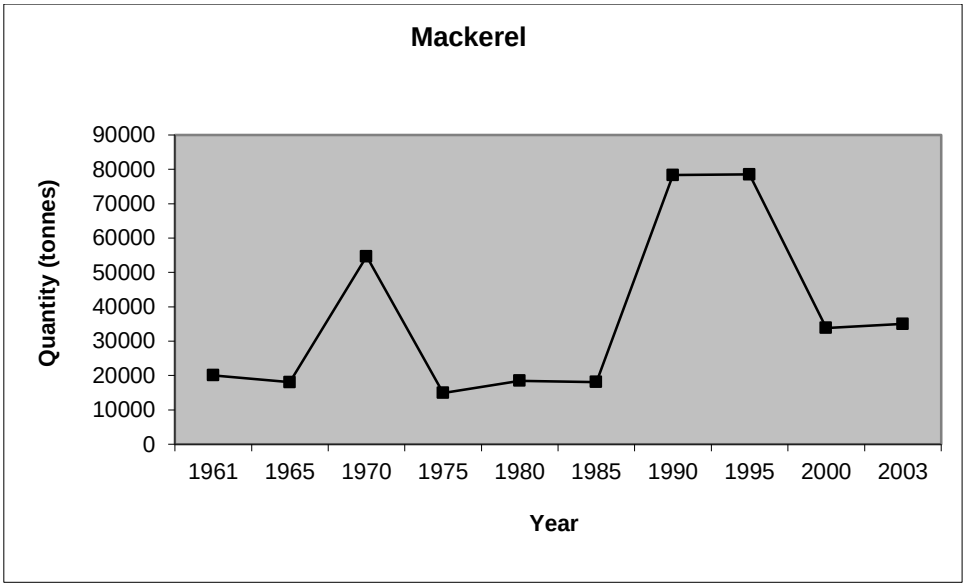
	Ribbon fish	Mackerel	Seer fish	Penaeid prawn	Oil-Sardine	ancho-vies	Lizard-fish	Perches	Carangids		Barra-cuda	Flat fish	Cephal-opods	Elasmo-branchs	Cat Fishes	Goat fishes
1961	4047	20044	2885	20627	166005	6742	5	1316	5311	4503	234	5882	28	8515	3114	226
1965	13826	18048	1513	14327	219170	3567	199	1057	4083	1831	902	7312	174	5969	3565	305
1970	4922	54659	1731	36940	191683	12558	1066	4336	2797	1226	79	10212	86	7490	16380	279
1975	15175	14930	4065	77207	97183	13070	11294	14741	7539	5845	396	6932	3342	10292	32603	23
1980	12937	18474	3763	52633	69667	10013	7080	17814	4760	10611	330	4394	4244	6803	13936	1
1985	25146	18115	8459	26685	79237	38045	5695	30710	12899	10009	921	11332	8308	6013	5184	100
1990	9751	78335	5372	45483	179276	29219	11469	67356	69068	32860	3842	15427	24206	6968	2739	6919
1995	4641	78515	5910	43224	13328	41406	12581	47620	102762	11088	4677	12385	43472	4109	308	174
2000	19264	33854	4998	56462	241411	25643	7779	50819	29368	16763	2996	16769	30627	2832	103	63
2003	15107	35026	8554	42862	264372	24644	10609	34215	37423	23325	4413	21692	27277	4856	261	1

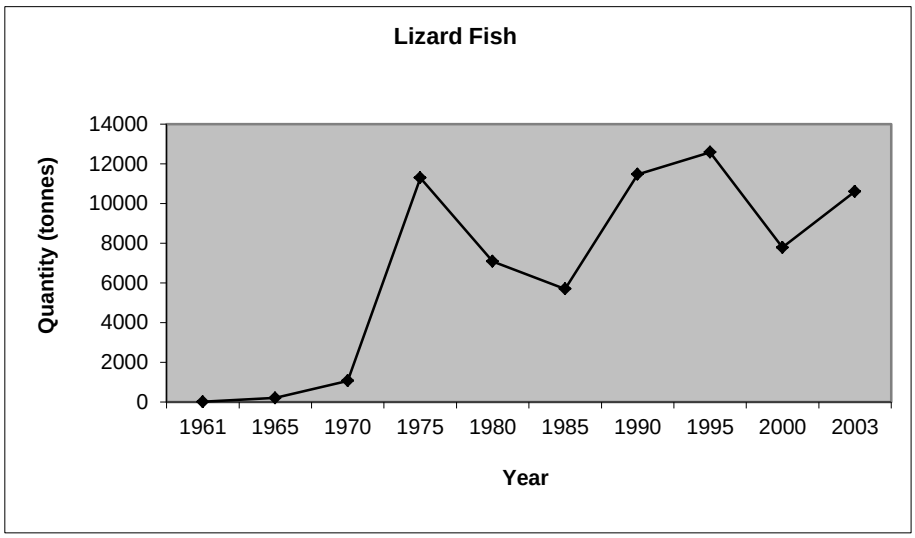
Source: Central Marine Fisheries Research Institute, Cochin-18


Penaeid Prawns
Quantity (tonnes)
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1961 1965 1970 1975 1980 1985 1990 1995 2000 2003
year


Oil Sardines
Quantity (tonnes)
300000
250000
200000
150000
100000
50000
0
1961 1965 1970 1975 1980 1985 1990 1995 2000 2003
Year


Cephalopods
Quantity (tonnes)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1961 1965 1970 1975 1980 1985 1990 1995 2000 2003
Year





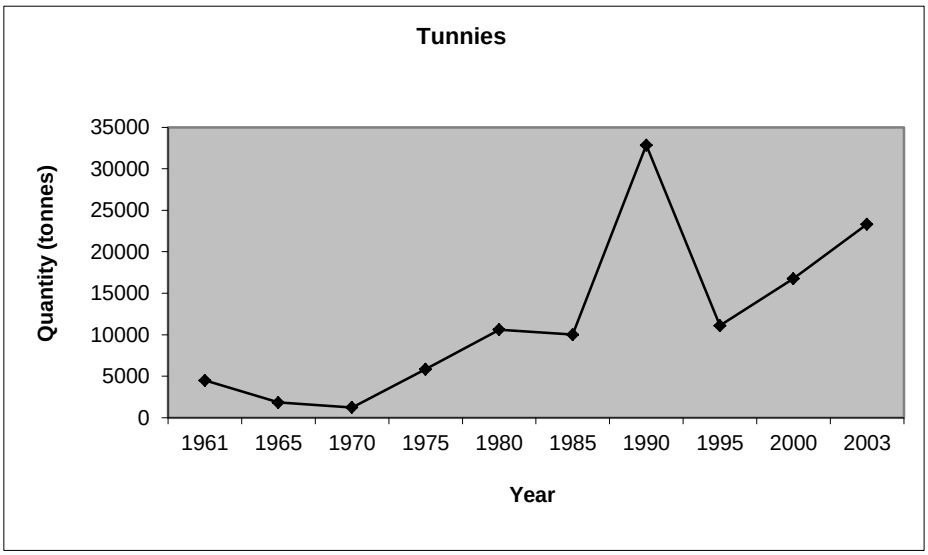


Figure 13.1 Catch trends of selected varieties of fish

The analysis of species-wise catch composition during the last four decades clearly indicates that these technological changes had affected some of the marine resources leading to their depletion. The catfish fishery along the Kerala coast is the best example for the indiscriminate fishing by the mechanised sector. The average annual catch of catfishes in 1961 was 3114 t, which rose to 32603 t in 1975 owing to the large-scale exploitation by the mechanised trawlers and purse seiners during the intensive mechanization period. The annual catch recorded in 2003 was only 261 t. One of the obvious reasons for the decline of this particular species was the overfishing of brooders. The harvest of catfishes was at its peak mostly during September-October period when the species congregated the coastal waters for breeding. During the period 1979-86, more than 50 per cent of the catch consisted of gestating males, each fish carrying about 50 eggs/embryos. This large-scale destruction took place over a period of two months, September and October. The landings of elasmobranch resources were the highest in 1970s (10292 tonnes). This might be proportionate to the intensive operation of mechanised trawlers, which resulted in the reduction of its landings in subsequent years. In the case of goatfishes, the maximum exploitation took place in 1990 (6919 tonnes), but later the species has almost disappeared from the landings by 2003, as was experienced during 1970s. If we assume a cyclic production pattern for catfish, the next turn up would happen after 30 years.

Harvesting strategies for deep-sea and oceanic resources

The scope of increasing fishing pressure in our inshore waters as there is excess capacity in traditional and small scale mechanised sectors. Further many of the existing mechanised boats are extending their fishing up to 100 meters of depth resorting to multi-day fishing operations. Hence our fishing policies should be oriented towards exploiting the fishery resources beyond 100 metres depth giving thrust to indigenous technology and more employment generation for coastal fisherfolk to avoid social conflicts.

Harvesting of marine fish resources is categorised into three levels viz., (I) subsistence fishing, (II) small-scale fishing and (III) industrial fishing. It is worth noticeable that the Marine Fishing Policy of India 2004 envisages schemes to motorise the traditional craft and also providing better material and technology for their traditional craft. The country has a very large fleet of traditional craft (181284 nos.). Motorisation of the entire fleet may make fishing unsustainable. The motorised craft with their operational limit would end up in overcrowding whereby exerting too much fishing pressure in a limited area. Accordingly, the policy visualises motorisation of about 50 per cent of traditional craft allowing the remaining to carry on subsistence fishing in the near shore waters. On the other side, providing incentives for acquisition of multi-day fishing units would encourage the small-mechanised sector. The suggestions for providing infrastructure support in terms of landing and berthing facilities for the growth of deep-sea vessel category is noteworthy.
Other ingredients of the support package include, provisions for special incentives for wholly Indian owned vessels for venturing into international waters and for concluding fishing arrangements with other countries under licence etc, promoting fishing in by Indian owned vessels or with equity participation or under licence by working out sustainable strategies, screening and approval of proposals for import of resource-specific fishing vessels by wholly Indian owned enterprises by designated authority in accordance with well laid out norms.

Integration of inshore fisheries with coastal mariculture

A report of the consultative group on international agricultural research states that within the next 15 years, fish farming and sea ranching could provide nearly 40 per cent of all fish for the human diet and more than half of the value of the global fish catches. According to a report of the FAO, the world aquaculture production is projected to increase by 2.69 times by 2025 AD. India as a leading country in Asia in aquaculture production should be able to achieve at least a production of 2mt (0.1mt finfish, 1.0mt crustaceans, 0.3mt molluscs and 0.6mt seaweeds) through mariculture by the year 2025 AD, i.e., 3.9 per cent of projected global aquaculture production of 51.8mt. With improvements in the domestic market, diversification of marine products exports, availability of a vast range of cultivable candidate species, several culture technologies and hydro climatic (or agro climatic) zones for coastal mariculture and sea farming, India is poised to become one of the world's leading producers of mariculture products.

Issues related to Coastal Regulation Zone (CRZ), Integrated Coastal Zone Management (ICZM) and the unfounded apprehensions that coastal mariculture would adversely affect the environment are leading to unnecessary or avoidable litigations retarding the growth of the mariculture sector. It is worth to note that the present shrimp oriented, land-based coastal mariculture has resulted in the under-utilisation of the technologies developed for the culture of bivalves, seaweeds and pearls, and hence requires to be diversified and broad-based to take maximum advantage from the high production potential of tropical aquaculture farms.

Product development and market diversification

Seafood products form a considerable segment of the post-harvest utility of marine fish resources. There has been considerable structural change in the seafood processing and export industry for the last few years. There is a growing demand for "ready to cook" or "ready to serve" type of seafood, hygienically prepared and attractively packed convenience foods to match the changing needs of urban population. The seafood processing and marketing has become competitive all over the world and exporters are switching over to value addition to increase profit.

Seafood exports alone constitute about 3.14 per cent of the gross export earnings of our country. During 2000-2001, India's seafood exports earnings have crossed Rs.6400 crores. Though there has been an increase in terms of total quantity of seafood exported and value realized, there was an overall decline in unit value realized per kg during the last few years. This is mainly due to the change in product composition with an increasing trend in finfish component, which fetch comparatively lesser prices.

Table 13.6 Export growth of marine products from India (1995-96 to 2010-2011)

Year	Quantity (Tonnes)	Value (Rs.Crores)	Unit Value (Rs/kg)
1995-96	296277	3501.11	118.17
1996-97	378199	4121.36	108.97
1997-98	385818	4697.48	121.75
1998-99	302934	4626.87	152.74
1999-00	343031	5116.67	149.16
2000-01	440473	6443.89	146.29
2010-11	812456	12541.25	154.36

The Marine Products Export Development Authority has listed about 65 value added products, suitable both for export and domestic markets. Product diversification always promotes price discrimination and enables us to realise maximum forex earnings. It further helps us to enhance the employment opportunities of coastal rural women. The emergence of value added products are accelerated by the current demand pattern of the major seafood markets in exporting countries. In India too the market for value added fish products is expanding. The introduction of microwave oven also helped to pick up markets for value added products (Garthwaite, 1997). Today the affluent society is gradually shifting towards value added products. Such a change is due to the attitudinal change towards fast-food concepts, due to the increasing preference for ovenable packets over deep fry products. An additional export of almost one-lakh tonnes of value added products in our marine products could easily corner about Rs.1500 crores of forex earnings and generates regular employment opportunity of about 35000 fisherfolk.

Quality control and promotion of exports complying with WTO regulations

Quality assurance in the domestic marketing channel will enable the parallel development of the internal marketing system, which is highly essential to withstand any market collapse and price crash in the export market at any point of time (Sathiadhas *et.al.,* 2002).

The marketing and distribution system in the fishery sector of the country is not well equipped with quality maintenance mechanism comprising essential marketing infrastructure and proper administrative procedures. In the light of HACCP regulations, the government as well as industrialists has been increasingly complying with the quality standards of the export products. However, quality maintenance in the internal distribution system of fresh and processed fish is also essential.

Ecolabelling

Ecolabelling is a voluntary method of environmental performance certification and labelling that is precise around the world. An "ecolabel" is a label which identifies overall environmental preference of a product or service within a specific product / service category based on life cycle considerations. There are many different voluntary (and mandatory) environmental performance labels and declarations. The International Organization for Standardization (ISO) has identified three broad categories of Voluntary

Environmental Performance Labels, with Ecolabelling fitting under the Type-I designation. Type-I clarified environmental labels as a voluntary, multiple criteria based, third party programme that awards a license that authorises the use of environmental labels on products indicating overall environmental preferability of a product within a particular product category based on life cycle considerations. Type II is informative environmental self-declaration claims and Type III is voluntary programmes that provide quantified environmental data of a product, under pre-set categories of parameters set by a qualified third party and based on life cycle assessment, and verified by that or another qualified third party.

The idea that Ecolabelling would lead to improved management of marine capture fisheries is recent origin. Unilever PLC/NV and the World Wide Fund for Nature (WWF) first publicly promoted it at their Marine Stewardship Council (MSC) initiative in early 1996. The usefulness of Ecolabelling in creating a market-based incentive for environment-friendly production was recognised about two decades ago when the first ecolabel products were put on sale in Germany in the late 1970s. Since then, and especially during the 1990s, Ecolabelling schemes have been developed in most industrialised countries for a wide range of products and sectors. In recent years, they have been gaining importance in a number of developing countries, including India, Brazil, Indonesia and Thailand. The concept was globally endorsed in 1992 at UNCED, where governments agreed to "encourage expansion of environmental labelling and other environmentally related product information programmes designed to assist consumers to make informed choices".

Despite the international community's general acceptance of product ecolabelling, the approach has caused controversy in several international arenas, including WTO Sub-Committee on Trade and Environment. General concerns about Ecolabelling are its potential to act as a barrier to trade and its coherence, or lack of it, with international trade rules. More specific concerns arise when applying Ecolabelling to products from marine capture fisheries because these have special characteristics. At any point of time, ecolabelling is market-based economic instrument that seeks to direct consumer's purchasing behaviour so that they take account of product attributes other than price. Consumer's preference are expected to result in price and/or market share differentials between products with ecolabels and those that either do not qualify for them or whose producers have not sought to obtain them. The large and progressive global fisheries trade, especially from developing to industrialised countries, indicate the potential of ecolabelling as both an incentive to improved fisheries management and a barrier to trade.

There is increasing acceptance on the part of those who are familiar with ecolabelling that such labels should not be used to discriminate against those who cannot afford to develop and implement the management practices needed for sustainable fisheries management. Governments, industry and consumers should promote international collaboration in order to agree on basic principles for the introduction and use of ecolabels in fisheries and aquaculture.

Subsidies

Fisheries subsidies are defined as "government actions or inactions that are specific to the fisheries industry and that modify – by increasing or decreasing – the potential profits by the industry in the short-, medium- or long-term". Subsidies have long been part and parcel of the fishing industry, partly because of the public good nature of fisheries management and associated research, but also because of the precarious livelihood experienced by most fishing communities. The WTO definition of subsidies is chiefly

concerned with the trade effects of subsidies in general, rather than effects on conservation or fisheries management. The SCM defines subsidies as, *inter alia*:

- Specific financial transfers from state to the industry (including implied transfers such as loan guarantees)
- Conversely, the state foregoing normally collectable revenue (e.g. tax free fuel)
- Provision of services or investments to industry that would not "normally" be state provided. E.g. indirect subsidies such as state cold storage facilities or specifically targeted research programmes
- State purchases of industry outputs other than on commercial terms
- All forms of state income or price support (e.g. production subsidies designed to maintain prices, reference prices etc.).

In addition subsidies are categorised in relation to the rights of members to make complaint and take action (countervailing measures) with respect to alleged trade-distorting subsidies undertaken by other members. 3 In this respect there are two categories of subsidy:

- Prohibited: including export enhancing subsidies or subsidies giving preference to domestic producers or grants tied to the use of domestically produced goods.
- Actionable: a subsidy that may be challenged on the basis of causing 'adverse effects' to the interests of other WTO members and if the subsidy is specific to an enterprise or group of enterprises or industries (generally available subsidies are permitted).

Boxes

In WTO terminology, subsidies in general are identified by "boxes" which are given the colours of traffic lights: green (permitted), amber (slow down or be reduced), red (forbidden). In agriculture, things are, as usual, more complicated. The Agriculture Agreement has no red box, although domestic support exceeding the reduction commitment levels in the amber box is prohibited; and there is a blue box for subsidies that are tied to programmes that limit production. There are also exemptions for developing countries (sometimes called an "S&D box", including provisions in Article 6.2 of the agreement).

In order to qualify, green box subsidies must not distort trade, or at most cause minimal distortion. They have to be government-funded (not by charging consumers higher prices) and must not involve price support. They tend to be programmes that are not targeted at particular products, and include direct income supports for farmers that are not related to (are "decoupled" from) current production levels or prices. They also include environmental protection and regional development programmes. "Green box" subsidies are therefore allowed without limits, provided they comply with the policy-specific criteria set out in the Agriculture Agreement. Amber box include measures to support prices, or subsidies directly related to production quantities. These supports are subject to limits minimal supports are allowed (5 per cent of agricultural production for developed countries, 10 per cent for developing countries). The reduction commitments are expressed in terms of a "Total Aggregate Measurement of Support" (Total AMS), which includes all supports for specified products together with supports, that are not for specific products, in one single figure. In the current negotiations, various proposals deal with how much further these subsidies should be reduced, and whether limits should be set for specific products rather than continuing with the single overall "aggregate" limits. Blue box is the amber box with conditions designed to reduce distortion. Any support that would normally be in the amber box is placed in the blue box if the support also requires farmers to limit production.
Parallel development of internal marketing system

Post-harvest fisheries activities including processing, product development, transport and marketing provide greater employment to labour than the harvesting sector. As the demand and price of fish keep continuously increasing in the domestic and export markets, the opportunities for the above activities also keep growing. Fresh fish, once inaccessible to distant locations still a few years ago are now easily available due to the vast improvements in handling technologies coupled with advanced transportation facilities and consequent market penetration. However, the infrastructure for fish marketing in India is still principally oriented towards the export market.

Fishermen's share in consumer's rupee is the best index to measure the efficiency of fish marketing system. Judging from the trend of fishermen's share on consumers' rupee at all India level during 1989-90, 1996-97 and 2003, the fish marketing efficiency has increased over the years (Table 12) for most of the varieties. During 2003, fishermen's share in consumers' rupee ranged from 45 per cent for silver bellies to 75 per cent for seerfish. Although the share of producers increased over the years for quality fishes like seerfish and pomfrets, there is enormous scope to enhance the marketing efficiency of low quality fishes such as silver bellies and lizardfishes in the internal markets. Marketing costs including transportation range from 6 per cent to 13 per cent of the consumer's rupee.

Table 13.7 – Percentage share of fishermen in consumers' rupee for different varieties of fish (1989-90 to 2003)

Name of Fish	1989-90 (per cent)	1996-97 (per cent)	2003 (per cent)
Seer Fishes	63	68	75
Pomfrets	62	60	65
Mackerel	54	50	72
Ribbon fishes	41	48	53
Tunnies	55	45	63
Catfishes	49	56	59
Barracudas	53	40	66
Silverbellies	41	30	45
Lizard fishes	42	35	56
Goat fishes	37	57	59
Rays	39	47	58
Whitebait	41	40	61
Threadfins	46	42	57

Source: SEETTD, CMFRI

Community based conservation strategies including awareness on responsible fisheries

The information from various segments reveals that the marine fisheries in India is currently undergoing through a phase of socio-economic cum ecological turbulence. A versatile study on responsible fisheries observes that the major factor that endangers its sustainable utilization is the open access nature of marine resources and the veritable lack of an enforceable property rights regime or unanimously agreeable regulatory mechanisms (Ramchandran, 2004). There are many activities, which adversely affects the sustainability of marine resources including shallow water mining, use of improper crafts, ghost fishing, destruction of mangrove forests, etc. Development processes such as urbanisation, industrial pollution and eutrophication of estuaries have also jeopardised the fragile ecological dynamics of the coastal area(Clark, 1990.,Weitzman, 1992., Johnson, 1993.,

Munasinghe, 1994., F. di. Castri and Younes,1996., McNeely, 1996., Dominic and Pearce, 1998., Escobar, 1998.,Gopal, 2001.

The concept of Responsible Fisheries advocated by FAO through its Code of Conduct for Responsible Fisheries is an epitome among global efforts for realising the coveted goal of sustainable utilization of our marine resources. The Code is a landmark in marine development thinking as it represents the consensus achieved by more than 150 nations across the world on the directions we should follow in order to avoid resource depletion due to irrational utilisation behaviour pattern shown by various stakeholders.

HRD for research and development personnel

Several organisations are engaged in marine fisheries R&D, but for various reasons, data exchange and use for a common national cause is not effective enough. The National Marine Living Resource Data Centre (NMLRDC) functioning in the CMFRI is consolidating data of the last more than five decades on various aspects of marine fisheries from various central and state agencies. The quality of this database needs to be constantly upgraded and the results of analyses brought out regularly. It is highly commendable that CMFRI has taken the effort to bring out comprehensive Census Report of marine fisheries sector, which is now in the concluding stage of compilation. The complexities of tropical marine fish stocks and fisheries necessitate specially trained manpower to carry out the various R&D and commercial tasks of the capture fisheries and mariculture. Some fisheries research institutes under the ICAR, fisheries colleges and many academic universities are conducting masters and doctoral programmes in various disciplines of fisheries science including mariculture since the late seventies.

Crisis and disaster management

Though natural disasters and its mitigation is a presumed agenda of development planners in India, it was only recently that it got such an importance especially in the coastal regions, with the havoc showered by tsunami. The tsunami, which hit on December 26, 2004, swept the coasts of South East Asian countries, seriously affecting Indonesia, Sri Lanka and India. The destructive earthquake (8.9 on Richter scale) occurred under the sea off Sumatra Island near Indonesia and the consequent killer waves that emerged in Indian Ocean affected most of the bordering coastal States and Islands of South East Asia. The surge of the ocean along the coastal belt ravaged many villages creating huge casualties, damages, distress and despair for millions of people. Coastal fishing communities living on the edge of the sea have largely borne the brunt of this catastrophe. The livelihoods of these people are at stake as they have lost everything and hence needs to be re-launched from a virtual zero-base. They lack capital resources, assets and capabilities to quickly rebuild their lives. A few minutes of killer waves with this magnitude and the wreckages it made has far reaching implications on the socio-economics and livelihoods of coastal population along the affected regions of India. The ecosystems that supported their livelihood particularly coral reefs, mangroves, coastal fish ponds, inshore fishing regions and landing centres have been substantially affected through the force of the waves and the subsequent run-off of mud, sediments and debris. This has awakened mankind towards the need for generating sustainable alternatives of environmental, ecological, social and economic and communication models to cope up with such oceanic repulsions and natural disasters in the future.

In India, due to tsunami tidal waves, Andaman and Nicobar Islands and coastal States of Tamil Nadu, Kerala and Andhra Pradesh has witnessed loss of life of 15,545

(official toll of dead or missing) as reported during the first week after the tsunami and complete displacement of thousands of people, making them refugees in their own land without having anything of their own. Among the States, Tamil Nadu has accounted for most of the human casualties with the loss of 7814 people and serious socio-economic crisis and catastrophic situation in several villages of Chennai, Cuddalore, Nagapattinam and Kanyakumari districts. Fishing crafts, gears and household belongings were washed off or damaged beyond recovery.

Though tsunami has not came under the purview of the unique disaster management system In India (as it has never been envisaged and earmarked in our map of areas prone to various calamities), the crisis and disaster management mechanism from the highest level to the grassroots level is fully geared up to face the critical situation. Funds and other resources, which had flown from public and private sectors for rebuilding the ravaged coastal sector, had been utilised to create an alternative development paradigm, promoting responsible fishing and aquaculture, aiming at comprehensive and sustainable coastal zone management with maximum equity. However, there are lot of conflicts in redistribution pattern of tsunami relief funds, especially in states like Kerala. The short-run measures of restoration include, provisions for drinking water, temporary shelter, sanitation, health, counselling for remedying depression and fear psychosis, revival of livelihoods, supply and repair of fishing implements and ecological restoration and economic rehabilitation within the framework of CRZ, development and dissemination of knowledge on natural calamities, its mitigation and management.

The long-run measures are the construction of sea walls and dykes, provision of housing sites beyond the coastal zone, community participation for the management of marine bio-sphere, raising artificial coral reefs, planting mangroves and other saline resistant tree species for the location specific development of coastal bio-villages and fishery estates. The super cyclone of Orissa and the present tsunami has raised the awareness level of people regarding the need for alternative disaster management practices. It has been proved that the impact of this tsunami (2004) was very less pronounced in those coastal areas where there were adequate green belts comprising mangroves (Pitchavaram and Muthupet) and casurina trees (in Naluvedhapathi coastal village near Vedaranyam).

Development of infrastructure and marine fisheries information system

Infrastructure development contributes substantially to the growth of marine fishing and growth of its ancillary sectors. The physical infrastructure in fisheries comprises 2244 landing centres (otherwise termed as primary markets) six major fishery harbours and 28 minor harbours. Among these landing centres only a few has centres have the well-developed landing and berthing facilities. This acts as an impediment since a lot of wastage occurs in handling the catches at the landing centres. The fishery infrastructure for handling and processing includes freezing plants, canning plants, ice plants, fishmeal plants, pre-processing centres (peeling sheds) and cold storage. The development of fishery infrastructure is vital for improving the quality of fish sold at domestic and export markets. The number of freezing plants increased from 264 to 372, number of ice-making plants increased from 131 to 148 and that of registered peeling sheds from 83 to 900 during 1977-1996 periods. The increase in cold storage facilities and thrust for preservation and quick transportation of fish improved our distribution and marketing system.

Earlier marine fishing was closely confined to the coastal and adjoining regions. By the mid of 1990s, it has been observed that about 50 per cent of the fish is consumed fresh in and around producing centres, 43 per cent in demand centres located up to a distance of 200 km from the coast and 7 per cent goes to the centres located beyond 200 km in our

internal marketing system (Sathiadhas, et.al., 1997). The reluctance of the consumers towards iced-fish has also changed. The extent of spoilage of fish at landing centres as well as various points of distribution channel has been considerably reduced due to the intensive use of ice, technological improvements in processing, improved transportation facilities, targeted awareness campaign measures by state and central government agencies etc. The marine products of India have attracted many new customers in foreign markets, which ultimately become advantageous for the fishing community. The fisherfolk got better prices for their catches and gained respect and recognition in society as primary producers of raw materials for marine products export industry.

A pre-requisite for planning coastal zone developmental programmes in the capture fisheries sector is the information base on the potentialities of human resource involvement, the magnitude of facilities such as fishing crafts, gears and other infrastructure available and the extent of current resource exploitation.

Comprehensive approach for coastal zone development

Coastal Zone Management Plan (CZMP) of each maritime State has been prepared and approved as per the Coastal Regulation Zone (CRZ) notification 1991 as amended in 1994 and also incorporating the directions given by the Supreme Court Judgement dated 18.04.1996. The CRZ forms only part of the agro-climatic zone of India in the geographical classification. As per the CRZ "the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (in the landward side) upto 500 metres from the High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the HTL as Coastal Regulation Zone". High Tide Line means the land upto which the highest water line reaches during spring tide.

The strict adherence and compliance of CRZ notification will ensure the protection of the degrading environment, depleting genetic diversity and natural beauty. However, the coastal zone management plans prepared by each maritime States failed to spell out the developmental aspects to be taken care of by them. Both public and private investment strategies may be worked out by integrating development aspects with CZMP. Marine fisheries being the sole sector wholly depending on the development of this zone, experts concerned with fisheries research and development should be associated not only in the preparation of the coastal zone development plans, but also in the Coastal Zone Development Authorities at National and State levels.

Conclusion and Recommendations

The strategies or development programmes to face various difficult situations ultimately for the general welfare of multiple stakeholders in fisheries sector should bear a participatory co-management approach. Since the sector thrives significantly on the natural ecosystem is very dynamic and hence policies and strategies requires flexibility. Alterations and evolutions of policies depend upon the developments in the national and international scenario. In terms of production and marketing, uncertainty is comparatively high in marine fisheries production. Hence continuous monitoring of production, supply and demand is a pre-requisite for evolving appropriate policy decisions.

Suitable strategies to overcome the problems in marine fisheries sector need to be developed on the basis of the following broad perspectives. The overcapitalisation of fishing fleets and the consequent issues of regulatory, conservatory and socio economic problems can be solved by formulating adequate mechanisms in the following direction.

- Complement the gradual phasing out of traditionally functioning boats with motorisation on collective basis
- Promotion of "co-operative fishing" instead of "competitive fishing" if advisable for optimum exploitation and introducing regulations
- Specific coastal zone development strategies may be worked out towards the ultimate welfare of the coastal community
- Alternative avocations other than capture fisheries for the fisherfolk, especially in agri-horticulture and livestock management
- Integration of coconut development in the coastal region with fisheries
- Alternative avocations should plan in such a way as to utilise the idle (disguised) labour in capture fisheries

Economic loss due to discards and juvenile fish catch can cause serious environmental threats that could be reduced by implementing the following strategies

- Mesh-size regulations to avoid juvenile catch
- Appropriate utilisation strategies should be developed with respect to discards
- Multi-day fishing operations should be regulated or innovative measures may be adopted to land the catches on frequent intervals
- A collective number of traditionally functioning boats may be engaged as carrier boats to land the fish which would otherwise turned as discards
- Awareness among fisherfolk regarding the consequences of juvenile catches and confiscation measures may be adopted to discourage mechanised boats from such catches

The disturbing trends in fish production pattern of Kerala resulting in the depletion of certain fishery resources warrants the adoption of following strategies

- The present scenario of disturbing production trends is attributed to intensified targeted fishing and this may be regulated
- Quota fixing in terms of number of fishing days according to the catch composition and volume of catch of fishing fleets
- Marine fishes like sharks, sea horses and sponges have immense pharmaceutical value, alike species should be catalogued and patent the pharmaceutically important products development from them under the IPR regime.

The pressure of fishing in the inshore waters is exceeding the limits resulting in overexploitation of the fishing stocks and consequential threat of depletion. The current situation of virtual absence of Deep-sea Fishing Policy is detrimental to the growth of marine fisheries and a clear-cut policy should be evolved.

Issues related to apprehensions that coastal mariculture would adversely affect the environment are leading retarding growth of the mariculture sector. The present shrimp oriented, land-based coastal mariculture requires being reoriented to take maximum advantage from the high production potential of tropical aquaculture farms. The following strategies would serve as milestones in this respect.

- Promotion of enclosure fisheries should be done wherever possible with appropriate legal support.

- Fishery estates and public sea ranching programmes with sufficient legal framework may also be made into practice for sustaining the fishery resources.
- Inshore artificial reefs needs to be established throughout the country as was done in South Korea as an industry in itself and duly integrated with inshore seafarming to promote productivity and production in the artisanal sector.
- Open sea mariculture of mussels, pearl oysters, edible oysters and other candidate species in the calm bays and coastal waters should also be given due importance.

The shift in demand towards value added products mainly in the export markets have opened an excellent opportunity for the seafood sector that requires to be tapped. The following steps will be beneficial in this respect

- Promotion of diversified value added products and accelerates our forex earnings in exports and provides a multiplier effect on employment front especially for weaker sections and womenfolk.
- Continuing support and adequate training to women self help groups engaged in the preparation of value added products and marketing.
- The most viable alternative to maximise our forex earnings from marine shrimp landings is to focus on export of value added ready to eat products.

Quality concern attracts atmost priority in the present day markets. On the basis of real field level observations, the following aspects could be taken care of for the post-harvest quality assurance of marine resources.

- Fish and shellfish should be preserved properly immediately after catch
- Ice should be prepared from good quality good quality water and used in appropriate proportion
- Handling area and containers should be properly disinfected
- Proper drainage should be provided in markets and landing centres
- Fish should be protected from flies, rodents, insects, birds and animals
- Species-wise sorting should be practiced immediately after the catch. Shrimps should be graded, beheaded, peeled and de-veined as soon as possible
- The quality standards like fixing limits for heavy metals and microbial limits etc should be imposed
- The bivalves as far as possible should be depurated before shucking
- Sun drying of fish in sandy beach should be strictly stopped and moreover good quality salt should be used
- Proper and cost-effective preservation facilities should be provided at all retail outlets. Preservation or cold storage units can be established on cooperative basis or by the local bodies extending the facilities by nominal charges

In October 1998, FAO convened a Technical Consultation on the Feasibility of Developing Non-discriminatory Technical Guidelines for Ecolabelling of Products from Marine Capture Fisheries, where a number of principles were identified, which should be observed by ecolabelling schemes. They should:

- Be consistent with Code of Conduct for Responsible Fisheries
- Be voluntary and market-driven

- Be transparent
- Be non-discriminatory, by not creating obstacles to trade and allowing for fair competition
- Establish clear accountability for the promoters of schemes and for the certifying bodies, in conformity with international standards
- Include a reliable auditing and verification process
- Recognise the sovereign rights of states and comply with all relevant laws and regulations
- Ensure equivalence of standards among countries
- Be based on the best scientific evidence
- Be practical, viable and verifiable
- Ensure that labels communicate truthful information
- Provide for clarity

Subsidies that distort trade are not promoted in the WTO regime and consequent measures to reduce the same are highly debated. The pros and cons of its implementation on fisheries sector require to be examined with reference to its far-reaching implications. Hence the following points are highly relevant in this context

- There is increasing pressure from Indian scientist community to club all the subsidies together, instead of being placed in separate boxes. India would not be adversely affected if these were clubbed together, as the aggregate measure of support (AMS) to Indian agriculture is still well below the *de minimus* of 10 per cent.
- AMS were calculated as the sum of product-specific and non-product specific support, as the former is significantly negative in the Indian case.
- If India avails of the input subsidies to the resource poor farmers who are exempt from reduction commitments even now under WTO provisions, the non-product-specific support may come down to less than half of the present condition.
- Anti-dumping and anti-subsidy duties or safeguard measures must be invoked in time. Imports should comply with standards and the TRIPs system needs to be strengthened (Rao, 2004).

Not only the export markets but also the internal marketing system should be supported by appropriate policies reoriented from time to time depending upon the market conditions. Not much thrust have been given on the development of the markets and towards improving marketing efficiency per se. The need of the hour is to develop wider perspective from marketing angle in terms of product, price, promotion and physical distribution with supportive factors such as market research and communication. The following guidelines will be helpful in developing fish marketing system in India

- Policies should follow market rather than markets follow policies. The observation that 85 per cent of catch is channelled to the internal marketing system and the rest exports should be restructured to give balanced importance.
- Cooperative marketing should be strengthened since hardly 5 per cent of the fish in the internal marketing system is marketed by cooperatives and the rest is through private marketing agencies and traders.
- Thrust for value added products
- Support price for commercially important varieties
- Identifying and cataloguing of pharmaceutically important marine products

- Utilisation of idle capacity of processing plans for internal marketing

Conservation of marine fisheries resources to achieve the goal of sustainable production with active participation of the community essentially entails the following points

- It is essential to inculcate awareness on the need to undertake all fisheries-related activities on a responsible manner.
- Since the code is voluntary in nature, it is only through concerned and continuous communication or extension interventions that we can bring about desirable cognitive changes among the varied and multiple resource users in the fisheries sector so that they would follow responsible practices as a moral obligation (Modayil, 2004).

Crisis and disaster management, the assumed priority agenda of the policy makers, were not that relevant to the coastal regions until the occurrence of tsunami of 2004. The disastrous havoc has thrown light into the need for developing a comprehensive strategy for the coastal area to face disasters in future. That it requires wide ranging strategies in terms of preventive, preparedness, relief and rehabilitation etc., some points which require to be mentioned are

- Adequate extension programmes utilizing the network of rural information centres through private-public partnership would equip the people to face such type of unforeseen natural calamities in the future.
- A comprehensive analysis of all the possible impacts of such a great disaster on different spheres of life (social, economical, occupational, environmental and related) needs to be done to formulate suitable disaster management preparedness programmes.

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.

- Periodic dissemination of information on prevailing prices of commercially important varieties of fish in different markets will be much useful to fishermen, traders and consumers.
- Adequate fishery infrastructure like freezing/ice plants, cold storage units may be established in the marketing centres which will help to store excess catch during the glut and sell it for a good price later.

Adherence and compliance of CRZ notification will ensure the protection of the degrading environment and depleting bio diversity, which falls under the auspicious of the concerned maritime states. This needs to be implemented with high priority essentially incorporating the following suggestions

- In addition to motorisation, withdrawal of substantial labour force from the inshore fisheries is highly advisable for optimising production without affecting sustainable development
- Formulate suitable programmes for their redeployment and rehabilitation under the overall framework of the integrated coastal zone management within the coastal agro ecosystem
- Delineation of environmentally rich regions and preserve them through declaration of protected areas, establishment of marine parks, biosphere reserves and national sanctuaries.

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Trade Related Intellectual Property Rights in Fisheries: The Indian Context

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Introduction

At the end of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) in 1994, the Trade Related Intellectual Property Rights (TRIPS) agreement was implemented to regulate standards of Intellectual Property (IP) regulations in WTO member countries. The Uruguay Round introduced IP rights into the multilateral trading system for the first time through a set of comprehensive disciplines. Being a member of the WTO and a signatory to the TRIPS agreement, it is compulsory for India to formulate its IP regulations to comply with the TRIPS agreement. The TRIPS Agreement is subject to WTO dispute settlement mechanism, which is contained in the Dispute Settlement Understanding ("Understanding on Rules and Procedures Governing the Settlement of Disputes", TRIPS) (Grain, 1998).

TRIPS constituted Annexure 1C of the Marrakesh Agreement (Marrakesh Agreement was the final act of the Uruguay Round of GATT negotiations concluded in Marrakesh, Morocco and was effective since 1st January 1995), which established the WTO. TRIPS is intended to maximize the contribution of IP systems to economic growth through accelerating trade and investment.

TRIPS agreement covers five broad issues:

- How basic principles of the trading system and other international IP agreements should be applied to improve trade?
- How to give adequate protection to IP rights?
- How countries should enforce those rights adequately in their own territories?
- How to settle disputes on IP between members of the WTO?
- Special transitional arrangements during the period when the new system is being introduced.

TRIPS and Intellectual Property Rights (IPRs) with Special Reference to Fisheries

The main objective of the TRIPS agreement is explained under Article 7 as "……..to provide protection and enforcement of IP rights, which should contribute to the promotion of technological innovation and to the transfer and dissemination of technology to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare and a balance of rights and obligations". According to Article 65, WTO members (including India) must ensure their laws meet the

minimum standards laid down in the TRIPS agreement. IP Rights (IPRs) at a multilateral level have their genesis in the Paris Convention for the Protection of Industrial Property in 1883, which protected industrial property i.e. Patents and trademarks. Through the TRIPS, the WTO makes it mandatory for all its member countries to follow basic minimum standards of IPR provided for under TRIPS and bring about a degree of harmonization of domestic laws in this field. The TRIPS agreement represents the existing global state of IPR standards and legally binds all its member countries. It is the only agreement amongst several multilateral agreements under WTO which have significant impacts on global trade (Maskus, 2000). TRIPS has a direct impact on agricultural and fisheries trade and development, particularly on biotechnology aspects (WIPO, 2009), and its impact on trade is comparatively more important for developing countries as fisheries is a significant stakeholder in India's GDP. The key element of the TRIPS agreement for the agricultural and fisheries sector is the requirement for WTO members to make patents available for any inventions in the sector. The most important article in the agreement when considering the agricultural (fisheries subject is included under agriculture) sector is Article 27, which reads as follows:

Article 27: Patentable Subject Matter

1) Patents shall be available for any inventions, whether products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application. Patents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced.
2) Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect …., including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law.
3) Members may also exclude from patentability:
    - Diagnostic, therapeutic and surgical methods for the treatment of humans or animals;
    - Plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof.

According to the TRIPS agreement India had to provide legal protection to farmers traditional knowledge (including that of fisheries) via patents or by an effective *sui generis* system or by both, by 2006. However, the agreement provides for each country to determine and adopt a suitable procedure to implement the provisions of the agreement within its legal system and practices. Developed countries like US and UK have adopted well-built IP regimes using strong patent systems in fisheries and agriculture sector, in general. The main reason for developed countries to choose patents for protection is due to their technological capabilities and the immense financial benefits that a patent system is expected to generate (Holger, 2001). Whereas, developing countries like India has weak regimes due to lack of financial and technical support. Most of the developing countries have faced several difficulties in protecting inventions related to fisheries which mainly attribute to lack of strong rules and regulations. Biological resources including that from fisheries sector have not been registered or documented in most developing countries and with the globalization process, bio-diversity and the traditional knowledge, skills and technologies

possessed by local farmers in developing these varieties are at stake. Global Multi-National Companies (MNCs) have engaged in bio-piracy of vital genetic resources and associated traditional knowledge found in developing countries to get patent rights for their own countries. In this process, the developing countries are continuously denied the benefits, which legitimately belong to them. The industrial property systems were set up centuries ago for inanimate objects and that too in formal systems of innovation. The time has come to revisit them. The emerging challenge is to look at the systems that will deal with animate objects (such as fishes).

ICAR Policies with Respect to TRIPS and Fisheries

With respect to the biological material (e.g., fish) used in various invention/s specific attention need to be given to the source or geographical origin of biological material used in the invention and the same need to be disclosed in the patent application will be mentioned in the specification. The reference samples deposited at the Genetic Resources Bureaus of ICAR will be helpful for internal reference (ICAR, 2006). However, in case of any litigation it is likely that the evidence in the form of such duly characterized and documented referral sample can be held valid at the discretion of a Court of Law. As referred in the ICAR Guidelines for Intellectual Property Management and Technology Transfer/Commercialization, all ICAR institutions must take individual initiative of depositing a referral sample at the respective National Bureaus (e.g., fish genetic resources) before filing a patent for any invention based on biological material. Traditional knowledge in fisheries also comprises an important share of IP as outlined under the TRIPS Agreement. Accordingly, ICAR shall also disclose the traditional knowledge related to the innovations made in its set up in all its patent/ IPR applications to the best of its knowledge and information.

In this context it requires to be mentioned that isolation of indigenous genes from fish or marine organisms and their application for specific target traits will have special significance and prospects. Therefore, ICAR genetic resources bureau for fish will make efforts to register document and index these knowledge items in public domain. This is to discourage any patenting of the public domain traditional knowledge.

Improved breeds/ strains of fish cannot be protected in India as patents or variety protection. However, these resources constitute valuable assets in ICAR and India. The ICAR has a system in place for plant germplasm registration and documentation at its National Bureau of Plant Genetic Resources (NBPGR) for long. However for elite fish genetic material in the public domain, there is no IPR enabling provision under the existing Indian laws nor is there any provision for the registration and documentation of the breeds and strains of fish developed by ICAR. To check their misuse or exploitation, "ICAR will develop a system of their registration and documentation, at the respective National Bureaus of Animal and Fish Genetic Resources for quickly placing them through disclosure in the public domain thereby forestalling any unforeseen patenting in other countries ….and to establish a system of their registration and documentation. It will suitably extend the existing system to register and document the elite and new breeds/strains of fish developed in ICAR, at the National Bureau of Fish Genetic Resources (NBFGR)" (ICAR, 2006).

Need for Registration of Aquatic Diversity

As per Section 3j of Indian Patents Act, no living organism as a whole obtained from nature can be patented. As per Indian Patent Act, Section 3(j), plants & animals in whole or any part thereof other than GMO and essentially biological processes for production or propagation of plants and animals are not patentable in India. However, IPA allows for

patenting whole organisms like transgenics, with human intervention. There is no national mechanism for documenting information about fish germplasm exists to bring it in public domain. NBFGR has been identified as a nodal institute to develop a system to register and document valuable fish genetic resources by ICAR. The registration system will bring elite germplasm into public domain to promote its use in research. To pre-empt any unforeseen grant of patents on fish, including the improved breeds/strains, there is a need to establish a system of their registration and documentation to suitably register and document the elite and new breeds/strains of fish developed in ICAR at National Bureau of Fish Genetic Resources (NBFGR).

Intellectual Property Rights in Fisheries Sector

Patent statistics revealed that has not been compared with other countries, it is seen that the patenting activity in India has been insignificant as compared to USA, Europe and Japan. The adoption insignificant number of patent protection in India and licensing of patented technologies is also reflected in the index of patent rights, which is 1.48 in 1990 (Ginarte and Walter, 1997; WIPO, 2011). Japan has the largest share of foreign patent grants by the USPTO (40 per cent, as recorded up to early 2010). The EU is second, with a 27 per cent share. The Asia-8 group was in third place with 20 per cent; its share nearly doubled from 2000 to 2010, largely because of rapid growth by South Korea and Taiwan. Chinese patenting activities in the U.S. remained insubstantial, as did those of Brazil, Russia, and India, in contrast to much higher activity of Chinese and other national patent offices. However, as compared to China the patents granted for favour of India remained insignificant (93706 patents by China as compared to 18230 by India during the year 2008).

In recent times among the Indian organizations, CSIR along with other private industries are the major patent applicants in India and US, the rest of patent applicants are foreign individuals. There is also lack in continuity in patenting activity for the last four decades from 1920-1950 in the field of aquaculture. However, in recent years (after 1996) there are incremental trend in patent filing in ICAR institutes including fisheries. Among fisheries, a maximum of 55 per cent of patents have been granted in the field of processing technology followed by 24.5 per cent in fishing technology and about 21 per cent in aquaculture. Among fish processing technology, about 43 per cent of the patents granted to the foreign nationals, and about 15 per cent to CSIR in the subject area of extraction and isolation of polysaccharides and protein from marine organisms, fish oil originated fat liquors, alkaloid from sponge etc. In post WTO era (1996-2000), the average number of patents granted in fisheries discipline is six in a year. Increasing awareness for patent search engines/sites, access to patent information, and the comparatively easier administrative procedures in the amended patent laws are among various reasons for increased patenting activity. In aquaculture too, the majority of patents (45 per cent) granted in India are to the foreign nationals (Ninan et al., 2005). Since the innovations in processing technology can be varied easily in the process patent application area, and are easily imitable towards various directions, there appeared to be greater trend to incline for processing technology in fisheries subject. Importance of processing technologies with respect to export and trade in and outside India also are the reasons that hold the edge towards patent application in India as compared to other subjects in fisheries like aquaculture, machinery or fishing technology. This is also an example that demonstrates the fact that process patents provides stimulus for dynamic competition wherein the same product is manufactured by different processes. The patents on method for obtaining carrageenan, chitin, phycocyanin, and products from spirulina, polyunsaturated fatty acids, bioactive compounds, alkaloids and other bioprocessed products.

In recent times seaweeds and marine plants have been identified as valuable resources to isolate bioactive molecules for use against different diseases. However, this area is vastly unexploited and after implementation of the product patent regime in 2005, research and patenting activity in this sector could rise. CMFRI has taken the lead to develop a nutraceutical supplement with concentrated anti-inflammatory principles as Cadalmin™ Green Algal extract from seaweeds for use against joint pain and arthritis (Indian Patent Appl. No. 2064/CHE/2010). Around 46 per cent of the total patents granted in fisheries sector during the post WTO era (1996-2002) are in processing technology. A total of 27.93 per cent of patents applications related to water treatment, waste water treatment, power and electricity generation from sea waves, river bank protection, manganese nodules, purification of microbes in water, etc., whereas 14 per cent of patent applications relate to aquaculture, and about 12 per cent patent applications relate to fishing technology.

Protection of Technologies in Fisheries with Special Glimpse of the Technologies Developed By Marine Fisheries in India

Technologies in the fisheries can receive protection by patents, trademarks, geographic indications, and copyright, and design. These technologies receive protection by one or a combination of different IPRs depending upon the nature of technology (Ravishankar and Archak, 2000). Given the vast and unexplored potential of utilization of aquatic resources, the increasing trend in biotechnological patents in the developed countries, patenting of aquatic genetic resources will have an increasing trend in times to come. The use of aquatic resources has a significant potential in pharmaceuticals, neutraceuticals, high value compounds/chemicals, cosmetics and food.

For example, technologies have been developed in marine fisheries in India for land-based culture of pearls, fish strains, packages of improved marine finfish and shellfish husbandry practices, natural resource management technologies, improved tools including cage culture technology for open sea fish farming, technologies for making neutraceuticals and value added products, computer software and data sets, and several other processes and products related to fisheries sector, some of which have been safeguarded by patents. Central Marine Fisheries Research Institute is the pioneering ICAR institute to conduct marine fisheries research in India, and endowed with the potential to benefit the fish farmers and related entrepreneurs with her technologies. CMFRI pioneered in shaping a number of IP protected technologies, which are of direct or indirect benefits to the society and mankind. Design, development and propagation of open sea cage device for cultivating marine fishes along the coastline of India (Indian Patent Appl. No. 31/CHE/2010), cutting edge mariculture technologies of food fishes such as cobia (*Rachycentron canadum*), silver pompano (*Trachinotus blochii*) and *Etroplus* sp are some of the success stories of marine fisheries and CMFRI. The mariculture in open sea cage device will expand a new mariculture space in future. The breakthrough of cobia and pompano breeding is considered as a milestone towards the development of foodfish mariculture in the country. CMFRI achieved the rare feat of joining the elite group of countries (US and Australia) engaged in satellite tracking of yellowfin tuna (*Thunnus albacares*) with pop up satellite tagging of this species in oceanic waters. CMFRI showed the way of land-based culturing of pearl oyster in marine body (Indian Patent Appl. No. 1543/CHE/2009), open sea green mussel and oyster farming, hatchery technology for production of ornamental fish (Indian Patent Appl. No. 3455/DEL/05), edible clams, sea horse, mass scale spat production of green mussel, artemia selective breeding to impart high value traits for use in mariculture (Indian Patent Appl. No. 2063/CHE/2010), biotechnological interventions to control fish diseases and maintain fish health, probiotics, bioprospecting beneficial microorganisms for aquaculture grade antiboiotic substitute, biocatalysts from beneficial bacterial flora (Indian Patent Appl. No. 203/CHE/2008), PCR kits to manage various fish diseases, gene mining technologies for

various important traits, phytoplankton culture and algal biotechnology, production process for sea cucumber *Holothuria scabra* and *Holothuria spinifera* seeds or fingerlings, resource management of the Indian sacred chank, Xancus *pyrum* (=*Turbinella pyrum*) by breeding, nursery rearing and sea ranching, propagation of soft coral *Sinularia kavarattiensis,* fish aggregating devices (FAD), capture based aquaculture of mullets and red snapper, lobster farming in floating sea cages, mud spiny lobsters (*Panulirus polyphagus* fattening in sea cages), image pearl production, cost effective and rapid duplex PCR kit for early detection of white spot syndrome virus of shrimp, Cadalmin™ Varna (Indian Patent Appl. No. 32/CHE/2010) and Cadalmin™ Silo fish feed, which are of direct use of the fish farming communities. Marine organisms too have various potential applications in the area of human health. This has more to do with the relative infancy of marine bioprospecting. In the process of harnessing high value bioactive molecules from marine organisms, CMFRI could able to successfully develop a number of products for use as nutraceuticals for human health. A patent protected product Cadalmin™ Green Mussel extract (Cadalmin™ GMe) containing anti-inflammatory principles from *Perna viridis* to combat joint pain, arthritis/inflammatory diseases developed by CMFRI as an effective green alternative to the synthetic drugs available in the market (Indian Patent Appl. No. 2065-2066/CHE/2010). Cadalmin™ Green Algal extract (Cadalmin™ GAe) is another addition to the pipeline of the neutraceuticals developed by CMFRI (Indian Patent Appl. No. 2064/CHE/2010). Cadalmin™ GAe contains 100 per cent natural and a vegetarian marine bioactive anti-inflammatory ingredient extracted from a blend of marine macro algae with an ecofriendly "green" technology, and is a natural remedy to chronic joint pain and arthritis. The institute has taken a leading role on frontier areas of research such as stock assessment of marine fisheries, mariculture, biotechnology, marine bioprospecting, development of neutraceuticals and valuable bioactive molecules from sea, bioinformatics, remote sensing, and climate change. Most importantly, CMFRI is mandated with natural resource management technologies. Several techniques, protocols, and technologies developed by CMFRI cannot be transferred to the end users. However, these are the vital links to ecosystem, and can be used for human welfare. Some of these natural resource management technologies developed in the area of marine fisheries are trawl ban, fish watch – spot information system of Indian marine fisheries, national marine fisheries data centre, database on socio- economic evaluation and technology, extension modules, multi-stage stratified random sampling for estimation of marine fish landings in the country and information system, mangrove restoration, conservation of shark and marine mammals, m-KRISHI® fisheries mobile service, documentation of seaweeds, seagrasses, hard corals and shallow water sponges of Indian coastline, among many.

Bioactive Compounds from Marine Organisms: A Potential Source of IP in Marine Sector

Ocean is a potential source of bioactive compounds, which does not have a significant history of use in traditional medicine as in the case of terrestrial plants (Kamboj, 1999). Previously, the research was focused mainly on terrestrial plants because of their easier availability. The isolation of biologically unique molecules from marine organisms that are not found in terrestrial sources leads to a remarkable progress in marine bio prospecting. The boom of marine bio-prospecting began in recent years and 18000 plus natural compounds from marine organisms have been isolated as compared to 155000 terrestrial products (Blunt, 2004; Mayer et al., 2007). Between 1969 and 1995, 63 marine substances were patented as antitumor agents, accounting for half the marine molecules patented for pharmaceutical purposes (Mart´ınezPrat, 2002). There are a significant (and growing) number of marine-derived compounds with pharmaceutical potential in the pipeline. The accompanying table (modified from one included in Kijjoa and Sawangong 2004) presents the marine-derived potential therapeutic compounds used for drug

discovery efforts. Many of these are still undergoing preclinical evaluation, but several others are currently being administered to patients as part of clinical trials.

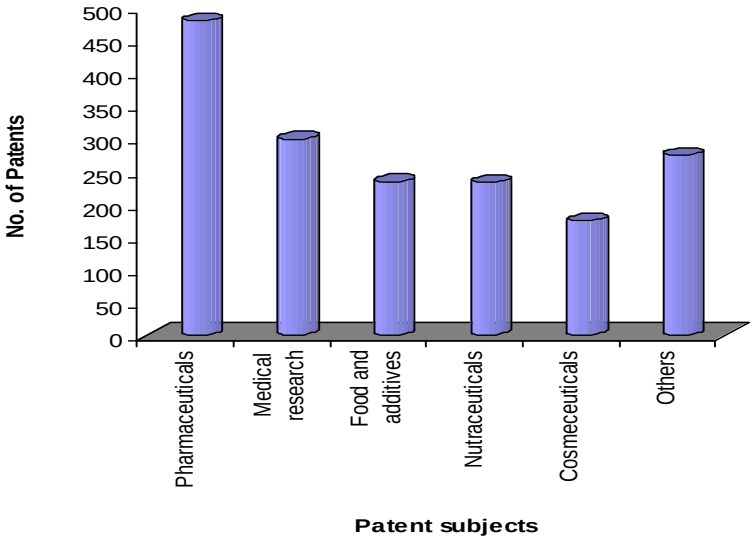

Figure 14.1 Distribution between patent subjects and its number

CMFRI is one of the pioneering institutes to isolate and characterize bioactive compounds with antioxidant, antibacterial, and anti-inflammatory properties from marine flora and fauna, some of them have been protected by patents (Appl. No. 2064/CHE/2010, 2065/CHE/2010, 2066/CHE/2010). A sampling of some of the most exciting marine based IP protected drug discoveries currently undergoing clinical evaluation are briefly summarized below.

Table 14.1 Marine based IP protected drug discoveries

Diseases	Biomolecules/bioactive compo	Marine source orga
HIV	Cyclodidemniserinol trisulfate	Tunicate
	Lamellarin α-20-sulfate	Tunicate
Pain	Conotoxins	Gastropods
Cancer	Bryostatin	Bryozoan
	Didemnin-B	Tunicate
	Dolastatin 10	Sea hare
	Halichondrin B	Sponge
	Ecteinascidin 743	Tunicate
	Kahalaide F	Gastropod
	Aplidine	Tunicate
Asthma	Contignasterol	Sponge

(Modified after Kijjoa and Sawangwong 2004)

IP in Marine Sector

A novel process to produce a product or by-product out of marine resource, or product itself is patentable. Also the pharmaceutical or other properties of bioactive compound(s) that is (are) unknown from marine resource is patentable. Marine organisms have various

biotechnological applications in the area of health, environment and mariculture. As compared to terrestrial ecosystem very meager is known and explored from marine environment probably because of the difficulty in reaching the depths.

The areas of patenting in fisheries sector includes Technologies and methodologies in fishing processing, and aquaculture/mariculture (with intervention) , Pharmaceuticals ,Food and feed, Neutraceuticals, Cosmetics , and Bioactive compounds .The percentage contribution of patented technologies under the three major divisions of fisheries sector include 21 per cent on aquaculture,25 per cent on fishing, and 54 per cent on fish processing (Ninan et al, 2005). An increasing trend of filing patents after the Indian Patent Act, 1970, and further increase in post WTO era is also noteworthy.

Fish Genetic Resources: Consultative Group on International Agricultural Research (CGIAR) Policy Framework

Cultures of the marine coastal populations are directly linked to marine biodiversity. Many of them have developed management systems that, while ensuring the conservation of marine biodiversity, they used several traditional practices using marine resources. For example, coastal peoples of northwestern America use marine algae for wound healing and health care purposes. Traditional healing practices in the Maldives rely both on terrestrial plant species and many marine species of fish, coral and seaweed. In Brazil, traditional zootherapy knowledge of the artisanal fishing community is well known for using marine organisms for use as folk medicine (Medeiros Costa-Neto, 2000). Marine diversity is increasingly feeding a myriad of industries. On the one hand, many industries are turning to the sea, expecting that its huge genetic, biochemical and physiologic diversity will contain useful substances.

The expectations on long-term productivity increases derived from the use of fish genetic resources have also resulted in the extension of property rights over them—in a process that parallels that of plant genetic resources for agriculture. As a member of the CGIAR, ICLARM has endorsed the CGIAR's IPR policy. The CGIAR is promoting the transfer of intensified production systems for the benefit of the poor. However, its IPR policy is highly controversial. On the one hand, it is designed to prevent others from obtaining IPRs on genetic resources as collected and provided by gene banks. On the other hand, it allows for the "defensive patenting" of in-house developed technologies and products. No matter whether this "defensive patenting" intends to ensure that the CGIAR inventions will not be slightly modified and patented by somebody else, or seeks providing the group with bargaining chips to negotiate the transfer of technologies from the private sector, it legitimates the patenting of genetic resources. The trend towards the patenting of fish genetic resources, and even the patenting of new breeds of fish, is accelerating as the aquaculture industry applies biotechnology shortcuts—including hybridization, sex manipulation, polyploidy and genetic engineering—which are more amenable to patenting than selective breeding (Correa, 1998).

Summary of Key Messages

The coastline of about 8118 km of Peninsular India with about 20 lakh square km of exclusive economic zone for fishing around coastline (Ayyappan et al., 2011). High priority is being offered to fisheries development with the support for production, marketing, canning the fishes as well as offering suitable training for fishery industry. The fish production has increased compared to other agricultural products (1.1 per cent of the total GDP and 5.3 per cent of the agricultural GDP in India). During 2010-11, the production of marine fishes was estimated to be about 3.07 million tons as compared to a meager 0.534

million tons during 1950-51. Marine fishery registered an annual growth rate of 3.2 per cent with a total fish production of about 3.07 million tons during 2010-11. The total quantities marine fish and products exported during 2010-11 was recorded to be 813091 tons as compared to 678436 tons in the previous year (2009-10). Marine fish has retained its position as the principal export item in quantity terms and the second largest export item in value terms, accounted for a share of about 38.42 per cent in quantity and 20.42 per cent in US$ earnings. Indian coastline and EEZ is gifted with an enormous resources of valuables hidden into the depths of sea, and can be explored to develop products with valuable patent protected nutraceutical, pharmaceutical and biomedical products for human health and well being. In doing so, our country can be the leader in this area if we efficiently harness the valuables for marine ecosystem and deliver efficient technologies from the sea, and to avoid other countries to intrude into our rich resources that happened earlier with turmeric, neem, and basmati rice. An inventor can be deprived of his rightful share of recognition for his invention if malicious persons get hold of his product and promote it as their own. IP system comes to the rescue of the inventor in this situation. This will provide the true inventors with the due recognition to the ownership of an inventor over his/her innovative idea. The ultimate goals of any intellectual property system are safeguarding the rights of an inventor in his invention/ intellectual richness while benefiting the end users and society as a whole.

The IP system operates, as TRIPS agreement states, towards securing its objectives as follows: "…..protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations." This will encourage scientific research, new technology and industrial progress. The patent protection system must be worked out towards the benefit all stakeholders- patentee, society, and the nation.

Patents therefore play an important role as far as the commercial aspects of the products are concerned. The purpose of an invention is to protect and encourage fair competition in the field of technology so as to transform inventions or creations into real and productive forces at the earliest. A nation's market economy is dependant on the successful working of its patent system (Industrial Gases v Kamsup Industrial Gases PTC (Supp.) (2) 358. 368). The Patent Act contains general principles applicable to the working of all patented inventions. It is provided that "…in exercising powers concerning grant of compulsory licences, regard should *inter alia* be had to encourage innovations and to secure that inventions are worked in India on a commercial scale, and to the fullest extent reasonably practicable without undue delay, but to see that patent rights contribute to technological innovation, and to transfer and to disseminate technology for the mutual advantage of producers and users of technological knowledge in a manner conducive to social and economic welfare and to ensure that the benefit of the patented invention is available at a reasonably affordable prices to the public and for grant of compulsory licences in respect of patents for the reasonable requirements of the public…..". It is therefore, obligatory for the patent holder/s or assignee/s to work out the patented invention towards commercialization for ensuring economic and social growth by providing an impetus to the advancement of science and technology towards the benefit of society and mankind.

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15

Quality Certifications Relevant to Seafood Trade

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The fisheries trade is very much linked with various types of certifications to meet different legal, market and customer requirements. This paper contains basic information on relevant certifications in the seafood trade with the broad context of quality, which essentially include environment and safety also.

I. Hazard Analysis and Critical Control Point (HACCP) System

1. Name of the standard : Hazard Analysis & Critical Control Points (HACCP)

2. Who created it ? In the early 1960's, a collaborated effort between the Pillsbury Company, NASA, and the U.S. Army Laboratories began with the objective to provide safe food for space expeditions. Using the traditional end product testing method, it was soon realized that almost all of the food manufactured was being used on testing and very little was left for actual use. It was realized that a new approach was needed.
3. What is it ? HACCP is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product. This generally comprise of 3 parts such as
   I) Good Manufacturing Practices
   II) Sanitation Standards Operating Procedures
   III) HACCP principles : there are 7 principles
   a. Principle 1: Conduct a hazard analysis. – Plans determine the food safety hazards and identify the preventive measures the plan can apply to control these hazards. A food safety hazard is any biological, chemical, or physical property that may cause a food to be unsafe for human consumption.
   b. Principle 2: Identify critical control points. – A critical control point (CCP) is a point, step, or procedure in a food manufacturing process at which control can be applied and, as a result, a food safety hazard can be prevented, eliminated, or reduced to an acceptable level.
   c. Principle 3: Establish critical limits for each critical control point. – A critical limit is the maximum or minimum value to which a physical, biological, or chemical hazard must be controlled at a critical control point to prevent, eliminate, or reduce to an acceptable level.
   d. Principle 4: Establish critical control point monitoring requirements. – Monitoring activities are necessary to ensure that the process is under control

at each critical control point. In the United States, the FSIS is requiring that each monitoring procedure and its frequency be listed in the HACCP plan.

e. Principle 5: Establish corrective actions. – These are actions to be taken when monitoring indicates a deviation from an established critical limit. The final rule requires a plant's HACCP plan to identify the corrective actions to be taken if a critical limit is not met. Corrective actions are intended to ensure that no product injurious to health or otherwise adulterated as a result of the deviation enters commerce.
f. Principle 6: Establish procedures for ensuring the HACCP system is working as intended. – Validation ensures that the plants do what they were designed to do; that is, they are successful in ensuring the production of a safe product. Plants will be required to validate their own HACCP plans. FSIS will not approve HACCP plans in advance, but will review them for conformance with the final rule.
g. Verification ensures the HACCP plan is adequate, that is, working as intended. Verification procedures may include such activities as review of HACCP plans, CCP records, critical limits and microbial sampling and analysis. FSIS is requiring that the HACCP plan include verification tasks to be performed by plant personnel. Verification tasks would also be performed by FSIS inspectors. Both FSIS and industry will undertake microbial testing as one of several verification activities. Verification also includes 'validation' – the process of finding evidence for the accuracy of the HACCP system (e.g. scientific evidence for critical limitations).
h. Principle 7: Establish record keeping procedures. – The HACCP regulation requires that all plants maintain certain documents, including its hazard analysis and written HACCP plan, and records documenting the monitoring of critical control points, critical limits, verification activities, and the handling of processing deviations.

4. What are the benefits ?

a. focuses on identifying and preventing hazards from contaminating food
b. is based on sound science
c. permits more efficient and effective government oversight, primarily because the recordkeeping allows investigators to see how well a firm is complying with food safety laws over a period rather than how well it is doing on any given day
d. places responsibility for ensuring food safety appropriately on the food manufacturer or distributor
e. helps food companies compete more effectively in the world market
f. reduces barriers to international trade.

II. ISO 9001:2008

1. Name of the standard : ISO 9001:2008

2. Who created it **?** ISO (from Greek 'isos' means 'equal') officially began in 1947

ISO (International Organization for Standardization) is the world's largest developer of voluntary International Standards. International Standards give state of the art specifications for products, services and good practice, helping to make industry more efficient and effective. Developed through global consensus, they help to break down barriers to international trade.

3. What is it ? ISO 9001 is by far the world's most established quality framework, currently being used by 1,064,000 organizations in 178 countries worldwide and sets the standard not only for quality management systems, but management systems in general. ISO 9001 is one of a series of quality management system standards. It can help bring out the best in the organization by enabling you to understand your processes for delivering your products/services to your customers.

4. What are the benefits? The benefits include the following :

    a. Strong customer focus (customer satisfaction)
    b. The motivation and implication of top management
    c. Staff consideration and motivation
    d. The Process approach
    e. Continual improvement.

    Using ISO 9001:2008 helps ensure that customers get consistent, good quality products and services, which in turn brings many business benefits.

III. ISO 22000: 2005

1. Name of the standard : ISO 22000:2005

2. What is it ? ISO 22000:2005 specifies requirements for a food safety management system where an organization in the food chain needs to demonstrate its ability to control food safety hazards in order to ensure that food is safe at the time of human consumption. It is almost an integration of ISO 9001 and HACCP system. It includes interactive communication, system management, prerequisite programs and HACCP principles. It is applicable to all organizations, regardless of size, which are involved in any aspect of the food chain and want to implement systems that consistently provide safe products. The means of meeting any requirements of ISO 22000:2005 can be accomplished through the use of internal and/or external resources.

3. Who created it? (Already explained in ISO 9001)

4. What are the benefits? ISO 22000:2005 specifies requirements to enable an organization

a. to plan, implement, operate, maintain and update a food safety management system aimed at providing products that, according to their intended use, are safe for the consumer,
b. to demonstrate compliance with applicable statutory and regulatory food safety requirements,
c. to evaluate and assess customer requirements and demonstrate conformity with those mutually agreed customer requirements that relate to food safety, in order to enhance customer satisfaction
d. to effectively communicate food safety issues to their suppliers, customers and relevant interested parties in the food chain,
e. to ensure that the organization conforms to its stated food safety policy,
f. to demonstrate such conformity to relevant interested parties, and
g. to seek certification or registration of its food safety management system by an external organization, or make a self-assessment or self-declaration of conformity to ISO 22000:2005.

IV. ISO 14000: 2004

1. Name of the standard : ISO 14001:2004

2. Who created it ? ISO (Already explained in ISO 9001:2008)

3. What is it ? ISO 14001:2004 sets out the criteria for an environmental management system and can be certified to. It maps out a framework that a company or organization can follow to set up an effective environmental management system. It can be used by any organization regardless of its activity or sector. Using ISO 14001:2004 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved.

4. What are the benefits ? The benefits of using ISO 14001:2004 can include:
    a. Environmental protection
    b. Reduced cost of waste management
    c. Savings in consumption of energy and materials
    d. Lower distribution costs
    e. Improved corporate image among regulators, customers and the public

V. ISO 26000

1. Name of the standard : ISO 26000 – Social Responsibility It is also called ISO SR.

2. What is it ? Business and organizations do not operate in a vacuum. Their relationship to the society and environment in which they operate is a critical factor in their ability to continue to operate effectively. It is also increasingly being used as a measure of their overall performance. ISO 26000 is an international standard launched by International_Organization_for_Standardization, has launched providing guidelines for social responsibility (SR) . ISO 26000 provides guidance on how businesses and organizations can operate in a socially responsible way. This means acting in an ethical and transparent way that contributes to the health and welfare of society.

3. Who created it ? (ISO – already explained about ISO)

4. What are the benefits ? The perception and reality of an organization's performance on social responsibility can influence, among other things:
    a. Competitive advantage
    b. Reputation
    c. Ability to attract and retain workers or members, customers, clients or users
    d. Maintenance of employees' morale, commitment and productivity
    e. View of investors, owners, donors, sponsors and the financial community
    f. Relationship with companies, governments, the media, suppliers, peers, customers and the community in which it operates.

VI. British Retail Consortium (BRC) Global Standard

1. Name of the standard : British Retail Consortium (BRC) Global Standards

2. What is it ? The BRC Global Standards are a leading global safety and quality certification programme, used throughout the world by over 17,000 certificated suppliers in 90 countries through a network of over 80 accredited and BRC recognised Certification Bodies. The BRC Global Standards are widely used by suppliers and global retailers. The standards provide the following
    a. Standardization of quality criteria
    b. Standardization of safety criteria
    c. Standardization of operational criteria
    d. Manufacturers' fulfillment of legal obligations
    e. They also provide protection to the consumer

3. Who created it ? In 1998 the British Retail Consortium (BRC), responding to industry needs, developed and introduced the BRC Food Technical Standard assisting retailers and brand owners to produce food products of consistent safety and quality and comply with the requirements of the enforcement authorities.

    Following the success and widespread acceptance of the BRC Food Technical Standard, the BRC published the first issue of the Packaging Standard in 2002, followed by Consumer Products Standard in August 2003, and finally by the BRC Global Standard - Storage and Distribution in August 2006 . In 2009, the BRC partnered with the Retail Industry Leaders Association (RILA) to develop the Global Standard for Consumer Products North America edition. Each of these Standards is regularly reviewed revised and updated at least every 3 years after extensive consultation with a wide range of stakeholders.

4. What are the benefits ?

a. CONFIDENCE - Developed by retailers and driven by retailers, BRC Global Standards are a market leading global brand that helps build confidence in the food safety industry.

b. CREDIBILITY - Now celebrating its tenth anniversary, the BRC Global Standard for Food Safety was the first Standard in the world to be approved by the Global Food Safety Initiative (GSFI) benchmarking committee.

c. COLLABORATION AND CONTINUOUS IMPROVEMENT - Expert International Technical Committees are fully engaged to ensure the ongoing development of the Standards through a process of collaboration and continuous improvement. The BRC provides a web-based, fully interactive database of information about BRC certificated suppliers giving immediate access to audit reports, audit data, management reporting and notification of remedial actions. The Global Standards Directory puts the BRC right at the heart of effective supply chain management.

d. CONSISTENCY - A global training infrastructure ensures that suppliers are well informed about how to implement the Standard, prepare for their audit and achieve certification. The BRC Food Standard is currently available in ten languages with additional translations being developed to facilitate understanding and consistency throughout the world.

e. COMPETENCE - The BRC's Compliance Team is developing robust performance monitoring assessment tools to help ensure that Certification Bodies carry out BRC audits to the highest possible standard. An established and transparent complaints procedure helps ensure that all customer referrals are investigated and vigorously followed up. Rigorous requirements around the competence, qualifications and experience of auditors help ensure that audit standards are stringently maintained.

f. COST EFFECTIVE - The BRC's straight forward certification process ensures that there are no hidden costs or added costly hurdles for sites wanting certification. For sites that are properly prepared and confident in their safety management systems the only cost is that of the audit.

VII. Marine Stewardship Council (MSC) certification

1. Name of the standard : MSC (Marine Stewardship Council) Certification
2. What is it ? MSC has two certification programs
    a. MSC environmental standard for sustainable fishing
    b. MSC chain of custody standard for seafood traceability
3. Who created it ? The MSC is an international non-profit organization committed to the values of independence, transparency, impartiality and stakeholder participation. MSC is working with fisheries, seafood complanies, scientists, conservation groups and public promote the best environmental choice in seafood.
4. What are the benefits ?
    a. Fisheries can demonstrate that their practices are sustainable and access market benefits by getting certified to the MSC standard for sustainable fishing.
    b. When seafood is sold with the MSC ecolabel every business in the supply chain must have undertaken a detailed traceability audit against the MSC Chain of Custody standard. This ensures that only seafood from a certified fishery is sold with the MSC ecolabel

VIII. Best Aquaculture Practice (BAP) Certification

1. Name of the standard : The Best Aquaculture Practices (BAP) standards
2. What is it ? BAP standards address environmental and social responsibility, animal welfare, food safety and traceability in a voluntary certification program for aquaculture facilities. BAP certification defines the most important elements of responsible aquaculture and provides quantitative guidelines by which to evaluate adherence to those practices. The BAP program outlines standards for each type of facility, from hatchery and feed mill to farm to processing plant. It currently certifies shrimp farms and hatcheries; salmon, tilapia, channel catfish and*Pangasius* farms; seafood processing plants and feed mills.

   The current BAP standards and guidelines includes
    a. BAP Seafood Processing Plant Standards
    b. BAP Shrimp Farm Standards
    c. BAP Tilapia Farm Standards
    d. BAP Channel Catfish Farm Standards
    e. BAP *Pangasius* Farm Standards
    f. BAP Salmon Farm Standards
    g. BAP Shrimp Hatchery Standards
    h. BAP Feed Mill Standards
3. Who created it ? The BAP standards are formed by GAA - The Global Aquaculture Alliance, which is an international, non-profit trade association dedicated to advancing environmentally and socially responsible aquaculture. Under GAA the certification is carried out by Aquaculture Certification Council (ACC) Drafted by

technical committees with broad stakeholder representation and overseen by a Standards Oversight Committee of ACC, Through the development of its Best Aquaculture Practices certification standards, GAA has become the leading standards-setting organization for aquaculture seafood.

4. What are the benefits ? The benefits of BAP standards are the following
    a. They are comprehensive and specific to aquaculture systems
    b. Individual standards gives detailed attention to specific type of operation
    c. All BAP standards address community and employee relations
    d. The Standards covers conservation of biodiversity, soil and water management
    e. The standards also attend to drug and chemical management.

    By implementing BAP standards, program participants can better meet the demands of the growing global market for wholesome seafood produced in an environmentally and socially responsible manner.

IX. Other Certifications

1. Organic Certification - http://www.ifoam.org
2. Safe Quality Food (SQF) - http://www.sqfi.com
3. Six Sigma - http://www.isixsigma.com

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16

WTO Dispute Settlement System and Fisheries Disputes

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With the establishment of the World Trade Organization resolution of international trade disputes has entered a new and highly legalistic era. Under GATT, dispute settlement was often called "conciliation" a term reflecting GATT's diplomatic heritage. The early GATT process was very much a diplomatic process, seeking to reconcile the conflicting views of the parties, sometimes ending in stalemate if this could not be accomplished.

The prime object and purpose of the WTO dispute settlement system is the prompt settlement of disputes through multilateral proceedings. The dispute settlement system of the WTO is a central element in providing security and predictability to the multilateral trading system.[1] The WTO dispute settlement system serves to preserve the rights and obligations of Members under the covered agreements, and to clarify the existing provisions of those agreements.[2] The system may not, however, add to or diminish the rights and obligations of the WTO Members. The system prefers WTO members to resolve a dispute through consultations rather than adjudication. Furthermore, the jurisdiction of the WTO dispute settlement system is compulsory, exclusive and contentious in nature.

Access to the WTO dispute settlement system is limited to WTO Members. It is a government-to-government dispute settlement system. Membership of the WTO constitutes consent to, and acceptance of, the compulsory jurisdiction of the WTO dispute settlement system. The WTO dispute settlement system is called upon to clarify the WTO law only in the context of an actual dispute.

The Dispute Settlement Understanding provides for four different methods to settle disputes between WTO Members: Consultations or negotiations (Article 4 of DSU); adjudication by Panels and the Appellate Body (Articles 6 to 20 of DSU); arbitration (Articles 21.3(c), 22.6 and 25 of DSU); and good offices, conciliation and mediation (Article 5 of the DSU).

The *Understanding on Rules and Procedures Governing Settlement of Disputes* or the Dispute Settlement Understanding (hereinafter referred to as DSU) with 27 sections and four appendices, is perhaps the most significant achievement of the Uruguay Round of multilateral trade negotiations. The DSU sets out the basic institutional and jurisdictional scope of the WTO Dispute Settlement. Its four appendices specify the agreements covered

[1] Article 3.2 of DSU
[2] Article 3.2 of DSU

by the DSU, itemize special or additional dispute settlement rules and procedures contained in covered agreements; outline working procedures and a suggested timetable for panels; and set out the rules and procedures that apply to any expert review groups that may be established by panels. In this context it is pertinent to note that if there is any difference between the DSU and the specialised or additional rules and procedures listed out in Appendix 2 the latter will prevail.

Institutions of WTO Dispute Settlement

Among the institutions involved in WTO Dispute Settlement one must distinguish between a political institution, the Dispute Settlement Body (DSB) and two independent judicial type institutions, the Dispute Settlement Panels and the Appellate Body.

Dispute Settlement Body

The DSB which is composed of all WTO Members administers the Dispute Settlement System. The Dispute Settlement Body is an *alter ego* of the General Council. Article 2.1 of the DSU broadly defines the functions of the DSB. The basic function of the DSB is to administer the dispute settlement system. It also has the authority to establish panels, adopt panel and appellate body reports, maintain surveillance of implementation of rulings and recommendations and authorise suspension of concessions and other obligations under the covered agreements.[3] Article 2.4 of the DSU stipulates that where the DSU provides for the DSB to take a decision, such a decision is always taken by consensus. However, for some key decisions the consensus requirement is in fact a 'reverse' or 'negative' consensus requirement.[4]

Dispute Settlement Panels

The actual adjudication of disputes brought to the WTO is done, at the first instance level by the Dispute Settlement Panels. The Panels are *ad hoc* bodies established for the purpose of adjudicating a particular dispute and are dissolved once they have accomplished their task. Panels normally are composed of three individuals with one serving as chair. They are composed of well qualified governmental and/or non-governmental individuals who are not nationals of the parties or third parties to the dispute.[5]

Appellate Body

The Appellate Body is an independent tribunal of seven independent individuals of recognised authority, appointed by the DSB for a term of four years. The composition of the Appellate Body is representative of WTO membership. The Appellate Body hears and decides appeals in divisions of three. Only parties to a dispute can appeal a panel report. An appeal is limited to issues of law covered in the panel report and legal interpretations developed by the panel. Issues of fact cannot be appealed. However, the treatment of the facts or evidence by a panel may raise the question of whether the panel acted consistently with Article 11 of the DSU. This is a legal issue and can therefore be examined by the Appellate Body. The Appellate Body may uphold, modify or reverse the legal findings and conclusions of the panel that were appealed.

[3] Article 2.1 of DSU
[4] The DSB shall be deemed to have decided by consensus on a matter submitted for its consideration, if no Member, present at the meeting of the DSB when the decision is taken, formally objects to the proposed decision.
[5] Article 8.1 of DSUS

Jurisdiction of WTO Dispute Settlement System

The WTO dispute settlement system has jurisdiction over any dispute between WTO members arising under the 'covered agreements'.[6] It provides for a single, coherent system of rules and procedures for dispute settlement, applicable to disputes under any of the covered agreements. However, some of the covered agreements provide for a few special and additional rules and procedures designed to deal with the particularities of dispute settlement relating to obligations arising under a specific covered agreement. According to Article 1.2 of the DSU, these special or additional rules and procedures prevail over the DSU rules and procedures to the extent that there is a 'difference' between them.

The WTO system provides for three types of complaints: (1) Violation Complaints; (2) Non-violation complaints; (3) situation complaints.

The DSU is primarily concerned with the settlement of disputes that involve an infringement of an obligation assumed under one or more of the WTO Agreements. Such an infringement is considered a *prima facie* nullification or impairment of a trade benefit accruing to other WTO members. Violation complaints are the most common type of complaints resorted to under the WTO system.

In accordance with GATT Article XXIII:1 (b), Article 26.1 of the DSU authorises a complaint against 'a measure' by a Member even if such measure does not conflict with any WTO Agreement, if the complaining Member considers that any benefit under a covered agreement is being nullified or impaired or the attainment of any objective of a covered agreement is being impeded as a result of the application of the measure. This procedure is available where not specifically excluded by the relevant covered agreement to secure the removal of trade barriers that impede market access even if there is no violation of the agreement. The burden of proof is on the complainant, which must present a "detailed justification of the complaint. This involves (1) defining the "benefit" being nullified or impaired or the objective being impeded; (2) defining the "measure" responsible; and (3) showing a causal relationship between the measure and the nullification or impairment or impeding of objectives.

In accordance with GATT Article XXIII:1 (c), Article 26.2 of the DSU authorises a complaint by a Member that considers that any benefit under a covered agreement is being nullified or impaired or the attainment of any objective of the agreement is being impeded by the existence of "any situation" other than those covered by the violation and non-violation complaint procedures'

Consultations

WTO Dispute Settlement begins with a formal request for consultations. In many instances, informal consultations may already have occurred between the Members concerned and the formal request is made only after the complaining Member concludes that the informal process has not been productive. The purpose of consultations is to enable the parties to gather relevant, and correct, information – both to assist them in reaching a mutually agreed solution or, failing that, to assist them in presenting accurate information to the Panel.

[6] Article 2.1 of DSU

Requests for consultations should be in writing and a copy should be served on the Dispute Settlement Body (DSB) and to the relevant WTO Councils and Committees. Article 4.5 requires that the Complaining party "give the reasons for the request including identification of the measure at issue and an indication of the legal basis for the complaint". Neither the DSU nor the WTO jurisprudence recognises the concept of "adequacy" of consultations. Consultations are confidential and take place without the involvement of the DSB, the Panel or the WTO Secretariat. Article 4.6 of the DSU requires that consultations be confidential and provides that they are without prejudice to the rights of a Member in any further proceedings. The request for consultation may be made at any time. Article 4.3 of the DSU requires a Member receiving a request for consultation to meet two deadlines: (1) it must respond to the request within 10 days of receipt; and (2) in that response, it must agree to consult within 30 days after receipt, or within a time frame mutually agreed. If the receiving Member does not respond within 10 days, or if it fails to consult within 30 days or within a period otherwise agreed, Article 4.3 provides that the requesting Member may proceed immediately to request the DSB to establish a Panel.

Establishment Of Dispute Settlement Panel

There is a provision that if consultations fail to settle the dispute within 60 days (20 days in cases of urgency), the complaining party may request the establishment of a panel. [7] A panel must be established at the next DSB meeting unless it is decided by consensus not to establish a panel.[8] The parties to a dispute have 20 days to agree on the panelists. If they fail to agree panelists are appointed by the Director General. The parties to the dispute also have 20 days from the establishment of the Panel to agree on the "terms of reference" of the Panel.[9] If the parties do not agree on the terms of reference the standard term of reference specified in Article 7.1 will be used.

Terms of Reference (TOR)

The terms of reference of a Panel are important for two basic reasons: (1) they fulfil an important due process objective by giving the respondent and interested third parties sufficient information concerning the claims at issue in the dispute to allow them to respond to the complainant's case; and (2) they establish the jurisdiction of the Panel by defining the precise claims at issue in the dispute. The terms of reference are determined by the complaining party's request for the establishment of a Panel. The scope of the request for consultations, as well as the actual consultations, in turn, affects the scope of the request for the establishment of a Panel, which is incorporated into the terms of reference. However, because the consultations themselves may lead the parties to new appreciation of the nature of their dispute, there need not necessarily be an exact parallel between the request for consultations and the request for the establishment of a Panel.

The Panels only address the claims that are put before them, either by the complaining party through its request for the establishment of a Panel, which is incorporated into the terms of reference, or by the defending party.

[7] Articles 4.7 and 4.8 of DSU.
[8] Article 6.1 of DSU.
[9] Article 7.1 of DSU.

Overview of Panel Process

The basic rules governing panel proceedings are set out in Article 12 of the DSU. Article 12.1 of the DSU directs a panel to follow the working procedures contained in Appendix 3 to the DSU, but at the same time authorises a panel to do otherwise. Ordinarily a panel will fix the timetable for its work and decide on detailed *ad hoc* working procedures within one week of its composition. Each party to the dispute normally submits two written submissions to the panel: a 'first written submission' and a 'rebuttal submission'. During the proceedings the panel will meet with the parties twice, first after the filing of the 'first written submissions' and then after the filing of the 'rebuttal submissions'. Unless specific deadlines for the submission of evidence are set out in the *ad hoc* working procedures of the panel, parties can submit new evidence as late as the second meeting with the panel. Panels have the discretionary authority to seek information and technical advice from experts in order to help them understand and evaluate the evidence submitted and the arguments made by the parties. The parties are under an obligation to provide the panel with the information or the documents that the panel requests at any time during the proceedings. Panels submit the draft report to the parties for an 'interim review'. After this 'interim review', the panel finalises the report, issues it to the parties and eventually makes the report public by circulating it to all WTO members. Within sixty days of its circulation, a panel report is either adopted by the DSB or appealed to the Appellate Body.

Overview of Appellate Review Process(ARP)

The appellate review proceedings commence with a party's notification in writing to the DSB of its decision to appeal and the simultaneous filing of a notice of appeal with the Appellate Body.[10] A notice of appeal will include;

(a) Identification of the alleged errors in the issues of law covered in the panel report and legal interpretations developed by the Panel;

(b) A list of the legal provisions of the covered agreements that the panel is alleged to have erred in interpreting or applying; and

(c) An indicative list of the paragraphs of the panel report containing the alleged errors.

A member may pursuant to Rule 30(1) of the Working Procedures withdraw an appeal at any stage of the appellate review process. Such withdrawal leads normally to the termination of the appellate review.

Adoption Of Appellate Body Report

Within thirty days following circulation of the Appellate Body report, the Appellate Body report and the Panel Report as upheld, modified or reversed by the Appellate Body are adopted by the DSB unless the DSB decides by consensus not to adopt the reports.[11] The adopted Appellate Body report must be accepted unconditionally by the parties to the dispute.

[10] See Rule 20 (1) of the Working Procedures for Appellate Review.
[11] Article 17.14 of DSU

Implementation Of Recommendations And Rulings

Prompt compliance with the recommendations or rulings of the DSB is essential in order to ensure effective resolution of disputes to the benefit of all Members.[12] The respondent must inform the DSB of its intentions "in respect of implementation of the recommendations and rulings of the DSB" within 30 days of the date of adoption of a panel or Appellate Body report. Respondents have an obligation to comply with the recommendations and rulings of the DSB within "a reasonable period of time". What is a "reasonable period of time" is determined under Article 21.3 of the DSU by any one of the following three methods:

(a) A period set by the DSB after a proposal by the Member concerned.

(b) A period agreed by the parties to the dispute.

(c) A period determined through binding arbitration within 90 days after adoption of the relevant report. In this case, the suggested period should not exceed 15 months from the date of the adoption of the report but may be shorter or longer depending on the circumstances.

Before the expiry of the reasonable period of time, the respondent must withdraw or amend the measure that was found to be WTO-inconsistent. In other words the respondent must take the appropriate implementing measures.

Disagreement on Question Of Implementation

It is quite common for the original complainant and respondent to disagree on whether any implementing measure was taken or whether the implementing measure is WTO consistent. Article 21.5 of the DSU provides that such disagreement as to the existence or WTO consistency of implementing measures shall be decided through recourse to the procedures set out in Articles 4 to 20 of DSU. The Panel which is established to decide on this question is referred to as a 'Compliance Panel'.

The mandate of an Article 21.5 'compliance panel' is to examine the WTO consistency of implementing measures. The examination under Article 21.5 involves a consideration of the 'new measure in its totality' and the fulfilment of that task requires that a Panel consider both the measure itself and its application.

Consequences of Non-Compliance

Two sanctions are specified if the recommendations and rulings of the DSB are not implemented within a reasonable period of time – *Compensation & Retaliation (Suspension of Concessions).* Both sanctions are temporary. Neither is intended to be a substitute for implementing a recommendation or ruling of the DSB.

Compensation consists of additional trade concessions by the losing party, usually in related economic areas to the dispute, that are acceptable to the winning party as a substitute for maintaining trade barriers in dispute. Compensation is voluntary. If no satisfactory compensation is agreed within 20 days of the expiration of the reasonable period, any party having invoked the dispute settlement procedures may request authorisation from the DSB to retaliate. The DSB must decide on the authorisation to

[12] Article 21.1 of DSU

retaliate within thirty days of the expiry of the reasonable period of time. The DSB decides on the authorization to retaliate by reverse-consensus.

There are three types of retaliation: (a) Parallel Retaliation; (b) Cross-sector retaliation; and (c) Cross-Agreement retaliation. Parallel retaliation involves suspension of concessions with respect to the same economic sector in which the nullification or impairment has been found. Cross-Agreement retaliation involves suspension of concessions relating to different sectors in the same agreement. Cross- Agreement retaliation involves suspension of concessions specified in different Agreements.

If the non-complying member objects to the level of suspension proposed, or claims that the principles and procedures for suspension have not been followed, the matter may be referred to arbitration before the DSB takes a decision. This arbitration under Article 22.6 of DSU is carried out by the original panel, if the same members are available, or by an arbitrator appointed by the Director-General.

Arbitration

WTO members can agree to use binding arbitration as an alternative means of dispute settlement.[13] In such a case, the parties to the dispute can define the issues and the procedures to be followed. A mutual agreement to arbitrate is required in such cases. The 'agreement to arbitrate' must be notified to all WTO members "sufficiently in advance of the actual commencement of the arbitration process.[14] Other Members may become party to an arbitration process only upon agreement of the parties that have agreed to arbitration.[15] The parties to an arbitration are required (a) to notify awards to the DSB and to any relevant Council or Committee of the WTO and (b) abide by the arbitration award.[16] Arbitration award must be consistent with the WTO agreements, and should not nullify or impair benefits under those agreements, or impede the attainment of any objective of those agreements.[17]

Legal Effect of Panel And Appellate Body Reports

WTO Panel and Appellate Body reports are binding on the parties to the dispute once the Dispute Settlement Body adopts them. They are not binding interpretations of the WTO and they have no legal effect on other WTO members. They also are not precedents that are legally binding in subsequent cases. Nevertheless, such reports constitute evidence of treaty practice, and subsequent dispute settlement panels and Appellate Bodies are free to cite them and rely on their reasoning. In fact, panels and Appellate Body closely examine precedents when dealing with a dispute and try not to deviate from the interpretations established by the precedents.

Good Offices, Conciliation And Mediation

The parties to a dispute may agree "voluntarily" to employ good offices, conciliation or mediation as a settlement technique.[18] Such procedures may begin or be terminated at any time. An agreement to use these procedures does not preclude the establishment of a Dispute Settlement Panel. If the parties agree, procedures for good offices, conciliation or

[13] Article 25 of DSU.
[14] Article 25.2 of DSU.
[15] Article 25.3 of DSU
[16] Article 25.3 of DSU.
[17] Article 3.5 of DSU.
[18] See Article 5 of DSU

mediation may proceed even after a panel has been established.[19] Normally, the WTO Director General, acting in an ex-officio capacity, will offer good offices, conciliation or mediation. These three procedures are similar in that a neutral third party is involved to aid the process of dispute settlement. These procedures are useful not only in resolving issues of law and fact but also in dealing with non-justiciable issues that an adjudication process cannot settle.

In order to properly appreciate the functioning of the WTO Dispute Settlement System and also to enable a proper understanding of how the WTO Dispute Settlement bodies (particularly the Appellate Body) have handled disputes related to 'fisheries' three cases have been taken up as case studies. The cases are: **(1)** ***United States – Import Prohibition of Certain Shrimp and Shrimp Products (2) Australia – Measures Affecting Importation of Salmon,*** **WT/DS18/AB/R; (3)** ***European Communities – Trade Description of Sardines, WT/DS231/AB/R***

Each of the three cases have been analysed and presented with the following components to facilitate an easy understanding: (1) Factual background of the dispute; (2) History of the dispute; (3) Summary of the findings of the Appellate Body and (4) Extracts from the Report of the Appellate Body (The extracts have been omitted in the context of the EC-Sardines dispute)

DISPUTE No.1

United States – Import Prohibition of Certain Shrimp and Shrimp Products

(Shrimp – Turtle CASE)

Factual Background of the Case

The United States issued regulations in 1987 pursuant to the Endangered Species Act of 1973 requiring all United States shrimp trawl vessels to use approved Turtle Excluder Devices ("TEDs") or tow-time restrictions in specified areas where there was a significant mortality of sea turtles in shrimp harvesting. These regulations, which became fully effective in 1990, were modified so as to require the use of approved TEDs at all times and in all areas where there is a likelihood that shrimp trawling will interact with sea turtles, with certain limited exceptions.

Section 609 was enacted on 21 November 1989. Section 609(a) calls upon the United States Secretary of State, in consultation with the Secretary of Commerce, *inter alia*, to "initiate negotiations as soon as possible for the development of bilateral or multilateral agreements with other nations for the protection and conservation of … sea turtles" and to "initiate negotiations as soon as possible with all foreign governments which are engaged in, or which have persons or companies engaged in, commercial fishing operations which, as determined by the Secretary of Commerce, may affect adversely such species of sea turtles, for the purpose of entering into bilateral and multilateral treaties with such countries to protect such species of sea turtles; … ." Section 609(b)(1) imposed, not later than 1 May 1991, an import ban on shrimp harvested with commercial fishing technology which may adversely affect sea turtles. Section 609(b)(2) provides that the import ban on shrimp will not apply to harvesting nations that are certified. Two kinds of annual certifications are required for harvesting nations, details of which were further elaborated in regulatory guidelines in 1991, 1993 and 1996.

[19] Article 5 of DSU

First, certification shall be granted to countries with a fishing environment which does not pose a threat of the incidental taking of sea turtles in the course of shrimp harvesting. According to the 1996 Guidelines, the Department of State "shall certify any harvesting nation meeting the following criteria without the need for action on the part of the government of the harvesting nation: (a) Any harvesting nation without any of the relevant species of sea turtles occurring in waters subject to its jurisdiction; (b) Any harvesting nation that harvests shrimp exclusively by means that do not pose a threat to sea turtles, *e.g*., any nation that harvests shrimp exclusively by artisanal means; or (c) Any nation whose commercial shrimp trawling operations take place exclusively in waters subject to its jurisdiction in which sea turtles do not occur."

Second, certification shall be granted to harvesting nations that provide documentary evidence of the adoption of a regulatory program governing the incidental taking of sea turtles in the course of shrimp trawling that is comparable to the United States program *and* where the average rate of incidental taking of sea turtles by their vessels is comparable to that of United States vessels.

According to the 1996 Guidelines, the Department of State assesses the regulatory program of the harvesting nation and certification shall be made if the program includes: (i) the required use of TEDs that are "comparable in effectiveness to those used in the United States. Any exceptions to this requirement must be comparable to those of the United States program … "; and (ii) "a credible enforcement effort that includes monitoring for compliance and appropriate sanctions." The regulatory program may be in the form of regulations, or may, in certain circumstances, take the form of a voluntary arrangement between industry and government. Other measures that the harvesting nation undertakes for the protection of sea turtles will also be taken into account in making the comparability determination. The average incidental take rate "will be deemed comparable if the harvesting nation requires the use of TEDs in a manner comparable to that of the U.S. program … ."

The 1991 Guidelines limited the geographical scope of the import ban imposed by Section 609 to countries in the wider Caribbean/western Atlantic region1, and granted these countries a three-year phase-in period. The 1993 Guidelines maintained this geographical limitation. On 29 December 1995, the United States Court of International Trade held that the 1991 and 1993 Guidelines violated Section 609 by limiting its geographical scope to shrimp harvested in the wider Caribbean/western Atlantic region, and directed the Department of State to extend the ban worldwide not later than 1 May 1996. On 10 April 1996, the United States Court of International Trade refused a subsequent request by the Department of State to postpone the 1 May 1996 deadline. On 19 April 1996, the United States issued the 1996 Guidelines, extending Section 609 to shrimp harvested in *all* foreign countries effective 1 May 1996.

History of The Dispute

On 8 October 1996, India, Malaysia, Pakistan and Thailand requested consultations with the United States concerning a ban on importation of shrimp and shrimp products from these complainants imposed by the US under Section 609 of US Public Law 101-162. Violations of Articles I, XI and XIII of the GATT 1994, as well nullification and impairment of benefits, were alleged.

On 9 January 1997, Malaysia and Thailand requested the establishment of a panel. At its meeting on 22 January 1997, the DSB deferred the establishment of a panel. On 30 January 1997, Pakistan also requested the establishment of a panel.

Further to Malaysia's and Thailand's request, the DSB established a Panel at its meeting on 25 February 1997. At the same meeting, the DSB established a panel in accordance with the request made Pakistan. It also agreed that the two panels would be consolidated in a single panel, pursuant to Article 9.1 of the DSU with standard terms of reference. Australia, Colombia, Costa Rica, Ecuador, the European Communities, Guatemala, Hong Kong, India, Japan, Mexico, Nigeria, the Philippines, Senegal, Singapore and Sri Lanka reserved their third-party rights.

On 25 February 1997, India also requested the establishment of a panel on the same matter. At its meeting on 20 March 1997, the DSB deferred the establishment of a panel. Further to a second request to establish a panel by India, the DSB agreed to establish a panel at its meeting on 10 April 1997. The DSB also agreed that this panel would be consolidated with the panel already established at the request of Malaysia, Thailand and Pakistan. El Salvador and Venezuela reserved their third party rights, in addition to those delegations who had reserved their third-party rights to the panel established at the requests of Malaysia, Pakistan and Thailand. On 15 April 1997, the panel was composed.

On 15 May 1998, the panel report was circulated to Members. The panel found that the import ban in shrimp and shrimp products as applied by the United States is inconsistent with Article XI:1 of the GATT 1994, and cannot be justified under Article XX of the GATT 1994.

On 13 July 1998, the United States notified its intention to appeal certain issues of law and legal interpretations developed by the panel. The Appellate Body report was circulated to Members on 12 October 1998. The Appellate Body reversed the panel's finding that the US measure at issue is not within the scope of measures permitted under the chapeau of Article XX of the GATT 1994, but concluded that the US measure, while qualifying for provisional justification under Article XX(g), fails to meet the requirements of the chapeau of Article XX.

The DSB adopted the Appellate Body report and the Panel report, as modified by the Appellate Body report, on 6 November 1998.

Note: It may be noted that this dispute was subsequently referred to a Compliance Panel and the Report of the Compliance Panel was thereafter appealed to the Appellate Body

Summary of the finding of Appellate Body:

The Appellate Body held that the U.S. measure - which prohibited imports of shrimp from any country that did not have a turtle-conservation program comparable to that of the United States was applied in a manner which amounts to a means not just of "unjustifiable discrimination", but also of "arbitrary discrimination" between countries where the same conditions prevail, contrary to the requirements of the chapeau of Article XX.

Relevant Extracts from the Appellate Body Report

[Para 28] Section 609, in its application, is, in effect, an economic embargo which requires *all other exporting Members*, if they wish to exercise their GATT rights, to adopt *essentially the same* policy (together with an approved enforcement program) as that applied to, and enforced on, United States domestic shrimp trawlers. As enacted by the Congress of the United States, the *statutory* provisions of Section 609(b)(2)(A) and (B) do not, in themselves, *require* that other WTO Members adopt *essentially the same* policies and

enforcement practices as the United States. Viewed alone, the statute appears to permit a degree of discretion or flexibility in how the standards for determining comparability might be applied, in practice, to other countries. However, any flexibility that may have been intended by Congress when it enacted the statutory provision has been effectively eliminated in the implementation of that policy through the 1996 Guidelines promulgated by the Department of State and through the practice of the administrators in making certification determinations.

[Para 29] According to the 1996 Guidelines, certification "shall be made" under Section 609(b)(2)(A) and (B) if an exporting country's program includes a requirement that all commercial shrimp trawl vessels operating in waters in which there is a likelihood of intercepting sea turtles use, at all times, TEDs comparable in effectiveness to those used in the United States. Under these Guidelines, any exceptions to the requirement of the use of TEDs must be comparable to those of the United States program. Furthermore, the harvesting country must have in place a "credible enforcement effort". The language in the 1996 Guidelines is mandatory: certification "shall be made" if these conditions are fulfilled. However, we understand that these rules are also applied in an *exclusive* manner. That is, the 1996 Guidelines specify the *only* way that a harvesting country's regulatory program can be deemed "comparable" to the United States' program, and, therefore, they define the *only* way that a harvesting nation can be certified under Section 609(b)(2)(A) and (B). Although the 1996 Guidelines state that, in making a comparability determination, the Department of State "shall also take into account other measures the harvesting nation undertakes to protect sea turtles", in practice, the competent government officials only look to see whether there is a regulatory program requiring the use of TEDs or one that comes within one of the extremely limited exceptions available to United States shrimp trawl vessels.

[Para 30] The actual *application* of the measure, through the implementation of the 1996 Guidelines and the regulatory practice of administrators, *requires* other WTO Members to adopt a regulatory program that is not merely *comparable*, but rather *essentially the same*, as that applied to the United States shrimp trawl vessels. Thus, the effect of the application of Section 609 is to establish a rigid and unbending standard by which United States officials determine whether or not countries will be certified, thus granting or refusing other countries the right to export shrimp to the United States. Other specific policies and measures that an exporting country may have adopted for the protection and conservation of sea turtles are not taken into account, in practice, by the administrators making the comparability determination.

[Para 32] The United States did not permit imports of shrimp harvested by commercial shrimp trawl vessels using TEDs comparable in effectiveness to those required in the United States if those shrimp originated in waters of countries not certified under Section 609. In other words, *shrimp caught using methods identical to those employed in the United States* have been excluded from the United States market solely because they have been caught in waters of *countries that have not been certified by the United States*. The resulting situation is difficult to reconcile with the declared policy objective of protecting and conserving sea turtles. This suggests to us that this measure, in its application, is more concerned with effectively influencing WTO Members to adopt essentially the same comprehensive regulatory regime as that applied by the United States to its domestic shrimp trawlers, even though many of those Members may be differently situated. We believe that discrimination results not only when

[Para 39] The United States negotiated seriously with some, but not with other Members (including the appellees), that export shrimp to the United States. The effect is plainly discriminatory and, in our view, unjustifiable. The unjustifiable nature of this discrimination

emerges clearly when we consider the cumulative effects of the failure of the United States to pursue negotiations for establishing consensual means of protection and conservation of the living marine resources here involved, notwithstanding the explicit statutory direction in Section 609 itself to initiate negotiations as soon as possible for the development of bilateral and multilateral agreements. The principal consequence of this failure may be seen in the resulting unilateralism evident in the application of Section 609……..The system and processes of certification are established and administered by the United States agencies alone. The decision-making involved in the grant, denial or withdrawal of certification to the exporting Members, is, accordingly, also unilateral. The unilateral character of the application of Section 609 heightens the disruptive and discriminatory influence of the import prohibition and underscores its unjustifiability.

[Para 40] The application of Section 609, through the implementing guidelines together with administrative practice, also resulted in other differential treatment among various countries desiring certification. Under the 1991 and 1993 Guidelines, to be certifiable, fourteen countries in the wider Caribbean/western Atlantic region had to commit themselves to require the use of TEDs on all commercial shrimp trawling vessels by 1 May 1994. These fourteen countries had a "phase-in" period of three years during which their respective shrimp trawling sectors could adjust to the requirement of the use of TEDs. With respect to all other countries exporting shrimp to the United States (including the appellees, India, Malaysia, Pakistan and Thailand), on 29 December 1995, the United States Court of International Trade directed the Department of State to apply the import ban on a world-wide basis not later than 1 May 1996. On 19 April 1996, the 1996 Guidelines were issued by the Department of State bringing shrimp harvested in *all* foreign countries within the scope of Section 609, effective 1 May 1996. Thus, all countries that were not among the fourteen in the wider Caribbean/western Atlantic region had only four months to implement the requirement of compulsory use of TEDs.

[Para 42] The Differences in the levels of efforts made by the United States in transferring the required TED technology to specific countries. Far greater efforts to transfer that technology successfully were made to certain exporting countries -- basically the fourteen wider Caribbean/western Atlantic countries cited earlier -- than to other exporting countries, including the appellees. Because compliance with the requirements of certification realistically assumes successful TED technology transfer, low or merely nominal efforts at achieving that transfer will, in all probability, result in fewer countries being able to satisfy the certification requirements under Section 609, within the very limited "phase-in" periods allowed them.

In 2001 (3 years after its Shrimp/Turtle ruling), the AB clarified and elaborated on its original holding. One of the Shrimp/Turtle complainants, Malaysia, had challenged the corrective measures the United States had taken in response to the AB decision. This second AB panel held that the United States had brought its turtle-friendly trade measures into compliance with Article XX, and it underscored those aspects of its original ruling that constituted a fundamental departure from the Tuna/Dolphin approach.

DISPUTE No. 2

***Australia – Measures Affecting Importation of Salmon,* WT/DS18/AB/R**

Australia – Salmon Case

Factual Background of the Case

The case revolves around Australia's prohibition on the importation of fresh, chilled or frozen salmon from Canada under Quarantine Proclamation 86A ("QP86A"), dated 19 February 1975 and any amendments or modifications thereto. Before the promulgation of QP86A on 30 June 1975, Australia imposed no restrictions on the importation of salmonid products. QP86A "prohibit[s] the importation into Australia of dead fish of the sub-order Salmonidae, or any parts (other than semen or ova) of fish of that sub-order, in any form unless: [...] prior to importation into Australia the fish or parts of fish have been subject to such treatment as in the opinion of the Director of Quarantine is likely to prevent the introduction of any infectious or contagious disease, or disease or pest affecting persons, animals or plants". Pursuant to QP86A and in accordance with the authority delegated therein, the Director of Quarantine has permitted the entry of commercial imports of heat-treated salmon products for human consumption as well as non-commercial quantities of other salmon (primarily for scientific purposes) subject to prescribed conditions.

Canada requested access to the Australian market for fresh, chilled or frozen, i.e., uncooked, salmon. Australia conducted an import risk analysis for uncooked, wild, adult, ocean caught Pacific salmonid product ("ocean-caught Pacific salmon"). This category of salmon is to be distinguished from the other categories of salmon for which Canada seeks access to the Australian market ("other Canadian salmon"). The risk analysis on ocean-caught Pacific salmon was first set forth in the 1995 Draft Report5, revised in May 19966 and finalized in December of 1996 (the "1996 Final Report").7 The 1996 Final Report concluded that:

> "... it is recommended that the present quarantine policies for uncooked salmon products remain in place".

The Director of Quarantine, on the basis of the 1996 Final Report, decided on 13 December 1996 that:

> "... having regard to Australian Government policy on quarantine and after taking account of Australia's international obligations, importation of uncooked, wild, adult, ocean-caught Pacific salmonid product from the Pacific rim of North America should not be permitted on quarantine grounds".

History of The Dispute

On 5 October 1995, Canada requested consultations with Australia in respect of Australia's prohibition of imports of salmon from Canada based on a quarantine regulation. Canada alleged that the prohibition is inconsistent with Articles XI and XIII of the GATT 1994, and also inconsistent with the SPS Agreement.

On 7 March 1997, Canada requested the establishment of a panel. At its meeting on 20 March 1997, the DSB deferred the establishment of a panel.

Further to a second request to establish a panel by Canada, the DSB established a panel at its meeting on 10 April 1997. The EC, India, Norway and the US reserved their third-party rights. On 28 May 1997, the panel was composed. The panel report was circulated to Members on 12 June 1998. The panel found that Australia's measures complained against were inconsistent with Articles 2.2, 2.3, 5.1, 5.5, and 5.6 of the SPS Agreement, and also nullified or impaired benefits accruing to Canada under the SPS Agreement.

On 22 July 1998, Australia notified its intention to appeal certain issues of law and legal interpretations developed by the panel. The report of the Appellate Body was circulated to Members on 20 October 1998.

The DSB adopted the Appellate Body report and the panel report, as modified by the Appellate Body report, on 6 November 1998.

Note: The report of the Appellate Body was followed by Compliance Proceedings under Article 21.5 as well as proceedings under Article 22 of DSU.

Summary of the finding of Appellate Body:

The Appellate Body reversed the panel's reasoning with respect to Articles 5.1 and 2.2 of the SPS Agreement but nevertheless found that:

- Australia had acted inconsistently with Articles 5.1 and 2.2 of the SPS Agreement.
- The Appellate Body broadened the panel's finding that Australia had acted inconsistently with Articles 5.5 and 2.3 of the SPS Agreement.
- The Appellate Body reversed the panel's finding that Australia had acted inconsistently with Article 5.6 of the SPS Agreement but was unable to come to a conclusion whether or not Australia's measure was consistent with Article 5.6 due to insufficient factual findings by the panel.

Relevant Extracts from the Appellate Body Report

[Para 101] We agree with Australia that the heat-treatment requirement mentioned in the 1988 Conditions applies only to smoked salmon, and that these Conditions exempt heat-treated smoked salmon and salmon roe from the import prohibition laid down in QP86A. Fresh, chilled or frozen salmon falls under the import prohibition of QP86A, as confirmed by the 1996 Decision of the Director of Quarantine. Fresh, chilled or frozen salmon is not, and cannot be, subjected to heat treatment. As a matter of fact, heat treatment would destroy fresh, chilled or frozen salmon. As the Panel itself explicitly stated: "heat treatment actually changes the nature of the product and limits its use. Heat-treated salmon can obviously no longer be consumed as fresh salmon." Moreover, both participants agree that fresh, chilled or frozen salmon is an entirely different product from heat-treated (commercially marketed as "smoked") salmon.

[Para 103] We do not share the Panel's position. In our view, the SPS measure at issue in this dispute can *only* be the measure which is *actually* applied to the product at issue. The product at issue is fresh, chilled or frozen salmon and the SPS measure applicable to fresh, chilled or frozen salmon is the import prohibition set forth in QP86A. The heat-treatment requirement provided for in the 1988 Conditions applies only to smoked salmon and salmon roe, not to fresh, chilled or frozen salmon.

[Para 104] We also do not share the Panel's view that the import prohibition and the heat-treatment requirement are "two sides of the same coin". Smoked salmon and fresh, chilled or frozen salmon are different products and the SPS measures applied to each are not "two sides of the same coin". We agree with Australia that it is not a consequence of the requirement that *smoked* salmon be heat treated that imports of *fresh, chilled or frozen* salmon are prohibited. Imports of fresh, chilled or frozen salmon are prohibited as a direct consequence of the application of QP86A, and this prohibition has not been revoked, but has, in fact, been continuously maintained since 1975. We likewise do not share the Panel's view that the 1996 Requirements apply to fresh, chilled or frozen salmon. These requirements clearly apply only to imports of small amounts of smoked salmon.

[Para 105] For the reasons set out above, we reverse the Panel's findings in paragraph 8.18 and 8.19 of the Panel Report that the 1988 Conditions and the 1996 Requirements fall within the Panel's terms of reference. We conclude that the SPS measure at issue in this dispute is the *import prohibition* on fresh, chilled or frozen salmon set forth in QP86A, as confirmed by the 1996 Decision, rather than the heat-treatment requirement set forth in the 1988 Conditions.

[Para 119] In examining whether Australia's import prohibition is consistent with Article 5.1, we first have to address whether the 1996 Final Report is, indeed, as Australia contends, a risk assessment within the meaning of Article 5.1 of the *SPS Agreement*. After a detailed analysis of the requirements of the *SPS Agreement* relating to risk assessments, and a detailed analysis on whether the 1996 Final Report fulfils these requirements, the Panel *assumed* -- without making a finding on this issue -- "that the 1996 Final Report meets the requirements of a risk assessment set out in Articles 5.1 and 5.2".66 We do not believe it appropriate to base our examination of Article 5.1 on this *assumption* made by the Panel that the 1996 Final Report is a proper risk assessment. We must, therefore, address this question ourselves.

[Para 128] We believe, however, that on the basis of the facts found by the Panel, it could, and should, have come to the conclusion that the 1996 Final Report does not contain the "evaluation of the likelihood of entry, establishment or spread" of the diseases of concern "and of the associated potential biological and economic consequences" as required by paragraph 4 of Annex A of the *SPS Agreement*. As we have already emphasized, *some* evaluation of the likelihood is not enough.

[Para 130] We might add that the existence of unknown and uncertain elements does not justify a departure from the requirements of Articles 5.1, 5.2 and 5.3, read together with paragraph 4 of Annex A, for a risk assessment. We recall that Article 5.2 requires that "in the assessment of risk, Members shall take into account available scientific evidence". We further recall that Article 2, entitled "Basic Rights and Obligations", requires in paragraph 2 that "Members shall ensure that any sanitary measure is based on scientific principles and is not maintained without sufficient scientific evidence, except as provided for in paragraph 7 of Article 5."……

[Para 131] We, therefore, come to the conclusion that the 1996 Final Report does *not* meet the second requirement of the type of risk assessment applicable in this case, i.e., the evaluation of the likelihood of entry, establishment or spread of the diseases of concern and of the potential associated biological and economic consequences.

[Para 134] On the basis of its factual findings, the Panel should have come to the conclusion that the 1996 Final Report does not fulfil the third requirement for the type of risk assessment applicable in this case, i.e., it does not contain the required evaluation of the likelihood of entry, establishment or spread of the diseases of concern according to the SPS measures which might be applied. We recall that, contrary to the Panel, we consider that *some* evaluation of the
likelihood is not enough.

[Para 135] We conclude, on the basis of the factual findings made by the Panel and the requirements for a risk assessment as set forth above, that the 1996 Final Report meets neither the second nor the third requirement for the type of risk assessment applicable in this case, and, therefore, that the 1996 Final Report is *not* a proper risk assessment within the meaning of Article 5.1 and the first
definition in paragraph 4 of Annex A.

[Para 136] Inasmuch as we have found that the 1996 Final Report is not a proper risk assessment, and since it was the only risk assessment put forward by Australia, we conclude that the measure at issue, i.e., the import prohibition on fresh, chilled or frozen salmon, is not based on a risk assessment as required by Article 5.1 of the *SPS Agreement*, and, therefore, that Australia has acted inconsistently with Article 5.1 of the *SPS Agreement*.

The Appellate Body also reversed the Panel's finding that the measure at issue, as it applies to ocean-caught Pacific salmon, is "more trade-restrictive than required" to achieve Australia's appropriate level of protection, and that Australia has acted inconsistently with Article 5.6 of the *SPS Agreement*. This was because the Panel made this finding on the wrong premise that the heat-treatment requirement, rather than the import prohibition, is the SPS measure at issue in this dispute.

However the Appellate Body was unable to come to a conclusion on whether or not the SPS measure at issue, i.e., the import prohibition, as it applies to ocean-caught Pacific salmon, is consistent with Article 5.6 of the *SPS Agreement* as a result of insufficient factual findings and undisputed facts in the Panel record.

There were certain other issues that were addressed by the Appellate Body. Since they are not very relevant to the topic of discussion they are not discussed in this analysis.

DISPUTE No. 3

European Communities – Trade Description of Sardines, WT/DS231/AB/R

EC – Sardines

Factual Background of the Case

This dispute concerns the name under which certain species of fish may be marketed in the European Communities. The measure at issue is Council Regulation (EEC) 2136/89 (the "EC Regulation"), which was adopted by the Council of the European Communities on 21 June 1989 and became applicable on 1 January 1990. 2 The EC Regulation sets forth common marketing standards for preserved sardines.

Article 2 of the EC Regulation provides that: Only products meeting the following requirements may be marketed as preserved sardines and under the trade description referred to in Article 7:

- they must be covered by CN codes 1604 13 10 and ex 1604 20 50;
- *they must be prepared exclusively from fish of the species "Sardina pilchardus Walbaum"* ;
- they must be pre-packaged with any appropriate covering medium in a hermetically sealed container;
- they must be sterilized by appropriate treatment. (emphasis added)

Sardina pilchardus Walbaum ("*Sardina pilchardus*"), the fish species referred to in the EC Regulation, is found mainly around the coasts of the Eastern North Atlantic Ocean, in the Mediterranean Sea, and in the Black Sea.

In 1978, the Codex Alimentarius Commission (the "Codex Commission"), of the United Nations Food and Agriculture Organization and the World Health Organization,

adopted a world-wide standard for preserved sardines and sardine-type products, which regulates matters such as presentation, essential composition and quality factors, food additives, hygiene and handling, labelling, sampling, examination and analyses, defects and lot acceptance. This standard,
CODEX STAN 94–1981, Rev.1–1995 ("Codex Stan 94"), covers preserved sardines or sardine-type products prepared from the following 21 fish species:

- *Sardina pilchardus*
– *Sardinops melanostictus, S. neopilchardus, S. ocellatus,*
S. sagax[,] *S. caeruleus*
– *Sardinella aurita, S. brasiliensis, S. maderensis, S. longiceps,*
S. gibbosa
– *Clupea harengus*
– *Sprattus sprattus*
– *Hyperlophus vittatus*
– *Nematalosa vlaminghi*
– *Etrumeus teres*
– *Ethmidium maculatum*
– *Engraulis anchoita, E. mordax, E. ringens*
– *Opisthonema oglinum*.

Section 6 of Codex Stan 94 provides as follows:

6. Labelling

In addition to the provisions of the Codex General Standard for the Labelling of Prepackaged Foods (CODEX STAN 1-1985, Rev. 3-1999) the following special provisions apply:

6.1 Name Of The Food

The name of the product shall be:

6.1.1 (i) *"Sardines" (to be reserved exclusively for Sardina pilchardus (Walbaum)); or*
(ii) "X sardines" of a country, a geographic area, the species, or the common name of the species in accordance with the law and custom of the country in which the product is sold, and in a manner not to mislead the consumer.

6.1.2 The name of the packing medium shall form part of the name of the food.
6.1.3 If the fish has been smoked or smoke flavoured, this information shall appear on the label in close proximity to the name.

6.1.4 In addition, the label shall include other descriptive terms that will avoid misleading or confusing the consumer. (emphasis added).

Peru exports preserved products prepared from *Sardinops sagax sagax* ("*Sardinops sagax*"), one of the species of fish covered by Codex Stan 94. This species is found mainly in the Eastern Pacific Ocean, along the coasts of Peru and Chile.

Sardina pilchardus and *Sardinops sagax* both belong to the *Clupeidae* family and the *Clupeinae* subfamily. As their scientific name suggests, however, they belong to different

genus. *Sardina pilchardus* belongs to the genus *Sardina*, while *Sardinops sagax* belongs to the genus *Sardinops*.

History of The Dispute

On 20 March 2001, Peru requested consultations with the EC concerning Regulation (EEC) 2136/89 which, according to Peru, prevents Peruvian exporters to continue to use the trade description "sardines" for their products.

Peru submitted that, according to the relevant Codex Alimentarius standards (STAN 94-181 rev. 1995), the species "*sardinops sagax sagax*" are listed among those species which can be traded as "sardines". Peru, therefore, considered that the above Regulation constitutes an unjustifiable barrier to trade, and, hence, in breach of Articles 2 and 12 of the TBT Agreement and Article XI:1 of GATT 1994. In addition, Peru argues that the Regulation is inconsistent with the principle of non-discrimination, and, hence, in breach of Articles I and III of GATT 1994.

Further to Peru's request, the DSB established a Panel at its meeting on 24 July 2001. Canada, Chile, Colombia, Ecuador, Venezuela and the US reserved their third-party rights. On 31 August 2001, Peru requested the Director-General to determine the composition of the Panel. On 11 September 2001, the Panel was composed. On 11 March 2002, the Panel informed the DSB that it would not be able to issue its report within 6 months, due to the complexity of the matter and scheduling constraints. The Panel expects to complete its work by end of April 2002. On 3 May 2002, the parties to the dispute requested the Panel to suspend its proceedings, pursuant to Article 12.12 of the DSU, until 21 May 2002. On 6 May 2002, the Panel agreed to this request.

The Panel Report was circulated to Members on 29 May 2002. The Panel concluded that the EC Regulation was inconsistent with Article 2.4 of the TBT Agreement.

On 28 June 2002, the EC notified its decision to appeal to the Appellate Body certain issues of law covered in the in the Panel report and certain legal interpretations developed by the Panel.

On 26 September 2002 the report of the Appellate Body was circulated.

The Appellate Body recommended that the DSB request the EC to bring the EC Regulation, as found in its and in the Panel Report, as modified by its Report, to be inconsistent with Article 2.4 of the TBT Agreement, into conformity with EC's obligations under that Agreement.

On 23 October 2002, the DSB adopted the Appellate Body Report and the Panel Report, as modified by the Appellate Body Report.

At the DSB meeting of 11 November 2002, the EC stated that it was working towards implementing the rulings and recommendations of the DSB in a manner consistent with its obligations under WTO rules, in particular, Article 2.4 of the TBT Agreement. However, the EC stated that in order to be able to achieve this it would need a reasonable period in which to bring its measures into conformity with its obligations under the TBT Agreement, especially given that implementation would entail the repeal of a statutory measure. To that end, the EC was willing to consult with Peru, pursuant to Article 21.3 of the DSU, in order to

achieve agreement on the reasonable period of time needed for implementation of the DSB's rulings and recommendations.

On 19 December 2002, Peru and the EC informed the DSB that they had agreed that the reasonable period of time for the EC to implement the recommendations and rulings of the DSB, will expire on 23 April 2003. On 14 April 2003, the parties informed the DSB that they had reached an agreement to extend the reasonable period of time until 1 July 2003.

On 25 July 2003, the European Communities and Peru informed the DSB that they had reached a mutually agreed solution pursuant to Article 3.6 of the DSU.

Summary of the finding of Appellate Body:

Measure at issue: EC Regulation establishing common marketing standards for preserved sardines, including a specification that only products prepared from *Sardina pichardus* could be marketed/labelled as preserved sardines.

Product at issue: Two species of sardines found in different waters – *Sardina pilchardus Walbaum* (mainly in Eastern North Atlantic, in the Mediterranean Sea and the Black Sea) and *Sardinops sagax sagax* (mainly in the Eastern Pacific along coasts of Peru and Chile).

The Appellate Body upheld the Panel's finding that the EC Regulation *was* a "technical regulation" within the meaning of Annex 1.1 as it fulfilled the three criteria laid down in the Appellate Body report in *EC – Asbestos:* (i) the document applied to an identifiable product or group of products; (ii) it lays down one or more product characteristics; and (iii) compliance with the product characteristics was mandatory.

The Appellate Body upheld the Panel's finding that the definition of "standard" does not require that a standard adopted by a "recognized body" be approved by consensus. Therefore, the standard in question, Codex Stan 94, fell within the scope of Art. 2.4 as well.

The Appellate Body reversed the Panel's finding that the European Communities had the burden of proving that the relevant international standard was ineffective and inappropriate under Art. 2.4 and found, instead, that the burden rested on Peru to prove that the standard was effective and appropriate to fulfil the legitimate objectives pursued by the European Communities through the EC Regulation. The Appellate Body upheld the Panel's alternative finding that Peru had adduced sufficient evidence and legal arguments to demonstrate that the international standard was not ineffective or inappropriate to fulfil the legitimate objectives pursued by the European Communities (of market transparency, consumer protection and fair competition), since it had not been established that most consumers in most member states of the European Communities have always associated the common name "sardines" only with *Sardina pilchardus Walbaum*.

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17

Subsidies in Indian fisheries-Methodological issues and implications for the future

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Introduction

Subsidies are financial contributions made by Government or public bodies which provide a private benefit. Westlund (2003) defined fisheries subsidies as "government actions or inactions that are specific to the fisheries industry and that modify – by increasing or decreasing – the potential profits by the industry in the short, medium or long-term". World attention was drawn to the scale of the global fisheries crisis and also the extent of fishery subsidies in 1992 with the publication of an FAO report, *Marine Fisheries and the Law of the Sea: A Decade of Change*. The adverse effect of subsides depend on the existing management regime and the bioeconomic conditions of the fishery. Subsidies lower the cost of harvest and raise the effective price of fish. As a management tool, cost-reducing or profit-increasing subsidies may result in increased productive efforts and hence considered as harmful through overexploitation of fish resources and unsustainable harvesting.

There have been three major studies that have collected data from governments to estimate the extent of fisheries subsidies. These studies are: Milazzo (1998); OECD (2003); and APEC (2000). In addition, the WWF (2001) has collated the data from the OECD and APEC studies and compared it with figures from the WTO. Global fisheries subsidies are estimated at US $ 30-34 billion annually with capacity enhancing and fuel subsidies accounting for US $20 to 24 billion (Sumaila, *et al*, 2010). The developed countries accounted for 55 per cent of the global fisheries subsidies and the rest contributed by developing countries. The fisheries subsidies account for a substantial amount of total gross revenues of US$ 80-85 billion from the world's fisheries (FAO, 2011).

The UNEP study (2005) distinguishes between eight different types of fisheries subsidies, namely (i) subsidies to fishing infrastructure (e.g. construction of port-facilities); (ii) management services (e.g. monitoring and surveillance, management related research); (iii) subsidies to securing fishing access (iv) subsidies to decommissioning of vessels (v)subsidies to capital costs (e.g. grants, loan guarantees) (vi) subsidies to variable costs (e.g. fuel, insurance), (vii) income supports and (viii) price supports (e.g. guaranteed minimum price).

International debates and status of the fisheries subsidies negotiations

Fish and fish products were excluded from the Uruguay Round's Agreement on Agriculture and the Agreement on subsidies govern the fisheries sector subsidies. In the Doha Development Agenda, held in November 2001 in Doha, Qatar, the negotiations on clarifying and improving the disciplines of the multilateral trade system with regards to fishing industry subsidies was approved by the WTO ministerial conference. In 2002, WTO members established the various negotiating bodies and designated chairs to lead the groups and manage the agenda. One of these groups –WTO Rules – was formed to address anti-dumping, subsidies, and regional trade agreements. In the first stages of the negotiations, WTO members identified the principal issues concerning fisheries subsidies and discussed conceptual approaches to new rules. In addition, members held discussions about the general types of subsidy programs and sought to identify the most harmful programs from a trade, conservation, and development perspective.

In the Johanneburg world summit on sustainable development, there was a call to eliminate subsidies that contribute to illegal, unreported and unregulated fishing and overcapacity. In March 2006, the first legal text proposals were introduced by countries in the fisheries subsidies negotiations. On November 30, 2007, Ambassador Guillermo Valles Galmes, Chair of the Rules Negotiating Group released the first draft legal text of fisheries subsidies disciplines, which would prohibit a broad range of subsidies that contribute to overcapacity and overfishing, provide additional flexibility in the rules for developing countries, and subject most non-prohibited subsidies to management requirements. The Chair's text proposed a "prohibited" category such as subsidies for vessel construction and outfitting and for operating costs of fishing, including fuel. Certain beneficial subsidies, such as for capacity reduction, are permitted. LDCs are exempted from the new disciplines while other developing countries are given flexibilities—especially for small-scale fishing in their territorial waters.

In May 2010, discussions were held on new text based proposal co-sponsored by Brazil, China, India and Mexico which focused on special and differential treatment and fisheries management related conditionality's on fisheries subsidies. The highlights of the new proposal were a definition based on socioeconomic criteria. The new proposal called for exempting subsidies given by all developing country members to those fishing activities where the benefits are conferred upon low income, resource poor or livelihood fishing activities. The paper also proposed an exclusion of bilateral fishing access agreements between developed -developing countries to be replaced by an exemption on access fees from rights acquired by developing country members only.

Analysis of the subsidy categories in India and the developed countries would serve to compare and to classify fisheries subsidies. According to WWF fact sheet(2009), 90 per cent of officially reported fishing subsidies are granted by Japan, the EU, the United States, Canada, Russia, Korea, and Chinese Taipei. The subsidies to the fisheries sector constitute 20 per cent of value of landings in US and 25 per cent of value of landings in EU.

Subsidies in US

Renée Sharp and Dr. Rashid Sumaila (2009) presented a detailed information and analysis on the nature and extent of subsidies to the U.S. fishing industry. By evaluating data on both state and federal subsidies, they found that government support to the U. S. fishing industry averaged $713 million per year for the period 1996-2004. The largest proportion of this money stemmed from federal and state fuel subsidies, which accounted for 11.6 per

cent to 32.4 per cent of total subsidies over the 9-year period. The U.S. fisheries subsidies accounted nearly 20 per cent of the value of the catch itself.

The federal and state fisheries research funding, accounted for 3.8–35.7 per cent of total subsidies. The next three largest contributors were state sales tax exemptions (5 per cent of total subsidies), disaster aid (4 per cent), and fishing access payments (3 per cent). Federal funding accounted for 79 per cent of the total subsidies and state funding accounted for 21 per cent.

All of the subsidies included in the study were classified as harmful or ambiguous subsidies, according to the classification scheme put forth by Khan *et al.* (2006). The harmful subsidies identified included federal and state fuel subsidies, state sales tax exemptions, fishing access payments, surplus fish purchases, the CCF, seafood marketing programs, the Fisheries Finance Program, and the Fishermen's Contingency Fund. From 1996 to 2004, 56 per cent of government funds went to harmful subsidies and 44 per cent went to ambiguous subsidies.

Table 17. 1 Subsidies in US (1996-2004)

Items	Amount(in million US$)	Per cent to total
Fuel subsidies	2,825	40
Fisheries research	2,536	5
State sales tax exemptions	338	4
Disaster aid	257	4
Fishing access payments	159	2
Surplus fish purchases	117	2
Capital Construction Fund	65	1
Seafood marketing	61	1
Vessel, permit buybacks	55	1
Fisheries Finance Program	2	1
Fishermen's Contingency Fund	1	1
Total	6,416	100

Subsidies in European Union

The EU is the world's second largest fishing power after China. The subsidies to the EU fishing fleet are supposed to the highest Government support than any other country. The main source of funding up to 2006 was the EU Financial instrument for the Fisheries Guidance (FIFG). In EU funding is mainly given to building and modernization of fishing vessels and payments for access agreements with third world countries, like financial compensation for the third parties for the use of fishing waters. The European Fisheries Fund (EFF) began operating in January 2007. Its aim is to improve the sector's competitiveness and help it become environmentally, economically and socially sustainable. It has a budget of EUR 3.8 billion (or EUR 4.3 billion in current prices) for the seven-year period 2007- 2013. Funding is available for all sectors of the industry: sea and inland fishing, aquaculture, and processing and marketing of fisheries products. Particular attention is given to fishing communities most affected by recent changes. The aid for

construction of new vessels and fuel tax exemptions were removed but aid for fleet modernization still exists.

The fisheries subsidies in EU included Fleet, aquaculture and processing, collective actions and infrastructures, sustainable development of fisheries areas. The Indirect subsidies included management, control, scientific advice and research. The EU fisheries sector receives about €850 million annually in structural support, including aid for modernization of vessels, and €150 million for access agreements from the EU. The EU contribution to control and enforcement as well as data collection is limited to about €50 million each. There was a steady growth in the EU subsidies from 70s to enhance industry and regional development and to ensure food supply.

According to Sumaila and Pauli, 2006, the European Fisheries sector receives almost 2.5 billion euros of aid per year, however the exact figure of fisheries subsidies is unavailable due to the wide range of financial instruments used to support the sector, including grants, fuel subsidies, contributions to social security and fuel tax exemptions. In addition, there are Agreements with non-European countries, under which the EU secures access for European fleets to African and Asian waters in exchange of financial compensation.

Fisheries subsidies in India

Government of India provides direct and indirect subsidies to the fisheries sector. Direct subsidies include those given for the purchase of vessels, gears and engines, fuel subsidy and assistance for aquaculture activities. Financial assistance for various welfare schemes, construction of ports, fishing harbours and fish landing centres and development of post- harvest and market infrastructure comes under indirect subsidies. Among the different items, subsidies to marine fisheries development infrastructure and post-harvest operations and export subsidies are considered as harmful subsides. According to the draft proposals on subsidies issued by WTO in 2007, the subsidies or grants for buying or modernizing boats, engines, fishing gear and other fishing equipment (iceboxes, GPS, communication systems, fish finders) in mechanized sectors and HSD fuel tax exemption for mechanized boats in India will be affected by the proposed WTO rules.

The Marine Product Export Development Authority (MPEDA) provides subsidy assistance for export promotion in culture and capture fisheries sectors and development of infrastructure and market promotion schemes. According to a study conducted by MPEDA in 2002, the total direct subsidy component contingent on export was negligible (less than Rs.100 crore) during the ninth five year plan when compared to the value of marine products exports of Rs. 26, 842 crores in the same period.
The Marine Product Export Development Authority (MPEDA) provides subsidy assistance for culture and capture fisheries production and trade. Some of the schemes are described below.

I. Export Production - Capture Fisheries

Financial assistance for installation of insulated / Refrigerated Fish Hold, Refrigerated Sea Water System (RSW) and Ice Making Machine on board mechanized fishing vessels, Financial assistance for the conversion of existing fishing vessels to Tuna long liners and Financial Assistance for constructing New Tuna Long Liners are covered under this scheme.

II. Export Production - Culture Fisheries

In the case of culture fisheries, subsidy assistance is given for new farm development, establishment of small and medium scale hatcheries, setting up of PCR labs, effluent treatment system (ETS) in shrimp farms and also for undertaking organic farming of shrimp and scampi.

III. Induction of New Technology, Modernization of Processing Facilities and Development of Infrastructure Facilities.

Financial assistance for Basic facilities (new) for Chilled fish / Chilled Tuna for export, Technology Upgradation Scheme for Marine Products (TUSMP), Subsidy for setting up new modern ice plant / renovation of existing plant, Financial support for acquisition of Refrigerated Truck/Containers, Financial assistance for setting up large Cold Storages Subsidized distribution of insulated fish boxes, Interest subsidy assistance for seafood units to facilitate upgradation and Developmental assistance for Export of Ornamental/ Aquarium fishes are covered under this scheme. In addition, under market promotion scheme of MPEDA, Group Insurance Coverage for workers employed in the pre-processing and processing plants is given. The premium of the insurance will be paid by the employer, employee and MPEDA in a ratio of 50 per cent, 25 per cent and 25 per cent.

The subsidies to capital construction and infrastructure in India consist of the following;

- Subsidies or grants for buying or modernizing boats, engines, fishing gear and other fishing equipment (iceboxes, GPS, communication systems, fish finders) in artisanal and mechanized sectors;
- Subsidies for land, capital costs and working capital assistance in aquaculture for small-scale and large-scale operatives;
- Equity participation
- Setting up, management and upgradation of ancillary industries – ice plants, freezing plants, hatcheries;
- Exploratory fishing and gear/aquaculture development;
- State investments in fisheries enterprises – the Fisheries Development Corporations
- Grants for safety equipment; disaster preparedness and mitigation infrastructure and equipment
- Infrastructure – ports, fishing harbours and jetties, fuel stations, access roads to fishing harbours and landing centres

Tax preference programs

- HSD fuel tax exemption for mechanised boats
- Tax exemption on kerosene for motorised boats (in Kerala)
- Income tax exemption and sales tax exemption (for sales) for cooperative societies
- Sales tax exempted for fish and dried fish and
- Reduced cess on seafood exports

The various fishery development measures like motorization of crafts and rebate on HSD oil and fishing harbor development are included under the subsidy class of WTO as they directly promote fishing operations. The assistance for fishing harbor development is considered as an indirect subsidy in the WTO definition. NFDB also promotes fisheries through development of fishing harbours, assistance to fish markets and deep sea fishing.

The total assistance for marine fisheries development was Rs.998 lakhs in 2010-11. The support to institutes like fishery survey of India, Central institute of fisheries nautical engineering, NIFPHATT, Central coastal engineering institute, integrated fisheries projects etc. are considered as favorable subsides as they promote sustainable fishing practices. The different items of subsidy in the Indian fisheries sector (Centrally sponsored schemes) are as follows:

Table 17. 2 Subsidies in the fisheries sector in India (2010-11)

Items	Amount in Rs.lakhs
1.Marine fisheries development	
a)Motorization of traditional crafts Central share (50 per cent): State share (50 per cent)	498
b)Rebate on HSD (central share-80 per cent state share 20 per cent)	936
2.Establishment of fishing habours and other infrastructure	5282
3.Welfare measures	746
4.Institutes	4376
5.NFDB	8675
6.Aquaculture	2000
Total	22,513

Table 17.3 Export subsidies (2010-11)

Export subsidies	in Rs.lakhs
Sea freight assistance scheme-for import of raw materials for preparation of value added products	
Tuna long lining	100
Development of potential farming area	679
Organic aquaculture	14.19
Digital data base on aqua farms	37
Ornamental fish breeding	209
Subsidy for promotion of aqua culture	414
Acquisition of processing machinery	1200
Technology for up gradation of marine products	105
Basic facilities for chilled fish/tuna	148
Effluent treatment plant	18
Promotion of aquaculture societies	177
Labs for quality certification	21.33
Landing centres/ fishing harbours-ice making machines and chill rooms	300
PCR lab	40.68
Total	3422.52

An international study by Sumaila and Pauly*(*2006) however identified three categories and 12 fisheries subsidy types and estimated the fisheries subsidies in India based on the subsidy amounts provided for the year 2000 in real inflation adjusted in US $. According to their study, beneficial subsidies included those amount spend for fisheries management and services, fishery research and development and maintenance of MPAs and

amounted to US $ 2,77,840. The harmful subsidies included fuel subsidies and the financial assistance provided for purposes like boat construction and modernization, construction and renovation of fishing ports, market and storage infrastructure and other fishery development and support services. The amount of subsidies came to US $ 5,56, 648. The third category was ambiguous or ugly which included vessel byback and rural fisheries community development and it came to US $ 1, 91,203. The overall quantum of fisheries subsidies in India amounted to $10,25, 690.

Analysis of fisheries subsidies in different states in India
Subsidies in the marine fisheries sector of Kerala

The different categories of fisheries subsidies in the state of Kerala included the central government grant for marine fisheries development, fishing harbour development, reimbursement of sales tax on HSD oil for fishing boats and kerosene subsidy for the motorized boats. The annual kerosene subsidy to the marine fisher folk is to the tune of Rs.60 crores. The state of Kerala received a grant of 1,717 lakhs for development of marine fisheries, infrastructure and post- harvest operations and Rs.700 lakhs for fishing harbour development in 2009-10 under the centrally sponsored schemes. Government of Kerala spent an amount of Rs.20 crores for integrated coastal development activities and Rs.18 crore for fishing harbour development including the central share. The total subsidies in the marine fisheries sector of the state constitute 4 per cent of the gross earnings from fisheries.

Analysis of subsidies in the marine sector of Karnataka

The Govt. of Karnataka provides different subsidies to marine fishing sector consisting of reimbursement of HSD oil, VAT exemption and motorization of traditional crafts. In addition, the government provides various assistance schemes for the welfare of fishermen. Among these the tax exemption for HSD oil and assistance for motorization of crafts are considered as fishing effort enhancing subsidies.

Table 17.4 Subsidy given for motorization of crafts in Karnataka (in Rs.)

2004-05	9,95,666
2005-06	29,78,217
2006-07	9,15,655
2007-08	2,89,8723
2008-09	2,58,4300

Table 17. 5 Reimbursement of HSD oil in Karnataka (in Rs.lakhs)

Years	Central share	State share	Total
2004-05	728	0	728
2005-06	600	0	600
2006-07	380		380
2007-08	400	0	400
2008-09	350	0	350
2009-10	400	0	400

The total amount of subsidy given for the motorization of crafts increased from Rs.9.95 lakhs in 2004-05 to Rs.25 lakhs in 2008-09. The total amount of subsidy given for reimbursement of central excise duty was Rs.400 lakhs. In addition, the amount of VAT exemption to amount to Rs.60 crores. The amount given for development and renovation of fishing harbors and fish landing centres amount to Rs.290 lakhs in 2009-10.

Analysis of subsidies in the marine fisheries sector of Maharashtra

Table 17.6 Amount subsidies given in the marine sector (Maharashtra)

Reimbursement of sales tax(HSD oil)	6800
Fishing harbours/ landing centres	186.29
Mechanization of fishing crafts(NCDC)	3252
Installation of modern equipments	119.85
Nets	10.45
Non -mechanized boats	128.2
Total	10496.79

The states of Karnataka and Maharashtra give 100 per cent sales tax exemption to the marine fisheries sector. The total amount of subsidies given in the marine fisheries sector amounts to 23 per cent of the total value of marine fish production in Maharashtra.

Subsidies to the fishing sector have trade and environmental consequences. Eventhough WTO member countries have been negotiating to clarify and improve the agreement on subsidies and countervailing measures, there has been little progress made in formulating an international regime for the regulation of fisheries subsidies. There are several issues which require clarifications and improvements like special and differential treatment for low income resource poor countries, bilateral fishing access agreements, migratory and straddling fish stocks, IUU fishing etc. There is an urgent need to regulate fisheries subsidies due to the negative impact that subsidies have on trade, environment and sustainable development.

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18

An Analysis on the Marine Products Exports During 2011-12

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The Marine Products Export Development Authority is a statutory body set up by the Government of India under the MPEDA Act 1972, under the Ministry of Commerce & Industry, Govt. of India.

MPEDA is the nodal agency for promotion of export of marine products from India. The MPEDA has presence in all the maritime states and is implementing its developmental schemes for export promotion/aquaculture production through the field offices.

During the financial year 2011-12, for the first time in the history of Marine product exports, the export earnings have crossed USD 3.5 billion. This is also first time export has crossed all previous records in quantity, rupee value and US $ terms. Exports aggregated to 862021 tonnes valued at Rs. 16597.23 crores and USD 3508.45 million. Compared to the previous year, seafood exports recorded a growth of 6.02per cent in quantity, 28.65per cent in rupee and 22.81per cent growth in US$ earnings respectively.

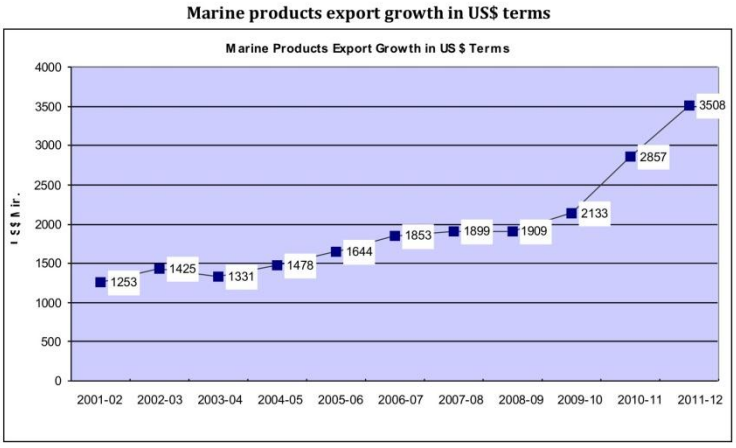

Figure 18.1 Marine products exports growth in US$ terms

The figures must be viewed in the light of the scenario of continuing recession in the international markets, debt crisis in EU economies, continuing antidumping duty in US, sluggish growth in US economy and the political instability in the Arab world. The increased production of Vannamei shrimp, increased productivity of Black tiger shrimp and better price realization of major items like Shrimp, Squid and Cuttlefish helped us

to gain such a higher export turnover.

Table 18.1 Exports during 2011-12 compared to 2010-11

Export details	2011-12	2010-11	Growth per cent
Quantity Tonnes	862021	813091	6.02
Value Rs.crore	16597.23	12901.47	28.65
Value US $ Million	3508.45	2856.92	22.81

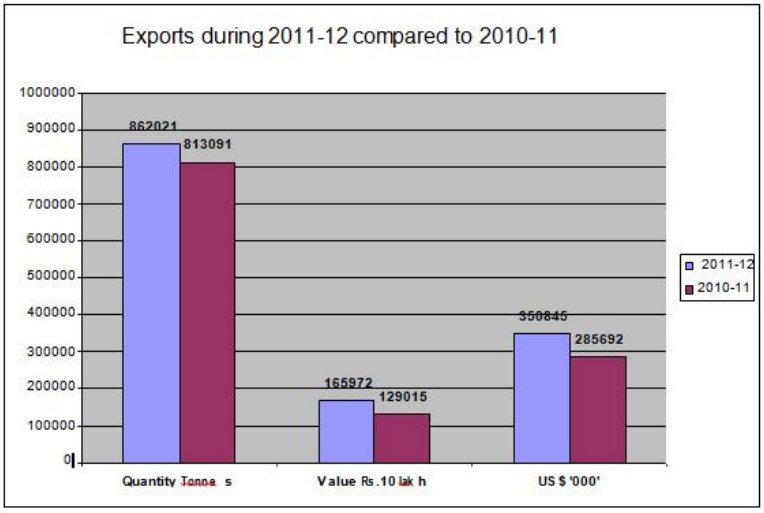

Fig. 18.2 Exports during 2011-12 compared to 2010-11

Major items of export

Frozen Shrimp continued to be the major export value item accounting for 49.63per cent of the total US $ earnings. Shrimp exports during the period increased by 24.86per cent, 42.97per cent and 37.99per cent in quantity, rupee value and US$ value respectively.

Fish, has retained its position as the principal export item in quantity terms and the second largest export item in value terms, accounted for a share of about 40.27per cent in quantity and 19.48per cent in US$ earnings. Fr. Cuttlefish recorded a growth of 21.92per cent in rupee value and 15.58per cent in USD terms. Unit value also increased by 25.06per cent, however, there is a decline in quantity (7.59per cent). Export of Fr. Squid showed an increase of 21.53per cent in rupee value and 17.46 per cent in US$ realization and the Unit value also increased by 32.95per cent. However, there is a decrease of 11.65per cent in terms of quantity. Live items also showed a growth of 8.76per cent in terms of rupee value and 3.18 per cent in terms of US$ realization compared to the previous year. Dried items showed a drastic decline in quantity, value and US$ terms by 32.05per cent. 41.08per cent, and 44.56per cent respectively. The details are given in the following table

Table 18.2 Major Item Wise Exports

ITEM		SHARE PER	2011-12	2010-11	VARIATION	(PER
FROZEN SHRIMP	Q:	22	189125	151465	37660	24.86
	V:	49.26	8175.26	5718.13	2,457.13	42.97
	$:	49.63	1741.20	1261.81	479.39	37.99
	UV$:		9.21	8.33	1	10.51
FROZEN FISH	Q:	40	347118	312358	34759	11.13
	V:	19.79	3284.15	2623.89	660.25	25.16
	$:	19.48	683.50	583.48	100.02	17.14
	UV$:		1.97	1.87	0	5.41
FR CUTTLE FISH	Q:					
	V:	6	54671	59159	-4488	-7.59
	$:					
	UV$:	8.11	1346.72	1104.57	242.15	21.92
		8.06	282.72	244.62	38.10	15.58
FR SQUID	Q:	9	77373	87579	-10207	-11.65
	V:	7.40	1228.19	1010.57	217.61	21.53
	$:	7.49	262.72	223.67	39.04	17.46
	UV$:		3.40	2.55	1	32.95
DRIED ITEM	Q:	6	53721	79059	-25338	-32.05
	V:	3.39	562.65	954.94	-392.30	-41.08
	$:	3.35	117.66	212.22	-94.56	-44.56
	UV$:		2.19	2.68	0	-18.41
LIVE ITEMS	Q:	0	4199	5208	-1009	-19.37
	V:	0.93	154.61	142.15	12.45	8.76
	$:	0.93	32.46	31.46	1.00	3.18
	UV$:		7.73	6.04	2	27.98
CHILLED ITEMS	Q:					
	V:	2	21278	21118	160	0.76
	$:					
	UV$:	2.15	357.42	257.54	99.88	38.78
		2.11	74.03	56.93	17.10	30.03
OTHERS	Q:	13	114538	97145	17393	17.90
	V:	8.97	1488.24	1089.67	398.57	36.58
	$:	8.95	314.16	242.72	71.44	29.43
	UV$:		2.74	2.50	0	9.78
TOTAL	Q:	100	862021	813091	48931	6.02
	V:	100	16597.23	12901.47	3,695.76	28.65
	$:	100	3508.45	2856.92	651.53	22.81
	UV$:		4.07	3.51	1	15.83

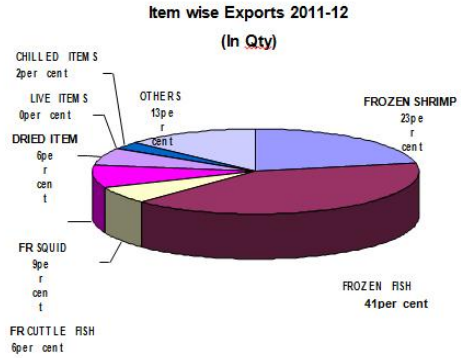

Figure 18.3

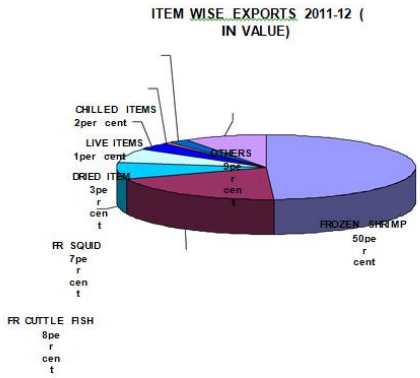

Figure 18.4

Figure 18.3 & 18.4 Item wise exports in quantity and value

Major export markets

South East Asia became the largest buyer of Indian marine products with a share of 39.90 per cent in volume and 25.09 per cent in US $ realization. European Union (EU) got into the second place with a share of 22.96per cent followed by USA 18.17per cent, Japan 13.01per cent, China 7.51per cent, Middle East 5.33per cent and Other Countries by 7.95per cent. Exports to South East Asia registered a growth of 87.51 per cent in US$ realization and 47.01per cent in terms of volume. Increase in export of Fr. Shrimp, Fr. Fish and Chilled items contributed to the growth. Exports to US had registered a positive growth of 36.45per cent in quantity and 45.39per cent in US$ realization and is mainly attributed by the export of Fr. Shrimp and cephalopods. Exports of Vannamei shrimp showed a tremendous increase in US market by 212 per cent in quantity and 209per cent in US $ realization.

Export to Japan also registered a positive growth of 21.33per cent in quantity and 22.35 per cent in US $ terms. Exports of chilled items showed a tremendous increase in Japanese market by 120.12per cent in quantity and 220.34per cent in US $ realization. Exports to China showed a drastic decline of 46.89per cent in quantity and 40.17per cent in US$ terms. The marine products exports have strengthened India's presence in South East Asia. There is a significant increase in exports to South East Asian Countries compared to the previous year.

Export of Fr. Shrimp to South East Asia has registered a growth of about 222.43per cent in volume and 356.36per cent in US$ terms. Export of Fr. Shrimp to USA has also showed a growth of about 47.68per cent in volume and 47.55per cent in US$ terms. Export of Vannamei shrimp had also picked up. We have exported about 40787 MT of Vannamei shrimp during this period.

Export to Middle East countries showed an increase of 25.98per cent in US$ realization but declined in quantity by 13.25per cent. The details are given in the following table.

Table 18.3 Major Market Wise Exports

: Quantity in Tons, V: Value in Rs. Crore, $: US$ Million						
Country		Share per cent	Apr-2011 - Mar-2012	Apr-2010 - Mar-2011	Variation	(per cent)
JAPAN	Q:	10	85800	70714	15085	21.33
	V:	12.90	2,140.67	1,683.39	457.28	27.16
	$:	13.01	456.35	373.00	83.36	22.35
USA	Q:	8	68354	50095	18259	36.45
	V:	17.94	2,977.53	1,990.26	987.26	49.60
	$:	18.17	637.53	438.49	199.04	45.39
EUROPEAN UNION	Q:					
	V:	18	154221	170963	-16742	-9.79
	$:	22.96	3,810.44	3,459.40	351.04	10.15
CHINA	Q:	10	84515	159147	-74631	-46.89
	V:	7.59	1,259.23	1,977.81	-718.58	-36.33
	$:	7.51	263.30	440.10	-176.80	-40.17
SOUTH EAST ASIA	Q:					
	V:	40	343962	233964	109998	47.01
	$:	25.27	4,193.27	2,114.48	2,078.79	98.31
MIDDLE EAST	Q:	4	38155	43983	-5827	-13.25
	V:	5.39	894.38	670.35	224.03	33.42
	$:	5.33	186.85	148.31	38.53	25.98
OTHERS	Q:	10	87014	84225	2789	3.31
	V:	7.96	1,321.72	1,005.77	315.94	31.41
	$:	7.95	278.94	222.50	56.44	25.37
Total	Q:	100	862021	813091	48931	6.02
	V:	100	16,597.23	12,901.47	3,695.76	28.65
	$:	100	3,508.45	2,856.92	651.53	22.81

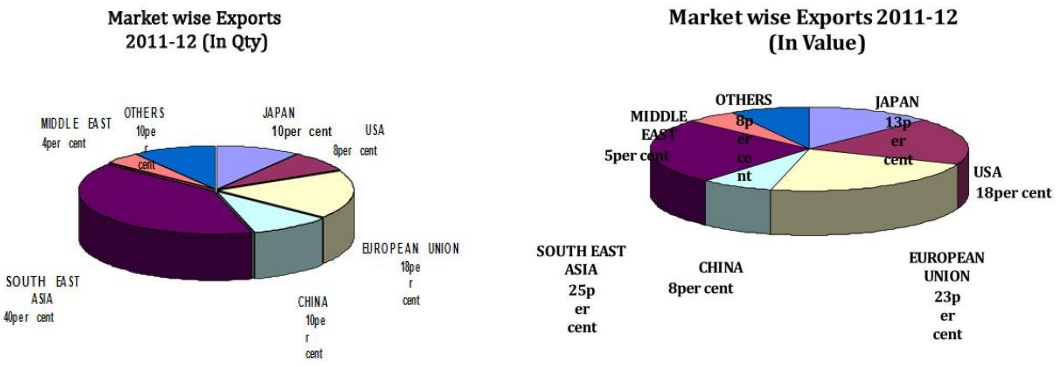

Figure 18.5 and 18.6 Item wise exports in quantity and value

Outlook for 2012-13

MPEDA envisage an ambitious target of USD 4.5 Billion for the year 2012-13. Increased production of L.vannamei shrimp and increase in infrastructure facilities for production of Value added items are the helping factors to achieve this target.

19

Sanitary and Phytosanitary Measures: Objectives and Principles of SPS Agreement and Implications for Indian fisheries sector

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Introduction

The basis of much of the world trade today is the governed by the various provisions and agreements of the World Trade Organization (WTO). It is a forum where the rules of global trade are evolved, trade agreements are negotiated and finalized and trade disputes are settled. Generally it supports the premise that there should be a free flow of goods, services, capital and labour across national boundaries and it should be as fair as possible. Historically it began in 1948 with the establishment of the General Agreement on Tariffs and Trade (GATT) which became an international organization for international trade matters and negotiations. While the timeline for the agreements of the WTO are rather torturous and long winding, a semblance of concurrence came about after the Uruguay Round of Negotiations which was held during the period 1986-1994, the result of which was the coming into being of the WTO itself on 1st January 2005. The WTO covers most aspects of trade including 'trade in services, and in traded inventions, creations and designs (intellectual property)' (htpp://www.wto.org). They are legally accepted by all the countries who are members in the WTO. Till then the agreements went by the name the GATT (General Agreement on Tariffs and Trade). The Agreement on the Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement or SPSA) along with several important agreements came into force from the date of establishment of the World Trade Organization on 1 January 1995. As on May 2012, 155 countries were members in WTO.

Trade in the world is either for goods or for services and these are the two broad areas covered by the WTO under various agreements governing the two. The outline for the agreements are common, with the details being specific (http://www.wto.org last accessed on August 7, 2012). There is the basic principles for trade (GATT), for services (GATS - General Agreement on Trade in Services) and for Intellectual Property (TRIPS- Trade-Related Aspects of Intellectual Property Rights) (Fig. 1). The basic structure of the WTO Agreements is given in table 1.

Table 19.1 The Basic Structure of WTO Agreements

Umbrella	Agreement Establishing the WTO		
	Goods	Services	Intellectual Property
Basic Principles	GATT	GATS	TRIPS
Additional Details	Other goods agreements and annexes	Service annexes	
Market Access Commitments	Countries' schedule of commitments	Countries' schedules of commitments (and MFN exemptions)	
Dispute Settlement	DISPUTE SETTLEMENT		
Transparency	TRADE POLICY REVIEWS		

Source: WTO (available at http://www.wto.org/english/rese/bookspe/agrmntseries4_spse.pdf)

The additional agreements and annexes which are sector specific are different for GATT and GATS and under GATT comes the regulations for food safety, animal and plant health protection which in other words is the Sanitary and Phytosanitary Measures (SPS). While most of the agreements are for aiding the growth of trade among different countries, there are some which may actually be trade restricting. These are however under very special circumstances and come into force only for ensuring the safety of human life and other living organisms. The SPS regulations fall under this category. The SPS measures aims to protect animal and plant life and human health by ensuring food safety. It recognizes the sovereign right of a country to have protective measures in meeting the above mentioned objectives.

Historical perspective of food safety measures

Food is a very important commodity that is traded the world over. Primary food products as well as processed food products find their way from one end of the globe to another, catering to the needs and demands of consumers. Even in ancient times food was traded because not all civilizations could produce everything it wanted. Also the evolution of settlements, villages, towns and cities saw the rise of agriculture and livestock rearing resulting in surplus production of location specific food produce. Rome depended on Egypt (http://history.knoji.com_last accessed on August 6, 2012) and other North African countries for grain. India exported grain fresh fruit and honey to Mesopotamia and Oman (Chinese traded in salt, fish and cattle, which were sent to even places like Greece. Food historians believe that food was selected or rejected based on observation (http://www.foodtimeline.org_last accessed on August 6, 2012).

Man realized quite early the relationship between food and health and the dangers of consuming food that is spoilt. This led to the creation of laws and regulations that would ensure safe food to consumers. Lásztity et. al. (2004) trace food laws to the ancient times and observe that most ancient civilizations like the Egyptians, the Indians, the Greek, Chinese and Romans had food regulations. They were mainly for protection of consumers against fraud as cases of adulteration of substances like milk etc. was found. Trade guilds formed in the Middle Ages controlled food quality of traded products, especially in Europe.

Detailed specifications on production of bread were stipulated. In thirteenth century France, for the first time the consumers' material interest and health, became part of the code for trade practices. Industrialisation and the rapid expansion of urban settlements and the resultant problems arising out of poor sanitation and hygiene led to growth of food control laws and measures with many such measures being put in place in Europe during the 1920s. After World War II the work towards common international standards began and the FAO/WHO Food Standards Program was established in 1963, and a joint inter governmental body was created: the Codex Alimentarius Commission (CAC) (http://www.who.int/foodsafety/codex/en/). Thus it is clear that safe food has been a priority for nations for centuries as man had the knowledge that food can be a cause for poor health and even death in humans. The natural corollary to human health was the health of animals and plants and this in turn forms the crux of the SPS regulations in place in different countries. That it also affects trade resulted in countries coming into agreements on the issue, however, it continues to be trade restrictive in many cases.

Basic Objectives of the SPS Measures

The SPS measures gained importance for countries not only because the safety of its people, animal and plant life was paramount but also because there was a need to offer some sort of protection for its trade as the tariff barriers had been considerably reduced after many rounds of negotiations and trade had been liberalised to a large extent. Countries had taken to Non Tariff Barriers (NTBs) as a form of trade restriction. Besides SPS, the other NTB are the Technical Barriers to Trade (TBT). The scope of TBT is much wider than that of SPS and includes human disease management, food labelling and packaging etc. However, if any of these falls under the purview of food safety it comes under the SPSA. The "SPS measures are expected to be imposed only to the extent necessary to protect human, animal or plant life or health on the basis of scientific information" while TBT can be imposed for other "legitimate" objectives like national security, environmental safety etc.

According to the definition by WTO, Sanitary means health in general and animal health sometimes, phytosanitary means pant health and sanitary and phytosanitary means food safety and animal and plant health. So in effect Sanitary and Phytosanitary means anything to do with food safety and animal and plant health.

The twin objectives of the SPS Agreement under WTO are that it "recognises the sovereign right of Members to provide the level of health protection they deem appropriate; and it ensures that SPS measures do not represent unnecessary, arbitrary, scientifically unjustifiable, or disguised restrictions on international trade". To meet both the objectives, WTO encourages members to use accepted International standards like the Codex of the FAO/WHO, the OIE, the World Organization for Animal Health (http://www.oie.int/) or the International Plant Protection Convention (IPPC) of the FAO (https://www.ippc.int/).
In specific cases where there are no such standards or even otherwise where they exist but countries would prefer higher standards, the member countries are free to evolve their own standards provided they are scientifically proven.

Principles that should govern SPS Measures

The core principles that govern the formulation of SPS measures and regulations by countries are non discrimination, harmonization and equivalence. The Most Favoured Nation principle (MFN) should be adopted and the application of the regulation should be uniform across different trading partners as well as within the country. A country cannot have a different standard domestically and another governing international trade. There should be a measure of transparency in the development and implementation of measures which includes that the measures should be notified sufficiently in advance giving time to trading countries to comply with the same. There is also a provision for technical assistance to developing countries and special and differential treatment in such cases. Developing countries will be aided with technology, research or infrastructure; may be given advice grants; and training, technical expertise and equipment for complying with the measures and take advantage of the market. The special and differential treatment takes into account the special needs of developing countries and gives provisions of longer time periods for compliance to the standards.

It is also expected under the SPSA that the control, inspection and approval procedures must also be fair and just. While it is necessary that the measures must be scientifically justified, there is also a need for harmonization, i.e., making an effort to bring the standards on par internationally and not much variation in similar standards/ measures. The equivalence principle requires that even if the measures are apparently different if an exporting country demonstrates that its measures achieves the similar objectives of the importing country, the measure has to be accepted as equal by the importing country.

Governments also have the right to restrict international trade when it is necessary to protect human, animal or plant health. Besides they can also have their own standards other than any recognised international standard and also can go in for higher or more stringent standards to protect human, animal or plant health but these measures or standards must be based on scientific risk assessment on, whether it is a food borne risk and has the potential to harm human and/or animal health or there is a possibility of introduction of a disease or pest which may spread in the country and cause economic or biological losses, and also follow all the other tenets prescribed like consistency in application and it should not lead to unnecessary trade restrictions

“According SPS Agreement, an SPS measure is any measure applied:

a. to protect animal or plant life or health within the territory of the Member from risks arising from the entry, establishment or spread of pests, diseases, disease-carrying organisms or disease-causing organisms;

b. to protect human or animal life or health within the territory of the Member from risks arising from additives, contaminants, toxins or disease-causing organisms in foods, beverages or feedstuffs;
c. to protect human life or health within the territory of the Member from risks arising from diseases carried by animals, plants or products thereof, or from the entry, establishment or spread of pests; or to prevent or limit other damage within the territory of the Member from the entry, establishment or spread of pests.”

Table 19.2 SPS Measures at a Glance

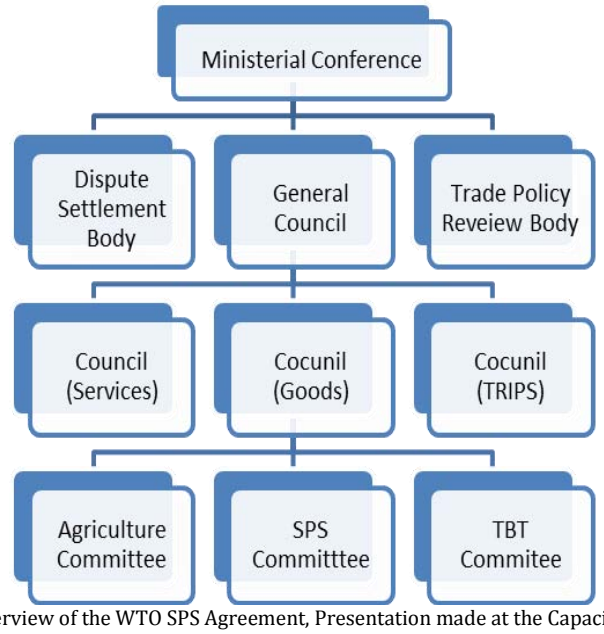
To protect:	from:
Human or animal life	risks arising from additives, contaminants, toxins or disease-causing organisms in their food, beverages, feedstuffs
Human life	plant- or animal-carried diseases
Animal or plant life	pests, diseases, or disease-causing organisms
Country	damage caused by the entry, establishment or spread of pests

htpp://www.wto.org

SPS measures may be related to product criteria, processes and production methods, testing, inspection, certification approval procedures, quarantine treatments, animal transport and packaging and labelling requirements which are directly related to food safety.

SPS Committee

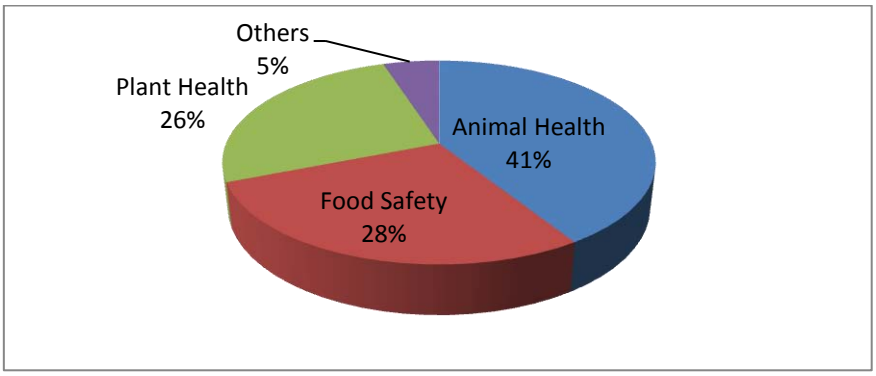
The SPS Committee is a special committee under the WTO that looks after the Implementation of the SPS Agreement. It takes into account the compliance and studies the impact on trade. It is basically a forum for exchange of information on SPS among member countries. The structure of the WTO with regard to the SPS Committee is given in Fig. 1. Members can also raise issues individually or a as a group with other members sometimes supporting the 'trade concern' in the meetings. The member countries agree to resolve the concerns bilaterally and the discussions and outcomes are reported to the Committee.



Source: Fall, Marième, Overview of the WTO SPS Agreement, Presentation made at the Capacity Building Workshop on WTO and Trade Issues' organized by UNCTAD-India, FICCI, CWTOS and ITC (Geneva) at New Delhi during July 20-22, 2010

Figure 19. 1 Structure of the SPS Committee under WTO

Most of the trade concerns during the period 1995-2009 were regarding animal health followed by food safety and plant health (Fall, 2010) (Fig. 2). While earlier the developed countries were the countries raising concerns now increasingly developing countries are also raising trade concerns with India being one of them.



Source: Fall (2010

Figure 19.2 Trade Concerns raise by member countries during 1995-

Increasingly the concerns are rising for developing countries mainly because the importing country standards are becoming more and more stringent. The developing countries are not sufficiently equipped infrastructural or with trained manpower to meet the challenges. Besides, there is an almost simultaneous and exponential growth in private standards, which are being adopted by importers in these countries.

Table 19.3 Some of the Specific Trade Concern (STC) (1995-2007) involving India and related to fisheries

S.No.	Item Number	Description of Measure	Member(s) Maintaining the Measure	Member(s) Raising the Issue	Status*
	India				
1.	39	Maximum levels for certain contaminants (aflatoxins) in foodstuffs	European Communities	Argentina, Australia, Bolivia, Brazil, Gambia, India, Indonesia, Malaysia, Philippines, Senegal, Thailand	R
2.	61	Import restrictions on bovine semen	India	Canada, European Communities	PR
3.	62	Restrictions on imports of horses	India	European Communities	NR
4.	96	Geographical BSE risk assessment	European Communities	Canada, Chile, India	R
5.	185	Restrictions due to avian influenza	India	European Communities	NR
6.	186	Phytosanitary import restrictions	India	United States, European Communities	PR
7.	192	Non-notification of various SPS measures	India	United States	NR
8.	200	Ban on food grade wax	India	United States	NR
9.	223	Import requirements for Indian mangoes	Japan	India	NR
10.	240	Biotech labelling and import approval process regulations	India	United States	NR
11.	253	Export certification requirements for dairy products	India	United States	NR
	Fisheries				
12.	8	Ban on salmon imports	Australia	Canada, United States	R
13.	11	Restriction on levels of copper and cadmium in imported squid	Spain, European Communities	United States	R
14.	33	Salmonella-related restriction on fishmeal imports	European Communities	Chile, Peru	NR

S.No.	Item Number	Description of Measure	Member(s) Maintaining the Measure	Member(s) Raising the Issue	Status*
15.	72	Measures regarding canned tuna in oil	Belgium, European Communities	Philippines	NR
16.	77	Restrictions on canned tuna	Egypt	Thailand	NR
17.	85	Import restrictions on prawns and prawn products; revised generic IRA for prawns and prawn products	Australia	China, Thailand	NR
18.	97	Restrictions on the use of fishmeal	European Communities	Chile, Norway, Peru	NR
19.	130	Restrictions on shellfish	European Communities	Indonesia	NR
20.	142	Zero tolerance for e-coli	China	United States	NR
21.	157	Quarantine measures for the entry and exit of aquatic products	China	European Communities	R
22.	171	Animal health conditions and certification requirements for live fish	European Communities	Australia	NR

*NR= Not Reported, P = Partially resolved, R= Resolved

Disputes and Dispute Settlement

Disputes arise when members feel that there is a violation of the commitments made in the Agreements and only governments can raise a dispute and that has to be notified to the WTO Secretariat. The dispute settlement procedure follows the usual mechanism as for all other disputes in WTO where the Dispute Settlement Body takes up the matter. It sets up panels of experts to look into the issue (but can accept or reject the panel findings). The concerned members are given time for bilateral consultations, followed by the setting up of the panel (in case no agreement is reached) and time for it to complete its assessment and preparation of the report. The Dispute Settlement Body takes the final decision in the matter and if not contested within 60 days will become the final ruling in the matter.

Over 250 disputes have been raised after the establishment of WTO. Several cases have been resolved through bilateral consultations. Panels have looked into cases relating to the EU ban on meat treated with growth-promoting hormones; Australia's restrictions on imports of fresh, chilled or frozen salmon; and Japan's requirement that each variety of certain fruits be tested with regard to the efficacy of fumigation treatment (http://wto.org).

The import restriction by Australia on salmon was contested by Canada on the ground that salmon being imported for human consumption may not lead to spread diseases in wild salmon. The timeline of the dispute spread over 1997 to 2000. The panel set up to look into the matter found that the ban violated Article 5.1, 5.5 and 5.6 of the Agreement. The dispute ended with a mutually agreed solution.

Article 5: : Assessment of risk and determination of the appropriate level of sanitary and phytosanitary protection

1. Members shall ensure that their sanitary or phytosanitary measures are based on an assessment, as appropriate to the circumstances, of the risks to human, animal or plant life or health, taking into account risk assessment techniques developed by the relevant international organizations.

5. With the objective of achieving consistency in the application of the concept of appropriate level of sanitary or phytosanitary protection against risks to human life or health, or to animal and plant life or health, each Member shall avoid arbitrary or unjustifiable distinctions in the levels it considers to be appropriate in different situations, if such distinctions result in discrimination or a disguised restriction on international trade. Members shall cooperate in the Committee, in accordance with paragraphs 1, 2 and 3 of Article 12, to develop guidelines to further the practical implementation of this provision. In developing the guidelines, the Committee shall take into account all relevant factors, including the exceptional character of human health risks to which people voluntarily expose themselves.

6. Without prejudice to paragraph 2 of Article 3, when establishing or maintaining sanitary or phytosanitary measures to achieve the appropriate level of sanitary or phytosanitary protection, Members shall ensure that such measures are not more trade-restrictive than required to achieve their appropriate level of sanitary or phytosanitary protection, taking into account technical and economic feasibility.

Tabble 19.4 Dispute: Restrictions on imports of mangoes

Raised by:	Brazil
Supported by:	India
Dates raised:	June 2003 (G/SPS/R/30, paras. 34-35), October 2003 (G/SPS/R/31, paras. 25-26), March 2004 (G/SPS/R/33, paras. 65-67), June 2004 (G/SPS/R/34, paras. 25-26), March 2005 (G/SPS/R/36/Rev.1, paras 81-82)
Relevant document(s):	Raised orally
Solution:	Regulations modified to permit imports
Status:	Resolved

1. Brazil indicated that it had been seeking approval to export mangoes to Japan for 18 years. Japan demanded steam treatment in spite of the satisfactory level of the measures taken by Brazil, Chile and other potential exporters to avoid fruit fly. Japan had continuously demanded more information and had not taken previous scientific studies into account. Although Japan had offered technical assistance, this had not facilitated the process. Brazil considered that Japan's measures were inconsistent with the provisions of the SPS Agreement on equivalence, regionalization and technical cooperation.

2. Japan stated that Brazil had requested technical assistance in 1986 but had stopped the technical assistance in 1990 because it wished to develop its own technique based on hot-water treatment. This design was launched in 1998. Both countries agreed on this and the final data was submitted in 2001. Supplementary information was needed, however, before Japan could approve the measures and conclude the necessary technical studies.

3. In October 2003, Brazil stressed that Japan's restrictions on imports of mangoes were unjustified as mangoes were produced in an area 2000 km away from the area where the fruit fly was found. Brazil was waiting for the completion of the public consultation process in Japan and requested Japan to act swiftly to allow the importation of mangoes. Japan reported its authorities had recently received data from Brazil on the trapping of fruit flies and was in the process of reviewing the information. Brazil had submitted technical information in October 2001 and the technical studies by Japan were progressing well.
4. In March 2004, Brazil stated that the Japanese authorities had reacted favourably to technical data provided by Brazil the previous year. The evaluation process had entered a new phase and Brazil

hoped to come to a satisfactory solution including the signing of a protocol on packaging, storage and transportation of mangoes to Japan. India noted that, while India was a fruit fly free area its request for market access for mangoes into Japan had been under review for ten years. India had submitted data to Japan and hoped for a favourable response. Japan stated that technical evaluation of data submitted by Brazil was in the final stages. With respect to India's concerns, Japan had not received technical data from India but looked forward to receiving such data.

5. In June 2004, Brazil reported that after the last meeting, Brazilian and Japanese phytosanitary authorities had held two technical meetings in Japan to discuss a phytosanitary protocol that would allow Brazilian mango exports to Japan. In the last meeting, the Japanese authorities had confirmed that negotiations on the protocol had been concluded, and certification of consignments remained the only outstanding issue. The Japanese authorities had indicated that this issue could be resolved in parallel with the public consultation phase and Brazil encouraged Japan to initiate the public consultation soon. Japan confirmed that the technical evaluation on the Mediterranean fruit fly had been completed and a bilateral meeting had been held to coordinate plant quarantine measures for market access and requirements for hot water dipping. The new protocol was expected to be implemented based on the outcomes of these bilateral discussions.

In March 2005, Brazil informed the Committee that on 29 September 2004, Japan had modified its phytosanitary regulations and established specific norms for the import of mangoes from Brazil. In December 2004, Japanese inspectors had gone to Brazil to examine packing houses. On 12 January 2005, the first shipment of Brazilian mangoes had been exported to Japan, which marked the beginning of a regular flow of exports of mangoes to Japan. To date, eight shipments of mangoes (variety Tommy Atkins) had been exported without restrictions. Japan noted that the measure was taken through the appropriate pest risk assessment process based on technical data submitted by Brazil.

Source: http:///wto.org

Are SPS provisions trade restrictive?

The SPS measures can very easily become trade restrictive and a Non Tariff Barrier by its characteristic features embedded in the Agreement, particularly for developing countries (Das, 2008). For instance Governments (countries) can restrict trade on the premise of protecting human, animal or plant health. Though not entirely arbitrary in cases where sufficient scientific evidence is lacking or even based on some available information such steps can be brought into force (though additional information must be sought and it must be subject to review within a reasonable period of time as a matter of 'precaution'. In spite being against fair access in international trade, many a times the protection of domestic industry from international competition is the underlying factor for resorting to such measures. More so because the market access in general has considerably increased because of substantial reduction in tariffs across the board. And because it is primarily a technical matter sometimes it is not possible for exporting countries to challenge the same for want of scientific evidence. If challenged however a country has to prove scientifically that there exists a risk to health. For developing countries the compliance to the standards is a major drawback with standards becoming more and more stringent. According to Das (2008) SPS measures were the third most frequently reported trade barrier for developing countries. 74 per cent of the submissions related to residue limits, freedom from disease and treatments and 17 per cent to testing, certification and conformity to standards. So

Implications for fisheries sector in India

Safe food is a requirement of the consumers that all sectors have to fulfill. The fact remains that the SPS measures are here to stay and to gain advantage in trade and to develop taking the advantage is what India must aim at. India has the expertise to put in place a robust system of SPS in the country on par with world standards. What is lacking is

suitable infrastructure as well as the fool proof monitoring system that is warranted in implementing the same.

For fisheries the challenges are even greater as the sector is catered to by a diverse fleet and methods of fishing, poor onboard and off board infrastructure and the lack of appropriate technical manpower for implementation of food safety in the sector.

As for the measures themselves there still exists non-harmonization of standards with standards more stringent than internationally accepted standards without proper risk analysis. For example EU does not stipulate limits for *V parahaemolyticus,* but some mEU countries like Italy and France has stipulated specific limits. *Vibrio parahaemolyticus* is found in marine environment in the tropics and is susceptible to chilling/freezing or heating to 60 degrees and is not considered a hazard in products which are to be cooked before consumption. In Japan the limits are 1000 to 10000 per gram for ready- to-eat cooked products. The differences in levels of pesticides and heavy metals in fish products stipulated by different countries are given in table 4 to illustrate the point.

Table 19.5 Levels of pesticide and heavy metals allowable in fish imported into different countries

Pesticides/ Heavy Metal	EU	USA	Japan
DDT	1ppm	5ppm	3ppm
Aldrin	0.2ppm	0.3 ppm	0.1 ppm
Chlordane	0.02ppm	0.3 ppm	0.5ppm
Fluridone	0.2ppm	0.5ppm	0.5ppm
Cadmium	0.5 ppm	3ppm	3 ppm
Lead	0.5ppm	1.5ppm	1ppm
Methyl Mercury	0.5ppm	1ppm	0.3ppm

Source: Deepak Shekhar, Joint Director, EIA-Koch, Role of Export Inspection Council of India and Export Inspection Agencies in the WTO scenario, presentation made at the National Seminar on WTO & its impact on Indian Seafood Trade, organized by SOFTI and CIFT and held at Cochin on 28 June 2008

India has been facing rejections in the International market, especially to EU, based on SPS measures. Cases of rejection of Indian Shrimp by EU in 2002 for the presence of residues of antibiotics cholomphenicol and nitrofuran. The stipulation was that residues should not exceed 0.3ppb and 1 ppb with little scientific evidence to prove that at intake of higher levels than those prescribed would be harmful to human health (Greenhalgh, 2004), Similarly heavy metal residues in cephalopods have resulted in rejections. The EU standards are more stringent than international standards and it comes under the special measures for consumer protection, animal and plant health (http://europa.eu/pol/food/index_en.htm). Earlier in 1997 (Salagrama, 2004the EU had banned all seafood imports from India citing poor infrastructure for harvesting and processing of fish, with exporters losing heavily in the subsequent years. This was when steps had already been initiated to upgrade processing facilities to meet EU standards.

It can be noted that even within EU, different countries have different standards, as mentioned earlier. Rejections have also taken place for unspecified reasons (Rajeev, 2008) There are instances of rejection of the Indian farm-raised and sea-caught marine products for the presence of bacterial inhibitors/ antibiotic residues without specifying the residue involved in such rejections. Health authorities involved in testing activities in India feel that harmful residues are not possible to be present in the sea caught products.

Different countries have different standards. Levels of Histamine can vary from 50ppm in US to 150ppm in EU (Mathew, 2003 quoted from Salagrama, 2004). EU requires a national agency certificate while individual processors certificate would be sufficient in US. Mouldy smell has been cause for rejections of shrimp to Japan. There is lack of transparency and the measures are not notified in a timely manner and sometimes available only in the local language.

EU has a system of Rapid Alert where a rejection from a particular is known to all the member nations. However the procedure for lifting rapid alerts by the member countries is not harmonized. The number of tests required varies from country to country for lifting the rapid alert. Another drawback, especially with EU., is the destruction of consignments with antibiotic residues. This causes heavy losses as it prevents the processor from the possibility of re-export to another country with permissibility of higher levels of the same.

The positive side of the various issues the seafood export sector faced in the late 1990s and early 2000s issue has been that today quality and food safety issues are taken seriously in the sector, especially for export purposes, and the country can boast of (http://www.mpeda.com) 287 processing units having EU approval. The EU approval is accorded by The Export Inspection Agency (EIA) after inspection by the Inter Departmental Panel (IDP) consisting of representatives of EIA, MPEDA (Marine Products Export Development Authority) and CIFT (Central Institute of Fisheries Technology). The US also enforced the HACCP system which Indian exporters have to comply. There has been support at the government level and programmes are being implemented by MPEDA for upgradation of facilities at landing centres and for fishing boats as well. India can do well to improve its technical capabilities, develop suitable infrastructure and generate country level data to support our claims that standards need not necessarily be so high.

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Tradeoffs in Fisheries -Sustainability and Development

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Fishery resources are renewable natural resources but not in-exhaustible. The threat of extinction or over-exploitation due to indiscriminate fishing practice is being witnessed at different countries. One of the important aim of the fisheries management is to develop programme for sustainable fishing. The concept of sustainable fishing focuses on maintaining inter and intra-generational equity in the parlance of resource economics.

Sustainability

Generally sustain refers to keep up continuously without any interruption or disturbance. "Sustainability refers to the simple principle of taking from the earth only what it can provide indefinitely, thus leaving future generations no less than we have access to ourselves."

Sustainability is viewed differently from the point of view of ecology, economics and sociology.

- From the ecology point of view, it is the ability of ecosystems to maintain its structure and function and to remain resilient in order to continue to give and support life.
- From economic angle, the sustainability refers to the ability of the market to optimally allocate scarce resources, to send proper price signals and to provide mechanisms for investment and to maintain a healthy labour market.
- For a sociologist, it refers to the ability of individuals and communities to remain in good health physically, mentally, emotionally and spiritually and ensure equity among and between generations.

Sustainable development

> "Sustainable development is a requirement to our generation to manage the resource base such that the average quality of life we ensure ourselves can be potentially be shared by all future generations ".(Asheim, 1991)

The definition sustainable development given by the World Commission on Environment and Development (1987) is taken as the guide line for the sustainable development now. "**Sustainable development is that Development that meets the need of the present generation without compromising the ability of future generations to**

meet their own needs" This definition of sustainable development is widely accepted and commonly used world-wide.

Since the definition of sustainable development in 1987 by the Brutland Commission report followed by extensive discussion, **there dimensions of sustainable development** have emerged.

1. **Economic dimension**: An economically sustainable system must be able t produce goods and services on a continuing basis, to maintain manegable levels of government and external debt, and to avoid extreme sectoral imbalances, which damage agricultural or industrial production
2. **Environmental Dimension:** An environmentally sustainable system must maintain a strong and stable resource base, avoiding over exploitation of renewable resource systems or environmental sink functions and depleting non-renewable resources only to the extent that the investment is made in adequate substitute. This includes maintenance of biodiversity, atmospheric stability and other ecosystem functions not ordinarily grouped as economic resources.
3. **Social dimension:** A socially sustainable system must achieve distributional equity, adequate provision of social services including health and education, gender equity and political accountability and participation.

Sustainability rules

The resource economics, environmental and ecological economics have described possible approaches for sustainability in various literature. There are a few sustainability rules for achieving sustainable development. They include (a)Hartwick-Solow approach; (b) Non-declining natural stock approaches, (c) safe minimum standards approach and (d) Daly's operational principles. The most popular model that is being quoted for sustainable development is Common and Perrings (1992) model. In this model, a pair of constraints that are sufficient for ecological and economic sustainability are incorporated. These constraints are endogenous and the objective function is dependent on discounted social welfare. (Hanley et al, 1997)

Sustainable Fisheries Yield

Fisheries are classified under renewable natural resources. However such resources are also liable to become extinct if the rate of harvest or exploitation is higher than the rate of regeneration or reproduction. Here the size of the stock (population) depends on the biological, economic and social considerations.

The sustainable yield in fishing commonly referred to as "Maximum Sustainable Yield (MSY) is a biological phenomenon. MSY means that level of fish catch or yield that can be harvested from a given system in perpetuity without affecting the stock of the system (or the sea). In other words, a catch level is said to be sustainable whenever it equals the growth rate of the population since it can be maintained for ever. As long as the population size remains constant, the growth rate will remain constant as well.

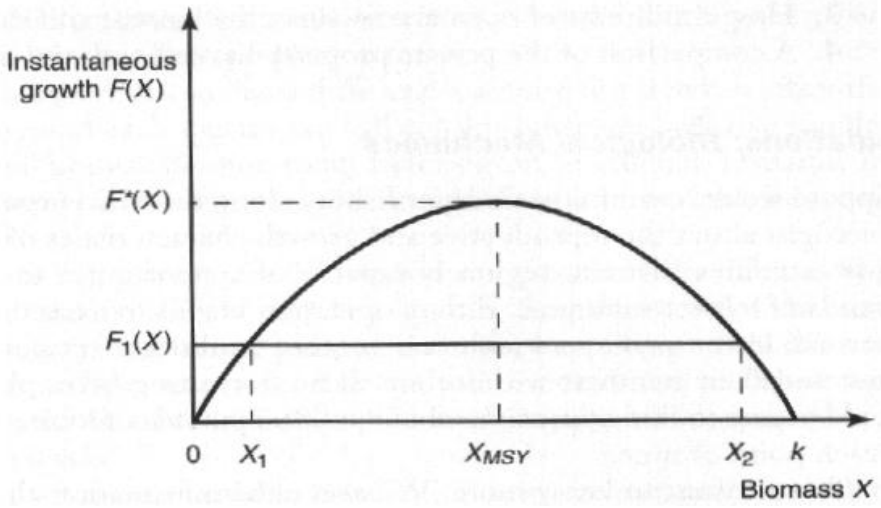

Figure 20.1 Sustainable Yield Curve

Source John A. Dixon, Fisheries and Aquatic Resources World Bank Institute

There is an additional concept called Maximum Economic Yield (MEY) which includes the monetary terms of the effort and returns.

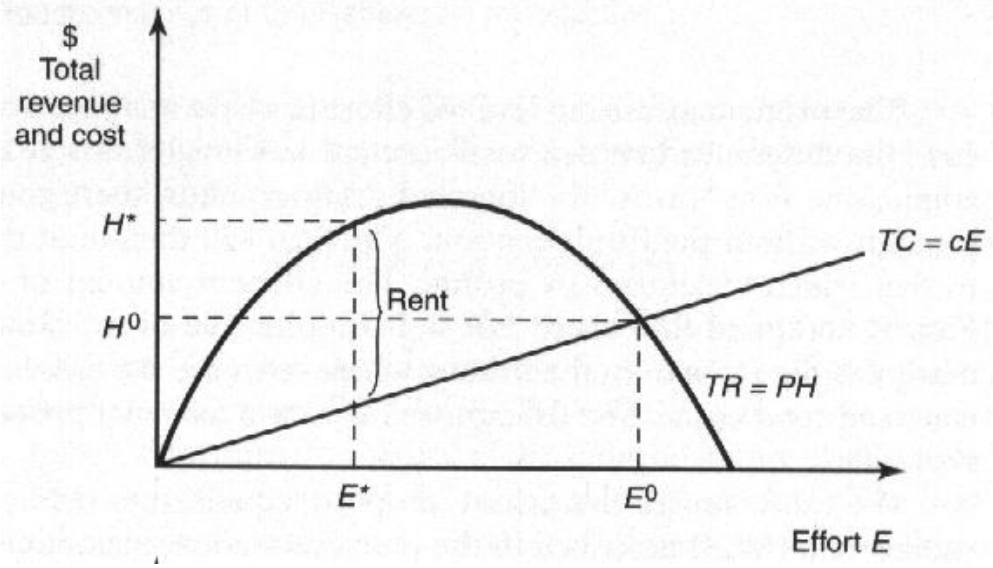

Figure 20.2 Maximum Economic Yield

When the relationship between effort and money are measured, it was observed that when stock is low, effort must be high.

- Total revenue (*TR*) = Price (*P*) × Catch (*H*)
- TC = Unit cost (*c*) × Effort
- Rent = TR – TC

The rent is maximized at the point E*. Here

- *MEY* is left of *MSY*
  - Optimal harvest (*H**) is less than the *MSY* harvest
  - But rent is larger than at *MSY*

The marginal analysis can show that the MEY occurs at the point where MC =MR. It is observed that for marginal unit of effort, marginal rent is = 0 and average rent >1.

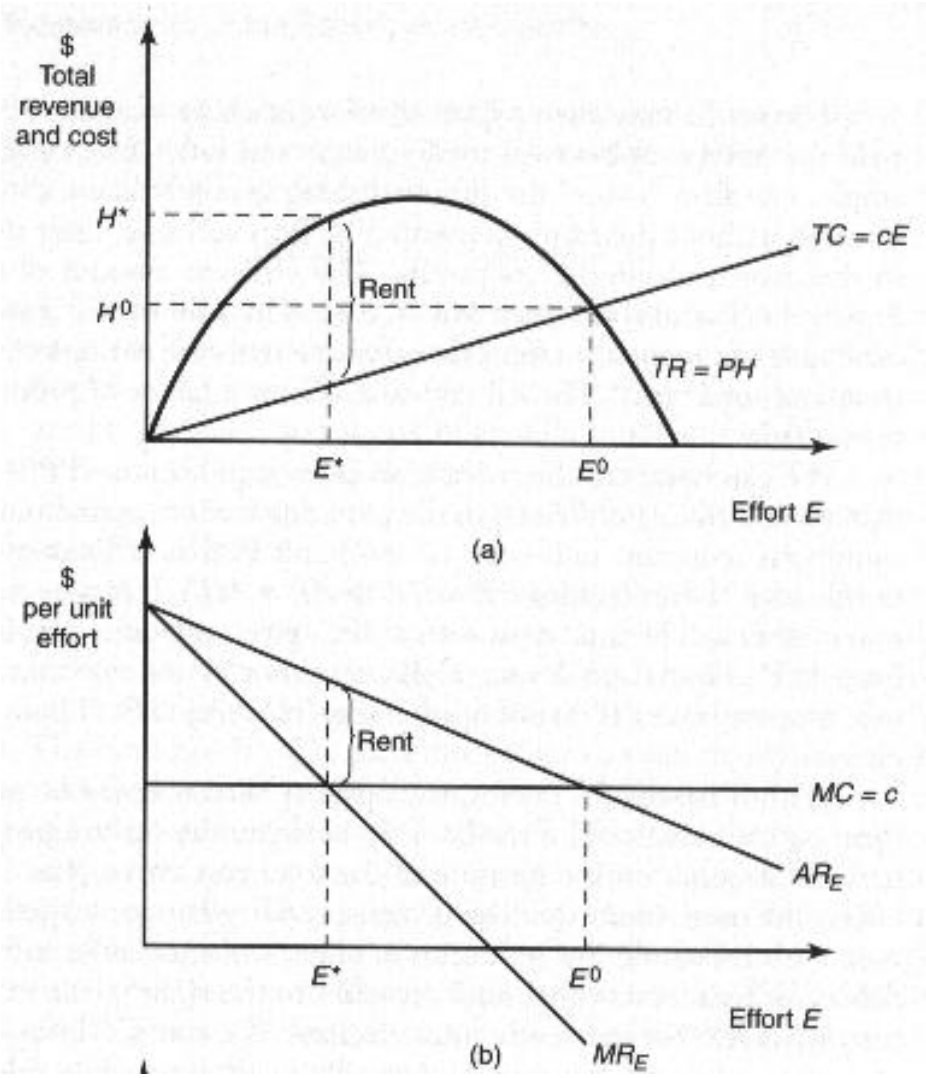

Figure 20.3 Cost and Earnings for Efforts

Dixon concludes that the "Goal of traditional fisheries management: achieve *MSY.* However the economists aim for MEY in contrast to MSY. AT MEY, compared to MSY, the fish catch is lower, fishing profit is higher, fishing effort is lower and the fish stock is higher. Thus the author concludes that MEY is where more fish is conserved. (Dixon, 2005)

The trade off

All fishery management plans aims to bring sustainable fishing to protect the stock from indiscriminate harvest. All the development programmes are also aimed at such sustainable fisheries management.

But there are certain issues that have cropped up in the due course. Initially our fishing is carried out on subsistence fishing since we did not have advanced fishing crafts to harvest the resources of our seas. Gradually when the mechanized fishing was introduced, the catch rates and the harvest increased. This has helped the fish catch to increase from 0.5 million tones in 1950 to 3,83 million tones in 2011 with fluctuating harvest over the years.

Initially our fishing fleet comprised only traditional crafts with limited mobility. This prevented the fishers to venture into far off seas, where the resources were abundant then. But the fishing fleet gradually increased over the years from about 90,424 in 1961-62 to the present level of 1,94,490 crafts. The mechanized crafts were introduced first and after 1980, the motorized crafts entered into the fishing fleet. At present there are about 50,618 non-mechanized crafts and 71,313 motorized and 72,559 mechanized crafts in the fishery (CMFRI, 2010).

The share of the non-mechanized landings in the total marine fish landings decreased from 24 per cent in 1985 to 2.45 per cent in 2011, while that of the mechanized crafts increased from 66 per cent to 78 per cent during the same period. The share of the motorized crafts also increased from 9 per cent to 19 per cent between 1985 and 2011. These statistics indicate that the non-mechanized crafts are almost nearing the stage of marginalization and being phased out of the fishery. But is the proportions of fishers who are depending on such traditional fishery have also shifted to other sectors? The answer is not a comprehensive yes. The incidences of marginalization of such traditional fishers are taking place in isolation. This point has to be looked into. The seafood export has also increased multi-fold during the last six decades to reach the level of about Rs.16,000 crores presently, which acts as as incentive to invest and expand the fishery infrastructure both on-shore and off-shore. How far the benefits of such developments have reached the gross root level fishers, who are also involved in fishery and fishery related activities. What is the impact on the harvest of the resources? Whether the resources have been over exploited or become extinct? Such questions needs a comprehensive evaluation of the sector in total.

This topic has raised some questions that normally arises when development takes place. But fisheries sector is very unique in the sense, we are managing a resource where we do not see the total stock unlike in other natural resource like land and forest. Hence our estimation needs more precise methods to arrive at any conclusion for translating into policy framework. The trade off between sustainability and development in fisheries, thus have to be arrived at after a comprehensive evaluation of the sector in total and arriving at an optimum path way. This is no doubt, a huge task but definitely achievable with all our concerted efforts.

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21

Issues of WTA in shrimp aquaculture for exports and options for way forward

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The global trade agreements under the ambit of World Trade Organization(WTO) (hereafter called as WTA), cover goods, services and intellectual property. They spell out the principles of liberalization, and the permitted exceptions. They include individual countries' commitments to lower customs tariffs and other trade barriers, and to open and keep open services markets. They also set procedures for settling disputes. They prescribe special treatment for developing countries. They require governments to make their trade policies transparent by notifying the WTO about laws in force and measures adopted, and through regular reports by the secretariat on countries' trade policies. As fisheries is not having the protection as agriculture under WTO regime, un understanding of WTA is important for fisheries professionals. Though WTA is put in place to ensure free trade among nations, many trade barriers are government-induced restrictions on international trade. The barriers can take many forms, including the following: tariffs, non-tariff barriers to trade import licenses, export licenses, import quotas, subsidies, voluntary export restraints, local content requirements, embargo, currency devaluation. Other trade barriers include differences in culture, customs, traditions, laws, language and currency. Most trade barriers work on the same principle: the imposition of some sort of cost on trade that raises the price of the traded products. If two or more nations repeatedly use trade barriers against each other, then a trade war results. Economists generally agree that trade barriers are detrimental and decrease overall economic efficiency, this can be explained by the theory of comparative advantage. In theory, free trade involves the removal of all such barriers, except perhaps those considered necessary for health or national security. In practice, however, even those countries promoting free trade heavily subsidize certain industries, such as agriculture and steel. Trade barriers are often criticized for the effect they have on the developing world. Because rich-country players call most of the shots and set trade policies, goods such as crops that developing countries are best at producing still face high barriers. Trade barriers such as taxes on food imports or subsidies for farmers in developed economies lead to overproduction and dumping on world markets, thus lowering prices and hurting poor-country farmers. Tariffs also tend to be anti-poor, with low rates for raw commodities and high rates for labour-intensive processed goods. The Commitment to Development Index measures the effect that rich country trade policies actually have on the developing world. Another negative aspect of trade barriers is that it would cause a limited choice of products and would therefore force customers to pay higher prices and accept inferior quality. Trade barriers affecting fisheries and shrimp exports from India are discussed hereunder.

1. Case of Tariffs

Worldwide, the average tariffs for fish products continue to be more than 40 per cent, well above the average of 6 per cent for manufactured goods. Tariff reduction has been below average in the case of fish, as well as in products which are of major export interest of developing countries. In some cases, fish products are among items whose rates show tariff peaks, i.e. whose rates are the highest among all products.

2. Cases of Non-tariff Measures

2.1. The GATT Tuna–Dolphin Cases

The principal issues raised by the tuna–dolphin cases whether the US measures to protect dolphins could be applied to tuna, whether domestic or imported. The Panel decided that dolphin and tuna could not be viewed as like products. Neither Panel however, was required to adjudicate as to whether dolphin-safe and non-safe tuna were like products and therefore whether national restrictions on non-safe tuna were GATT-consistent. The difficulty with the definition of like products is where negative externalities arise because of joint production. In the tuna case, this is because certain catch technologies lead to protected dolphins as well as yellow fin tuna being caught in the eastern Pacific. The issue of negative externalities arising from joint production however, was never tested by either tuna Dispute Panel because of the indirect nature of the US protective measures. The second tuna Panel found that the US dolphin conservation policy was GATT-consistent and could be applied extraterritorially. As in the first Panel Decision however, the actual measures were deemed neither 'necessary' nor GATT-consistent.

2. Shrimp–turtle case

The WTO shrimp–turtle case covers a very similar range of trade and environmental – and therefore PPM – issues as the two tuna–dolphin cases outlined above. The most important contribution of the shrimp–turtle case however, is that it was launched after the introduction of the WTO DSU such that the final Panel Decision has become part of WTO case law. The 1973 US Endangered Species Act requires US shrimp trawlers and other shrimp vessels in US waters to use turtle-excluder devices (TEDs) 'when fishing where there is a likelihood of encountering sea turtles' (United States, 1973). TEDs are now regarded as the international standard for protecting turtles because of their low cost, effectiveness and ease of use (CIEL, 1999). The Act was amended in November 1989 to permit the placing of embargoes on shrimp imports from countries that did not have a comparable regulatory programme to that of the United States to protect sea turtles. All US shrimp imports require certification that they were harvested using TEDs and that their incidental sea turtle mortality rate is similar to the United States unless their fishing environment does not pose a threat to sea turtles. In 1995, the Marine Turtle Specialist Group of the IUCN (International Union for Conservation of Nature & Natural Resources) prioritised the threat of shrimp fishing methods to endangered sea turtle species. The United States applied the embargo under the Endangered Species Act on all non-turtle-safe shrimp imports in May 1996. In October 1996, India, Malaysia, Pakistan and Thailand lodged a WTO complaint against the US embargo on the grounds that such import bans cannot be applied extra-territorially (WTO, 1996a). The US defence, unlike in the tuna cases, rested upon GATT Article XX exceptions alone rather than incorporating Article III on national regulations. The WTO shrimp Panel Report, published 6 April 1998, found that the measures were discriminatory in that the United States took no account of methods other than TEDs used to protect sea turtles. The argument was rejected by the Panel on the

grounds that sea turtles are not an exhaustible resource and that such 'unilateral measures could jeopardize the multilateral trading system' (WTO, 1998).

2.3. Anti-Dumping on Shrimp Exports

Anti-dumping has been one of the most talked about area of WTO in the recent times. There is extraordinary concern about areas of WTO in the recent times. This is mainly on two counts. First, India is one of the highest users of anti-dumping, second only to United States in the year 2001 according to the WTO sources. Second, India is also one of the main victims of anti-dumping action by foreign authorities. There are several reasons as to why dumping takes place across nations, but it needs to be underlined that the act of dumping per se is not the cause of concern. Only when dumping leads to material injury or threatens to cause material injury that the WTO Agreement on Anti-dumping allows imposition of anti-dumping duties. In other words, it must be clearly understood that anti-dumping duty is not a protection measure but is to be used only to remedy a particular trade distortion. Anti-dumping Agreement of the WTO is the basis on which various national authorities have formulated their own national legislations. The concepts and definitions, rights and obligations, and to a great extent the procedures followed by different national authorities remain identical flowing out of the same agreement. Therefore, this article attempts to discuss various aspects of anti-dumping with a view to give an insight into the basic concepts of anti-dumping mechanism. Before imposition of any anti-dumping measures, three main conditions are to be necessarily established by the anti-dumping authorities. These are:

1. Existence of Dumping beyond *de minimis* limits
2. Existence of Injury
3. Causal link between dumping and injury

To initiate an anti-dumping action, the domestic industry must be able to provide sufficient evidence to support the contention of 'material injury'. Material injury or thereof cannot be based on mere allegation, statement or conjecture. Moreover, a 'causal link' must exist between the material injury being suffered by the Indian Industry and dumped imports. Related to all of the above is what is termed as, the *De Minimis* Margin. According to the provisions of the Agreement on Anti-dumping, any exporter whose margin of dumping is less than 2 per cent of the export price shall be excluded from the purview of anti-dumping duties even if the existence of dumping injury as well as the causal link is established. The Directorate General of Anti-dumping and Allied Duties (DGAD) is the designated authority for filing and monitoring anti-dumping investigations in India. The DGAD applies the Lesser Duty Rule for making their recommendations regarding the amount of anti-dumping duty to be imposed. Going purely by the economic rationale behind antidumping, duties levied by most countries, several studies undertaken by various scholars suggest that antidumping legislation is economically inefficient and that antidumping practices do not conform to the economic explanation of protection. On the contrary, these studies seem to imply that a political economy motivation seems to be driving the imposition of anti-dumping levies in most countries. It must however be remembered that 'anti-dumping is not a tool for protection of the weak. It is a tool for dealing with a situation where the strong may attack the strong.'

As things stand, almost 90 per cent of the total world imports are now entering countries in which anti-dumping laws are in place. In India also, there has been a spectacular growth of anti-dumping investigations in recent years. The number of such investigations launched in 1999 was more than double that of those started in 1995. The national law on antidumping in India has been in place since 1985. The first Anti-dumping

investigation in India was initiated in 1992. During the period from 1992 – 93 to 2003 – 2004, the DGAD received large number of applications for initiating the Anti-dumping investigations. After the examination of these applications, the anti-dumping investigations were initiated in 167 cases.

2.3.1. Anti-dumping Duty on Shrimp

On December 31, 2003, the United States Department of Commerce (DOC) received antidumping duty petitions on imports of certain frozen and canned warm water shrimps from Brazil, Eucador, India, the People's Republic of China, Thailand, and Vietnam filed in proper form by the Ad Hoc Shrimp Trade Action Committee ("Petitioner") on behalf of the domestic industry and workers producing frozen and canned warm water shrimp ("Petition") On January 8, 2004, the Department sent the Petitioner a deficiency questionnaire requesting clarifications of certain items in the petition. On January 12, 2004, the Petitioner submitted their deficiency questionnaire response. On February 17, 2004, the United States International Trade Commission (ITC) preliminarily determined that there is a reasonable indication that imports of certain frozen and canned warm water shrimp from India are materially injuring the United States Industry, On 20th February 2004, the Department selected Hindustan Lever Limited ('HLL'), Devi Sea Foods Limited ('Devi') and Nekkanti Sea Foods Limited ('Nekkanti'), the largest exporters of shrimp to the US during the Period of Investigation (POI) as mandatory respondents. These companies submitted extensive information to DOC in their responses to DOC's questionnaires. During the period February to June 2004, various interested parties, including the petitioners submitted comments on the scope of this and concurrent investigations of certain frozen and canned warm water shrimp concerning whether certain other seafood products to be covered under the scope of the investigation. The mandatory respondents submitted their reply to the questionnaire by April 2004. A supplemental questionnaire was issued and the replies were received by July 2004. On May 3rd 2004, the petitioners alleged that Devi, HLL made third country sales below the cost of production (COP), and therefore requested that department initiate a sale-below-cost investigation of these respondents. On May 28, 2004, the department initiated a sales below-cost investigation for Devi and HLL. May 18, 2004, the department determined that the case was extraordinarily complicated and postponed the preliminary determination until no later than July 28, 2004 . The International Trade Commission ("the Commission"), which is responsible for determining whether "the domestic industry" has been injured, must also determine what constitutes a domestic like product in order to define the industry. The Act defines the domestic like product as a product which is like or in the absence of like, most similar in characteristics and uses with, the article subject to an investigation under this title." The scope of the investigation included certain warm water shrimp and prawns whether frozen or canned or wild caught or farm raised, head on or head less, shell on or peeled, cooked or raw or otherwise processed in frozen and canned form. The petitioner in the US ascertained that the industry's injured condition is demonstrated by (1) reduced sales; (2) reduced prices; (3) declining employment; (4) declining market share; and (5) Significant financial losses. It is important to note that these duty margins do not imply that the Indian exporters are selling their products in the US market below cost. Rather these margins are the result of certain complex calculations by which primarily a range of products sold in the US and a pre-selected third country are matched by product specifications and adjusted selling prices.

There is no Shrimp Aquaculture in the US and US Shrimp resources are only from the wild. It is known phenomenon that Shrimp catches from the oceans are declining and it is becoming increasingly more expensive to catch shrimp from the ocean. Whereas aquaculture has made tremendous progress in farming technology as well as production yields and as a result, Asian and Latin American Countries can today produce shrimp more

efficiently at lower costs of production. Therefore, these countries are able to offer Shrimp at more competitive prices Consequently, shrimp that was once a luxury item is now available to the average American consumer at competitive prices. On July 29, DOC made affirmative preliminary determination and imposed provisional antidumping duty ('AD duty') as follows :

Table 21.1Details on the antidumping duties

S.No	Exporter	Prelim Rate
1	Devi Sea Foods Limited	3.56 per cent
2	Nekkanti Seafoods Limited	9.16 per cent
3	Hindustan Lever Limited	27.49 per cent
4	All others	14.20 per cent

DOC made the mandatory 'disclosure' of adjustments made to each company's data in arriving at the margins; and relevant details of software program they used for margin calculations. It was noticed during the course of the investigation that DOC made several adjustments to HLL's data, some of which are prima facie not warranted. This was brought to DOC's notice pointing out that the adjustments made were 'ministerial errors' that could be rectified immediately. The margin calculations were performed making several adjustments to the data submitted by the Companies. Most of these adjustments are unique to the US anti-dumping law and do not conform to normal commercial methods of determining profit or loss.

2.3.2. Tenure of Anti-dumping Duty Order ('ADO')

The ADO will be in force for five years unless it is revoked in a changed Circumstances Review (CCR) initiated by DOC or ITC. The CCR should not normally be initiated for atleast two years after ADO is issued unless sufficient reasons exist for its initiation. In the fifth year, a 'sunset review' will be initiated by DOC. Then DOC and ITC will conduct the sunset review mostly like the way investigation is conducted, to determine whether duties can be withdrawn or should be continued for another five years.

2.3.3. Changed Circumstances Review (CCR)

In an unprecedented move, ITC decided to invite comments on whether they should initiate, on their own, a 'changed circumstances review' for frozen shrimp imports from Thailand and India on account of destruction caused by tsunami after December 2004. There is no set procedure outlined in the ITC manual for this measure.

2.4. Case of 'Muddy smell' and shrimp export to Japan

As alternative markets, Japan is the most likely buyer. But quality concerns such as the `muddy' smell in shrimps from some centres in Andhra Pradesh have dampened the scope. Japan was till recently the largest market for Indian shrimps, though it continues to pick up stocks they are nowhere near the quantities it used to buy in the late 1990s. Indian shrimp exports to Japan have dropped to about 28,000 tonnes in 2003, just half that of its exports in the mid-1990s. Though exporters hope to step up sales to Japan, the other producers particularly Thailand and Vietnam will also be targeting this market. Competition will be high and prices low.

2.5. Case of Zero-tolerance of Residual Antibiotics

In recent years, in order to export aquaculture products into EU, the United States and other markets, In 2001, EU decided to examine 100 per cent of shrimp products imported from China, Thailand, Vietnam, Indonesia and other countries because they discovered residual antibiotics chloramphenicol (CAP) and nitrofurans (NF) in some products. EU authorities have initiated a food-safety policy called "zero tolerance" towards chloramphenicol, nitrofuran and other antibiotics. However, there is no scientific evidence to show that a very low content of residue - as low as one billionth - of antibiotics can be harmful to the health of the consumers. EU has stipulated that the residue in food should be 0.3ppb or even 0.7ppb. It is difficult for exporters, including those from EU, to achieve such accurate results in the products they export. These strict food-safety regulations have enabled EU member countries to destroy all imported lots which contain residual antibiotics of chloramphenicol and nitrofurans. Even worse, EU authorities have destroyed several lots of imported shrimps from Vietnam and other Asian countries while these products were still in storehouses. Many of these were destroyed without advance notice, and not in the presence of the owners. These regulations have caused serious difficulties for exporters of fisheries from Asian countries. In 2001, EU banned the import of shrimp from China and, on account of residual chloramphenicol in shrimp from Indonesia, shrimp export from this country into EU has decreased by 64 per cent. The existence of nitrofurans in shrimp from Thailand caused severe restrictions to be placed on shrimp export from this country into EU. The issue of residual antibiotics in shrimp continues to be a cause for concern for exporting countries. Meanwhile, many products manufactured in EU and sold in many Asian countries have been discovered to contain residual antibiotic chloramphenicol and other toxins. China has demolished 2 containers of 'sausages' infected with antibiotics from the Netherlands. It was also discovered that two types of powdered milk from the Netherlands - Protifar and Frisolac 2 - contain residual chloramphenicol of about 0.545 ppb and 0.303 ppb respectively. These products are being sold in Asian countries. Current regulations on food safety in some member countries of the EU still permit the use of antibiotics in livestock husbandry and the export of beef containing residual chloramphenicol of more than 10 ppb. EU policies regarding the export of domestic products to developing countries on the one hand and imports from developing countries to EU on the other can be thus seen as following two different sets of standards. The EU restrictions on import mentioned above can be considered as a non-tariff barrier that obstructs the export of seafoods and agricultural products from Asian countries. EU's "zero-tolerance" policy and its implementation by EU authorities have clearly resulted in damage to the trade between EU and Asian countries as well as to the economic development of Asian countries. On 20 September 2002, EU's Veterinary committee decided to abrogate the compulsory examination policy of 100 per cent of shrimps imported from India, Vietnam and some other countries on account of residual antibiotics.

3. Options for Way forward

3.1. Eco-labelling

Labelling - especially eco-labelling - is a new concept for the fisheries sector. However, eco-labels will become increasingly important in the world markets. As a result of successful campaigning by environmental groups, the consumers of fish and fish products in several developed countries have begun showing an increasing preference for fish and fish products that are produced under better conservation and management regimes. In the near future, international markets are likely to demand eco-labelled or, in other words, "fairly traded" fish products. Over the last decade, some countries have developed systems of environmental labelling for their products. Currently a concern for producers, importers

and exporters from several countries in the world, eco-labelling has received attention from the WTO during its recent trade and environment discussions on account of its potential impact on international trade as a "green" non-tariff barrier. The experience of European Eco-Labelling Network demonstrates how national and regional standards can create links between trade and environment. Eco-labelled products need to meet the minimum requirements specified by EU's Eco-Labelling Network. If this Network is strictly implemented, it may hinder exports from almost all manufacturers in developing countries. These manufacturers will have to face serious difficulties in order to meet the EU standards, since they employ technologies that are suitable for the level of scientific and technological development in their country. The examination of products from non-European companies to determine whether they meet the eco-labelling standards in Europe will place an additional burden on these companies. In the light of the growing interest in the linkages between environmental standards and international trade, one may view eco-labelling either as an opportunity or as a bottleneck for exports of fish and fish products. Environmental standards could complement the standards for food safety, which are strictly adhered to in the United States, European Union and Japan. Environment standards and those for food safety could address the two major external concerns regarding fish production and consumption. One can conceive of a situation where a fish product imported and sold in EU markets may carry two logos - one for food safety, and the other for its origin in a sustainable fishery. A fisheries sector with improved management and better organization may be able to take advantage of important new marketing opportunities in international trade.

3.2. Food Safety and HACCP in Fisheries Trade

The biggest challenge faced by fisheries in relation to market access, especially to markets in the United States and EU, concerns food safety, rather than environment-related issues. Canada, EU and the United States introduced regulations based on the HACCP system in the 1990s. In 1997, the HACCP system was incorporated into the WHO/FAO *Codex Alimentarius* and it became the basic instrument in international trade disputes under the WTO Agreement on the Application of Sanitary and Phytosanitary (SPS) Measures. Fish-processing and exporting firms see HACCP primarily as a non-tariff barrier to trade with developed countries. They comply with it only to the extent that they can export their fish products to the developed-country markets. In the near future,

3.3. Meeting Certification Requirements

Like eco-labelling, certification is a relatively new concept for fisheries. At present, near-shore fisheries consists mostly of a very large number of small scale fishing boats whose operations are not managed through an effective legal or regulatory mechanism. Attempts to comply with the certification requirements of the seafood-importing markets and introducing the concepts related to sustainable fisheries that figure in certification requirements are being made. The Marine Stewardship Council and ISO 14000 are particularly relevant in this context.

3.3.1. Meeting Marine Stewardship Council standards

The Marine Stewardship Council (MSC), launched in early 1996, was set up mainly to design and implement market-driven incentives for sustainable fisheries, which would translate into responsible, environmentally appropriate, socially beneficial and economically viable fisheries practices that maintain the biodiversity, productivity and ecological processes of the marine environment. The MSC accreditation scheme was established in mid-1998 and the first seafood products certified by the MSC were launched

in early March 2000. The launcher of MSC, Unilever, has already made it known publicly that only fish carrying the MSC logo will be sold through its outlets by the year 2005. The fisheries trade companies should be interested in MSC certification because the MSC logo will help them in enhancing their market access and in improving their public image. There are many reasons for supporting the MSC initiative, including (a) its potential for reducing tariffs on fish and fish products in the major markets, (b) its potential to increase the market share of Indian exports; and (c) the opportunity it provides for improving the general public's perception of fisheries. However, MSC may well become a non-tariff trade barrier to fish exports from developing countries.

3.3.2. Meeting ISO 14000 standards

Demands on environmental standards can pertain to the products or to production processes. Customers and importers from developed countries often demand that developing-country suppliers should abide by specific environmental standards or have an Environmental Management System (EMS) in place. ISO 14000 is an international standard that can respond effectively to these demands. The ISO 14000 series includes international standards developed on the basis of negotiations and therefore helps to harmonize the views of different countries regarding eco-labelling, environmental management and life-cycle assessment. There is no clear evidence that importing countries will require the exporters to obtain ISO 14000 certification. However, this has been suggested by discussions in the current international environmental movement and the policies of several developed countries. The tendency to use EMSs or eco-labelling standards as non-tariff barriers may well emerge in the future as a problem in the major markets or fish products. Fish exporters may find it difficult to overcome such barriers in the coming years. It is difficult to estimate the potential impacts of ISO 14000 on the export of fish products. Some companies can find in ISO 14000 a means to strengthen their export competitiveness and their foothold in the market, even when there is no major pressure from foreign customers. ISO 14000 can be used potentially as a marketing tool in both domestic and international markets. Companies from developing countries may use an ISO 14000 EMS certification to meet the requirements of foreign customers, community pressures, policies or legal requirements. However, ISO 14000 can be a nontariff barrier in trade if the certification process is difficult and costly. Thus, ISO 14000 may help in removing trade barriers, although it may also function as a potential trade barrier.

22

WTO agreements and quality concerns in Indian Fisheries

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Introduction

WTO agreements are legal ground rules of international commerce. As several facets of WTO agreements are discussed in this short course this paper will be a snapshot of Sanitary and Phytosanitary Agreement popularly known as SPSA which is a non-tariff barrier in international trade. The Agreement on the Application of Sanitary and Phytosanitary measures sets out the basic rules for food safety and animal and plant health standards. Safe and hygienic food is preferred anywhere in the world. More so in the northern world where advances in science have increased the level of awareness regarding the health ailments caused due to consumption of unsafe food. This has lead to development of food safety standards in these countries. Not only do these countries adopt these standards but also expect other countries to follow them giving rise to a plethora of issues. The general nature of such food standards can be said to be (1) a growing use of risk analysis (2) treatment of public health as a primary goal of food safety regulations (3) emphasis on a farm-to-fork approach in addressing food safety hazards (3) adoption of HACCP for microbial quality control (4) emergence of newer and extensive regulations to handle newly identified hazards.

For the purposes of the SPS Agreement, sanitary and phytosanitary measures are defined as any measures applied:

- to protect human or animal life from risks arising from additives, contaminants, toxins or disease-causing organisms in their food;
- to protect human life from plant- or animal-carried diseases;
- to protect animal or plant life from pests, diseases, or disease-causing organisms;
- to prevent or limit other damage to a country from the entry, establishment or spread of pests.

These include sanitary and phytosanitary measures taken to protect the health of fish and wild fauna, as well as of forests and wild flora.
The problem can visualized as two sides of a coin. Ensuring food safety is one side which is done with standards and regulations. The other side is using the same standards and regulations to prevent import and export to protect vested interests like restricting a slump in prices of domestic production by banning imports saying that the imports are tainted using food safety standards.
Since the entire mechanism is self regulated, standards can be set based on science. Adopting international standards and certifications are also encouraged. Higher standards

can be set based on risk assessments. In short all these should be done with consistency and arbitrariness invites problems.

Features of SPS

Protection or protectionism?

Trade restrictions are necessary for food safety in any country. Governments ensure unsafe food is not produced within the country, imported or exported. The spirit being this, there is a tendency to misuse this by using it as a barrier to protect domestic production. Even if safe food is available elsewhere at a cheaper cost its import is curbed using technicalities in the SPS. Thus as WTO itself put it 'A sanitary or phytosanitary restriction which is not actually required for health reasons can be a very effective protectionist device, and because of its technical complexity, a particularly deceptive and difficult barrier to challenge.'

Justification of measures

The justification given for application of SPS is that, to ensure food safety these measures should be used consistently and constantly avoiding any arbitrariness. As these measures involve application of science it will have clear objectives which are assessed based on scientific data.

International standards

WTO is not directly involved in the development of standards. It only encourages the member countries to adopt standards developed by international bodies. However, WTO countries have the freedom to refuse adoption with proper scientific justification.

Adapting to conditions

Due to geographical differences sanitary and phytosanitary conditions cannot be applied uniformly. Recognizing this fact WTO allows agreements cutting across political boundaries. The agreement, however, checks unjustified discrimination in the use of sanitary and phytosanitary measures, whether in favour of domestic producers or among foreign suppliers.

Risk assessment

In order to make the SPS transparent, risk assessment procedures for every safety measure is encouraged. Factors taken into consideration for making a particular risk assessment also has to be revealed. . Although many governments already use risk assessment in their management of food safety and animal and plant health, the SPS Agreement encourages the wider use of systematic risk assessment among all WTO member governments and for all relevant products.

Transparency

All changes in the sanitary and phytosanitary conditions which affect trade should be notified by the member countries. Governments are requested to set up enquiry points or offices for clarifications or to respond to requests for more information. All changes should be open to scrutiny. A special Committee has been established within the WTO as a forum

for the exchange of information among member governments on all aspects related to the implementation of the SPS Agreement. The SPS Committee reviews compliance with the agreement, discusses matters with potential trade impacts, and maintains close co-operation with the appropriate technical organizations. In a trade dispute regarding a sanitary or phytosanitary measure, the normal WTO dispute settlement procedures are used, and advice from appropriate scientific experts can be sought.

Table 22.1 Classification of SPS measures:

Import Bans		Technical Specifications			Information Requirements	
Total Ban	Partial Ban	Process Standards	Product Standards	Packaging Standards	Labeling Requirements	Controls on Voluntary Claims

Source: Roberts et al. (1999)

As shown above there are three broad categories. In case of bans, it can be partial or total. These are imposed on categories of goods which will directly impact human health. Partial ban can be based on particular varieties or grades, supplies from particular countries/regions and/or imports at particular times of the year. In this case there are no alternatives and technical controls are not feasible. Eg. Tainted milk from China and detergents with mercury.

Secondly, technical specifications define requirements that products must satisfy in order to be permitted entry. These can encompass the characteristics of the product itself, the process by which it is produced and the manner in which it is packaged. Predefined methods of conformity assessment are specified to determine whether the product is in compliance and can be permitted to enter. Examples, include maximum bacterial counts for milk and dairy products, use of hazard analysis critical control point (HACCP) in the processing of meat or fish, maximum residue levels (MRLs) for pesticides in fresh fruit and vegetables, and restrictions on the types of material that can be used when packaging comes in direct contact with the food product.

Thirdly, information measures require certain information to be disclosed on the product label and/or control the claims that can be made about the characteristics of the product. These are most commonly applied when the risk is relatively low, can be controlled easily through the actions of the consumer, or the risk is confined to a sub-set of the population (for example in the case of allergies). Examples include instructions on how a product should be stored and prepared.

Issues in seafood trade – implications of WTO-GATS

The implications of WTO-GATS on are multidimensional. Complex negotiations take place in terms of level of tariffs and subsidies. Bilateral and regional negotiations take place with European Union (EU) in formulation of Economic Partnership Agreements (EPAs) and Fisheries Partnership Agreements (FPAs). Therefore these issues are discussed under tariff measures non-tariff measures and subsidies.

Tariff measures

In general, tariffs on export of fishery product were high in developed countries before the Uruguay round of negotiations. This was reduced to 4.5 per cent in developed countries which were as high as 60 per cent. It should be noted that 4.5 per cent is a general figure and there are `tariff peaks' for value added products. Developed countries maintain a

tariff escalation for processed fish when compared to import of unprocessed fish and chilled fish. However, the main barrier still remains to be the import duties on fishery products. Tariff exemptions by developed countries are an important action in the international trade of fish. In general it is 10 per cent, but 0 per cent apply for Asia, Caribbean and Pacific (APC) and Least Developed Countries (LDC).

EU is India's largest trading partner in sea food which has the highest tariff of 10.2 per cent. Interestingly China has a bound tariff rate of 18 per cent. The biggest seafood market for India is Japan which has a tariff of 4.1 per cent. US are the next biggest market with a tariff of only 1 per cent. The EU, Japan and the US extend preferential tariff treatment under Generalized System of Preferences (GSP) to Indian products including seafood. In general, tariff measures are not seen as a trade barrier by the Indian seafood industry to the US and Japanese markets. However, it is seen as a barrier to access some of the markets in developing countries, including China, as well as the EU market. India is still in List 1 of Annexure 1 of the EC Decision 97/276/EC, amended by 99/136/EC, whereby all organizations exporting seafood to the EU require export-worthy certification of their processing facilities by an EU-nominated inspection agency. In the case of India, that agency is the Indian Export Inspection Council (EIC).

Non tariff measures

SPS and Technical barriers to Trade (TBT) agreements of the WTO adopted by the members in 1995 after the Uruguay round were intended to ensure quality, safety and labeling in international trade of seafood. Development of Hazard Analysis and Critical Control Points (HACCP) by the US imposed significant costs especially to suppliers from developing nations. Similarly, eco-labeling though voluntary, can also add to the cost. SPS even though imparted transparency in the process indirectly gave status and legal force to the Codex Alimentarius Commissions food code of WHO and FAO created in 1963. Standard equivalence between the countries promoting trade and notifying the changes in standards can be pointed out as the most significant outcomes of the adoption of SPS. EU has been the champion in development of food safety standards. Through legislation they have covered all aspects under the concept of farm-to-fork which has a strong influence on all the developing economies exporting to EU. In US Federal Regulations, often referred to as 21 CFR 123 (see US FDA Centre for Food Safety and Applied Nutrition, web site www.cfsan.fda.gov*).*These regulations apply to domestically produced products and imports. While new regulations with regard to quality control, such as HACCP, have been adopted by all major importing countries and made compulsory for their fish processing industries, one notable exception is Japan. While some firms in Japan have neither HACCP nor external suppliers. Standards for imports of fish and fishery products into Japan are governed by the legislation set out in the Food Sanitation Law and the Quarantine.

Subsidies

Subsidies fall under the Agreement on Subsidies and Countervailing Measures (ASCM). Fisheries is a subject under Non-Agricultural Market Access (NAMA). The WTO's definition of subsidies in the Agreement on SCM include: Specific financial transfers from state to the industry; The state foregoing normally collectable revenue (*e.g.* tax free fuel) ; Provision of services or investments to industry; State purchases of industry outputs other than on commercial terms and also includes all form of state income or price support. Subsidies can also be categorized in relation to the rights of members to make complaint and take action (countervailing measures) and can be prohibited. Export enhancing subsidies or subsidies giving preference to domestic producers or grants tied to the use of domestically produced goods are actionable. That is, a subsidy may be challenged on the

basis of causing 'adverse effects' to the interests of other WTO members. At Doha (2001) WTO Ministerial Conference there was there was a call to eliminate fisheries subsidies which are likely to increase fishing capacity. Transparency regarding subsidies is an issue: few members of the WTO have complied with their obligation to report subsidies. The political sensitivity of the subsidies issue is highlighted by the use of less offensive synonyms for subsidy: *e.g.* `government financial transfers' and 'economic incentives'. There are also large inconsistencies in the data that is publicly available. Subsidies are reported to lead to overcapacity in the fishing industry leading to overfishing.

Inappropriate subsidies have a threatening effect on fisheries. According to the World Bank (2004), formal access of foreign vessels to fishing grounds within the EEZ of fish-rich countries is usually regulated under fishing agreements and many fishing agreements are heavily subsidized by industrial countries (e.g. the EU pays 83 per cent of the license fee, the vessels themselves only 17 per cent). The type of subsidy most frequently found in developing countries is in form of bilateral or multilateral development projects. However, there are some fishing subsidies in developing countries, for example: port facilities owned and managed by the public sector; subsidized lending and credit provision – in some cases in order to adopt new technology; sales tax exemptions for inputs used by the fishing industry; subsidized fishing inputs in the form of import tax exemptions.

Quality - an Indian perspective

SPS related issues always had problems as far as marine products are concerned and in 1977 there was a strict ban on Indian seafood due to quality and hygiene issues (Jha, 2005) Though the ban was lifted subsequently this has resulted in the extensive development of infrastrcuture like potable water system and effluent treatment plant, flake ice machines, chill rooms, standby generators, laboratory etc. costing over $25 million towards upgradation (Kaushik and Shahib, 2001).

Since 2000, the issue has been revolving around the use of antibiotics and bacterial inhibitors in shrimps. In the beginning India did not have the infrastructure to detect at ppb level of the chemicals but later on developed analytical system with Liquid chromatographic systems equipped with Mass Spectrometer to detect the banned chemicals in use in aquaculture or otherwise. As there are over 250 chemicals in use and checking for all these chemicals for a particular product has always been a problem faced by the industry.

The problems of export rejections still continue in exports related to EU and now it is related in most cases to antibiotic residues, bacterial inhibitors and hygiene issues, though there are strict regulation prevail in India as far as marine products are concerned. The export in the present scenario is possible only if the processing unit is pre-approved by the EU and only if the consignments is certified by Export Inspection Council, which is the authorized agency for a number of food products.

Cases beyond TBT

Ethoxyquin in tiger shrimp

There was a sudden move by the Japanese Food and Safety Authority to impose compulsory testing for Ethoxyquin in shrimp consignments from India on the basis of a default standard of 0.01 ppm. There are no international norms for Minimum Residue Limits (MRLs) fixed for Ethoxyquin in shrimp. Scientific evidence was insufficient to show it was not safe for human health. The Chairperson of MPEDA pointed out that the overnight notice to India regarding the decision and the fact that the default standard fixed was not

based on any scientific studies on safety evaluation, nationally or internationally. The Govt. of India delegation lead by the Chairperson MPEDA urged the Minister of Labour and Health, Japan to keep the default standard in abeyance for the time being, because shipments hit are mainly from Odisha and West Bengal which will affect the livelihoods of poor aquafarmers. The same threat is perceived by Andhra Pradesh farmers also being the major shrimp exporting state.

Ethoxyquin is an antioxidant which finds its way into shrimp through the feed which contains fish oils which need to be protected from oxidation. Otherwise, rancidity may affect feeds which will deplete its nutritional quality. Antioxidants and antifungals are used to enhance the shelf life of food and feed products.

Semicarbazide in scampi

Some of the challenges in residue testing are beyond technical barriers. For instance, Interfield Laboratories, Cochin, conducted a series of studies to understand why fresh water scampi (*Macrobrachium rosenbergii*) from natural sources and found not to contain the antibiotic nitrofuran marker semicarbazide (SEM) were rejected from the European Union, particularly in Belgium in 2008-09. They found that the shells of scampi contained SEM and that if the sample is processed with shell (as in Belgium), you get the marker, although it is not an indication of antibiotics abuse. On the other hand, if only the edible part, meat, is used for analysis, as in Germany and several other EU countries and also in the laboratories in India, no SEM is detected. The EU authorities assigned a project to the University of Ghent, Belgium, to verify these conclusions of India in an independent study and the results published in 2011 vindicated India's stand.

Capability development

One of the positive outcomes in food sector in general and fisheries sector in particular in the underdeveloped countries and developing countries subsequent to becoming signatories of WTO is the development of food analytical certification mechanisms and facilities. Investment from the private sector was another encouraging aspect. Understanding this WTO itself was proactive and initiated a self-supporting mechanism called The Standards and Trade Development Facility (STDF).

Standards and Trade Development Facility

The Standards and Trade Development Facility (STDF) is a global partnership that supports developing countries in building their capacity to implement international sanitary and phytosanitary (SPS) standards, guidelines and recommendations as a means to improve their human, animal and plant health status http://www.wto.org/index.htms and ability to gain or maintain access to markets.

The STDF is a joint initiative of the Food and Agriculture Organization (FAO), the World Organization for Animal Health (OIE), the World Bank, the World Health Organization (WHO) and the World Trade Organization (WTO). The WTO provides the secretariat for the STDF. Other participating organizations include the International Trade Centre (ITC), the United Nations Conference on Trade and Development (UNCTAD) and the United Nations Industrial Development Organization (UNIDO). Donors contributing funds to the STDF and representatives of developing countries, including LDCs, are also members of the facility (More detailed information on the STDF and its activities can be found on the STDF website http://www.standardsfacility.org)

STDF vision is - improved sanitary and phytosanitary capacity in developing countries supports sustainable economic growth, poverty reduction, food security and environmental protection. STDF mission - is a global partnership that supports developing countries in building their capacity to implement international sanitary and phyto sanitary standards, guidelines and recommendations as a means to improve their human, animal and plant health status and ability to gain and maintain access to markets. STDF's mandate is to increase awareness, mobilize resources, strengthen collaboration, identify and disseminate good practice; and provide support and funding for the development and implementation of projects that promote compliance with international SPS requirements. The STDF is committed to the Paris Principles on Aid Effectiveness and to achieving the Millennium Development Goals.

Conclusion

Quality in fisheries is paramount especially in the export market. Fishery products with certifications and traceability are already available in the world market. Quality not only added safety but also value to the products. Issues of safe limits of micronutrients, pollutants, antimicrobials, pesticides do surface and mechanisms to address these problems also evolve leading to a world trade which is balanced.

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23

Assessing Competitiveness: A Policy Analysis Matrix Approach

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Introduction

The policy analysis matrix (PAM) framework developed by Monke and Pearson (1998) is used in this analysis for computation of input use efficiency in production, comparative advantage and degree of divergence in factors markets. The PAM is a product of two accounting identities, one defining profitability which is the difference between revenues and costs and the other measuring the effects of divergences (distorting policies and market failures) as the difference between observed prices and the prices (social) that would exist if the divergence are removed.
The PAM matrix is presented in table 1. The data in the first row provide a measure of private profitability (D), defined as the differences between observed revenues (A) and costs (B+C) valued at actual market prices. It shows the competitiveness of the agricultural system with the present technologies, output, inputs and policy valued at current market prices. The second row in the matrix calculates the social profitability measured at social prices that reflect social opportunity costs. The social profitability measures comparative advantage or efficiency in the agricultural system. A positive social profit indicates that the country uses scarce resources efficiently and has a static comparative advantage in the production of that commodity at margin. Negative social profits indicate that a sector cannot sustain its current output without assistance from the Government, resulting in waste of resource.

Governments often institute policies that are overlapping and contradictory, and policy makers may be unaware of the relative magnitudes of various policy effects on individual commodities and levels in the commodity chain (Staal & Shapiro, 1994). The simple and convenient manner in which overlapping policy impact results can be presented to policy-makers is one of the principal motivations for the development of the PAM (Monke and Pearson, 1989). The PAM uses data on costs and revenues from budgets of representative farms instead of time-series data of prices and marketed quantities which could be inaccurate and difficult to obtain in certain settings.

Monke and Pearson (1989, p. 17) state that the PAM is relevant to three areas of economic analysis:

1. The impact of policies on the competitiveness of commodity systems;
2. The impact of investment policy on economic efficiency and comparative advantage;
3. The effects of agricultural research policy on steering the processes of technological change in desirable directions.

In the context of this paper, interest is in the first area.

The PAM is constructed through double entry book-keeping, with the purpose of ensuring complete and consistent coverage of all policy influences on the returns to, and costs of, agricultural production and/or marketing (Kydd, Pearce & Stockbridge, 1997). Various indicators of the economic outcomes resulting from the implementation of polices can be calculated from the parameters in the matrix. The parameters are derived from the standard farm budgets depicting costs incurred on various inputs and revenues derived. The standard form of the PAM matrix is shown below:

Table 23.1 Policy analysis matrix

	Revenues	Costs		Profits
		Tradable Inputs	Domestic Factors	
Valued at private prices	A	B	C	D[1]
Valued at social prices	E	F	G	H[2]
Divergences	I[3]	J[4]	K[5]	L[6]
[1]Private profits, D= A- (B + C)		[4]Input transfers, J= B- F		
[2]Social profits, H= E - (F + G)		[5]Factor transfers, K= C-G		
[3]Output transfers, I= A-E		[6]Net policy transfers, L= D-H		

Source: Based on Monke and Pearson (1998).

The PAM defines profitability as the difference between revenues and costs, and also measures the effects of divergences (distorting policies and market failures) as the difference between observed parameters (private values) and parameters that would exist if the divergences were removed (social values). PAM is constructed for a specific commodity system to be analyzed. The PAM can indicate the impact of commodity and macroeconomic policies (shown by parameters and indicators) in changing policy scenarios.

The matrix consists of revenues, costs and profits, at private and social (shadow) prices. The top row of the matrix shows costs of production and revenues at market prices. Cost elements are divided into two groups: (i) tradables and (ii) nontradables (domestic resources or domestic factors). Private revenues and costs reflect actual market prices received or paid by farmers, merchants, or processors in the agricultural system. The private, or actual, market prices thus incorporate the underlying economic costs and valuations plus the effects of all policies and market failures.

The second row in the matrix shows the same cost elements expressed at social prices, i.e. social opportunity costs. For tradable products, adjusted world prices are normally taken as social prices, applying import or export parity measures as appropriate. The social price of domestic resources is taken as their opportunity cost, in other words the return at the margin in the best available alternative.

The third row of the PAM is the first row minus the second. It shows the net impact of: market failure; distorting policies; and efficient policies (those which correct market failure). The signs of the revenue and cost terms in the third row indicate whether the net effects of policy and market imperfections for these categories amount to an implicit subsidy or tax. If, for example, I were positive, the net effect of policy and/or market failure is that the market price paid to the system is in excess of the social opportunity cost, i.e. output prices are subsidized. Positive J and K represent negative transfers because they

reduce private profits i.e. producers being taxed or paying duties, whereas negative J and K indicate input subsidies to producers.
The PAM permits sixteen indicators of economic efficiency, four of which are non-ratio indicators. Ratio measures are more useful for comparison of commodity systems which are dissimilar in the relative proportions in which they use inputs. The various indicators obtained from PAM are indicated below:

i. Indicators of Transfers: output transfers - I, input transfers - J, factor transfers - K, net transfers - L.
ii. Indicators of Private (Financial) Profitability: Net Private Profits - D = A-B-C, Private Cost Ratio - PCR = C/ (A-B), Private Cost Benefit ratio - PCB = (B+C)/A, Profitability coefficient – PC = D/H, Correspondence among these indices - D>0 => PCR<1 => PCB<1.
iii. Indicators of Social (Economic) Profitability: Net Economic Profits - H=E-F-G, Domestic Resources Cost - DRC = G/ (E-F), Social Cost Benefit ratio - SCB = (F+G)/E, Correspondence among these indices: H>0 => DRC<1 => SCB<1.
iv. Indicators of Protection: Nominal Protection Coefficient (for tradable outputs) - NPCo = A/E, Nominal Protection Coefficient (for tradable inputs) - NPCi = B/F, Coefficient of Distortion in Domestic Factor Cost - DDFC = C/G, Effective Protection Coefficient - EPC = (A-B)/ (E-F), Subsidy ratio to producers – SRP = L/E.

The primary limitation of the PAM is the assumption of fixed input-output coefficients, used to characterize each production and processing technology. Under the PAM, transfers to consumers and producers can be translated into consumer and producer surplus measures only under the restrictive assumptions of fixed input prices and zero elasticities of supply and demand. Some do not consider the results realistic in a dynamic setting (Nelson and Panggabean, 1991). One of the ways to overcome this limitation is to conduct sensitivity analysis under various assumptions. Nevertheless, given the limited data usually available in the agricultural context, the PAM approach provides policy results that address critical issues.

PAM Applications in Agriculture

Various studies have applied the PAM technique in agriculture. Abidin and Ismono (2004) have examined the impact of government policies on the revenues, costs and profits of factory estate and farmers in Indonesia. Hall et al (2004) have assessed the impact of adopting herd health programs by small-scale dairy producers of central Thailand using the PAM technique. Mohanty et al (2002) have used the PAM to assess the competitiveness of Indian cotton production. In their work, sensitivity analysis by modifying input and output prices has shown that only large changes in prices would change the comparative advantage of cotton as compared to competing crops. Guba (2000), in his work on assessing the competitiveness of Polish milk processing industry, has used PAM and other empirical tools such as the domestic resource cost ratio and private cost ratio. Budidarsano et al (2000) have applied the PAM technique to assess the profitability of robusta coffee systems in Indonesia. Yao (1999) has used the PAM to assess the comparative advantage of rice production in Thailand as compared to production of legume crops. Sensitivity analysis has been conducted to study the effects of price changes and externalities on the comparative advantage of rice against the legume crops. Adesina and Coulibaly (1998) have applied the PAM technique to analyze the social profitability of agro-forestry based technologies for maize production in Cameroon, and the impacts of policy shifts on the financial competitiveness of maize production under these technologies. Their work shows that maize production under agroforestry-based systems has high comparative advantage. Nelson (1997) has used the PAM to determine the effects of various agricultural policies in Ethiopia on different types of households and in aggregate. Staal & Shapiro (1994) have

used the PAM to assess the impact of a policy change on peri-urban dairy producers in Kenya when the prices of milk products were decontrolled to improve incentives to producers. Nelson and Panggabean (1991) have applied the PAM to analyze the effects of sugar policy in Indonesia, and to identify the distribution of resource transfers. In an analysis of global competitiveness of Indian sugar, it was observed that PAM captured in a systematic manner all the outputs and inputs involved in the production and distribution process of sugarcane biomass irrespective of whether these fall under tradable or non-tradable categories (Datta & Gupta, 2001).

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24

Trade barriers: Implications for Indian Fisheries Sector

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Introduction

The fisheries sector of Indian economy provides livelihood to millions of poor households located in the coastal belt of the country. These households generate income through harvest, marketing and export of marine fishes and fish products. From the point of view of employment and income generation, international trade plays significant role. In many ways, fish as a food commodity is treated as a poor sister to agriculture. In many developing countries including India, prosperity of the fisheries sector relies largely on the international trade. It is the trade aspect of the sector that would be the focus of this paper. Even though India's trade share in this sector is only 2.64 per cent in 2006–07 to the total global trade (with total global trade amounting to about US$ 70 billion1), in rupee terms it constitute a non trivial amount of Rs 83630 million. The country faces both tariff and non-tariff barriers in fish trade and is imposing high tariff in case of imports. India till now has a restrictive stand as far as fish import is concerned, while countries open up their markets for India. Given such varied economic and political dimensions, it is necessary to take a stock of the present situation. This assumes all the more importance in the light of the proposed trade agreement with many countries and trade blocks. This article makes an attempt to analyse the aspects of international trade in Indian fisheries sector in the light of World Trade Organization (WTO).

Production and Growth

When compared to agriculture as a whole, profitable trade in fisheries sector was possible due to both supply and demand side factors. As far as supply side is concerned, India is endowed with a large production base. India has a coastline of 8118 km with an exclusive economic zone (EEZ) stretching over 2.02 million km , and a continental shelf area of 0.5 million km. India has inland water sources covering over 190,000 km and open water bodies with a water-spread area of over 6.6 million hectares. Brackish water area available for aquaculture is 1.2 million hectares, of which, according to the Aquaculture Authority of India (AAI, 2002), some 157,000 hectares (1570 sq. km) was under shrimp aquaculture in 2002. Potential of fish production from marine and inland sources has been estimated at 3.9 million tonnes (2.2) million tonnes in the inshore and the rest in the offshore waters and 4.5 million tonnes, respectively.

As far as domestic demand is concerned, FAO (2002) estimates as per capita availability of fish in India to be 4.8 kg in 1997–98, which, when estimated for the fish eating population in the country (constituting 56 per cent of the total population), works out to about 9 kg. In coastal areas, fish consumption is usually higher – perhaps twice the normal

rates. In addition to the domestic demand, as mentioned above, there is a growing demand in the export market. There is a considerable demand for Indian shrimp in the international market. Indian fish is exported to USA, Europe and also to the Asian countries. here is a well-developed processing industry as well. This provides import demand for fish for re-export. Thus the sector assumes considerable significance in the context of international trade.

The Fish Distribution System in India

There are four distinct channels through which fish is marketed in India. These are: (i) local fresh fish trade; (ii) processed fish trade; (iii) export trade; and (iv) domestic urban trade. Fishmeal trade is another important market chain catering to poultry and aquaculture sectors. It is estimated that, in 1997–98; about 780 thousand tonnes of fish out of a total production of 5.3 million tonnes (roughly 15 per cent) was used for 'non-human' uses (FAO, 2002), which could be for fish meal purposes. The 'traditional' market chains – involving local and processed fish trades – are informally organised and remain significant because they provide employment to a large number of the poor, mainly women.

Direction and Trade

Import: In the Indian fisheries industry, the situation for imports is quite different from that of exports. From being a country where no imports were allowed, imports quickly increased when the borders were opened, though the level of imports is still very low. An analysis of real imports data for a long period of 1962 to 2005 shows that though in the initial years imports were high, it fell drastically later and remain low till now. From the year 2000, however, an increasing trend is visible. Currently, India's imports consist primarily of fishmeal. The other product India has been importing is Hilsa from Bangladesh. In 1998, 97 per cent of the imports of fresh and frozen fish came from Bangladesh.

Export: India has been exporting varieties of fisheries items for a long time now. India's fish exports even in real terms show an impressive growth from the decade of 1960s till about 1980–81. Though a downward trend is visible thereafter, it picks up from 1999–'00 again.

USA had the maximum share in Indian exports (above 20 per cent), followed by Japan, Belgium, China and UK. Reports suggest that, India is largely dependent on specific export markets, which reduce the Indian exporters to the position of price takers, and they are unable to charge higher prices despite rising costs in recent years.

Trade Barriers

Main means of barriers to trade are: Tariffs, Quotas and Non-Tariff barriers. Prior to trade liberalization under the aegis of WTO, tariff and quotas were the main tools used to prevent free flow of goods from one country to other. In fact, tariff was the major source of income for many developing and under developed countries. However, historical process of 'Globalisation' which, came into force due to human innovation and technological progress resulted in increasing integration of economies around the world through trade and financial flows. As far as fish trade is concerned, developed countries generally maintain higher tariff rates on processed fish commodities than on chilled fresh fish – a case of 'tariff escalation'. It is found that market access barriers faced by developing country exporters are not decreasing under the liberalized trade regime for some of their most important export sectors.

Tariffs and Tariff Rate Quotas

Tariffs, which are taxes on imports of commodities into a country or region, are among the oldest forms of government intervention in economic activity. They are implemented for two clear economic purposes. First, they provide revenue for the government. Second, they improve economic returns to firms and suppliers of resources to domestic industry that face competition from foreign imports. Tariffs are widely used to protect domestic producers' incomes from foreign competition. This protection comes at an economic cost to domestic consumers who pay higher prices for import competing goods, and to the economy as a whole through the inefficient allocation of resources to the import competing domestic industry. In the past, and even under GATT, tariffs levied on some commodities by some countries have been very large. When coupled with other barriers to trade they have often constituted formidable barriers to market access from foreign producers. In fact, tariffs that are set high enough can block all trade and act just like import bans. A tariff-rate quota (TRQ) combines the idea of a tariff with that of a quota. The typical TRQ will set a low tariff for imports of a fixed quantity and a higher tariff for any imports that exceed that initial quantity. In a legal sense and at the WTO, countries are allowed to combine the use of two tariffs in the form of a TRQ, even when they have agreed not to use strict import quotas.

Tariff Measures in general

Tariffs on fish and fishery products are generally quite higher in developing countries posing problems to the development of international trade. After the completion of the Uruguay round, the average weighted import tariffs on fish products were reduced to 4.5 per cent in developed countries. Although this may seem quite low, the average hides a number of very high tariffs for selected species and products (tariff peaks), as well as cases of tariff escalation where processed or value added fish products are subject to higher duty than unprocessed fish. Tariffs on primary fish commodities have declined significantly in developed countries and have decreased even in the developing countries of Asia, where they were previously much higher than in developed countries.

The WTO, regional and bilateral trade agreements all play a significant role in removing and easing traditional trade barriers such as tariffs and quantitative restrictions to fish trade. Despite the significant reductions in tariffs by both developing and developed countries, selective tariff use (including tariff peaks and tariff escalation), countervailing duties and technical, food safety and environmental standards continue to limit access of fish in international markets.

Tariff levels on fish and fish products in major importing countries

The large number of tariff lines, with wide range in applied, bound and unbound rates between countries, adding to the existence of preferential and free trade agreements makes it impossible for meaningful generalizations. A comprehensive study of the global fish tariff situation published by the FAO in 2006 concluded that:

- In the WTO context, average bound tariffs in seafood are above 30 per cent but the actual tariff burden faced by importers is more likely around 10 per cent.
- The WTO's Most Favoured Nation status (MFN) applied tariffs for seafood are higher than tariffs for manufactured goods.
- The extent of tariff binding is somewhat lower for seafood than for other goods.

- The binding levels are much higher in developed countries than developing. High-income countries have on average bound 79 per cent of their seafood tariffs while low-income countries on average have bound only 43 per cent.
- There is a lot of water in the fish tariffs so that applied tariffs would only be affected if there were considerable reductions in the level of bound tariffs.

Tariff rates in the Big Three

Given that tariffs are applied on imports, and approximately 75 per cent of global fish imports are concentrated in three main markets (the EU 39 per cent, Japan 19 per cent and the US 16 per cent – it is useful to look at the tariff situation that prevails in these markets since it is tariff schedules there that have the most profound effects on trade.

EU tariff rates

After the Uruguay Round, the weighted average tariffs on fish products in developed countries was 4.5 per cent suggesting that tariffs on fish and fish products in developed countries are relatively low. However, the EU - by far the world's largest single market for fish - has a simple average MFN tariff line for fish of 11.8 per cent. or more than twice the developed country average. But the EU has much higher MFN tariffs on many individual products, with rates of 20 per cent on some forms of shrimp, cooked lobster and certain mussel products. The simple tariff line average therefore can mask what are known as tariff peaks (much higher tariffs on certain products) and tariff escalation (increasing tariff levels as a product changes through processing). According to one analysis, the EU has tariff peaks (defined as bound MFN rates over 15 per cent) in 128 tariff lines.

The practice of tariff escalation is best illustrated by how the EU treats tuna. When it comes to raw material intended for EU based processors in Spain, France and Italy, tuna enters the EU market at a zero tariff; the tariff increases to 15 per cent for fresh tuna fillets, 18 per cent for frozen fillets, 22 per cent for tuna intended for direct consumption, and 24 per cent for tuna loins and canned tuna.

US tariff rates

The situation in the US is even more striking. While most fresh and frozen seafood can enter the US duty free or for a few cents per kilogram, the US practises steep tariff escalation by increasing tariffs sharply for processed fish products. For example, processed (smoked, dried, salted or in brine) salmon, herring, mackerel and anchovies all have 25 per cent duties. Tariffs are even higher for canned sardines (30 per cent) and canned tuna (35 to 45 per cent) (US, 2006). Moreover, the US has not hesitated to apply draconian tariff sanctions against importers that threaten certain domestic producers. In recent years, the US has levied the following anti-dumping duties on fish and seafood products to protect the local interest:

- Warm water shrimp: duties of 2.35 to 112 per cent on imports from Brazil, Ecuador, India, Thailand, China and Viet Nam
- Catfish: duties from 36 per cent to 63 per cent on imports from Viet Nam, which, because of another US ITC ruling, is forced to market its products in the US under the name of "basa" and "tra".
- Salmon: duties ranging from 2.3 to 31 per cent on imports from Norway.
- Crawfish: duties of 223 per cent on imports from China.

Japanese tariff rates

The fish and seafood tariff schedule for Japan is even more mixed. While the average MFN applied rate is 5.9 per cent with a GSP rate for LDC's of 3.9 per cent, a look at the individual tariff lines shows that many items (frozen lobster, shrimp and prawns) have duties of only 1 per cent - significantly below the average. At 2 to 3.5 per cent the tariff rate for many categories of fresh fish fillets follow this pattern as well. However, some forms of mussels, octopus and herrings have tariffs of 10 per cent. Some Pacific salmon, hard clams and oysters are at 10.5 per cent, and some crab products are levied at a 15 per cent rate. There is also evidence of tariff escalation in the Japanese treatment of tuna. All fresh, refrigerated and frozen tuna entering the Japanese market is assessed a 3.5 per cent MFN rate. The rate jumps to 9.6 per cent, however, for canned tuna.

Tariff levels, however, do not provide a complete picture of the extent of Japanese protection for its fishing industry as it also imposes import quotas on products from certain other countries. One can only make sense of all of this by remembering that tariff protection, like trade negotiations, is all about interests. The rule of thumb is that countries protect those domestic interests they think would be vulnerable to foreign competition if the tariff protection was not there. For example, US tariffs for canned tuna are there to protect the jobs o f 5000 workers in American Samoa where two of the largest fish plants in the world produce 500 million US$ worth of tuna a year for the US market. While Samoan hourly wage levels are low by US standards (3.50 US$ per hour in 2002), they cannot compete with the low-wage canning industries of South-East Asia (Wolman 2002). Tariffs therefore serve to protect special interests and vulnerable sectors of a country's economy. There are also clear interests behind those seeking to remove tariffs completely.

Implication of Tariff barriers for India:

EU is India's largest trading partner. According to the Indian Export-Import Policy 2002-2007, all marine products with a few exceptions under the Wildlife Protection Act 1972, can be exported free subject to pre-shipment quality inspection. 90 per cent of Indian seafood exports comprise frozen fish, shrimp and cephalopod. The average tariff rate in Japan, the biggest Indian seafood market, is 4.1 per cent. US, the second biggest market for Indian seafood, has just a nominal 1 per cent tariff duty. EU, the third biggest importer, has an average tariff duty of 10.2 per cent, followed by China, the fourth biggest, which has a bound tariff rate of 18 per cent. The EU, Japan and the US extend preferential tariff treatment under Generalized System of Preferences (GSP) to Indian products including seafood. In general, tariff measures are not seen as a trade barrier by the Indian seafood industry to the US and Japanese markets. However, it is seen as a barrier to access some of the markets in developing countries, including China, as well as the EU market. India is still in List 1 of Annex 1 of the EC Decision 97/276/EC, amended by 99/136/EC, whereby all organizations exporting seafood to the EU require export-worthy certification of their processing facilities by an EU-nominated inspection agency. In the case of India, that agency is the Indian Export Inspection Council (EIC).

Tariff structures in developed countries

The profiles of tariff structures vary widely among developed countries as does the complexity of their tariff systems. Since developed countries are major markets for developing country fisheries exports, their tariff profiles have a significant impact on

economic opportunities for developing country producers and exporters. In most developed countries, the Uruguay Round left in place tariffs which vary significantly depending on the type of product. Looking across OECD nations as a whole, about 68 per cent of OECD fish imports are subject to tariffs ranging from zero to five per cent. Only three per cent of imports are subject to tariff peaks greater than 15 per cent. Tariff peaks are usually defined as those at 15 per cent and above, or more generally to describe the existence of relatively high tariffs, usually on 'sensitive' products, amidst generally low tariff levels.

Since the end of the Uruguay Round, the key fish importers have maintained higher tariff rates for most value-added processed fishery products from developing countries. For developing countries, such 'tariff escalation' (i.e. where tariffs are higher on processed and semi-processed products than on unprocessed ones) is particularly worrisome as it can limit exports of processed and value-added commodities to developed countries. Overall, the EU and Korea apply the highest duties and have the highest occurrence of tariff peaks, with 41 per cent and 69 per cent respectively of their tariffs set at rates higher than 15 per cent. In total, the EU applies tariffs peaks to around 5 per cent of developing country exports. EU also provides duty-free access for raw seafood products from many developing countries through preferential trading arrangements. Tuna – a commercially-valuable export for many developing countries – provides a good example of the application of differential import tariffs.

Table 24.1 Reductions in Average Tariffs for Fisheries Imports in Select Asian

Countries Country	Share of c.i.f value (per cent)			
	Tariff before WTO		Tariff after WTO	
China	1991	47	2001	11-23
Thailand	1995	60	1999	5-30
Philippines	1994	10-60	2000	2-15
India	1993-94	60	2002-03	35
Bangladesh	1991-92	59	200-2001	28

Tariff structures in developing countries

Developing country tariffs on fish and fishery products are higher than developed country tariffs (largely due to *ad valorem* duties which are calculated based on the value of the product). Average tariffs for developing countries are 19.4 per cent for raw foods, 22 per cent for intermediate products, and 23.8 per cent for processed food. Tariff structures vary significantly, however, between developing countries. Malaysia and India, for instance, apply their highest level of duties to intermediate products. Thailand has the highest consistent tariff rates at 60 per cent, followed by India, while Chile and Malaysia apply the lowest duty rates. Countries such as India, Thailand, Chile and Kenya have identical tariffs for all kinds of raw products. Other countries differentiate between raw products and have more heterogeneous tariff systems overall. Malaysia, for example, applies tariffs from 0–18 per cent, Mexico from 8–30 per cent and India from 15-45 per cent.

Developed countries often have zero or relatively low levels of tariffs on fish, but there are cases of escalation with some peaks. EU rates are higher than in many developed countries i.e. on average are around 10 per cent, but zero rates apply for ACP (African Caribbean and Pacific) and LDC states. As such the issue of concern to developing country exporters depends on their current exemption status and hence potential change in

competitiveness arising from further liberalization (*e.g.* the extension of tariff exemptions to non-ACP and LDC states which may radically alter competition in the supply of EU markets.

Table 24.2: Tariff Escalation for Some Developed-Country Fisheries Imports

Product	Share of border c.i.f. value (per cent)			
	European Union		Japan	
	Conventional	GSP	MFN	GSP
Skipjack				
Fresh	22	0	3.5	3.5
Canned	24	0	9.6	6.4
Mackerel				
Fresh	20	0	0	0
Processed	25	0	9.6	7.2
Scallops				
Fresh	8	2.8	10	7.2
Processed	20	7	9.6	7.2
Crabs/Lobsters				
Fresh	10	8.2	7	7
Processed	20	7	6.7	6.7

Implication of Tariff barriers for India

EU is India's largest trading partner. According to the Indian Export-Import Policy 2002-2007, all marine products with a few exceptions under the Wildlife Protection Act 1972, can be exported free subject to pre-shipment quality inspection. As already mentioned, 90 per cent of Indian seafood exports comprise frozen fish, shrimp and cephalopod. The average tariff rate in Japan, the biggest Indian seafood market, is 4.1 per cent. US, the second biggest market for Indian seafood, has just a nominal 1 per cent tariff duty. EU, the third biggest importer, has an average tariff duty of 10.2 per cent, followed by China, the fourth biggest, which has a bound tariff rate of 18 per cent. The EU, Japan and the US extend preferential tariff treatment under Generalized System of Preferences (GSP) to Indian products including seafood. In general, tariff measures are not seen as a trade barrier by the Indian seafood industry to the US and Japanese markets. However, it is seen as a barrier to access some of the markets in developing countries, including China, as well as the EU market. India is still in List 1 of Annex 1 of the EC Decision 97/276/EC, amended by 99/136/EC, whereby all organizations exporting seafood to the EU require export-worthy certification of their processing facilities by an EU-nominated inspection agency. In the case of India, that agency is the Indian Export Inspection Council (EIC).

Import Barriers

Currently, India imposes strong barriers on the import of fisheries items. While the official sources feel that import should increase at least for re-export purposes, fishermen's associations are opposing such moves.

In order to import fish, one requires a special import permit (SIP). This permit is given at an office in Delhi. In order to receive each consignment in the port, one needs to acquire fresh permits from Delhi. This creates immense amount of hassles for the importer. It also raises the possibility of corruption on the part of the officials in charge of providing

such permits. It has been alleged that sometimes the permits takes considerable time and that adds to the cost of storage of fish at the port.

Barrier on Ornamental Fish Imports

As far as live ornamental fish import is concerned, only limited verities of fishes are allowed. Rules also appear to bemore stringent than most countries across the globe. However, as there is increasing demand for ornamental fish from the growing corporate sector, they are often brought through the illegal routes.

The transition from tariffs to non-tariff barriers

Non-tariff barriers to trade (NTBs) are trade barriers that restrict imports but are not in the usual form of a tariff. Although they are called "non-tariff" barriers, they have the effect of tariffs once they are enacted. Their use has risen sharply after the WTO rules led to a very significant reduction in tariff use. With sources of income other than tariffs, industrialized countries have moved from tariffs to NTBs is the fact that developed countries have. However, most developing countries still rely on tariffs as a way to finance their spending. Developed countries can afford not to depend on tariffs, at the same time developing NTBs as a possible way of international trade regulation. The second reason for the transition to NTBs is that these tariffs can be used to support weak industries or compensation of industries, which have been affected negatively by the reduction of tariffs. The third reason for the popularity of NTBs is the ability of interest groups to influence the process in the absence of opportunities to obtain government support for the tariffs.

Types of Non-tariff barriers

Non-tariff barriers to trade include import quotas, special licenses, unreasonable standards for the quality of goods, bureaucratic delays at customs, export restrictions, limiting the activities of state trading, export subsidies, countervailing duties, technical barriers to trade, sanitary and phyto-sanitary measures, rules of origin, etc. Sometimes in this list they include macroeconomic measures affecting trade.

According to traditional classification of non-tariff barriers, they are divided into three principal categories: The first category includes methods to directly import restrictions for protection of certain sectors of national industries: licensing and allocation of import quotas, antidumping and countervailing duties, import deposits, so-called voluntary export restraints, countervailing duties, the system of minimum import prices, etc. Under second category follow methods that are not directly aimed at restricting foreign trade and more related to the administrative bureaucracy, whose actions, however, restrict trade, for example: customs procedures, technical standards and norms, sanitary and veterinary standards, requirements for labeling and packaging, bottling, etc. The third category consists of methods that are not directly aimed at restricting the import or promoting the export, but the effects of which often lead to this result. The non-tariff barriers can include wide variety of restrictions to trade. Here are some example of the “popular” NTBs.

Non-Tariff Barriers to trade can arise from:

Government participation in trade & restrictive practices tolerated by governments which includes export subsidies ,government monopoly in export/import state subsidies, procurement, trading, state ownership, preference given to domestic

bidders/suppliers, requirement for counter trade, domestic assistance programmes for companies, discriminatory or flawed government procurement policies, import bans, determination of eligibility of an exporting country by the importing country ,determination of eligibility of an exporting establishment (firm, company) by the importing country, occupational safety and health regulation, multiplicity and Controls of Foreign exchange market ,buy national" policy ,lack of coordination between government institutions etc

The Customs and administrative entry procedures includes government imposing antidumping duties, arbitrary customs classification, issues related to the rules of origin, import licensing, decreed customs surcharges ,additional taxes and other charges, international taxes and charges levied on imports and other tariff measures, lengthy and costly customs clearance procedures, issues related to transit fees ,inadequate or unreasonable customs procedures and charges ,lack of control in Customs infrastructure, lack of capacity of Customs officers and
Issues related to Pre-Shipment Inspections

Technical barriers to trade (TBT) include restrictive technical regulations and standards not based on international standards ,inadequate or unreasonable testing and certification arrangements, standards disparities , intergovernmental acceptance of testing methods and standards ,issues related to packaging, labelling and marking ,conformity assessment related to TBT, inadequate infrastructure etc

Sanitary & phyto-sanitary (SPS) measures include issues related to sanitary and phyto-sanitary measures and conformity assessment related to SPS .The Specific limitations include quantitative restrictions, exchange controls, export taxes, quotas, import licencing requirements , proportion restrictions of foreign to domestic goods (local content requirement) ,minimum import price limits, embargoes, non-automatic licensing, prohibitions , quantitative safeguard measures ,export restraint arrangements , Restrictive licenses and other quality control measures

Charges on import include prior import deposits and subsidies, administrative fees, special supplementary duties, import credit discriminations, variable levies and border taxes. Other procedural problems include arbitrariness, discrimination, corruption, costly procedures, lengthy procedures ,lack of information on procedures (or changes thereof) ,complex variety of documentation required, consular and Immigration Issues and inadequate trade related infrastructure

Transport, Clearing and Forwarding issues include government Policy and regulations ,administrative (Border Operating Hours, delays at border posts, etc.),immigration requirements (Visa, travel permit),transport related corruption ,infrastructure (Air, Port, Rail, Road, Border Posts,),vehicle standards, costly Road user charges /fees and issues related to transit

Issues related to transit

Contrary to tariff measures (duties) which are normally transparent, NTBs are often more difficult to detect because they can be “hidden” in rules and practices that have a perfectly legitimate objective. They also leave more discretion to administrators in applying them. Furthermore, NTBs can have more trade-restrictive effects than tariffs, which raise the cost of a given product, and go as far as excluding a good from a market altogether. It is an experienced fact that, the economic effect of NTBs is very substantial, it appears that in some cases NTBs were introduced in order to counter-balance the loss of protection in the

wake of lower tariffs. Further, governments find it easier to conceive of non-tariff measures against imports in times of economic difficulties or in the case of a struggling sub- sector in an economy than taking less popular measures of a domestic nature.

Recent research by ITC based on market access map shows that, non-tariff barriers are growing in the case of LDCs. A staggering 40 per cent LDC exports are subject to non-tariff barriers. For developing and transition economies and developed countries the figure is only 15 per cent. Even with preferential agreements that grant LDCs duty-free access to markets, non-tariff barriers may prevent these countries from entering those markets. Non-tariff measures, such as safeguards, anti-dumping measures, standards, technical regulations and rules of origin, can play an even more significant role as possible barriers to market access than tariffs.

Market Access – Non-Tariff Measures –

Non tariff measures include the SPS regulations and the growth in quality control regimes promoted particularly by the developed importing countries. The Uruguay Round Agreement on the Application of Sanitary and Phytosanitary (SPS) agreement and the agreement on Technical Barriers to Trade (TBT) adopted by WTO Members in 1995 have given a new direction to the international sea-food trade and services. These agreements are intended to ensure that requirements such as quality, labeling and methods of analysis applied to internationally traded goods are not misleading to the consumer or discriminate in favour of domestic producers or goods of different origin. A key aspect has been the development of HACCP, which can impose significant costs from the viewpoint of the developing country supplier. SPS measures are unlikely to be relaxed and hence issues arise primarily in the form of mitigation and enhancement options. TBTs arise especially in the context of specification and labeling. Whilst the latter may assist in promoting (more) sustainable fishing practice they also again impose costs on producers. Areas such as eco-labeling are voluntary and there is scope for negotiation for those developing country suppliers wishing to participate. The SPS Agreement was set up to avoid sanitary standards being used as an unjustified barrier to trade by importing countries. There are several key principles including the sovereign right of a country to put protective measures in place, but these measures should not be more restrictive than necessary to achieve the appropriate level of protection.

The EU has been at the forefront in developing food safety standards and has had a profound influence on the development of the seafood export industry in developing economies. EU standards are enforced and regulated at the country level and thus a restriction of exports to the EU under the regulations affects all members of the export community. EU legislation for all food products has recently been brought under one directive and the scope has been extended to all aspects of the supply chain from "farm to fork". This legislation supersedes the individual commodity based directives. All the steps in the chain from primary producers (fishermen and aquaculture units) need to take on board, in a more structured manner, the principles of HACCP systems and other quality assurance needs thus broadening the scope of the competent authority in regulating the industry. The need to ensure that quality assurance measures are instituted prior to arrival at the processing factory gate poses a major challenge to export industries, particularly for the small-scale and non-industrialized sectors of the industry. Of even greater concern is the fact that in order for the 'farm fork' principle to be seen to be working a system of traceability of products throughout the chain will need to be instituted. Imports into the USA are regulated under the Federal Regulations. These regulations apply to domestically produced products and imports. They require that processors of fish and fishery products

operate preventive control systems that incorporate the seven principles of HACCP. While new regulations with regard to quality control, such as HACCP, have been adopted by all major importing countries and made compulsory for their fish processing industries, one notable exception is Japan. While some firms in Japan have neither HACCP nor external suppliers. Standards for imports of fish and fishery products into Japan are governed by the legislation set out in the Food Sanitation Law and the Quarantine.

Implications of Non-tariff barriers for India:

According to the Seafood Exporters Association of India (SEAI), since February 2002, there were several cases of rejection of Indian shrimp imports in the EU market on account of detecting traces of prohibited carcinogenic antibiotics like *nitrofuran* and *chloramphenicol* as well as other bacterial inhibitors like *amino-glycosides* and *macrolides*. Following the EU requirements, on 17 August 2001 India issued a notification specifying the limits for various antibiotics, pesticide and heavy metal residues in seafood products, ITN (2002). International Organization of Standardization (ISO) 9000 is recognized under the Export-Import Policy of Government of India. Firms, including seafood firms, enjoy certain privileges if they are ISO 9000 firms. Under the 1997-2002 Export-Import Policy, Government of India, exporters with ISO 9000 were given Special Import License (SIL) up to 5 per cent of f.o.b. value. Certification against ISO 9000 is beginning to emerge as a major industry in India. There are many auditors with experience in assessment of quality management against ISO 9000, and the certifiers in India with the highest credibility in the international market are those under multinational companies.

Food Safety Standards

While tariffs are more a problem in relation to accessing seafood markets in EU and developing countries, non-tariff measures have emerged as a significant bottleneck in accessing markets of rich countries. Processors who export to EU and US markets in particular need to either cost-effectively comply with import regulations or face costly rejections. These standards vary from one market to another. In the US, for example, histamine in canned sardines, mackerel and anchovies should not exceed 50 parts per million (ppm). However, in the EU, up to 150 ppm of histamine in canned fish is permitted.

The regulatory approaches used in the US, EU and other markets have changed quite significantly since the creation of free trade blocks and the WTO. The EU requires fish imported from a foreign processor to be accompanied by a certificate from an authorized national agency (In India's case it is the Export Inspection Agency under the Ministry of Commerce and Industry, Government of India), and it reserves the right to inspect the regulatory process and to decertify a national agency until remedial action is taken. In the case of US, the individual exporter has to demonstrate an understanding and ability to produce seafood according to US regulations.

Advances in the technology of seafood analyses have been made to the point that pesticide and pharmaceutical residues can often be detected at the parts per billion (ppb), and in some cases, at the parts per trillion (ppt) levels. When zero tolerances are established based on the ability of a test to detect parts per million, the increase in sensitivity to ppb or ppt can turn a "safe" product to an unsafe one. According to the Seafood Exporters Association of India (SEAI), since February 2002, there were several cases of rejection of Indian shrimp imports in the EU market on account of detecting traces of prohibited carcinogenic antibiotics like nitrofuran and chloramphenicol as well as other bacterial inhibitors like amino-glycosides and macrolides.

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Food Safety Standards and Small-scale Fisheries

From a small-scale fisheries perspective, in addition to the cost aspects, one of the main problems in adopting a HACCP plan would be the difficulty in implementing such a plan at the level of fish catch, especially for beach landing fishing units like *kattumaram* and canoes. According to EU and US standards, fish is to be stored in ice or in frozen storage as soon as it is harvested. Storage of fish in iceboxes would be difficult on board traditional fishing craft like *kattumaram*, which is made of lashed logs. Yet, many *kattumaram* using long lining and bottom set gillnets are in the process of catching fish for the export market. Strict implementation of HACCP plans could result in small
producers using such fishing craft being excluded from the export market. On reaching the fishing harbour or landing centre, traditional fishers are expected to handle fish for export market without exposing them to the beach-sand under fish handling standards of import markets. Many of the fishing villages that harvest fish, shrimp and cephalopods for the export market, have only the beach for landing their catch and it would be difficult for them to comply with a HACCP plan unless they invest in iceboxes and maintain them in a hygienic manner. Instead of a one- size-fits-all approach, there is need to develop different standards for different situations so that benefits of global trade can be shared by all. Moreover, a significant bottleneck in maintaining better hygiene standards in fish landing centres all over India is the shortage of potable water.

Equivalence of Sanitary and Phytosanitary Standards

Under Article 4 of Agreement on Sanitary and Phytosanitary Measures, members are in the process of bilateral determination of the equivalence of sanitary and phytosanitary regulations and regulatory processes between importing and exporting nations . While the international standards of US, EU and Japan are more an extension of their domestic standards, such standards in India are exclusively applied to its export market. India, for example, does not have any quality standard for seafood for its own domestic consumers. Given the situation, establishing equivalent standards are only to the extent of helping the domestic seafood export industry to meet the quality standard of the import markets. Therefore, how far the equivalent standards can be meaningful is moot as long as there are no domestic standards for seafood safety. It is important that such standards are developed for the domestic market so that the distinction between fish handled with gum boots and rubber gloves and bare feet and naked hands can come to an end.

Sanitary and Phyto-sanitary Measures (SPS Measures)

In 1998-99, i.e., in the wake of the EU sanctions on Indian seafood, the seafood sector is reported to have lost 21.48 per cent in export quantity and 14.58 per cent in dollar value. The sector responded to this and the successive SPS measures by investing (with some support from the Government) in upgrading the processing infrastructure. With the enforcement of Hazard Analysis Critical Control Point (HACCP), India has specified limits for various antibiotics, pesticide and heavy metal residues in seafood products. International

Organization of Standardization (ISO) 9000 is recognized under the Exim Policy of the GOI and certification against ISO 9000 has emerged as a major industry in India. Adapting the HACCP standards comes with a rather big price tag. Following the norms substantially increases the cost of production, because most of the capital goods need to be imported from the developed countries. Although it appears that some of the earlier estimates for upgrading to HACCP were exaggerated, the minimum cost of an EU certified plant is still high at about Rs. 80 million. The net worth of companies who are certified to export to the EU ranges between Rs. 800 million and Rs. 3,000 million. According to the Seafood Exporters' Association of India (SEAI), the Indian processing sector spent US $25 million in order to upgrade their facilities to the required standards. The overall compliance cost for meeting the EU norms, as estimated by the exporters (and confirmed by MPEDA), is between 15 and 40 per cent of the FOB value. The high cost of upgrading is the reason why, of a total of more than 400 processing establishments in India, only 169 were approved for exporting to the EU by 2005. On the other hand, the larger processors may have found few difficulties in upgrading to HACCP standards, which is to be expected as the larger processors are likely to be the net beneficiaries of the SPS measures in so far as the measures allow them control over a larger market share. The government's package of assistance also helped some of companies to improve the quality standards and it has been reported that the quality of seafood processing in the country is much better than that prevailing in many developed countries.

There is a widespread perception that the standards which the exporting units are asked to follow are those that even European plants do not follow, leading to charges of double standards. The Export Inspection Council of India (EIC) acknowledges that the EU process requirements impose more-than-necessary conditions often not listed in formal documents. Another frequent complaint about the standards is that, with upgraded infrastructure, there is no proportionate increase in the unit value realisation of seafood. In fact, the average realization cost that had stood at Rs.149.16 per kg during 1999-2000 came down to Rs.144.08 per kg in 2005, showing 3.53 per cent decline (MPEDA, 2000 and 2006), despite the huge increase in investment and cost of production. The impact of the measures on ancillary units like the shrimp peeling sheds has been even more damaging, forcing them to close down as a direct result of the provisions or because of the excessive cost of upgrading. The shift of shrimp processing from peeling sheds to processing plants for maintaining a highly sanitized factory environment also made the peeling units and their infrastructure unviable through reduced level of operations, making he investment dead. Apart from the economic losses accompanying the closure of shrimp peeling sheds, the loss of livelihoods for a number of women peelers has been a bigger concern, particularly as many of these women are the main bread-earners in their families.
Lack of alternatives continues to make their conditions more difficult. With the growing stringency of quality tests in the importing countries, there is also a constant fear that every consignment will be at risk because there are simply too many parameters to follow and also because the expertise and equipment necessary to implement some of the measures is simply not available (or affordable) in the country. Non-harmonious importing conditions among the importing countries are another cause of concern, which was particularly glaring in the case of countries within the EU (Kulkarni, 2005:18). Such fears and uncertainties often translate into measures that aim at maximising returns in the short term at the expense of long term sustainability of the sector.

Technical Barriers to Trade (TBT Agreement)

Mathew (Undated) and Srivastava and Ahuja (2002) examine the extent to which shrimp exports from India were affected during 1996-97, i.e., the year following the imposition of the US ban on Indian shrimp for not complying with its turtle conservation

provisions, by comparing them with the previous year (1995-96) and conclude that the US ban did not affect shrimp exports from India in general, and even to the US market in particular. In fact, in 1996, the year in which the US imposed the ban, exports of shrimps from India showed a modest increase in quantity terms. Two reasons are suggested to explain the absence of any significant effect of the US embargo. Firstly, since the US imposed a ban only on captured shrimps and not on cultured shrimp, there may have been some kind of switch from captured shrimps to cultured shrimps destined for the US market. There is a strongly pronounced trend in the Indian shrimp exports which has come to be increasingly dominated by cultured shrimp. In 2001, for instance, the cultured shrimp accounted for more than 60 per cent of the overall exports. The second reason could be the redirection of exports away from the US and towards Japan since the ban was imposed only by the US and not by other major importing destinations. Again, this is a familiar trend: whenever Indian seafood sector received a shock from one of the major importers, its first response has been to take the product elsewhere (Salagrama, 2002). Srivastava and Ahuja suggest that the ban had a limited impact because the US accounted for only 15 per cent of all shrimp exports from the country. Although even this share was not adversely affected due to the ban, TBT measures could certainly have serious consequences if imposed by all major importing countries. At the same time, the eastern coastal state of Orissa bore the brunt of several turtle conservation measures and provides an interesting case study in which issues of trade, environmental concerns and livelihood needs got entwined in a tangled web of contending interests. Here, the efforts to conserve turtles took two routes. On the one hand, the MPEDA started commercial production of Turtle Excluder Devices (TEDs) for distribution to the fishers free of cost. But the fishing boat operators were reluctant to use the TEDs, which would increase fuel consumption and hence, the cost of operations. A 1994 study done by the Ministry of Commerce, Government of India for United Nations Conference on Trade and Development (cited by Mathew, undated) estimated a loss of U.S. $23 million if TEDs were to be made mandatory in Indian shrimp trawlers. Moreover, the fishers complained, that the TEDs not only prevented capture of turtles, but also kept off bigger fishes and led to other catch losses, which could be up to 30 per cent of the catches. As a consequence, the use of TEDs remained rather low in commercial fishing operations. The impact of the ban has been felt by the fishers in the dozens of villages abutting the banned areas and has led to serious livelihood problems. It was also reported that between 40,000 to 50,000 fishworkers and fishing vessel operators were affected in Orissa as a result of sea turtle conservation programmes. The closure of fishing areas is believed to deprive the fishing sector of 2,000 tonnes of shrimp, about 50 per cent of the total marine shrimp production of Orissa, and the potential loss to the fishing sector as a result of sea turtle conservation programmes was put at Rs. 1,000 million (about U.S.$22 million at 2001 prices).

Subsidies

While some of the direct subsidies into the sector – for instance, those going to the export and processing sectors, have remained largely intact, the study also identifies some important areas where there have been changes to the existing subsidy regimes (both explicit and implicit), which have implications for the sector at large. Some of these include:

Fishers sharing part or whole of the cost of public investments: These include the fishers sharing the cost of infrastructure such as landing jetties, drying platforms or access roads, as well as paying a more realistic user fees for utilising common facilities like fishing harbours. The increasing prevalence of 'Build-Operate-Transfer' arrangements for setting up public infrastructure like ports and roads also ensures that the users pay for the assets over a longer time period.

Reduction or removal of tax preferences: This is reflected in the current taxation policy of the country which converts duty entitlement passbook (DEPB) income on export turnover above Rs. 10 crore ($ 2.2 million) into taxable income. This has landed the seafood exporters in considerable amount of trouble (Economic Times, 18 February 2006) and led to arguments that this kind of internal taxation will put additional burden on the ailing sector. It is estimated that with the implementation of the new tax policy, around Rs 500 crores will be removed from the seafood sector annually.

Anti-Dumping Measures (ADM)

Based on a complaint by the US-based Ad Hoc Shrimp Trade Action Committee in December 2003 that the US shrimp industry was being materially injured by shrimp being sold below fair value, the US Department of Commerce imposed anti-dumping duties on frozen or canned warm-water shrimp from Brazil, China, Ecuador, India, Thailand, and Vietnam in 2005. In addition to the 10 per cent antidumping duty and regular tariffs on shrimp, exporters to the US also have to give the US government a deposit or "bond" of 10 per cent of the value of the year's export which the US government would hold for three years. Since ADM is targeted at individual companies, there is no single levy structure: Hindustan Lever, for instance, was levied 27.49 per cent duty, which was much higher than the weighted average of 14.20 per cent paid by most other exporting companies. The ADMs were also country-specific, with certain countries (for e.g., Vietnam, China) being made to pay a higher duty, while others (for e.g., Thailand) paid less. While there was much heartache about the US shrimp anti-dumping tax, the fact remains that India itself has been aggressively using ADMs on a variety of imports (although not directly related to seafood). In fact, in terms of using ADMs, India is considered to be in league with the 'traditional' users of these measures like the EU and the US. More than half of these measures are targeted at developing countries.

In 2004-5, the USA slid to the 2nd position among the importers of seafood from India and, according to the MPEDA (MPEDA, 2006), the decline was mainly due to the antidumping duty imposed by the US government on import of frozen shrimp from India. Export of frozen shrimp to USA declined by 15.02 per cent in quantity, 9.81 per cent in rupee value and 7.93 per cent in US$ terms during the year. This was followed by the EU emerging as the largest market for Indian marine products, increasing its share to 25.52 per cent from 23.37 per cent in quantity; to 27.37 per cent from 24.15 per cent in rupee value and to 27.42 per cent from 24.04 per cent in US$ realisation. Overall, it has registered an export growth of 22.29

Eco-labelling and Certification

Eco-labelling has yet to become an established trade measures, but generates considerable interest for its potential impacts upon trade, environment and livelihoods. On the other hand, the price premium for sustainably managed Indian seafood remains untested, since India does not yet have a single seafood eco-label.

Eco-labeling

A number of fisheries related eco-labels already exist (e.g. Marine Stewardship Council (MSC), Responsible Fisheries Society of the United States, Global Aquaculture Alliance) for labeling species that are judged to be sustainably fished. The objective of such ecolabeling programmes is to create market based incentives for better management of fisheries by creating consumer demand for seafood products from well managed Stocks or from sustainable aquaculture. The DDA also addressed labelling requirements for

environmental purposes (i.e. eco-labels), in order to clarify the impact of eco-labelling on trade and examine whether WTO rules stand in the way of eco-labeling policies. While certification and labelling schemes may in some cases offer the opportunity of higher prices and access to niche markets, there are concerns (but little evidence) over the possible negative impacts on developing country producers. Although eco-labelled products are not yet prominent in any market, concerns are based around a number of issues, such as: Legitimacy and credibility; a mismatch between certification requirements and the reality of tropical small-scale fisheries and potential distortions to existing practices and livelihoods.

Implications of Eco-labelling for India: There are several concerns about eco-labelling in developing countries and specifically India. Firstly, there is fear of losing access to market if eco-labeled fish and fish products gain greater preference in import markets. Secondly, there is worry about the affordability of costs associated with adjusting fisheries to comply with eco-labelling standards, and about costs of certification and chain of custody and whether or not the market, if they go for certification, can adequately compensate their higher costs. Thirdly, there is apprehension that fishers in the small-scale artisanal sector would lose their autonomy if they have to comply with standards that are developed and applied by external agencies to their fish exports without taking into account the specific aspects of their fisheries. Fourthly, there are doubts about the practicability of eco-labelling in multi-species, multi-gear fisheries since the unit of certification is the fishery in its entirety. Apart from the above, several concerns about the implications of voluntary eco-labelling for the artisanal and small-scale fisheries in developing countries have been expressed, particularly in the context of the eco-labelling programme in fisheries, viz., the MSC, which was established in 1997, ICSF (1998). In the history of MSC from 1997 to 2002, for example, there are no fisheries from developing countries that have been certified, although there are potential candidates for MSC certification from developing countries including a couple of village-specific crab, mackerel and sardine fisheries from Tuticorin in Tamilnadu.

Licenses

The most common instruments of direct regulation of imports (and sometimes export) are licenses and quotas. Almost all industrialized countries apply these non-tariff methods. The license system requires that a state (through specially authorized office) issues permits for foreign trade transactions of import and export commodities included in the lists of licensed merchandises. Product licensing can take many forms and procedures. The main types of licenses are general license that permits unrestricted importation or exportation of goods included in the lists for a certain period of time; and one-time license for a certain product importer (exporter) to import (or export). One-time license indicates a quantity of goods, its cost, its country of origin (or destination), and in some cases also customs point through which import (or export) of goods should be carried out. The use of licensing systems as an instrument for foreign trade regulation is based on a number of international level standards agreements. In particular, these agreements include some provisions of the General Agreement on Tariffs and Trade and the Agreement on Import Licensing Procedures, concluded under the GATT (GATT).

Quotas

Licensing of foreign trade is closely related to quantitative restrictions – quotas - on imports and exports of certain goods. A quota is a limitation in value or in physical terms, imposed on import and export of certain goods for a certain period of time. This category includes global quotas in respect to specific countries, seasonal quotas, and so-called

"voluntary" export restraints. Quantitative controls on foreign trade transactions carried out through one-time license.

Quantitative restriction on imports and exports is a direct administrative form of government regulation of foreign trade. Licenses and quotas limit the independence of enterprises with a regard to entering foreign markets, narrowing the range of countries, which may be entered into transaction for certain commodities, regulate the number and range of goods permitted for import and export. However, the system of licensing and quota imports and exports, establishing firm control over foreign trade in certain goods, in many cases turns out to be more flexible and effective than economic instruments of foreign trade regulation. This can be explained by the fact, that licensing and quota systems are an important instrument of trade regulation of the vast majority of the world.

The consequence of this trade barrier is normally reflected in the consumers' loss because of higher prices and limited selection of goods as well as in the companies that employ the imported materials in the production process, increasing their costs. An import quota can be unilateral, levied by the country without negotiations with exporting country, and bilateral or multilateral, when it is imposed after negotiations and agreement with exporting country. An export quota is a restricted amount of goods that can leave the country. There are different reasons for imposing of export quota by the country, which can be the guarantee of the supply of the products that are in shortage in the domestic market, manipulation of the prices on the international level, and the control of goods strategically important for the country. In some cases, the importing countries request exporting countries to impose voluntary export restraints.

1. Harmonisation of testing procedures

The European Union has its own standards as a whole in addition to each member state having its own standard. Indian side feels that it is essential to harmonize these standards within EU so that the countries, which are exporting to EU could comply with one set of norms. Due to the prevalence of separate set of norms , there is increased number of rejections of marine products export to this part of the world. There are instances of rejection of sea-food consignments exported from India to EU, specifically to Italy and France, for the presence of Vibrio Parahaemolyticus, a commonly found micro organism in coastal and estuarine waters. Indian authorities and exporters are of the opinion that the practice of judging sea food based only on total Vibrio Parahaemolyticus counts, without accounting for the virulence factors TDH/TRH is not appropriate.

2. Rejection on account of bacterial inhibitors/ unspecified antibiotics

There are instances of rejection of the Indian farm-raised and sea-caught marine products for the presence of bacterial inhibitors/ antibiotic residues without specifying the residue involved in such rejections. Health authorities involved in testing activities in India feel that harmful residues are not possible to be present in the sea caught products.

3. Rapid Alert System

The procedure for lifting rapid alerts by the member countries is not harmonized. In order to lift rapid alert, the number of minimum consecutive checks varies from member state to member state. For example, France checks 3 consecutive consignments for lifting rapid alert, while Spain insists on 10 and Belgium on 5 and so on. There is a need to harmonize this system.

The rapid alert system

Basically, the purpose of the RASFF is to provide the European Union control authorities with an effective tool for exchange of timely information on measures taken to ensure food safety. Basically, Member States shall immediately notify the Commission, under the rapid alert system, of:

(a) any measure they adopt which is aimed at restricting the placing on the market or forcing the withdrawal from the market or the recall of food or feed in order to protect human health and requiring rapid action;
(b) any recommendation or agreement with professional operators which is aimed, on a voluntary or obligatory basis, at preventing, limiting or imposing specific conditions on the placing on the market or the eventual use of food or feed on account of a serious risk to human health requiring rapid action;
(c) any rejection, related to a direct or indirect risk to human health, of a batch, container or cargo of food or feed by a competent authority at a border post within the European Union.

These latter notifications are called *Information Notifications.* Information notifications concern a food or feed for which a risk has been identified, but for which the other members of the network do not have to take immediate action, because the product has not reached their market. These notifications mostly concern food and feed consignments that have been tested and rejected at the external borders of the European Union. Products subject to an information notification have not reached the market or all necessary measures have already been taken.

The RASFF also issues *Alert Notifications.* These are sent when the food or feed presenting the risk is already on the market and when immediate action is required. Alerts are triggered by the Member State that detects the problem and that has initiated the relevant measures, such as withdrawal/recall. As of 26 May 2003 the European Union began posting a weekly internet report with information on all notifications from the Rapid Alert System.

1. Destruction of Consignments

Destruction of consignments which have been found to contain chloraphenicoland nitrofuran residues has been a major issue which India has taken up in various bilateral forum. As a result of these discussions many countries are now agreeing to return rejected consignments to India. But consignments are still destroyed in UK and India is not in favour of this practice.

Recent restrictions to trade

1. After the events of September 11, 2001, the US Government has taken a number of steps to enhance the security of the food supply. Accordingly, US Congress has passed the Public Health Security and Bioterrorism and Response Act of 2002. This Act has created indirect barrier for seafood exports from India as inspections have increased.
2. Indian export consignments have also been rejected under country of origin labelling norms.
3. While catching shrimps it needs to be ensured that sea turtles are not killed. In 1996 USA banned imports from India accusing that Indian fishermen are not using turtle excluder devices.
4. Similarly, Tuna exports need to have dolphin safe catching procedure labelling.

Non-Tariff Barriers from other countries

1. Saudi Arabia has been imposing a ban on India since 1984, as WHO reported India as a country affected by cholera at that time.
2. Chinese authorities do not have details of their norms.
3. Revised quarantine measures to be imposed by Australia on prawn imports would also create barriers to Indian exporters.

Policy Implications for Indian fisheries sector

To conclude the above discussion, the following policy measures were suggested for the betterment of the sector:

1. Any changes in tariff or other rules of market access will have direct consequences for them. The Government must therefore give special consideration to this fact and any deliberation on NAMA must entail special discussions on the impact on employment and livelihood in such sectors. The key issue concerning NAMA is that while developing countries protect their markets through higher tariffs, the main mode of protection for the developed countries is through non-tariff measures, particularly through the use of technical barriers. Such barriers in the developed countries are not being discussed simultaneously or with the same priority. Therefore a further reduction in tariffs as is being negotiated in NAMA will not lead to any greater market access for the developing countries including India but will certainly ensure greater market access for the developed countries.

2. The major fishing companies in developed countries use massive factory ships to process their catch. Small-scale fishers in India point out that their problems arise from the open access regime for foreign trawlers, not from subsidies. From their perspective, blanket rules that prohibit subsidies would restrict the right of governments to support small fishers and protect the food security of coastal communities.

3. In EU and Japanese markets, the average tariffs are comparatively higher than in USA. A one per cent tax reduction on exports can fetch a sizeable amount, which could provide extra financial resources to meet the expenditure involved to comply with international trade standard, and to access international markets in an era of increasing consolidation of the food retail by MNCs. Further, a verifiable environment management system can be adopted in marine fisheries to demonstrate effective fisheries management measures to the import markets.

4. Increasing fish exports should not result in increased prices on local markets, and traditional fish producers, processors and persons involved in processing should be protected. Further, a comprehensive central policy in regulating the number of boats and trawlers going in to sea in each state should be regulated to conserve our marine resources from over exploitation.

5. Subsidies to the industry to adopt and implement new fisheries management plan such a plan should be defended as non-actionable subsidies based on the lines being followed by EC and other developed countries.

25

WTO Agreements and Fisher Livelihoods: Tradeoffs and Strategies

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Introduction:

Rural communities often rely exclusively on natural resource utilization for both subsistence and income generation. It is their deep connection to the resources in their region that forms the base of livelihood that sustains both family security and offers potential to increase economic opportunities that improve standards of living, increase educational levels of their children and help raise people out of poverty. Natural resource use has many faces and functional aspects in these communities. For a large portion of the world, agriculture provides the bulk of livelihood activities, a practice that depends on continued fecundity of the land and adequate water resources to sustain harvestable yields. For other communities, forests provide the economic base for their existence, utilized not just for timber, but also for non-timber products like herbs and fruits, wild game, raw materials for craft production, and small wood for firewood and charcoal production. In riverine, lake and estuarine communities the water resource provides access to important protein sources and economic currency in the form of fisheries and marine life. Combined, these packages of ecological goods and services form the asset base of many impoverished communities throughout the world.

As countries race to develop their industrial potential to compete in global markets, they in turn rely on natural resources to fuel this economic expansion. The Food and Agriculture Organization (FAO) estimates that some 70 per cent of the world's major fisheries grounds are already exploited to the limit of natural replenishment or already past that stage. A number of factors have contributed to these trends. Poor fisheries management and inappropriately designed subsidies to fishing industries have been widely recognized as key drivers of over-exploitation of fisheries resources by contributing to significant overcapacities of fishing fleets, particularly in developed countries. The numbers of middle and large scale fishing vessels doubled from 585,000 in 1970 to 1.2 million in 1990. A recent World Bank paper estimated that worldwide fishery subsidies total between $14.5 and $20.5 billion annually, conceding that even these figures ''probably err on the low side, perhaps by a considerable margin.'' The European Union alone spends around two-thirds of its fisheries budget subsidizing commercial fleets. Government subsidies have been used to prop up domestic producers confronted with diminishing local catches, by encouraging them to migrate to foreign waters. That is the case, for example, with the European Union's desperate need to dump 40 per cent of its excess fishing capacity — much of it owned by Spanish fishing companies. The European Union (EU) pays handsome subsidies called "exit grants" to vessel owners to send their ships to fish in other countries' waters. Multinational fishing companies like Spain's Pescanova or Japan's Mitsubishi, are well placed to take advantage of such subsidies. Like many other corporations with worldwide fishing and

seafood marketing operations, they maintain extensive worldwide operations concentrated around Africa, Asia and Latin America and even in such far-flung places as New Zealand and the waters off Antarctica. Geographical diversification enables transnational fishing companies to offset the impact of declining catches in one region by substituting supplies from another. A good example of the impact the above practices is illustrated by what has happened to the traditional, artisanal fisheries sector in Senegal, a sector characterized by low technology, a large workforce, and a limited investment. The artisanal sector is key to the Senegalese economy for both economic and nutritional reasons. Senegal has 47,000 artisanal fishermen. They comprise over 7 per cent of the economically active population and bring in more than 70 per cent of the total volume of fish caught. As European waters have become progressively overfished, the European Union (EU) has looked further afield, to countries like Senegal, for new fishing grounds. Over 15 years, in the absence of an appropriate management regime and effective enforcement, EU fishing operations have penetrated traditional fishing areas and have affected the resource, the marine environment and the Senegalese fishing communities dependent on it. As fish become scarcer, artisanal fishermen had to travel further out at sea to meet their catch. Some fishermen, unable to pay for equipment and fuel, resort to cutting deals with European or Asian boats that use local fishermen and their pirogues to gain access to coastal areas and resources, to which they have restricted access. According to a survey by the Washington-based World watch Institute, the people in Europe, Japan, and North America consume a disproportionate amount of fish — about 40 per cent of the world total. World watch Institute researcher Anne Platt McGinn, in her World watch paper, "Rocking the Boat: Conserving Fisheries and Protecting Jobs", says that most fish from African, Asian and Latin American waters are exported and that 85 per cent of internationally traded fishery products originate in the coastal waters of developing nations. Yet, people in these countries rely on fish for a much larger portion of their animal protein than people do in industrialized countries. To keep the exports flowing, domestic supplies have been cut, making fish more expensive in places like Malaysia, Suriname, Laos and Cambodia. While countries may have laws regulating the fisheries sector, she says, “Local fishers in developing countries are rarely consulted, foreign fleets regularly under-report catches and the enforcement of the few environmental provisions that do exist is generally scant.'' Fish provide roughly 40 per cent of the protein consumed by nearly two-thirds of the world's population. For example, over a billion people throughout Asia depend on fish and seafood as their major source of animal protein. But, fish have moved into the luxury-style, high-priced food class. The United Nations Educational, Scientific and Cultural Organization (UNESCO) warns that fish, long regarded as the "poor man's protein", is diminishing globally as a result of increasing market demand and overfishing. Declaring that "the golden age" of fishing had ended, UNESCO, along with the Food and Agriculture Organization, has warned that there will be a global shortfall of fish for human diets of 20 to 30 million tons by the year 2010. The developed nations are winning in the consumption stakes. While their citizens have average annual supplies of about 26 kilograms of seafood per person each year, people in the developing countries have only nine kilograms of fish per person each year. During the period 1988-1990, the developed nations imported 76 per cent by weight of all fish for direct human consumption that went into international trade. Almost three years after it was presented for signature, the majority of the world's major fishing nations have not signed the 1995 UN treaty that would regulate world fish stocks. The agreement, formally called the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks, to date has been ratified by only 27 countries: Australia, Bahamas, Barbados, Brazil, Canada, Cook Islands, Fiji, Iceland, Iran, Maldives, Mauritius, Micronesia, Monaco, Namibia, Nauru, Norway, Russia, St Lucia, Samoa, Senegal, Seychelles, Solomon Islands, Sri Lanka, Tonga, United States and Uruguay. Thirty are needed before it can go into effect, while only five of the top 20 major fishing nations — Russia, Canada, Norway, Iceland, and the United States — have signed this convention. Eight developing nations, which account for 27 per cent of world fishing, have not signed the

agreement: Chile, Peru, India, North Korea, Thailand, Mexico, Malaysia and Vietnam. Sutton believes that ''this(UN) agreement is very good, it sets new international standards for responsible fishing, along with the FAO code of conduct.'' But since 1995, governments have begun to realize just how expensive it is going to be to put it into force, both politically and financially, and began to back away from it. In comparing the world's two marine fishing industries — large-scale vs. small-scale — several important points can be made that also have bearing on cutbacks. Comparisons have shown that the small-scale, community based fisheries actually provide about the same amount of marine fish for human consumption as the large-scale, company-owned fleets on a global basis million vs. 27 million tons respectively). In producing its half-share of fish for human consumption, however: - The small-scale, community based sector produces little or no damaging by catch/discards, keeping almost all its catch for local consumption; whereas, the large-scale, industrialized sector discards range between 17 to 39 million tons of wasted fish annually. - Small-scale artisanal fisheries employ about twenty times more people to catch its near-equal share of fish for human consumption. The small scale, artisanal sector also employs about one hundred times more fishermen per million dollars of capital invested in fishing vessels than the industrialized sector. The annual consumption of fuel oil ranges one to two-and-a-half tons for the small-scale, artisanal sector compared to 14 to 19 million tons for large-scale industrial fisheries. And the small-scale sector catches from four to five times more fish per ton of fuel consumed compared to the large-scale, industrial sector. In the final analysis, over-fishing is the principal threat to long-term employment in fisheries. Saving jobs means ensuring that fish populations remain abundant, and the oceans' health and productive processes are continuously protected. Those concerned with secure and sustainable livelihood strategies also must recognize that the "traditional" fishing sector is far more appropriate for the "industrialized" alternative.

The WTO should promote environmentally and socially beneficial trade. An area of great significance to developing countries and the livelihoods of the poor are the need to reform and/or abolish fishery subsides. World fishing fleets are estimated to be as much as two-and-a-half times the size that would allow sustainable harvest to oceanic fishery resources. The EU pays developing countries more than $260 million a year for fishing rights on its oversized fleet. The US has already moved to “buy-out” and decommission a portion of its fishing fleet. The WTO could play a central role in working towards elimination of fishing subsidies that promote over capacity of the fleet and use this as the first example of promoting environmentally and socially
acceptable trade.

Fish are also one of the world’s most highly traded commodities. Almost 40 per cent offish output by value is traded internationally – primarily from developing to developed countries – with an export value of US$ 63 billion in 2003 (Emerson, 2005). Seafood is now one of the most traded commodities in the world (FAO, 2004a). In the developing world, exports of fishery products make up 20 per cent of their agricultural and food-processing exports – more than tropical beverages, nuts, spices, cotton, sugar and confectionary combined (World Bank, 2004). Expected increases in prices for fish and fishery products could have potentially significant ramifications for the availability of fish for food use as well as fishmeal, which provides an important source of livestock feed in some countries. International fisheries trade can play an important role in the development strategies of many developing countries, and it is the cornerstone of many fishing communities throughout the world. For developing countries, the fisheries sector is a major source of export revenue, a key dietary input and an important provider of local livelihoods. Nearly a billion people worldwide depend on fish as their primary source of dietary protein (Schorr, 2004). Further, small-scale fisheries form a significant part of the fisheries sector (though

their actual contribution to total capture fishery products remains difficult to estimate) (FAO, 2004b). In the past several decades, bilateral fisheries access agreements between developed and developing countries have emerged as a critical part of trade relations between developed and developing countries. While these agreements have the potential to help build capacities in developing countries and maintain fishing communities in developing countries, they can also fuel over-exploitation of fisheries resources in developing country national waters by distant water fleets that are provided access under the agreement while reducing the competitiveness of the local industry. The fisheries sectors in many of the poorest countries often face serious obstacles to expanding their participation in international trade and diversifying production and exports towards value-added processed products. These barriers include tariff escalation, stringent standards, countervailing measures and rules of origin requirements in export markets as well as domestic supply-side capacity constraints. In addition, fisheries subsidies in developed countries have contributed to market distortions, reducing developing countries' ability to compete with subsidized fleets and often making it economically unviable for poor countries to build up their own fisheries industries. Trade liberalisation in the form of subsidy cuts and reduced tariff escalation may promote more efficient use of fisheries resources, reduce trade distortions, enhance market access for developing countries (particularly for processed fishery products) and thus increase incomes and employment opportunities. On the other hand, while some countries may gain from expanding fisheries trade, some portion of their populations, or other countries, may not reap any benefits, or indeed, may be made worse off. There are fishing communities that fear the impact of expanded trade on their livelihoods, culture, local development and food security. Alongside these considerations exists a debate about the environmental impacts of expanding fisheries trade. On the one hand, expanding international trade may further strain the sustainability of fish stocks and the marine environment where resources are not effectively managed or regulated. Moreover, some trade laws and policies may impede efforts to reduce pressures that drive overfishing. The global market does not currently contain feedback loops that ensure that environmental costs and sustainability concerns are recognised and internalised. There is, for example, no automatic mechanism within the trade system for constraining trade at points where it is clear that the scale of trade and production are out of proportion to the availability of the fisheries resources. Some argue that growth in aquaculture production and trade could mitigate some of the pressures on the resources and provide opportunities for expanding domestic industry. To be sustainable, however, the sector will need to address livelihood considerations, including the likelihood of market concentration at the expense of small-scale industries and the environmental impacts, such as pollution from aquaculture pens or the use of wild fish as fishmeal and oil for use as feed in aquaculture production.

On the other hand, the opportunity to generate profits and foreign exchange from increased trade could be one way to focus the minds of some countries on the need to ensure sustainability as a way to safeguard long-term economic opportunities. In some instances, trade measures have been proposed as possible avenues to address some of the drivers of fish stock depletion, including the use of import controls, traceability systems and labeling schemes which take into account developing countries' capacity constraints to implement and comply with such measures.

The fishing industry is a vital source of social and economic development, providing employment, livelihoods and food security in developed and developing countries alike. A core challenge for governments is to devise policies to maximize social and economic benefits for those linked to the industry, particularly in coastal areas, while balancing socio-economic gains with sustainability considerations in order to ensure the long-term viability of the resource base. Employment and livelihoods For both developing and developed

countries, the productivity, sustainability and profitability of fish stocks is of critical importance to sustain the millions of families and communities who rely on the fisheries sector for their livelihoods. The world's fisheries sector provides employment to over 200 million people. Developing countries account for an estimated 98 per cent of the 51 million people engaged directly in the global fishing industry and related processing activities (FAO, 2004a; World Bank, 2004). A further 150 million people in developing countries are estimated to work in sectors associated with the fishing industry, such as marketing, boat building, gear making and bait (ICLARM, 1999). Furthermore, the number of full-time fishers has increased at a rate of 2 per cent per year since1990 and is continuing to grow. In particular, aquaculture has become an important source of work, employing roughly 10 million people worldwide. While only partial statistics are currently available for the industry, numbers indicate that over the last decade, aquaculture employment has increased an average of 8 per cent per year (FAO, 2004a). Artisanal and small-scale fishers comprise nearly 90 per cent of fishers worldwide and produce nearly 25 per cent of the world's catch (Schorr, 2005). That at least 6 million of the world's fishers earn less than US$ 1 per day reinforces the critical link between fisheries and the survival of the world's poorest people (World Bank, 2004). Small-scale fishers are particularly vulnerable to external shocks that impact their capacity to harvest and market fish. Beyond direct employment, the socio-economic importance of the fishing industry to livelihoods is known to be significant but is difficult to quantify. For many coastal communities, fish resources represent the livelihood of the entire family. Women play a particularly prominent role in the fisheries sector – with many women (and family members) engaged in fishing and in some area of harvest, processing or marketing (Josupeit, 2004). In developed countries too, fisheries resources can be a critical source of income for coastal fishing communities whose communities and local traditions have relied for many decades, and sometimes centuries, on fishing and related processing activities(ANFACO, 2005; YUTAIKYO and ZENGYOREN,2005).When it comes to international fish trade, the implications for employment and livelihoods are complex. From an exporter's perspective, increased trade in fish and fishery products facilitated through improved market access and strengthened supply-side capacity can provide important export revenue and employment opportunities. At the same time, greater trade orientation can result in less or lower quality fish for domestic consumption and in the longer term may negatively impact the sustainability of fisheries resources. From an importer's perspective, fish and fishery products can provide an important source of protein as well as inputs into the domestic processing industry. At the same time, cheaper imports can threaten to displace less competitive local fishers and processors. In any case, fishing communities in both developed and developing countries have a vested interest in the long-term sustainability and productivity of their fisheries as the basis for addressing food security and livelihoods objectives – particularly those with low incomes and/or limited possibilities to shift to other sectors or locations for work. Whether in ICTSD — Natural Resources, International Trade and Sustainable Development 21 developed or developing countries, when fish stocks collapse, fishing communities are forced to undergo difficult economic adjustments and the loss of income. Food security The FAO defines food security as the situation "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996). The role of fish in nutrition shows marked continental, regional and national differences as well as income-related variations (see Figure 1.8). The importance of fish to food security is highest for artisanal and small-scale fishers in developing countries. For developing country populations, fish provides nearly 20 per cent of animal protein (World Bank, 2004). In many coastal areas and especially among the poor, fish are the staple source of animal protein, particularly in developing countries. The FAO warns that "unless the appropriate actions are taken very soon, the contribution of fisheries to food security – and to economic welfare in general – will decline" (FAO, 1995). The effects will be felt most severely in developing countries. A

further decline in fish stocks, or a significant increase in the price of fish for consumption would seriously affect the nutritional status of many population groups, including some of the most vulnerable. Given food security concerns, there is increasing criticism of the inefficient conversion of high per centages of the global fish catch into oil and meal to feed livestock, poultry and farmed fish.

Human health

In the past decade, there have been growing concerns about the levels of chemicals in fish intended for human consumption and the potential impacts on human health. According to the FAO (2004a), several studies have concluded that levels of these chemicals in such fish are low and probably below levels likely to affect human health. Nevertheless, the FAO advises that they can be of potential concern for populations for whom fish constitutes a major part of the diet as well as for pregnant and nursing women and young children who consume substantial quantities of oily fish. The presence of chemical contaminants in seafood is highly dependent on geographic location, species, fish size, feeding patterns, solubility of chemicals and their persistence in the environment. To clarify the risks and concerns, focused risk assessments are needed. At present, there is little information about the effects of concerns about chemical levels on demand for fishery products. Comprehensive studies and clear information would improve opportunities for producers to respond to and manage concerns – particularly as consumer awareness of these issues rises. Several organic and inorganic compounds can find their way into fish and seafood. These compounds can be divided into three major groups:

• Inorganic chemicals: arsenic, cadmium, lead, mercury, selenium, copper, zinc andiron.
• Organic compounds: polychlorinatedbiphenyls (PCBs), dioxins and insecticides (chlorinated hydrocarbons). These chemicals are able to accumulate and persist in the environment.
• Processing-related compounds: sulphites (used in shrimp processing), polyphosphates, nitrosamines and residues of drugs used in aquaculture (e.g. antibiotics or hormones).

Many of the inorganic chemicals are essential for life at low concentration but become toxic at high concentration. Several studies indicate that fish in the open seas (which are still almost unaffected by pollution) mostly carry only the natural levels of inorganic chemicals (FAO,2004a). However, these elements can be found at concentrations that exceed the natural loadin heavily polluted areas, in waters that have insufficient exchange with the world's oceans(e.g. the Baltic Sea and the Mediterranean Sea),in estuaries, in rivers and especially in locations that are close to industrial sites. Organic compounds, on the other hand, are mostly of human origin and are brought to the aquatic environment by humans. Increasing amounts of chemicals may also be found in predatory species as a result of bio magnification, which is the concentration of the chemicals in higher levels of the food chain. Similarly, they may be present as a result of bioaccumulation, which is the accumulation of chemicals in the body tissues over the lifespan of the individual fish.
Work safety-While fisheries are an important source of employment, work in the industry is often accompanied by considerable risks. The FAO observes that fishing is considered one of the most dangerous occupations (FAO, 2004a).A particular set of safety concerns for crews arises in relation to ageing fishing fleets. Older vessels often do not comply with the minimum standards for accommodation and safety that are applied to newly-built vessels. Several labour unions with members in fisheries and related processing sectors have also raised concerns about extremely poor labour standards and low wages for work on fishing vessels and in processing facilities (ICSF, 1997). For vessels at sea for many weeks or months, the working conditions and safety of crew may be compromised in favour of keeping costs low. Importantly, the International Labour Organization (ILO) is currently

establishing anew Convention on labour conditions in the fishing industry (which includes accommodation standards for new fishing fleets). The FAO, the ILO and the International Maritime Organization(IMO) are also together finalising major revisions of the Code of Safety for Fishermen and Fishing Vessels and the Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels. ICTSD — Natural Resources, International Trade and Sustainable Development 23Political volatility and tensions in fisheries A growing source of tension in the fisheries sector is the relationship between artisanal and industrial fishers. Increasingly, artisanal fishers protest the presence of foreign, often heavily-subsidized industrial fishing fleets in coastal waters, uniting through social movements to protest irresponsible harvesting techniques and the related impacts on artisanal fishing communities and traditional livelihoods (ICSF, 1994; ICSF, 1997). In the face of fierce competition, many of these communities fight to maintain local skills and knowledge of local ecosystems, often arguing that their fishing methods are more efficient and sustainable. While some artisanal and small-scale fishers are integrated into international supply chains, many artisanal communities struggle to maintain local marketing channels as a way to meet local food needs and improve food security (Kurien, 1998;SeaFish for Justice, 2005). Artisanal fishers have also raised a series of concerns about the effects of aquaculture on coastal environments, fish stocks and local fish markets. In developed countries, too, many fishing communities struggle to protect their livelihoods. In the face of both domestic and local competition, fishers use strikes and political power to influence political processes. In late 2004, for example, Spanish fishers wary of the potential for declining government support to their industry held a strike that halted traffic and business for a number of days (BBC, 2005).Similarly, in several developed countries, there are also small-scale and owner-operated fishers with long-standing community and family traditions in the fishing industry that face the threat of being pushed out of the industry by larger and more powerful companies. Debates about use of, and access to, diminishing fish stocks have also culminated in legal challenges, diplomatic tensions and even the use of force among states. There have been disputes between states over fish resources in the Grand Banks of Newfoundland, the Bering Sea, the Barents Sea, and off Patagonia and the Falklands (see, for example, Farnsworth,2005). More recently, there have been conflicts over tuna in the north-eastern Atlantic, crab and salmon in the North Pacific, and squid in the south-western Atlantic. Particular political problems have arisen regarding straddling and highly migratory stocks, as was the casein a 1995 dispute between Canada and Spain over turbot. From 2000 to 2001, Chile and the European Union were also engaged in a trade dispute over swordfish. The EU-Chile dispute over swordfish In 2000, a dispute arose between Chile and the EU regarding trade in swordfish. Concerned that the Spanish fishing fleets were undermining Chilean conservation efforts related to swordfish, Chile prohibited EU vessels in the South-East Pacific from landing swordfish for warehousing, transshipping onto other vessels in Chilean ports or direct importation.

The impacts of tariff liberalisation in the fisheries sector on social development, livelihoods, income and poverty alleviation are hotly contested (Ahmed, 2006; Kurien, 2004). On the positive side, liberalisation could raise producer prices – benefiting poor fishers. Increased demand and access to new markets that emerge from liberalisation could bring new opportunities to small-scale fisheries and workers in processing industries. Where tariff escalation restricts the opportunities for developing countries to diversify production, liberalization could aid efforts to diversify employment opportunities within national economies (Bulteand Barbier, 2005). In addition, increased trade as a result of further tariff reductions could lower consumer prices of fishery products and increase the variety of fishery products available for processing and sale. On the other hand, tariff liberalisation may also produce social costs, including threats to food security, threats to fish stocks in fisheries important to local livelihoods and, in some cases, pressures on local cultures and traditions. From a food security perspective, poor consumers may be

negatively impacted, as fishery products may be diverted into more lucrative export markets instead of being34 Fisheries, International Trade and Sustainable Development available for local consumption. As fishers devote effort to producing fish for higher prices in export markets, liberalisation may increase the cost of fish in local markets and/or reduce the variety of fish available – leaving local communities with only lower-value fish to consume. As commercial operators take overfishing and aquaculture activities, more fish may be consumed by wealthier consumers, and the share of fish protein available to artisanal fishers could also decline. A study on Senegal, for example, found that the switch of the local Senegalese fishing effort to export species had a serious impact on local food supplies (and on key stocks) (UNEP, 2001).An expansion of trade in aquaculture-based fishery products also generates some socioeconomic concerns. At present, most production in developing countries is subsistence farming for local consumption (OECD, 2003). However, for some products, production is almost entirely export-oriented and the export orientation of production in many developing countries I growing (OECD, 2003). There are some concerns that increases in the export orientation of aquaculture production may displace small-scale producers, lead to greater market concentration and compromise local food security. In some countries, there are concerns about labour standards in the industry. As aquaculture production for international market has grown, there have also been conflicts between culture and capture producers. Fishermen have, for example, argued that the environmental issues associated with aquaculture – including pollution, coastal degradation and 'escape' of culture fisheries into the wild – could have a negative impact on ecosystem health and wild fish populations.8From a community development perspective, liberalisation may also have a polarizing effect if some communities reap the benefits of increased trade while the majority remains poor. Where trade liberalisation motivates over-exploitation of fisheries, the loss of employment opportunities important to local people can compromise food security goals. Moreover, the potential benefits to the poor of the increased growth that accompanies trade should not be taken for granted. Without proactive measures by governments, it is not clear that enhanced local development and investment useful to the poor will transpire. Tariff reductions have the capacity to incitestructural change in the world's fisheries industries, rendering some skills or equipment obsolete. Thus, many developing countries are working to control the pace at which they open their own markets to imports of fishery products and services to ensure liberalization is consistent with, and complementary to, development objectives. Liberalization can also generate concerns in developed countries. Some producers in developed countries, such as Japan and Korea, fear that liberalization of import tariffs could undercut their domestic fishing and processing industries by allowing more competitively-priced fish and fishery products to enter the domestic market. In particular, reductions of tariff escalation could cause greater competition and, in some instances, loss of competitiveness in processed fishery products. If imports depress the price of domestically produced fish, this is likely to reduce wages, rents to equipment and even jobs. This explains why domestic fishing industries in developed countries are "typically a vehement opponent of free trade in fish, arguing for tariff protection, import quotas or other barriers to trade" (Hannesson, 1998).Empirical evidence on the actual impacts of trade liberalisation on food security remains scarce. An FAO study of eleven developing countries concluded that overall, international trade in fishery products appears to have had a positive impact on food security. Growing fish production in LIFDCs (excluding China) did not appear to be diverted for exports as is often feared, and per capita supply increased slightly. Food imports, however, did not seem to have kept pace with demand in LIFDCs. At the same time, the conventional terms of trade in fishery products for the LIFDC were found to have deteriorated since the entry into force of the WTO Agreement in 1995 with a consequent loss of export earnings (Kurien, 2004).The impacts of tariff liberalisation in the fisheries sector on social development, livelihoods, income and poverty alleviation are hotly contested (Ahmed, 2006; Kurien, 2004).On the positive side, liberalisation could raise

producer prices – benefiting poor fishers. Increased demand and access to new markets that emerge from liberalisation could bring new opportunities to small-scale fisheries and workers in processing industries. Where tariff escalation restricts the opportunities for developing countries to diversify production, liberalization could aid efforts to diversify employment opportunities within national economies (Bulteand Barbier, 2005). In addition, increased trade as a result of further tariff reductions could lower consumer prices of fishery products and increase the variety of fishery products available for processing and sale. On the other hand, tariff liberalisation may also produce social costs, including threats to food security, threats to fish stocks in fisheries important to local livelihoods and, in some cases, pressures on local cultures and traditions. From a food security perspective, poor consumers may be negatively impacted, as fishery products may be diverted into more lucrative export markets instead of being34 Fisheries, International Trade and Sustainable Development available for local consumption. As fishers devote effort to producing fish for higher prices in export markets, liberalisation may increase the cost of fish in local markets and/ or reduce the variety of fish available – leaving local communities with only lower-value fish to consume. As commercial operators take overfishing and aquaculture activities, more fish may be consumed by wealthier consumers, and the share of fish protein available to artisanal fishers could also decline. A study on Senegal, for example, found that the switch of the local Senegalese fishing effort to export species hada serious impact on local food supplies (and on key stocks) (UNEP, 2001).An expansion of trade in aquaculture-based fishery products also generates some socioeconomic concerns. At present, most production in developing countries is subsistence farming for local consumption (OECD, 2003). However, for some products, production is almost entirely export-oriented and the export orientation of production in many developing countries is growing (OECD, 2003). There are some concerns that increases in the export orientation of aquaculture production may displace small-scale producers, lead to greater market concentration and compromise local food security. In some countries, there are concerns about labour standards in the industry. As aquaculture production for international market has grown, there have also been conflicts between culture and capture producers. Fishermen have, for example, argued that the environmental issues associated with aquaculture – including pollution, coastal degradation and 'escape' of culture fisheries into the wild – could have a negative impact on ecosystem health and wild fish populations.8From a community development perspective, liberalisation may also have a polarizing effect if some communities reap the benefits of increased trade while the majority remains poor. Where trade liberalisation motivates over-exploitation of fisheries, the loss of employment opportunities important to local people can compromise food security goals. Moreover, the potential benefits to the poor of the increased growth that accompanies trade should not be taken for granted. Without proactive measures by governments, it is not clear that enhanced local development and investment useful to the poor will transpire. Tariff reductions have the capacity to incite structural change in the world's fisheries industries, rendering some skills or equipment obsolete. Thus, many developing countries are working to control the pace at which they open their own markets to imports of fishery products and services to ensure liberalization is consistent with and complementary to, development objectives. Liberalisation can also generate concerns in developed countries. Some producers in developed countries, such as Japan and Korea, fear that liberalisation of import tariffs could undercut their domestic fishing and processing industries by allowing more competitively-priced fish and fishery products to enter the domestic market. In particular, reductions of tariff escalation could cause greater competition and, in some instances, loss of competitiveness in processed fishery products. If imports depress the price of domestically-produced fish, this is likely to reduce wages, rents to equipment and even jobs. This explains why domestic fishing industries in developed countries are "typically vehement opponent of free trade in fish, arguing for tariff protection, import quotas or other barriers to trade" (Hannesson, 1998).Empirical evidence on the actual impacts of trade liberalisation on food security

remains scarce. An FAO study of eleven developing countries concluded that overall, international trade in fishery products appears to have had a positive impact on food security. Growing fish production in LIFDCs (excluding China) did not appear to be diverted for exports as is often feared, and percapita supply increased slightly. Food imports, however, did not seem to have kept pace with demand in LIFDCs. At the same time, the Conventional terms of trade in fishery products for the LIFDC were found to have deteriorated since the entry into force of the WTO Agreement in 1995 with a consequent loss of export earnings(Kurien, 2004).

The use of anti-dumping and safeguard measures can raise serious socio-economic concerns in targeted countries. Aquaculture production in particular, which has been the main target of safeguard measures in the past, is often dominated by small-scale family business(Peacock, 2004). These producers are most vulnerable to possible negative impacts as they will find it difficult to pay the required duties and bonds and therefore risk being marginalized vis-à-vis a few large-scale competitors. The measures can also have impacts in the importing countries (by raising costs for domestic consumers) and on local producers in related industries (by raising the prices of inputs for processing industries).The impact of US anti-dumping measures on shrimp producing countries in India provides a clear overview of the challenges. The Indian shrimp industry is dominated by small primary producers of wild-caught and aquaculture shrimp with an average farm size of around three ha, producing 1.6 tonnes annually(Peacock, 2004). Shrimp aquaculture – which accounted for 78 per cent of shrimp exports in2000 – provides livelihoods to one million people in South Asia, both in cultivation and ancillary activities (Salagrama, 2004). Fisheries exports in general and shrimp in particular, play a significant role in India's economy. In 2003,shrimp exports from India to the US accounted for almost US$ 400 million in export revenue(ITA, 2005). The imposition of duties by the US – amounting to between 5.02 per cent and13.42 per cent for Indian producers (DOC, 2005)– is expected to result in a significant drop in exports with wide-ranging repercussions on the economic development of India's shrimp producing regions. Interestingly, the US shrimp duties are also opposed by grocers, restaurants, processors, distributors, business councils and other consuming groups in the United States who came together under the Shrimp Task Force to campaign against the duties. These groups have pointed to likely impacts on employment and earnings in the United States, claiming that every job in the shrimp-producing industry is matched by 20 jobs in the shrimp-consuming(processing and distribution) industry (STF, 2005). They also predict that the price of shrimp in the US market would rise if the supply of cheap shrimp were reduced. In 2002,almost 90 per cent of the US shrimp product supply came from imported shrimp, of which 70per cent is supplied by the countries targeted by US anti-dumping measures (Buck, 2004).Given the over-exploitation of wild fisheries, US production is unlikely to increase to compensate for lower imports, forcing importers to source from alternative countries such as Bangladesh(Peacock, 2004).In principle, a core purpose of several nontariff measures is to safeguard particular public interests in importing countries. SPS and TBT standards may be designed with an eye to protecting consumers and ensuring that they have a supply of safe food. On the other hand, nontariff measures that advance these social goals in some countries may simultaneously constrain both economic and development opportunities in other countries that bear the burden of compliance. Where countries cannot comply with foreign rules and regulations governing imports, this can not only frustrate their opportunities to expand and diversity exports, but can also have specific micro-economic effects. In particular, where exports are rejected by foreign markets, this can slow down or eliminate local employment opportunities and reduce local investment. Export-based businesses that ignore foreign standards risk failure. Small-scale producers, in particular, often lack the capacity to comply with export markets' standards ordeal with consequent repercussions on income and employment. Compliance with export standards could potentially have positive spill-over effects in the exporting

country by leading to a general rise in standards across the industry, both for export and domestic consumption. At the same time, however, concerns have been raised that stringent standards in export markets might lead to two-tier production systems in the producing countries where considerably lower SPS standards are applied to fish and fishery products destined for domestic consumption.

The use of trade measures in environmental regimes can be contentious for socio-economic reasons. Whether trade measures are taken to defend distinctly national standards or an internationally accepted environmental or fisheries management objective, they can raise questions of equity between trading partners. Of particular concern to developing countries are trade-measures that require them to engage in expensive environmental protection or fisheries management measures which demand significant government resources or capacity. In cases where financial resources and technical capacity is limited, the burden of promoting more sustainable fisheries through trade measures may fall disproportionately on the weakest countries and on some of the poorest fishing communities (CSE, 1996; CSE, 1998; Pearson, 1998). In particular, decisions taken by RFMOs to require Catch Documentation Schemes (as well as other management tools such as vessel monitoring systems) generate costs that developing countries often find difficult to shoulder. At present, there are no arrangements within RFMOs to share the burden of compliance with these regulations which can include the need for sophisticated administrative, logistical and documentation procedures as well as investment in vessels and technologies to aid in monitoring (Roheim and Sutinen, 2006). To promote fairer cost-sharing, the RFMOs could look to a range of MEAs for precedent; CITES, for example, has a system of financial and capacity-building assistance for developing countries, including training of individuals, purchase of capital equipment and development of infrastructure. A core constraint to improved monitoring and enforcement in developing countries, particularly the implementation of various catch documentation and certification schemes, is the affordability and appropriateness of monitoring equipment. To aid compliance, one important option is to promote stronger technology transfer. Industry or private foundations might, for example, support the acquisition of relevant on-board computerised traceability systems and other environmentally-friendly technologies. Finally, to ease the regulatory and cost burdens on developing countries, greater efforts could be made between RFMOs and MEAs to streamline the different certification, documentation and other requirements. Along with various national labelling laws, developing countries otherwise confront a bewildering number of labelling and documentation requirements in order to get their fish to market. In addition to capacity building, cost-sharing for enforcement and greater coherence among the trade measures adopted, other cooperative options could include joint financing and implementation of projects, 'green loans', credit guarantees, and grace periods for countries within which to satisfy MEA and RFMO commitments (Osakwe, 1997). Finally, the willingness of governments to develop and implement trade-measures adopted by MEAs and RFMOs is likely to improve significantly if they were coupled with broader efforts to reduce the economic pressures which drive overfishing in their waters. This could include efforts to reduce foreign debt which drives some countries to sacrifice sustainability considerations to acquire foreign exchange. It could also include measures that help countries improve the profitability of their fisheries resources, including support for initiatives to add greater value to fisheries exports (e.g. through processing) and to meet higher quality standards, and also to improve the access of developing country fish exports to the most profitable segments of the international market.

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World Trade agreements and fisheries policy instruments

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Introduction

India being a republic with the essence of federal principles encapsulated in its constitution has vested very important responsibilities and power with its 28 states and 6 union territories. According to the constitution the state legislatures have the power to make laws and regulations with respect to a number of subject matters including water, land, fisheries as well as the preservation, protection and improvement of stock and the prevention of animal disease. As regards the implementation of strictures and regulations on mattered concerned with the natural resources like fish the three major branches of the nation play equally important roles. They are the legislative, judicial and executive branches, which have been clearly envisaged under the constitution. But when it comes to implementation a smooth division of responsibilities between these federal pillars has also been delineated vide article 240 of the constitution which gives raise to the union list, state list and concurrent lists. The major features coming under union list are:

(i) Entering into agreement with foreign countries and implementation of treaties, agreements and convention with foreign countries

(ii) Shipping and navigation on inland waterways

(iii) Maritime shipping and navigation, including shipping and navigation on their waters

(iv) Regulation and development of inter- state rivers and river valleys

(v) Fishing and fisheries beyond territorial waters

The points addressed to by the state list are the following:

(i) Public health and sanitation

(ii) Land

(iii) Fisheries

Whereas the concurrent list attends to the following:

(i)' Shipping and navigation on inland waterways as regards mechanically propelled vessels

(ii) Fisheries

Needless to say, fisheries sector plays a very important role in the socio economic development of India. It provides employment to 7 million fishermen. The marine sector

pumps in an estimated 8000 crores INR by way of marine products export and another 200 million USD worth by seafood generation. Not to be left far behind the inland sector too contributes significantly to our GDP. As regards marine sector, from a coastline of 8129 km with a continental shelf of about half a million square kilometers and an EEZ spread to about 2.02 square kilo meters, an estimated potential of 3.9 million tons has been projected consistently in the past decade. The total production including both marine and inland sectors is around 7 million tons as per recent estimates.

With so much at stake and so many countrymen eking out a living from it, fisheries sector needs utmost care and planning when it comes to addressing sustainability and management of the resources. One such step with profound impact has been the legislations passed by successive Governments, which had direct or indirect impact on the fisheries sector.

Trade agreements which India is party to

Apart from the classic bilateral agreements, India is party to many regional trading arrangements (RTAs) which include structures such as free trade agreements (FTAs), preferential trade agreements (PTAs), and comprehensive economic cooperation agreements (CECAs). The following table summarises the TAs of which India is a party.

Table 26. 1 Trade agreements which India is party to

Type	Country/ countries	Features
Bilateral/ multilateral TA	Bangladesh, Bhutan, Srilanka, Maldives, China, Japan, South Korea, Mongolia	Specifies terms of commerce involving mutually beneficial concessions
Trade Treaty	Nepal	
Comprehensive Economic Cooperation Agreement	Singapore	
Framework Agreement	Gulf cooperation council nations, Association of Southeast Asian Nations and Chile	Setting the period for future substantialliberalisation by defining the scope of some new area of discussions.
Regional Trade Agreement	SAFTA with Pakistan, Nepal, Sri Lanka, Bangladesh, Bhutan and Maldives	To promote interests of people of South Asia, increasing economic development and social progress; supporting active partnership in the economic, social, cultural, technical, and scientific fields

Preferential Trade Agreement	Afghanistan, Chile, Latin American community (Brazil, Argentina, Uruguay and Paraguay)	To facilitate free movement of goods, services, capital and people.
Bay of Bengal Initiative for Multi Sectoral Technical and Economic Cooperation	SAARC, Thailand, Myanmar	Cooperation in 13 sectors like trade and investment, technology, fisheries, energy etc.
Association of South East Asian Nations (ASEAN)	India is a summit level partner to the ten member association	Key elements are FTA in goods, services and investment as well as areas of economic cooperation; Fisheries is a prominent sector covered.
Double taxation avoidance treaty	With 83 countries	Tax treaty giving benefits to capital gains with three countries viz. Mauritius, Singapore and Cyprus.

Although such bilateral and multi-lateral trade agreements cover many facets of Indian economy, fisheries sector has a role of prominence in SAFTA and ASEAN ventures. India has a legal framework in place to govern the loosely woven marine fisheries setup with a three dimensional perspective (local, regional (state) and national) in place and the understanding of such instruments would shape the future initiatives in view of the global marketing and ecological structures and strictures.

Fisheries legislation in India

Since introduction of legislations in fisheries sector the primary focus has always been on marine fisheries sector. The first such act was the one introduced in British India. The Indian Fisheries Act was introduced in 1857. Though few reviews and re-planning has been taking place subsequently, the major legislative interventions by independent India started only in the seventies. In 1976 Maritime Zones Act was propounded followed by Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act (1981) and Rules in 1982. The pioneering states to implement regulatory acts (MFRAs) were Kerala and Goa in 1980. The Coastal Regulation Zone Protection Act was passed in 1986. The Environment Protection Act was cleared in 2002. The same year witnessed the Biological Diversity Act also.

Towards achieving the main goal of sustainable fisheries, the following acts and regulations were framed:

(i) Code of Conduct for Responsible Fisheries which came into being on 31st October 1995 which for the first time added a rider to the perpetual right to fishing of fishermen. The right carries with it the obligation, that is to do so in a responsible manner.

(ii) Another act of relevance is the Wildlife Protection Act of 1973.

(iii) A Coastal Zone Management Authority was formed in 2003.

(iv) The Aquaculture Authority of India was established in 1997.

(v) There was another variant of Coastal Regulation Zone act, which came into effect in 1991.

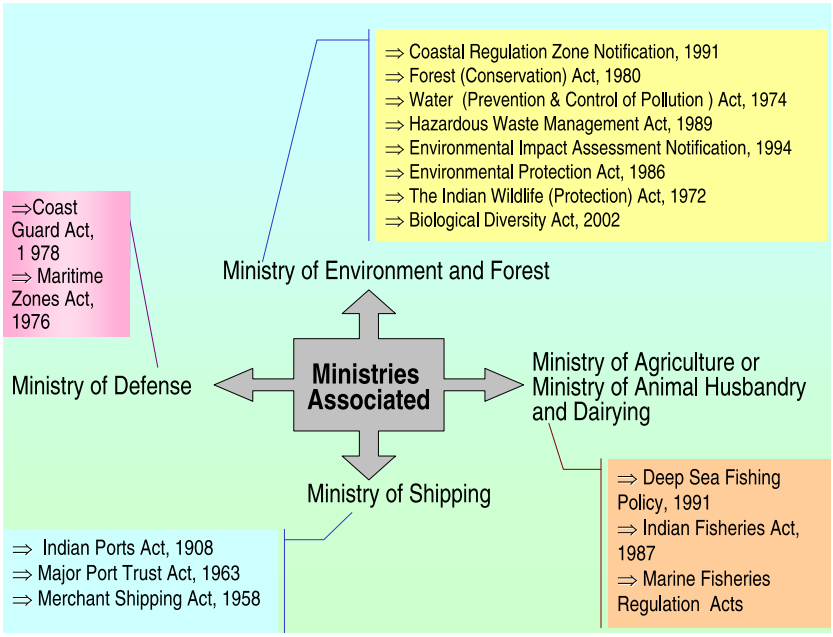

Figure 26.1 Ministries assocaited with Fisheries legislation

Yet another comprehensive insight into the existing regulations in our country from the Institutional angle would be as follows:

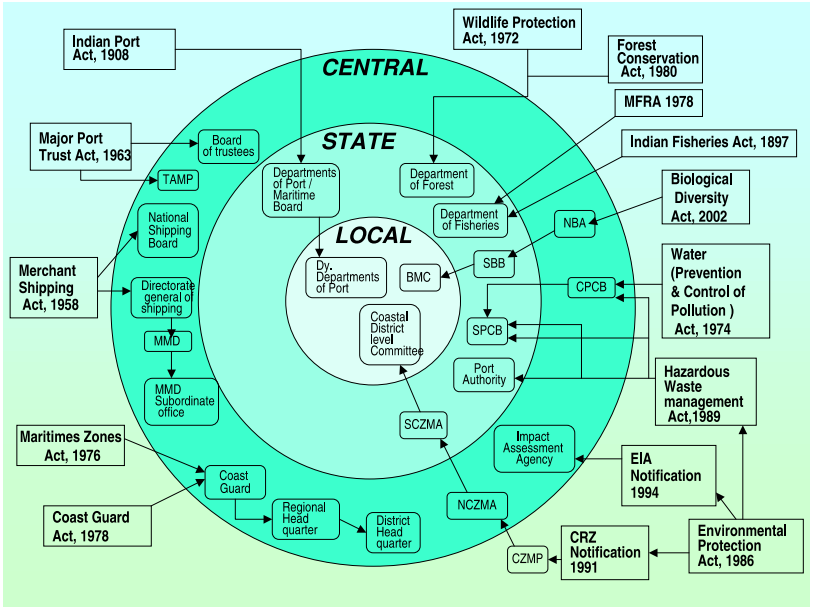

Figure 26.2 Regulations existng in India

An overview of existing policies in India

The Environmental Protection Act (EPA) of 1986 acts as an umbrella act under which a whole lot of activities could be channelised. The Coastal Regulation Zonenotification of 1991 aids in regularizing the various activities in the coastal zone. The Hon'ble Supreme Court's intervention brought in the issue of Coastal Zone Management Plans (CZMP) into focus with an instruction that all the coastal states must prepare their own plan by 1996. The Hazardous Waste Management Act 1989 paves way for hazardous waste management including import and export of such wastes. The Environmental Impact Assessment Notification of 1994 is to conserve and protect environment including that of the coastal precincts. Water (Prevention and Control of Pollution) Act 1974 which was subsequently amended in 1988 gives directions on the control of pollution from land-based sources. As an offshoot of this act Pollution Control Board was formed. The Indian Ports Act of 1908 was for enactment of procedures pertaining to port and port charges. It provides for rules for the safety of shipping and conservation of ports. The Major Port Trust Act of 1963 makes the provision for the constitution of port authorities for certain major ports in India and to vest the administration with control and management of such ports in such authorities and for matters connected therewith. The 1958 introduced Merchant Shipping Act aims at the control of pollution from ships and offshore platforms. The Coast Guard Act 1950 provides for levying of heavy penalties for the pollution of port waters. In 1993 Coast Guard under Ministry of Defence made directly responsible for combating marine pollution. The Maritime zones Act of 1976 describes various zones such as territorial waters, EEZ, continental shelf etc.

The Forest Conservation Act 1980 which was amended in 1988 paved way for protection of marine biodiversity. The Wildlife Protection Act of 1972 which faced amendments in 1983, 1985, 1991,1997 and 2001 offers protection to marine biota. It further aims at creating conditions favourable for in situ conservation of fauna and flora. The 2001 amendment paved way for the inclusion of several species of fish, corals, sea cucumbers and sea shells in Schedule I and Ill. It was during this amendment the whale shark was placed in Schedule I. The good old Indian Fisheries Act of 1897 offered for the protection of fisheries against explosives or dynamites being deployed for fishing. The Marine Fishing Regulation Act, 1978 enshrined the following issues in it.

(i) A model act, which provides guidelines to the maritime states to enact laws for protection to marine fisheries by regulating fishing in the territorial waters.

(ii) The measures include the regulation of mesh size and gear, reservation of zones for various fishing sectors and also declaration of closed seasons.

(iii) Laws were framed and amended from time to time by different maritime states.

Conventions to which India is a signatory

The following are the major international conventions which are abiding and applicable to India:

Table-26.2 International Conventions

UNCLOS	Disposal of ship wastes
Basel convention, 1992	The Basel Convention contains specific provisions for the monitoring of hazardous waste. A number of articles in the Convention oblige Parties (national governments which have acceded to the Convention) to take appropriate measures to implement and enforce its provisions, including measures to prevent and punish conduct in contravention of the Convention.
Ocean Policy Statement	Basic principles for ocean development
Convention on migratory species	Convention gives protection to many species of crocodiles, Sharks, turtles etc.
International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78)	Disposal of ship based wastes

Zoning and other regulations

The following are the salient snapshots of the steps initiated by various governments to regulate marine fishery activities.

In Maharashtra the operation of trawl net by mechanized fishing vessel is prohibited in some specific depth (5 fathoms and 10 fathoms). There is a complete trawl ban during monsoon and there is a prohibition on trawl gear operation between 6 pm and 6 am.

In Goa the area upto 5 km from the coast line is specified area and mechanized fishing vessels are prohibited from fishing in the area. Further there is restriction on mesh size of nets, *viz* 20 mm for prawns and 24 mm for fish etc.

In Karnataka the area upto 6 km from the shore or up to 4 fathoms is reserved for the traditional craft. The deep sea vessels are requested to operate beyond 20 km.

In Kerala the regulatory setup took legal form as early as in 1950. The Cochin Fisheries Act of 1950 which had a binding on the Travancore area formulated fishing rules. The rules and regulations paved way for Marine Fishing Regulation Act, Fisherman's Welfare Fund Act, Mechanised Fishing Boats Rules, Fisheries Service Special Rules etc. The area from shore up to 30 m line in the coast from Kollengode in the south to Paravoor is called the first zone. The area up to 20 miles line in sea along the coast line from Paravoor

in the south to Manieswar in the north spanning 512 km is called the second zone. Mechanised fishing except fishing by motorized country craft is prohibited in the first and second zones. The Government notification prohibiting the use of purse-seine, pelagic trawl and mid water trawl in the territorial waters has also been an offshoot of this regulation.

The other technicalities involved in regulations are as follows:

(i) The code end mesh size of bottom trawl - 35 mm

(ii) Ring seine mesh size - 20 mm

(iii) Drift net mesh size- 20 mm

(iv) Mini trawl, mid water trawl and bull trawl were banned.

(v) Night trawling was prohibited

(vi) A separate fishing ground was demarcated for traditional fishermen.

(vii) The breeding season which coincides with the monsoon has been declared as a closed season.

As per Tamil Nadu fishery legislation, area up to 3 nautical miles reserved for traditional vessels. Fishing within 100 m below a river mouth is prohibited. No fishing gear of less than 100 mm mesh from knot to knot in respect of net other than trawl net shall be used. In Andhra Pradesh, the area upto 10 km from shore is reserved for traditional craft. Mechanized boats are allowed to operate beyond 10 km only. In the case of Orissa, non mechanized traditional craft shall be allowed to operate freely without restriction. Mechanized fishing vessels up to 15 m in length shall be allowed to operate beyond 5 km from the coast. Mechanised fishing vessels of 25 GRT and above or 15 m in length shall be allowed to operate beyond 10 km from the coast. West Bengal has reserved the area upto 15 km from the shore to traditional fisherfolk. Fishing craft fitted with more than 30 hp engine are allowed to operate beyond 15 km only.

Exclusive Economic Zone

The Exclusive Economic Zone (EEZ) declaration of 1976 facilitated exploration, exploitation and utilization of marine living resources in the sea around India extending to 200 nautical miles, thereby giving the nation immense opportunities and challenges to harvest the resources and to manage them on sound scientific basis. The past three decades have witnessed rapid initiatives by the government and private agencies in the marine fisheries sector of the country. Upon realizing that most of the deep sea fishery resources beyond the conventional fishing limit and fishing capability of the indigenous crafts can be gainfully exploited only if the upgraded and of adequate size and capabilities are inducted into the fishery and mobilization of capital and expertise indigenously to achieve this was found difficult in short span of time. This was addressed to in the charter policy of the government. After the expiry of five years of operation of this policy, the government revised to rectify the deficiencies noticed during its operation and to make it more beneficial to the country. Accordingly a revised 1986 Charter Policy was pronounced.

The Charter Policy envisaged acquisition of vessels by the Indian Companies either through import / construction or through joint venture etc. As a result of the above charter policy, 97 companies were permitted to operate 311 foreign fishing vessels. Besides augmenting the marine fish production in the country, the policy also facilitated greater inflow of

foreign exchange through export of fish caught by these vessels. All these vessels were operating on 100 per cent EOU basis. The conditions for acquisition of vessels of adequate type and number by Indian companies who chartered vessels helped the growth of Indian deep sea fishing fleet within a short span. Having laid the foundation for the Indian deep sea fishing industry the government went ahead to broad base the initiatives through 1991 policy which envisaged joint ventures, test fishing and leasing besides allowing the vessels chartered under 1988 policy to continue till their permits lasted. It is significant that the new policy is being pronounced during the initial years of the X five year plan, whereby the elements contains therein may be gainfully used for implementation by the government agencies.

The policy objectives as follows

(i) 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.

(ii) To ensure socio-economic security of the artisanal fishermen whose livelihood solely depends on this vocation.

(iii) To ensure sustainable development of marine fisheries with due concern for ecological integrity and bio-diversity.

Coastal Regulation Zone Notification- 1991

The notification had its genesis in early 80's with a view to initiate measures to protect the ecological balance in the coastal areas of our country. The draft CRZ was published in 1989. On 1990 December 15thMoEF issued notification regulating restrictions on industries operation and processes in the zones.

For regulating activities the coastal stretches were classified into 4 categories

(i) CRZ-I: sensitive area- Area between L TL and HTL

(ii) CRZ-II: The coastal stretches of urban and developed areas

(iii) CRZ-III: Areas which do not belong to the above with the exception of beach resorts etc.

(iv) CRZ-IV: Lakshadweep, Andaman, Nicobar and other small islands.

As per the zones list of permissible and prohibited activities have been prepared and guarded against. A draft notification on CZM was notified again in 2007 in the post Tsunami scenario. Prof M.S. Swaminathan headed a committee in July 2004 in order to recommend necessary amendments to make CRZ legislation more effective.

Synoptic view of marine fishing regulations enforced by various state governments

The following table lists the ban period state-wise along with the exceptions.

Table 26.3 Closed season/Trawl Ban/Fishing ban practiced by maritime states

State/ UT	Notified Period	Days	Type of fishing banned	Type of fishing permitted
Gujarat	10th June- 15th August	67	All crafts	Nil
Maharashtra	10th June to 15th August	67	All crafts	Nil
Goa	10tn June to 15th August	67	All crafts	Nil
Karnataka				
(i) Dakshin Kanada & Udupi	15th June to 10th August	57	All except motorized canoes with OBM/IBM upto 25 HP	Motorised up to 25 HP
(ii) Uttara Kanada	15tn June to 29th July	45	All except motorized canoes with OBM/IBM upto 25HP	Motorised upto 25 HP
Daman and Diu	1st June t 15th August	75	Trawlnet, Gillnet and dolnets	Motorised and traditional vessels
Kerala	15tn June to 29th July	45	Mechanised trawling	All traditional and motorized gears including OBM/IBM with capacities upto 110HP
Tamil Nadu				
(i) East Coast	15th April to 29th May	45	Mechanised fishing/trawlers	All non-motorised and motorised with less than 25 OBM
(ii) West coast	15th June to 29th July	45	-do-	-do-
AndhraPradesh	15th April to 31st May	45	Trawling and motorized above25 HP	Traditional and motorized below 25 HP
Orissa	15th April to 15th June	60	-do-	-do-
West Bengal	15th April to 31st May	45	Trawling, Gillnets, Behundinets, Bir net	Not available

Legal framework of Indian marine fishing policy and its critique

Apart from the previously mentioned major legal instruments, the complex marine fishing policy scenario of India is interwoven with a lot of complexity due to frequent intertwining of jurisdiction and the non-subtlety of the impacts in face of mild aberrations on the ground. The latest and most inclusive of policy initiatives happens to be the Comprehensive Marine Fishing Policy (CMFP 2004).

Comprehensive Marine Fisheries Policy 2004

The 2004 CMFP is the current national fisheries policy framework for India.The policy document establishes three key objectives:

i) Augment marine fish production of India up to the sustainable level in a responsible manner so as to boost export of seafood from the country and also increase per capita fish protein intake of the masses;
ii) Ensure socio-economic security of the artisanal fishermen whose livelihood solely depends on this vocation;
iii) Ensure sustainable development of marine fisheries with due concern for ecological integrity and biodiversity.

The 2004 CMFP consists of ten components which include establishing a "stringent fisheries management system" encompassing an improved regulatory and Monitoring, Control, Surveillance (MCS) systems. The CMFP also proposes a new legal framework to enable various components of the new policy to be implemented. What makes the CMFP significant is that it also identifies a need to reform the legal framework. An Inter-Ministerial Empowered Committee on Marine Fisheries has been established to steward the implementation of the Policy under the Chairmanship of the Secretary in the DAHDF. Outside this framework, regional consultations have apparently been held to discuss how best to make this policy operational.

A comparative juxtaposition of major policy components out on display in the Indian marine fisheries scenario is given below in Table. 3

Table 3. Comparison of fisheries objectives in key policy documents in India

Tenth Five Year Plan	Eleventh Five Year Plan	CMFP 2004	Policy elements
To enhance fish production from aquaculture and marine fisheries and in particular to utilise the full potential of the deep sea fisheries to enhance fish consumption Management of coastal fisheries Increase fish seed production Equity of participation	*Enhancing the production of fish from Indian waters, both marine and inland,* on an environmentally sustainable and socially equitable basis; Address the hitherto unexplored potentials of the Indian fisheries such as island fisheries and non- food fisheries;	To augment India's marine fish production up to?the sustainable level in a responsible manner so as?to boost export of seafood from the country and also increase per capita fish protein intake of the masses	**Fish production outcomes: Increased production Increased consumption Increased exports**
Train fisherwomen Optimal exploitation of the fishery wealth Increased investment for infrastructure	Promoting fish as health food and meeting the changing requirements of both domestic and export markets to make the sector globally competitive; Increasing profitability of fishers and aqua-farmers through an integrated approach from production to consumption; Strengthening of infrastructure in harvest, post harvest, value addition and marketing and upliftment of fisher and aqua-farmer communities with gainful employment opportunities and capacity strengthening	*To ensure socio-economic security of the artisanal fishermen* whose livelihood solely depends on this vocation *To ensure sustainable development of marine fisheries* with due concern for ecological integration and biodiversity	***Socio-economic outcomes*** **Social equity Socio-economic security Increased profitability/ optimal use of fishery resources Infrastructure development**
	Enhancing the production of fish from Indian waters, both marine and inland, on an *environmentally sustainable and socially equitable basis;* Conservation of aquatic resources and genetic diversity, as also preservation of the health of eco-systems;	To ensure sustainable development of marine fisheries with due concern for ecological integration and biodiversity	**Environmental outcomes Protection/ preservation of the environment Environmental sustainability**

Assessment of policy performance and efficacy of implementation of legal stipulations

The most perplexing part of analysis of Indian marine scenario is the study of the impact of interventions introduced by the fishers, governments and natural developments. Though the overall assessment would paint a not so rosy picture, the causes and opportunities are the real matter of interest as they hold the key for the future prospects. Let us take a couple of such issues.

Problems of Open Access

What is now evident is that marine fisheries in India have largely reached a plateau in terms of production, especially for inshore waters. Efforts to stimulate expansion of fishing in unexploited deep water fisheries may materialise but will not address the issues surrounding inshore fishing. Clearly, the problems classically found in fisheries worldwide when the open access incentives of fishing are not adequately managed are emerging in India. A basic tenet of the FAO International Code of Conduct is that: *States should prevent overfishing and excess fishing capacity and should implement management measures to ensure that fishing effort is commensurate with the productive capacity of the fishery resources and their sustainable utilisation;*

It is very difficult to increase these natural limits, and although some suggest that interventions such as artificial reefs, restocking, and marine ranching can increase productivity, result have been far from spectacular. Such measures can theoretically speed up recovery of degraded natural resources back to natural limits, but the costs often do not justify the results, except where overall labor costs are low. Further, stock enhancement strategies must be linked to policies and regulations that limit new entry of fishers; otherwise increased stocks could induce still further fishing capacity. Allowing fish stocks to recover naturally will ultimately give greater yields with reduced risks of stock collapse. Reducing the fishing effort can increase the value of the catch by reversing the "fishing down the food chain"phenomenon that has occurred in all the maritime states in India, thus restoring eco-system health and resilience, increased catches of prime species etc.

Policy Complexity

Fisheries policy in India has become increasingly complex and seeks to achieve a wide range of objectives aimed at industrial and artisanal fisheries, fish production and use, the generation of economic returns, providing social benefits and ensuring conservation of fish stocks and the environment. Many of these objectives are conflicting and have accumulated during the development of successive planning documents. Even with a high level of funding and capacity, it would still be difficult to achieve these objectives across the range of fisheries jurisdictions in India in the short-term. The reforms proposed in this report will take many years of stakeholder commitment, support and investment.

Policy Implementation Failure

Where fisheries management rules are applied, their implementation is often fragmented and the capacity to implement is weak. The management and use of fisheries information is one such example. Both the Fishery Survey of India (FSI) and CMFRI are mandated to provide information on the status of the resource. The fishery potential of the Indian EEZ is periodically assessed by an expert committee consisting of the scientists of the

CMFRI, FSI and other fisheries institutes of the country. The last such assessment was done in 2000. These findings are approved by the Ministry of Agriculture and are considered for planning and development activities. However, there is an urgent need for more formal and frequent reporting structures and a framework on which the decision-making in response to the findings can be applied, so as to make fisheries research in India more application-oriented. This will also help to bridge the gaps among the fisheries research community, fisheries policy, and day-to-day fisheries management, with scope for better public scrutiny and review of scientific advice.

The fisheries laws themselves generally provide a weak environment for officials to enforce. Penalties are very low in relation to international standards. For example, the Maritime Zones of India (Regulation of fishing by foreign vessels) Act, 1981 lists the powers of search and seizure by authorised officers, but only in the context of boarding vessels. There is no authority to exercise enforcement powers on land – for example, to conduct searches for fish that may have been landed or are being transported after landing, to inspect documentation or to carry out other activities to investigate compliance. Offences under the Rules are punishable by a maximum Rs50,000 (US$1,282) fine. Compared to other global jurisdictions, this is exceedingly low and would have little or no deterrent effect for larger operators. Higher fines for "serious offences", such as those described in Article 21 of the 1995 UN Fish Stocks Agreement, are not distinguished. However, in the 1980s, there were more stringent penalties when the offending foreign fishing vessels were detained, crew arrested and put in jail, and vessels were confiscated and auctioned.

Other reasons for poor implementation of fisheries rules include (i) inadequate human resources and capacity, especially to police long stretches of coast scattered with landing sites26, (ii) a lack of focus in the DOF on the role of officers to enforce (it often conflicts with the role of providing welfare support, especially to poor fishers), (iii) low awareness of the rules and regulations by many stakeholders, and, more importantly, (iv) an absence of effective co- management arrangements where self-regulation could be fostered and encouraged, building on local experience, for example the traditional Padu system for managing common property inshore fisheries in southern India and Sri Lanka.

One classic case of conflict of interests is the MPA issue prevalent in Odisha coast.In Orissa, inshore fishers suffer from loss of access to fishing grounds in traditional coastal Mangrove areas due to the restrictions related to conserving the Olive Ridley turtle. Although the non-motorised sector has been granted certain exemptions, the smaller motorised boats have not. The ban affects 120 km of the state's 480 km coast for 7 months each year, from November to May. The restricted fishing area covers about 2,800 km2 or 14 per cent of the harvestable area up to 100 meters depth, with a potential loss of 20,000 tonnes of fish harvest. According to the Orissa Department of Fisheries (DOF), around 17,546 families, comprising some 100,000 people are subjected to loss of livelihood because of the ban. In Kendrapara district alone, over 85 fishing villages, comprising about 40,000 fishers, are affected. The NGOs, Orissa Traditional Fish Workers Union and Samudram, put the number of families affected at 27,825. While few dispute the need to protect the turtles during egg laying and hatching periods, the affected fishers have not been compensated for the loss of fishing access and income.

International regulations and Indian position vis-à-vis marine fishing regulations

With the advent of WTO rooted policies and norms like antidumping, HACCP regulations etc. taking firm root in the global marketing scenario, quite a large number of resources which have very high export value have been brought under special scrutiny. Oceanic resource like Tuna, Marlin and sailfish have been brought under an inter-governmental gaze and the issues pertaining to such migratory resources are compelled to be viewed with one more dimension alongside the existing three viz. local, state and EEZ. The fourth is the major ecosystem based view, which presumes a cross country at times cross-continental delineation of the common resource base and shared exploitation. The classic case is that of the IOTC, whose regulations and recommendations released from time to time is bound to influence Indian policy perspectives. An incisive peek into the hitherto compiled regulations and recommendations throw up the following points of discussion which would be of special focus under existing marine fishing policies of the country. These are sufficient to highlight the type of divergence of purpose as envisaged by the international policy instruments and the reality enveloping Indian fisheries scenario.

(i) In India Tuna fishing is carried out by variegated type of fishermen who put different gears to target the species. The crafts range from non-motorised country crafts (catamarans) to highly sophisticated mechanized vessels. Hence certain stipulations envisaged under IOTC norms like mandatory reporting of each trip that targets Tuna like species need to be relooked.

(ii) As the range of crafts is so divergent, it becomes more complicated to tow the trips and record the figures. In any case under the existing setup it would be nearly impossible to have complete census of the tuna targeting crafts. Hence there is a need for sampled estimation of catch.

(iii) Landings and subsequent handing over of tuna and tuna like resources take place in three major paths: (i) Mid-sea inter vessel transfer (ii) Transfer to designated processing hands, through dedicated channels and (iii) Classical landings in centres alike other marine resources. The third happens to be the most volatile channel with frequent spikes and lulls which are very difficult to track, sample and study.

(iv) Based on the resource research carried out by institutions like CMFRI, it can be concluded that only a composite hybrid estimate involving inputs from centres, processors and markets could provide a scientific basis for a robust estimate of tuna being caught/ handled in the country.

(v) Further there is a need for taking up review of resource assessment efforts made in the past decade on tuna like resources, both using exploratory vessels as well as based on commercial landings.

(vi) As the gears usually employed for tuna catching range from trawlnet and ring seine on one extreme to hooks and lines and pole and line on the other, only a dedicated and concerted study (if not done already) can try help ascertain the resource status of tuna and similar resources.

(vii) Specially endemic fishery of tuna resources, as those existing in Lakshadweep and the north east coast of main land (off Vizag) need to be given due focus as these involve livelihood issues which can never be considered at par with the huge long line vessels.

The international instruments of marine governance have come here to stay, their implementation with respect to Indian condition needs a rather careful planning. The marine policy outlines existing in our country have to be revised to the extent it reaches out to international standards without suffocating the livelihood issues of the fishers while concerted efforts are required in the international arena towards sensitising the agencies formulating and governing such regulations on the essentiality of tweaking their stipulations to match the reality of constituent countries.

27

Economic efficiency in fishing operations-Technology, Exploitation and Sustainability Issues

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Introduction

Fisheries sector in India has become a significant part of the economy through its consistent contribution to the GDP –both overall and agricultural-during the last few years, besides serving as vital source of employment and livelihood to millions of people of the country and also earning substantial foreign exchange (About Rs.16,000 crores in 2011-12). Fishing avocation, which was practiced as a means of subsistence in the early century has gradually transformed into a multi crore rupees industry during the last six and a half decades. This development has been made possible through a concerted effort by the stakeholders ably supported by capital investment in the harvest and post-harvest infrastructure both by the private and public sector. The Government supported the sector under various schemes for its development under the various plan periods.

Marine Fishery resources of India

Indian marine fishery resources include an exclusive economic zone (EEZ) of 2.02 million sq.km and a coastal length of 6,068 km. There are 3,288 marine fishing villages and 1,511 marine fish landing centres among nine maritime states and the two union territories of Puducherry and Daman & Diu The revalidated marine fishery resources potential of 3.934 mt is being harvested by a fleet size of 1,94,490 crafts comprising 72,559 (37.3 per cent), mechanized crafts, 71,313 (36.7 per cent) motorized crafts and 50,618 (26 per cent) non-mechanized crafts. (CMFRI, National Marine Fisheries Census, 2010).

The human resource potential of the marine fisheries sector include 8,64,550 families with a total fisher folk population of 39,99,214. Out of the 8.64 lakh fisher folk families, 5.23 lakh are living below povery line (BPL). The number of traditional fisher folk families is 7,89,679 (91.3 per cent of total fishermen families) . (Table 1)

Table: 27.1 Maritime State Profile

State	Coastal length (km)	Landing centres	Fishing Villages	Fishermen families	Traditional fishermen families	BPL families	Fisher folk population
West Bengal	158	59	188	76,981	52,532	48,870	38,0138
Odisha	480	73	813	1,14,238	87,541	56,279	6,05,514
Andhra Pradesh	974	353	555	1,63,427	1,61,039	1,59,101	6,05,428
Tamilnadu	1,076	407	573	1,92,697	1,85,465	1,27,245	8,02,912
Puducherry	45	25	40	14,271	1,424	10,998	54,627
Kerala	590	187	222	1,18,937	1,16,321	65,459	6,10,165
Karnataka	300	96	144	30,713	28,533	23,624	1,67,429
Goa	104	33	39	2,189	2,147	489	10,545
Maharashtra	720	152	456	81,492	74,203	15,509	3,86,259
Gujarat	1,600	121	247	62,231	59,469	15,784	3,36,181
Daman &Diu	21	5	11	7,374	7,181	333	40,016
Total	6,068	1,511	3,288	8,64,550	7,75,855	5,23,691	39,99,214

Source: CMFRI, National Marine Fisheries Census, 2010 India, p.27

Marine fish production

The marine fish production in India increased from 14.30 lakh tonnes in 1985 to 38.30 lakh tonnes in 2011. The landings by the mechanized sector increased from 9.52 lakh tonnes in 1985 to 30.07 lakh tonnes, motorized sector's landings increased from 1.30 lakh tonnes to 7.29 lakh tonnes, while that of the non-mechanized sector declined from 3.48 lakh tonnes to 0.94 lakh tones during the same period. (Table 2)

Table: 27.2 Sector-wise marine fish landings in India 1985-2011 (lakh tonnes)

Year	Mechanised	Motorised	Non-mechanised	Total landings
1985	9.52	1.30	3.48	14.30
1990	13.11	4.48	3.04	20.63
1995	14.93	4.44	2.04	21.41
2000	16.82	6.67	2.04	25.53
2005	15.21	5.92	1.03	22.16
2006	18.52	6.47	1.25	26.25
2007	18.95	7.95	1.13	28.03
2008	22.70	7.43	1.19	31.33
2009	23.59	6.84	0.93	31.36
2010	26.07	6.44	0.68	33.19
2011	30.07	7.29	0.94	38.30

Source: FRAD, CMFRI, 2011

In terms of per cent share also the mechanized sectors contribution to the total landings increased from 66.56 per cent in 1985 to 78.51 per cent in 2011. The motorized

sectors' share in the total landings also increased from 9.10 per cent to 19.04 per cent while that of the non-mechanized sectors' share declined from 24.34 per cent to 2.45 per cent between 1985 and 2011. (Table 3)

Table 27.3 Sector-wise marine fish landings in India 1985-2011 (per cent)

Year	Mechanised (per cent)	Motorised (per cent)	Non-mechanised (per cent)	Total landings (per cent)
1985	66.56	9.10	24.34	100.00
1990	63.53	21.72	14.75	100.00
1995	69.74	20.74	9.52	100.00
2000	65.89	26.13	7.98	100.00
2005	68.63	26.72	4.65	100.00
2006	70.58	24.65	4.77	100.00
2007	67.61	28.36	4.03	100.00
2008	72.47	23.73	3.81	100.00
2009	75.23	21.80	2.97	100.00
2010	78.54	19.40	2.06	100.00
2011	78.51	19.04	2.45	100.00

Growth of marine fishing units in India

The overall trends in growth o fishing units during the last five decades indicate the possible phasing out of non-mechanized canoes at least in certain regions, which ultimately reflected a negative growth rate of 51 per cent between 2005 and 2010. The total marine fishing fleet has in fact declined from 2,38,772 in 2005 to 1,94,490 in 2010, registering a decline of 19 per cent. While the number of non-mechanised (51 per cent decline) and motorized (6 per cent decline) declined between 2005 and 2010, the mechanized boats alone registered an increase of 23 per cent (from 58,911 in 2005 to 72,559 in 2010(Table 4). There is a shift towards mechanized fishing units by the fisherfolk due to their higher mobility, stability and technical efficiency. This increase in mechanized boats may be further attributed to the assistance provided for the purchase of crafts by different government and non-government agencies including the tsunami rehabilitation measures. When the technical efficiency of a particular gear is better than the other, the lesser efficient gears gradually disappear from the operation (Sathiadhas, 1998).

Table 27. 4 Growth rate of marine fishing fleets in India 1961-62 to 2010

Year	Non-mechanized		Motorized		Mechanized		Total	
	Number	Growth (per cent)	Number	Growth (per cent)	Number	Growth (per cent)	Number	Growth (per cent)
1961-62	90,424	-	0	0	0	0	90,424	0
1973-77	1,06,480	18	0	0	8,086	0	1,14,566	27
1980	1,37,000	29	0	0	19,013	135	1,56,013	73
1998	1,60,000	17	32,000	0	47,000	147	2,39,000	53
2003	76,596	-52	50,922	59	49,070	4	1,76,588	-26
2005	1,04,270	36	75,591	136	58,911	25	2,38,772	35
2010	50,618	-51	71,313	-6.0	72,559	23	1,94,490	-19

Source: Sathiadhas, 2009

Economic performance of marine fishing methods

The analysis of the economic performance of fishing methods is assessed by working out the fixed cost, operating cost per trip, gross revenue per trip, net operating income per trip and annual net income through **tabular analysis**. The capital and labour productivity are also worked out using operating ratio and catch per labour per trip respectively to assess the economic performance

The annual fixed cost comprises the depreciation on fishing equipment including the crafs, gears and other accessories, annual tax levied, annual wage paid to any permanent employee in the craft, interest on fixed capital and insurance premium paid.

The operating cost per trip (also known as variable cost) is calculated as follows

VC/trip = {(Fuel + Crew wage + Food + Auction + Other charges)}.....(1)

The gross revenue per trip is calculated from the species composition of the catch and price per unit. The gross revenue per trip is thus estimated as follows

$$\text{GR per trip} = \sum_{i=1}^{n} q_i\, p_i \quad \ldots\ldots\ldots(2)$$

where, q_i is the quantity of catch in kg of the i^{th} variety
p_i is the price per kg of fish of the i^{th} variety

Case studies

Our Division is conducting the research projects on the economic analysis of marine fishing methods across the selected centres along the coast of India. A glimpse of their findings are given below to understand the concept.

In BV Palem, Andhra Pradesh, the average operating cost per trip of the **single day trawl** fishing worked out to Rs.8,572 per trip earning a gross revenue of Rs.22,941 with a net operating income of Rs.14,369 per trip. Fuel accounted for 57 per cent of the total operating cost followed by crew wages 27 per cent.

In Kakinada Fisheries Harbour, the average operating cost per trip of the **single day trawl** fishing worked out to Rs.8,258 per trip earning a gross revenue of Rs.21,238 with a net operating income of Rs.12,980 per trip. Fuel accounted for 57 per cent of the total operating cost followed by crew wages 25 per cent

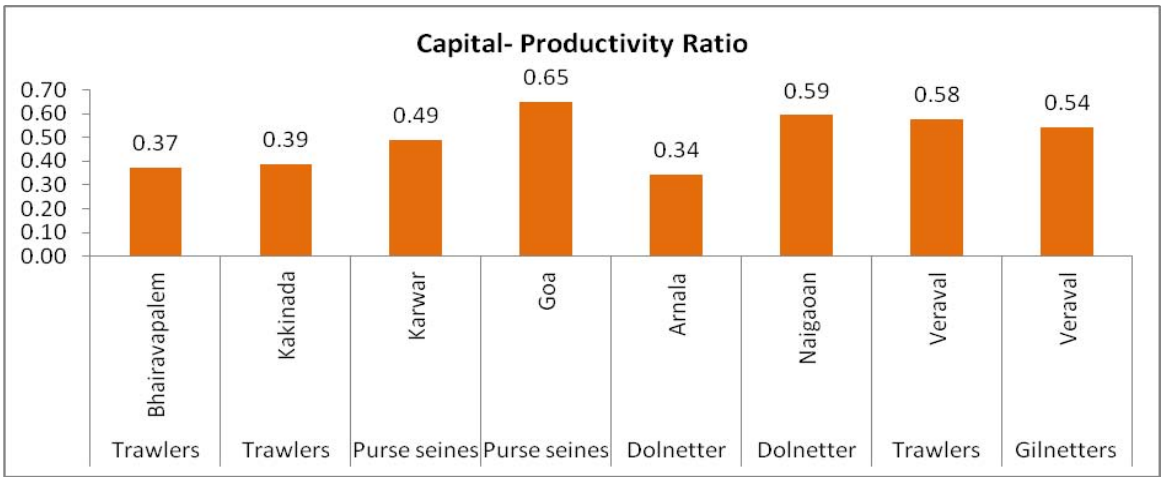

Figure 27.1 Capital productivity Ratios of Single Day Operations

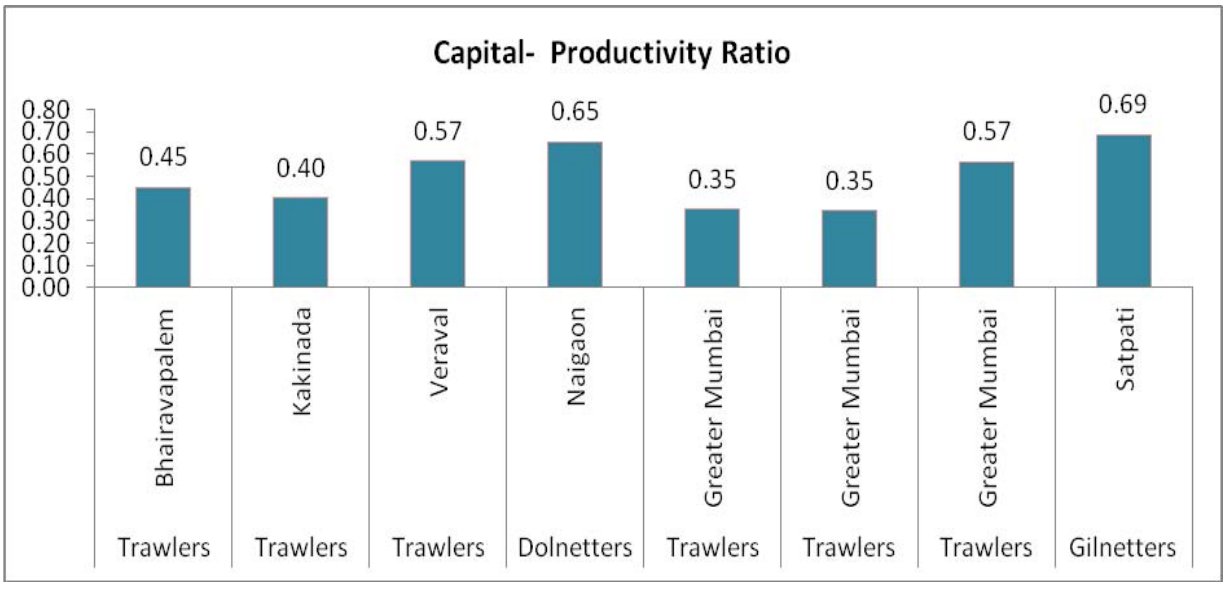

Figure 27.2 Capital productivity Ratios of Multi-day Operations (2-5 days)

Economic Efficiency measurement concepts

` Farrell (1957) proposed that the efficiency of a firm consists of two components namely technical efficiency and allocative efficiency. The technical efficiency reflects the ability of the firm to obtain maximum output from a given set of inputs, while the allocative efficiency reflects the ability of the firm to use the inputs in optimal proportions, given their respective prices. These two measures are then combined to provide a measure of total economic efficiency.

The efficiency of resource use has been studied by many methods. The simple yield or return per unit or costs per unit have been used earlier in efficiency studies to compare the different firms or decision-making units. However these methods do not mention how much of the difference in efficiency is due to the amount of or ratio of inputs used and related effects.. Coelli (2002) highlighted the problems of using the simple measures for comparisons and also indicated that such measures do not tell anything about the existence or otherwise of scale economies. To avoid these problems he attempted constructing non-parametric production frontiers using data envelopment analysis (DEA) method. The parametric method can be estimated using frontier production method.

The technical efficiency (Timmer's measure) of multi-day trawl fishing (2-5 days) operated from Visakhapatnam centre is given below.

Table 27.5 Technical efficiency of multi-day trawl fishing, Visakhapatnam 2010-11

Efficiency Level	Frequency of the operators	Percent	Cumulative per cent
Less than 0.2	4	3.85	3.85
0.21 -0.30	22	21.15	25.00
0.31-0.40	50	48.08	73.08
0.41-0.50	17	16.35	89.42
0.51-0.60	3	2.88	92.31
0.61-0.70	3	2.88	95.19
0.71-0.80	1	0.96	96.15
0.81-0.90	2	1.92	98.08
0.91-1.00	2	1.92	100.00
		100.00	

Thus it can be seen that abut 90 per cent are operating with 50 per cent efficiency and there is some scope to increase the efficiency of operation.

Sustainable fishing and development

Sustainable development

Generally sustain refers to keep up continuously without any interruption or disturbance. "Sustainability refers to the simple principle of taking from the earth only what it can provide indefinitely, thus leaving future generations no less than we have access to ourselves."

Sustainability is viewed differently from the point of view of ecology, economics and sociology.

- From the ecology point of view, it is the ability of ecosystems to maintain its structure and function and to remain resilient in order to continue to give and support life.
- From economic angle, the sustainability refers to the ability of the market to optimally allocate scarce resources, to send proper price signals and to provide mechanisms for investment and to maintain a healthy labour market.

- For a sociologist, it refers to the ability of individuals and communities to remain in good health physically, mentally, emotionally and spiritually and ensure equity among and between generations.

The definition sustainable development given by the World Commission on Environment and Development (1987) is taken as the guide line for the sustainable development now. "**Sustainable development is that Development that meets the need of the present generation without compromising the ability of future generations to meet their own needs"** This definition of sustainable development is widely accepted and commonly used world-wide.

Since the definition of sustainable development in 1987 by the Brutland Commission report followed by extensive discussion, **there dimensions of sustainable development** have emerged.

1. **Economic dimension**: An economically sustainable system must be able t produce goods and services on a continuing basis, to maintain manegable levels of government and external debt, and to avoid extreme sectoral imbalances, which damage agricultural or industrial production
2. **Environmental Dimension:** An environmentally sustainable system must maintain a strong and stable resource base, avoiding over exploitation of renewable resource systems or environmental sink functions and depleting non-renewable resources only to the extent that the investment is made in adequate substitute. This includes maintenance of biodiversity, atmospheric stability and other ecosystem functions not ordinarily grouped as economic resources.
3. **Social dimension:** A socially sustainable system must achieve distributional equity, adequate provision of social services including health and education, gender equity and political accountability and participation.

Sustainable Fisheries Yield

Fisheries are classified under renewable natural resources. However such resources are also liable to become extinct if the rate of harvest or exploitation is higher than the rate of regeneration or reproduction. Here the size of the stock (population) depends on the biological, economic and social considerations.

The sustainable yield in fishing commonly referred to as "Maximum Sustainable Yield (MSY) is a biological phenomenon. MSY means that level of fish catch or yield that can be harvested from a given system in perpetuity without affecting the stock of the system (or the sea). In other words, a catch level is said to be sustainable whenever it equals the growth rate of the population since it can be maintained for ever. As long as the population size remains constant, the growth rate will remain constant as well.

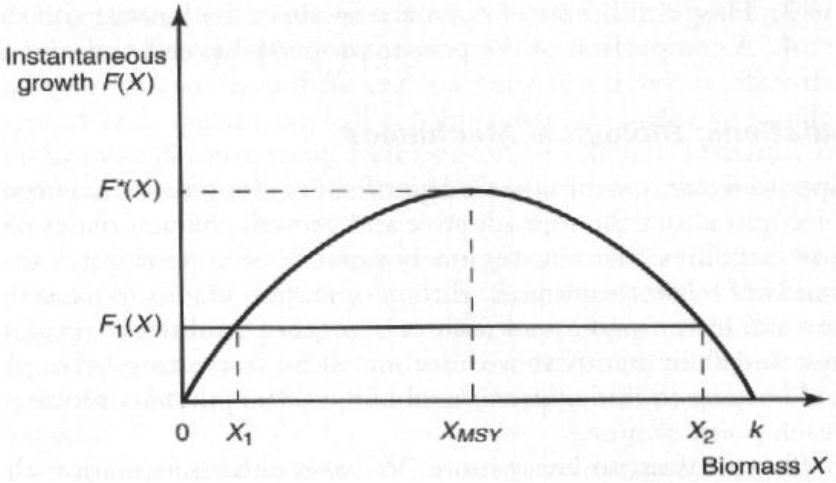

Figure 27.3 Sustainable Yield Curve

Source John A. Dixon, Fisheries and Aquatic Resources World Bank Institute

There is an additional concept called Maximum Economic Yield (MEY) which includes the monetary terms of the effort and returns.

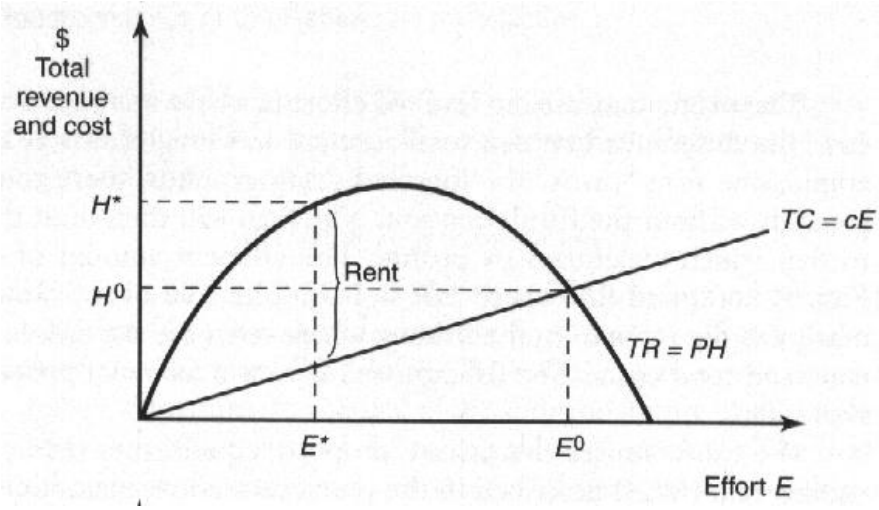

Figure 27.4 Maximum Economic Yield

When the relationship between effort and money are measured, it was observed that when stock is low, effort must be high.

- Total revenue (*TR*) = Price (*P*) × Catch (*H*)
- TC = Unit cost (*c*) × Effort
- Rent = TR – TC

The rent is maximized at the point E*. Here

- *MEY* is left of *MSY*
  - Optimal harvest (*H**) is less than the *MSY* harvest
  - But rent is larger than at *MSY*

The marginal analysis can show that the MEY occurs at the point where MC =MR. It is observed that for marginal unit of effort, marginal rent is = 0 and average rent >1.

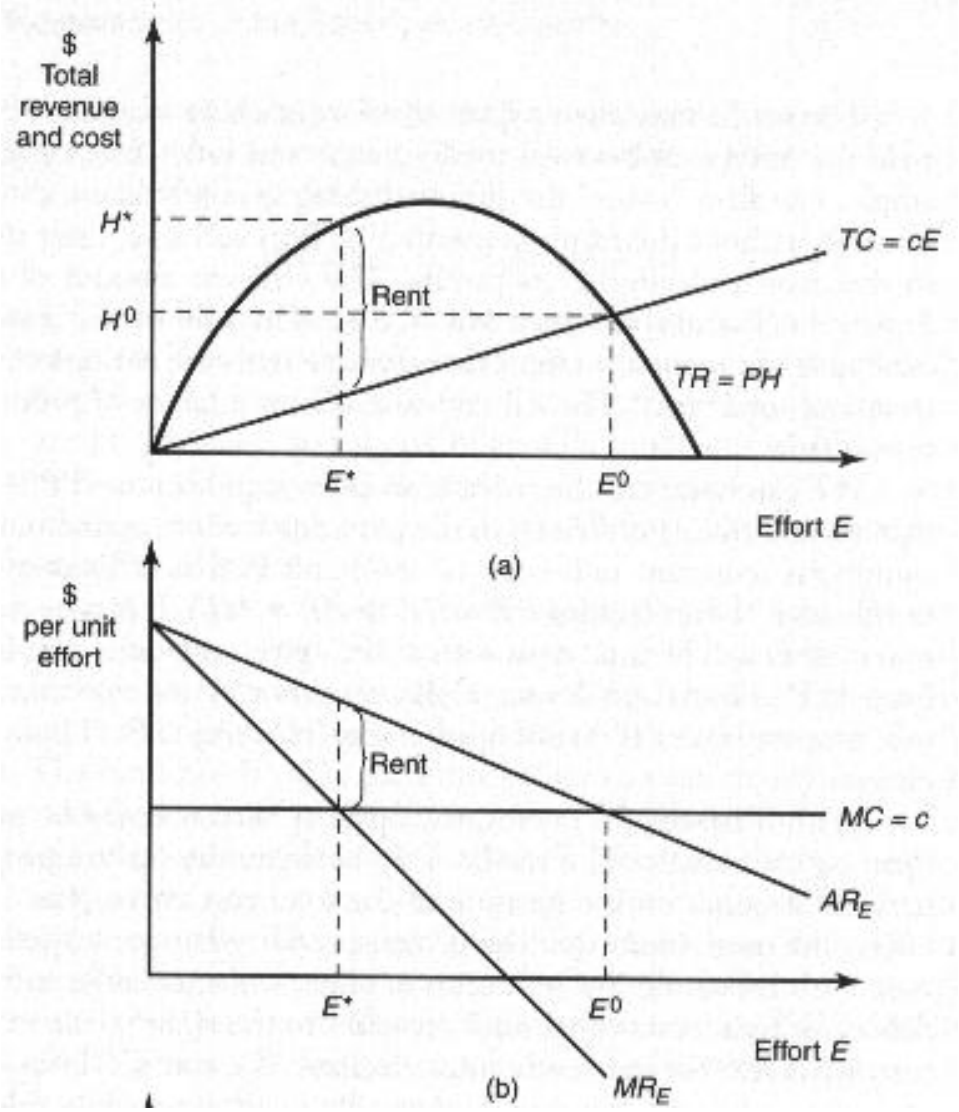

Figure 27.5 : Revenue Cost Effect relationships

Dixon concludes that the "Goal of traditional fisheries management: achieve *MSY.* However the economists aim for MEY in contrast to MSY. AT MEY, compared to MSY, the fish catch is lower, fishing profit is higher, fishing effort is lower and the fish stock is higher. Thus the author concludes that MEY is where more fish is conserved. (Dixon, 2005)

Technology, exploitation and sustainability issues

The marine fishing sector has witnessed vast technological developments in both harvest and post harvest fisheries during the last few decades. The investment in fishing sector is mostly private capital formation with government's participation coming up in ports, harbours and similar major infrastructure. Now what are the issues that are likely to arise?

First, the basic economics of operation. Whether the economics of fishing operations are profitable in India now? The answer is both yes and no but mostly a positive response. Unless there is some income, no one will invest in this venture. IF you compare

the census figures, the mechanized crafts have increased between 2005 and 2010 (23 per cent), which may be taken as an indicator of profitability.

Second the encouragement received from the seafood trade front also prompts the fisher folk to remain in the industry. The consistent export earnings has given a sense of support to the fishers to get assured that their fish are being purchased atleast a little higher price than that of the domestic market. The recent trend of increasing fin fish exports in the seafood basket is a testimony to this.

Third the concept of sustainability needs a serious thinking. Whether the export has led to indiscriminate harvest of targeted harvest of a few species needs to be analysed critically. Already a few researchers have started asking whether India needs to export seafood at all? What is the impact of seafood export in the domestic market?

Fourth point is the impact of sea food export on the socio economic conditions of the million fisher folk,who depend on the industry especially seafood industry. Whether they are earning a sustainable income or fluctuating income. How the seafood export can safeguard their livelihood?

Thus the economics of fishing operations needs to be studied in total with the sustainability and technological issues to arrive at a comprehensive evaluation of the economic performance of the fishing operations in India.

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28

Fisheries Management and Trade: Lessons Learnt in Indian Context

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Introduction

International trade has expanded markets for fishery products, especially for those that originate from developing countries like India. Fish exports from developing countries have exceeded traditional export crops such as sugar, beverages, and meat. While total net fish export from developing countries has increased, the same from developed nations has experienced a net loss in recent years. It is widely accepted that the globalization and free trade have rendered tremendous boost to developing economies. However, the fish trade expansion is feared to have caused social disparity between traditional and modern fishers, escalation of fishing intensity, and declines in selected stocks and diversity of commercially important species around the world. Increasing demand for fish products, however, will continue to mount pressure on India's fishery resources. Kumar P (2004) projected that the supply and demand for fish in India would increase by an annual average rate of 3 per cent and 2.4 per cent respectively. The export demand for fish was projected to increase at an annual rate of 5.5 per cent during 2000-2015. The aggregate fish consumption would increase to 7.7 million tonnes by 2015. Thus, higher market prices for certain species are forcing producers to intensify their effort towards a few selected species, and thus, are contributing to rapid depletion of their stocks. New markets for certain fish, which used to be discarded until recently, encourage fishers to catch broader range of species. However, the actual effects that the above structural changes in fish demand and supply have on marine biodiversity are still unknown. Also, the information on the trade's effects on social structure of fishers, processors, labor class and women is very sketchy. Notable exception includes Kurian (1998). A mere knowledge of the regional changes in the availability of fish products is not enough to design resource and welfare policies that would promote the long-term sustainability of trade as well as resource base. An effective policymaking process must be guided by more comprehensive analysis of the influences that the trade-driven, species utilization pattern has on the Indian fishery industry and fishery ecology of major fish basins.

India had traditionally practiced highly protective trade policies especially in the case of primary sectors such as agriculture and fisheries. Except for a few commercial commodities, agricultural and fisheries trade was subject to measures of quantitative restrictions, canalisation, licenses, quotas and high tariff rates. The process of globalization had its share in making India embark upon a major liberalization reform, in order to overcome a massive balance of payment crisis in the early 1990s. The policy makers had realized that the interventionist, import-substitution policies had largely failed in promoting economic growth (Pursell, 1999; Bhagavati 1993). International lenders such as the World Bank and International Monetary Fund required that India adopt a structural adjustment program that would liberalize foreign investment, imports and exports.

The World Trade Organization (WTO), of which India is a member, has in place an agreement that calls for long-term reforms in agricultural trade (Rameshchand, 1997). The agreement particularly urges its members to promote increased market access, export competition, and sanitary and phyto-sanitary restrictions on one hand, and to tear down quantitative restrictions (QR) on imports on the other. In keeping with this agreement, India had reduced the customs duty from 60 per cent to 35 per cent and removed QR on almost all the fish products by year 2001. It was estimated that the fish processing companies would have to spend an additional cost of Rs. 5.20 to Rs.10.37/kilogram to process at the new international standards Kumar A, 2004). Further it was shown that the competitiveness of Indian seafood exports in the international market declined substantially with the burden of SPS and HACCP standards. At the aggregate level the fisheries sector lost competitiveness by 14 per cent. It was reported that the compliance to SPS standards would result in a net social loss of Rs.2 billion (Kumar A 2004). During the previous decade, the per centage of total fish production exported has doubled from 6.5 per cent in 1990 to 16 per cent in 2004 by taking advantage of the policy shift. Secondly, although shrimp still constitute 70 per cent of the value, its importance in quantity is declining and many of the fishes hitherto exclusively consumed in domestic market are finding export market. The international trade in fish is increasing after the removal of quantitative restrictions. The import of fish and fishery products increased from a mere of 1,390 metric tones in 1991 worth USD 1.7 million to 24,175 metric tones worth USD 23.2 million in 2001. Although imported fish constitutes negligible share of the total production; there has been growing trend to cater to high-end consumer market and also users in feed industry. The import of fish is mainly in terms of fish meal and oils used by industrial feed mills to produce aqua-shrimp feed and poultry feed which in turn increases export capability. Thus, liberalization has resulted in catering to high-end consumer demand on the one hand and promoting export oriented fish production. Its direct and indirect impact in domestic income and employment and on future sustainability needs further research. It is of great policy relevance to understand how the Indian fish-processing sector should re-organize itself to compete in the world market in the face of new product standards and growing consumer eco-sensitivity. Currently, the lack of institutional mechanism and training in manufacturing and marketing eco-friendly products has been a major handicap in increasing export market access for Indian fishers.

Existing studies suggest that the globalization process may have particularly affected the dynamism and self reliance of the small-scale fishery in three-fold ways (Kurien, 1998): (1) importing of new technology leading to de-skilling, indebtedness and dependence on outsiders and fossil fuel, (2) exporting all the harvest from sea, and (3) giving access rights to Exclusive Economic Zone (EEZ) to foreign vessels. Kurien asserts that the quantity increase in the post-SAP marine exports of the 1980s and 1990s came largely from fish that were popular in the mass consumption domestic markets, resulting in price hike and affecting domestic consumption. The current credit policy also supports large-scale multinational corporations rather than small and marginal farmers/fishermen. Large corporations can easily raise money from banks at 9 per cent through debentures or commercial papers. But small fishers continue to bear an interest of 12-14 per cent. In addition, the companies enjoy fiscal concessions. In this early stage of market re-organization, it is critical to identify strategies for women and small fishers to gain equitable shares in the export-led fishery development. It also crucial to understand the existing barriers of participation for these dis-advantaged groups.

Issues

Trade liberalization has brought significant benefits to the world economy over the past 40 years. However the benefits of further liberalization are shrinking and the cost of deep integration could be significant. The World Bank has estimated that global gains from trade liberalization would be just USD 96 billion with only 16 billion going to the developing world. In per capita terms it amounts to USD 3.13 or less than 50 paisa per day per capita. Total tariff losses for developing countries under NAMA liberalization were estimated to be as high as 63.4 billion. In the long run declining terms of trade undermine developing countries' efforts to diversify and develop. The gains from adopting industrialized country style intellectual property rules, have led to profit transfers from South – North due to patent rents around USD 41 Billion. Preferential Trade agreements are negotiated by the advanced countries which cause costly trade diversion (6.6-21 billion USD/year). Some of the other major challenges of the trading system are food and climate changes. Since 2008 the world has entered a new era of highly volatile food prices which calls for climate change policy. The increase in food prices has been adversely affecting the livelihood and nutritional security of poor in developing countries. The UN Special Rapporteur for Right to Food has identified five sets of policies for food security. They are reinvestment in agriculture and general support for small farmers, Safety nets and income insurance, establishment of food reserves, Orderly marketing management, limiting excessive reliance on international trade in food.

Subsidies and International Trade in Fish and Fish products

Fishing subsidies is a missing piece within the manufacturing and agriculture sector. The prohibition of subsidy under Article 3 of the WTO Agreement on Subsidies and Countervailing Measures (SCM) apply only t the situations in which subsidies are contingent upon export performance or use of domestic goods over imported goods. Neither of these apply to the fishing enterprises which are granted with subsidies. The SCM Agreement also defines a category of actionable subsidies that have adverse impact

Nearly 40 per cent of the total fish production enters international trade with an estimated value of USD 102 billion in 2008. Developing countries account for 80 per cent of world fish production and 50 per cent of world exports in value terms. It is also observed that 85 per cent of the world fisheries are over exploited. It is stated that the global fishing fleet is 2.5 times larger than necessity to fish at sustainable level. The global economic loss is estimated to be USD 50 Billion annually. Even before the launch of the Doha Round members have realized the clear link between the fishery depletion and subsidies. The Ministerial meeting in 2001 decided to include negotiations to discipline the fisheries subsidies. The development of sustainable fisheries was seen as a prerequisite for trade. However it is more than a commercial recognition. The sustainability objective creates substantial stress on commercial interests. During the Hong Kong 2005 meeting prohibition of certain subsidies that contribute to over capacity was discussed. World fisheries could be split into domestic fisheries which operate within EEZ and international fisheries that is made up of fish stocks such as trans-boundary fish stocks that are shared by two or more countries and highly migratory fish stocks. Subsidies differ significantly whether fishing is domestic or international and within the later whether a fishery is trans-boundary or highly migratory. In the case of international stocks a coordinated effort is required since actions of one country may not solve the problem of over fishing. If a country depletes its domestic fish

stock it will suffer and hence elimination of harmful subsidies should be undertaken. The SCM Agreement also defines a category of actionable subsidies that have adverse effect on the interests of another member. However, what is an adverse effect? The effect on common resources on which all producers depend is not included. The traditional definition of trade distortion effects misses such points. Adverse effect on sustainability is not considered and also subsidies that contribute to over fishing seriously effect the common interests of other members.

Illegal Trade

Illegal, Un-reported and Un-regulated fishing is another important trade issue. Illegal means the vessels are operating in violation of the laws of the fisheries. For example a vessel operating in an area for which it is not a member (RFMO) and or vess3els which does not comply with safety measures. It is estimated that globally USD 10 billion to 23 billion /year is reportedly harvested illegally. Existing trade agreements already cover various forms illegally traded goods. For example TRIPS include provisions for broader measures to prevent import of goods suspecting /violation of IPRs. Anti-Counterfeiting Trade Agreement also prevent trade in illegal goods.

The trade should promote production in a manner that takes proper account of the value of common resources. Resource sustainability is necessary for developing countries to achieve higher standards of living on par with developed countries.

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29

World Trade Agreements and Fisheries Policy Instruments

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Introduction

Globally, fish has become a highly traded commodity, with 38 per cent (live weight equivalent) of total fisheries product being traded internationally in foreign markets, Vannuccini (2004). In terms of overall merchandise production and trade, the global share of developing countries was 37.5 per cent in 2001 but their share in global fish exports was over 50 per cent *(See Table 1)*, WTO (2002). The livelihoods of approximately 150 Million (mln.) people depend on fisheries, aquaculture and associated activities and over 20 per cent of the world's 38 million fulltime fishers earn less than US$ 1 per day, World Bank (2006).

India is poised to emerge as a major player in the world trade by 2020 and assume a role of leadership in the international trade organizations commensurate with its growing importance. The goal envisaged in the medium-term as outlined in the Foreign Trade Policy (FTP 2009-14) is to double India's exports of goods and services by 2014 with a long term objective of doubling India's share in global trade by the end of 2020 through appropriate policy support.

The period 2003-07 witnessed unprecedented growth of world output and trade; world GDP growing at 3.8 per cent per annum and world trade growing at an average annual rate of 16.6 per cent. The growth of India's GDP and foreign trade has been even more impressive. In spite of an average annual increase of about 25 per cent in exports in value terms, the trade deficit has also been growing due to higher growth in imports necessitated by increased requirements of growing economy. During the last five years current account deficit has been less than 2.5 per cent of the GDP but based on recent trends is expected to move higher in the years ahead. For ensuring stable macroeconomic environment for accelerated growth of economy, the trade and current account deficits needs to be kept within sustainable limits. The only option available towards attainment of this objective is to achieve further acceleration in exports growth.

Keeping in line with the cherished goal of the economy to grow at a double digit rate over the next decade, ***the aspiration is to achieve an average annual growth of exports of 25 per cent over the next six years***. Working on this aspiration, the Government aims to double its merchandise exports from US $225 billion in 2010-11 (expected level) to US $450 billion in 2013-14 and then to US $750 billion in 2016-17.

The realization of the aspirations of the exports growing at the targeted rate would depend to a great extent on the early recovery of the world economy and its sustained high growth thereafter. The strategies being adopted by other major exporting countries including currency valuation, conducive multilateral and regional trading arrangements, effective handling of the non-tariff barriers, depth of trade facilitating reforms etc. would also be strong factors relevant for the attainment of the above goal. Even the largest importer of goods like USA has launched a major initiative in the form of National Export Initiative (NEI) to double its exports from US $1.57 trillion in 2009 to US$ 3.14 trillion in 2015.

India's Trade Performance

India's merchandise exports reached a level of US $ 251.14 billion during 2010-11 registering a growth of 40.49 per cent as compared to a negative growth of 3.53 per cent during the previous year. India's export sector has exhibited remarkable resilience and dynamism in the recent years. Despite the recent setback faced by India's export sector due to global slowdown, merchandise exports recorded a Compound Annual Growth Rate (CAGR) of 20.0 per cent from 2004-05 to 2010-11.

As per WTO's International Trade Statistics, 2010, in merchandise trade, India is the 20th largest exporter in the world with a share of 1.4 per cent and the 13th largest importer with a share of 2.1 per cent in 2010. The year 2011 has been a difficult year with Japan facing a major earthquake and tsunami, the swelling of unrest in the Middle East oil producing countries, the slowing down of US economy and the Euro area facing major financial turbulence. The current global economic slowdown has its epicenter in the Euro-region but the contagion is being witnessed in all major economies of the world. As a result, India's short-term growth prospects have also been impacted.

Exports

Exports recorded a growth of 40.49 per cent during April-March 2010-11. The Government has set an export target of US $ 300 billion for 2011-12. With merchandise exports reaching US $ 217.66 billion in 2011-12(Apr-Dec), the export target of 300 US $ billion is expected to be achieved. Export target and achievement from 2004-05 to 2010-11 and 2011-12 (Apr-Dec) is provided in the Table 1:

Imports

Cumulative value of imports during 2011-12 (Apr-Dec) was US $ 350.94 billion as against US $ 269.18 billion during the corresponding period of the previous year registering a growth of 30.4 per cent in $ terms. Oil imports were valued at US $ 105.6 billion during 2011-12 (Apr-Dec) which was 40.39 per cent higher than oil imports valued US $ 75.2 billion in the corresponding period of previous year. Non-oil imports were valued at US $ 245.35 billion during 2011-12 (Apr-Dec) which was 26.49 per cent higher than non-oil imports of US $ 194.0 billion in previous year.

Trade Balance

The Trade deficit in 2011-12 (Apr-Dec) was estimated at US $ 133.27 billion which was higher than the deficit of US $ 96.21 billion during 2010-11 (Apr-Dec). Performance of Exports, Imports and Balance of Trade during 2004-05 to 2011-12 (April-Dec) is given in the Table 29.1.

Export Strategy

Traditional sectors like textiles, gems & jewellery and handicrafts have been the strong areas of our exports. These sectors individually account for only a small segment in the world trade. On the other hand, India's share in the most dominant segment of world exports i.e. machinery and transport equipment (accounting for 37 per cent of word exports during 2003-07) was only 0.3 per cent during this period. Similarly, our share in other important sectors like chemicals, pharmaceuticals and agri-products is not significant. The strategy to boost our capabilities of exports in these sectors would receive high priority in any future strategy for export promotion and diversification.

Trade Agreements of India

Along with product diversification, diversification of markets based on the changing dynamics of growth in the world economy is equally important to ensure sustained and accelerated growth of exports.

Working out conducive trading arrangements with trading partners holds a crucial place in the entire strategy of export promotion. The Department would continue to work towards successful conclusion of negotiations under the ongoing Doha Round. The efforts towards successful conclusion of free trade agreements (FTAs) with our important partners would receive utmost attention. India has recently concluded Comprehensive Economic Partnership Agreement (CEPA)/ Comprehensive Economic Cooperation Agreement (CECA) with ASEAN, Japan and Malaysia. Negotiations for similar agreements with EU is progressing well and is expected to be concluded soon. FTAs with Canada, New Zealand and Australia have been initiated for early finalization.

India has adopted a multi-pronged strategy to deal with issues relating to NTMs and to increase India's market access abroad and will play a proactive role in addressing the concerns of India's trading community on these measures. On the import side, efforts will be strengthened to create suitable Sanitary and Phytosanitary (SPS) measures/ technical regulations on Indian imports in a phased manner over a period of time depending on the capability of the domestic sector to comply with the same.

Share of Top Principal Commodities in India's Export 2011-12 (April-October)

1. Petroleum and crude products (20.4 per cent)
2. Jems and Jewellery (16.3 per cent)
3. Transport (7.8 per cent)
4. Machinery and Instruments (4.6 per cent)
5. Drugs, Pharmaceuticals and Fine Chemicals (4.0 per cent)
6. Others (46.9 per cent)

Emerging Trends in Fish Trade

- Globalization and market liberalization drive fisheries policies and institutional support in nine
- Asian fish-exporting countries — Bangladesh, China, India, Indonesia, Malaysia, the Philippines, Sri Lanka, Thailand, and Vietnam
- Future fish exports to developed countries depend mainly on compliance with food safety standards, potentially hampering trade by countries that use traditional postharvest and processing methods

- Development and growth in fisheries are sustainable only with adequate support for training, extension, credit, skilled human resources and market infrastructure, which lay the foundation for improved productivity and competitiveness
- Support services have traditionally focused on capture fisheries but have recently shifted toward aquaculture
- Small investors have little access to formal credit, mainly because of inadequate collateral and the perceived risks of fisheries investments
- Asian fish-exporting countries urgently need to develop such ancillary support services as administration, input delivery and market infrastructure to close the critical links between domestic production and foreign markets
- The vast potential for increasing aquaculture output calls for establishing a regional center for
- advanced education, research and training in tropical fisheries sciences and management
- As open-access aquatic resources are vulnerable to overexploitation, institutional arrangements at all levels are essential to sustain the resource base by determining the allocation of rights and implementing rules
- China and Malaysia have capable, centralized administrations and effective extension machinery that enables them to implement policies nationally, while Bangladesh, Indonesia and Philippines have promoted local administration and extension, community-based management, and the active participation of private business and NGOs to govern resource use and develop community capacities.

Indian Marine Exports

The marine products exports touched 8,62,021 tonnes valued at Rs 16597.23 crore ($3508.45 million)in 2011-12. This translates to $3.5 billion. The quantity has gone up by 6.02 per cent, while the value in rupee terms jumped by 28.65 per cent over the previous year. In US dollars, the value showed a growth of 22.81 per cent. The unit value increased to $4.07 from $3.51 in the previous year. In 2010-11 seafood exports stood at 8,13,091 tonnes valued at Rs 12,901.47 crore.

It is to be noted that continuing recession in international markets, debt crisis in EU economies, continuing anti-dumping duty in the US, sluggish growth in the US economy and the political instability in the Arab world prevailed during the above period. Frozen shrimp was the major export value item accounting for 49.63 per cent of the total dollar earnings. In quantity terms shrimp exports increased by nearly 25 per cent. The share of vannamei shrimp in the total shrimp exports has shot up from 14 per cent to 35 per cent while the share of black tiger shrimp has declined from 82 per cent to 61 per cent. South East Asia has become the largest buyer of Indian marine products with a share of 40 per cent in volume and 25 per cent in value in dollars. European Union came second with a share of 23 per cent followed by the US with 18 per cent in volumes. Exports to China recorded a fall of 47 per cent in quantity and 40 per cent in value in dollar terms. MPEDA has targeted $4.5 billion worth exports in2102-13. Rising production of vannamei shrimp and better infrastructure facilities for production of value added items will help achieve this target.

Table 29.1 Marine Products Export Projections (in US $ Billion)

Year/Product Category	2009-10	2010-11	2011-12	2012-13	2013-14
Shrimp exports	873	1594	1950	2362	2750
Others including value added items	1256	1594	1800	2012	2250
Total	2129	3188	3750	4374	5000

WTO Agreements

The main provisions ofWTO agreements are:

- ✓ Trade related intellectual property right (TRIPS) and imposition of patent regime
- ✓ Trade related investment measures (TRIMS)
- ✓ Reductions of domestic and export subsidies
- ✓ Tariff reduction and bindings to provide market access
- ✓ Removal of quantitative restrictions (QR)
- ✓ Application of sanitary and phytosanitary (SPS) measures

Trade Agreements

India views Regional Trading Arrangements (RTA's) as 'building blocks' towards the overall objective of trade liberalisation. Hence, it is participating in a number of RTA's which include Free Trade Agreements (FTA's); Preferential Trade Agreements (PTA's); Comprehensive Economic Cooperation Agreements (CECA's); etc. These agreements are entered into either bilaterally or in a regional grouping.

Agreement on South Asia Free Trade Area (SAFTA)

The Agreement on South Asian Free Trade Area (SAFTA) was signed by all the member States of the South Asian Association for Regional Cooperation (SAARC)during the twelfth 'SAARC Summit' held in Islamabad on 4-6th January, 2004. As a result, SAFTA came into force from 1st January, 2006.

According to the agreement, SAFTA will be implemented through the following instruments:-

- ➢ Trade Liberalisation Programme
- ➢ Rules of Origin
- ➢ Institutional Arrangements
- ➢ Consultations and Dispute Settlement Procedures
- ➢ Safeguard Measures
- ➢ Any other instrument that may be agreed upon

Asia-Pacific Trade Agreement (APTA)

The Asia-Pacific Trade Agreement (APTA), formerly known as the **Bangkok Agreement**, was signed on 31st of July 1975 as an initiative of the **United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)**.

APTA/ Bangkok agreement is the 'First Agreement' on trade negotiations among the developing member countries of ESCAP. It is a preferential tariff arrangement that aims at promoting intra-regional trade through exchange of mutually agreed concessions by the members (developing country) of the ESCAP region. The Bangkok Agreement is essentially a preferential trading arrangement designed to liberalize and expand trade progressively in the ESCAP region through such measures as the relaxation of tariff and non-tariff barriers and trade-related economic cooperation.The developing countries and associate members of ESCAP are eligible to accede to the Agreement.

The original signatories to the Agreement were Bangladesh, India, Lao People's Democratic Republic, the Republic of Korea and Sri Lanka. Lao PDR has not issued customs notification on the tariff concessions granted, and hence to this extent, is not an effective participating member. China's accession to the Agreement was accepted at the Sixteenth Session of the Standing Committee of the Bangkok Agreement in April 2000.

The objectives of the agreement is to promote economic development through a continuous process of trade expansion among the developing member countries of ESCAP and to further international economic cooperation through the adoption of mutually beneficial trade liberalization measures consistent with their respective present and future development and trade needs, and taking into account the trading interest of third countries, particularly those of other developing counties.

BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation)

BIMSTEC (Bangladesh India Myanmar Sri Lanka and Thailand Technical and Economic Cooperation), a sub-regional economic cooperation grouping was formed in Bangkok in June 1997. Myanmar joined the grouping later in December 1997. Bhutan and Nepal too joined in February 2004. Its membership involves 5 members of SAARC (India, Bangladesh , Bhutan, Nepal & Sri Lanka) and 2 members of ASEAN (Thailand, Myanmar). Thus, it is visualized as a 'bridging link' between the two major regional groupings i.e. ASEAN and SAARC. Its chairmanship of BIMSTEC rotates among the member countries in alphabetical order. The immediate priority of the grouping is consolidation of its activities and making it attractive for economic cooperation.

BIMSTEC member countries agreed to establish the **BIMSTEC Free Trade Area Framework Agreement** in order to stimulate trade and investment in the parties, and attract outsiders to trade with and invest in BIMSTEC at a higher level. The Framework Agreement on the BIMST-EC FTA was signed on 8th February, 2004 in Phuket, Thailand. The Framework Agreement includes provisions for negotiations on FTA in goods, services and investment. A Trade Negotiating Committee (TNC) has been constituted to carry forward the programme of negotiations. The TNC had its 1st Meeting in Bangkok on 7-8 September 2004. TNC's negotiation area covers trade in goods and services, investment, economic cooperation, as well as trade facilitations and also technical assistance for LDCs in

BIMSTEC. It was agreed that once negotiation on trade in goods is completed, the TNC would then proceed with negotiation on trade in services and investment.

Framework Agreement on Comprehensive Economic Cooperation between India and the Association of South East Asian Nations

India's engagement with the **Association of South East Asian Nations (ASEAN)**started with its "Look East Policy" in the year 1991. India's focus on a strengthened and multi-faceted relationship with it is an outcome of ASEAN's economic, political and strategic importance in the larger Asia-Pacific Region and its potential to become a major partner of India in trade and investment. Also, it now provides a land bridge for India to connect with the Asia-Pacific-centred economic crosscurrents shaping the 21st century market place. While, ASEAN seeks access to India's professional and technical strengths. India and ASEAN have convergence in their security perspectives.

ASEAN was established on 8 August 1967 in Bangkok by the five original member countries, namely, Indonesia, Malaysia, Philippines, Singapore, and Thailand. Now, it has a membership of 10 countries namely Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. India is one of the four 'Summit level Dialogue Partners' of ASEAN.

India-Mercosur Preferential Trade Agreement (PTA)

MERCOSUR is a trading bloc in Latin America formed in 1991 and comprising Brazil, Argentina, Uruguay and Paraguay. It was formed with the objective of facilitating the free movement of goods, services, capital and people among the four member countries. It is the fourth largest integrated market after the European Union (EU), North American Free Trade Agreement (NAFTA) and ASEAN.

A **Framework Agreement** was signed between India and MERCOSUR on 17 th June 2003 . The aim of this Framework Agreement is to create conditions and mechanisms for negotiations in the first stage, by granting reciprocal tariff preferences and in the second stage, to negotiate a free trade area between the two parties in conformity with the rules of the World Trade Organization. As a follow up to the Framework Agreement, a**Preferential Trade Agreement (PTA)** was signed in New Delhi on January 25, 2004. The aim of this Preferential Trade Agreement is to expand and strengthen the existing relations between MERCOSUR and India and promote the expansion of trade by granting reciprocal fixed tariff preferences with the ultimate objective of creating a free trade area between the parties.

Other agreements include:-

- India And Singapore Comprehensive Economic Cooperation Agreement (CECA)
- India-Sri Lanka Free Trade Agreement (ISFTA)
- India-Chile Prefrential Trade Agreement (PTA)
- India-Afghanistan Preferential Trade Agreement (PTA)
- India-Bhutan Trade Agreement
- India-Nepal Trade Treaty
- Framework Agreement For Establishing Free Trade Between India And Thailand
- Free Trade Agreement (FTA) Between India And Gulf Cooperation Council (GCC)
- India- Japan Trade Agreement

- Joint Study Group Between India And Korea
- Trade Agreement Between India And Bangladesh
- Comprehensive Economic Cooperation And Partnership Agreement (CECPA) Between India And Mauritius

Conclusion

Agriculture will continue to remain at the centre stage of socio-economic development in India. Notwithstanding its outstanding performance in making the country self-sufficient in foodgrains, deceleration of its performance beginning with mid-nineties is of serious national concern. Two major developments impacting Indian agriculture during nineties have been: (1) the Agreement on Agriculture implemented from 1st January, 1995 under WTO, and (2) emergence of highly volatile price regime thereafter. Several recent studies, on the causes of poor performance of agriculture, often relate to WTO agreement on agriculture and its likely adverse implications against promise.

It is also a fact that WTO agreements are now a reality and these agreements can only be modified. The global scenario in future is going to become more competitive and the pressure for liberalisation of domestic market would also grow. In this context, India needs to follow two pronged strategy. One, based on the post WTO experience of last 10 years India should continue taking active part in negotiating agreement to its advantage with sound arguments. This would require objective understanding of the implications of the changed trade regime, promoted and planned under the auspices of WTO. Such an understanding is of critical importance to play an effective role in future negotiations as well as to plan adequately for designing our policies and economic activities including agricultural R&D programmes which are basic to accelerated sustainable agricultural development. Two, in order to effectively operate in the WTO driven environment, the member countries need to devise appropriate domestic policies and strategies. The crux of these policies should be to identify weaknesses and strengths of domestic produce vis-à-vis major competing players, and to improve competitive attributes of our produce, involving production, processing, marketing, trading practices and other processes from the farm to the final destination. Upgradation of competitive strength requires improvement in policies, infrastructure, institutions and technology. Out of these, the major role lies in technology and its favourable interplay with institutions and policies. India's agricultural research system has stood several tests successfully in the past and has helped the country to tide over formidable food crises and other challenges. To address WTO related challenges, research system should know what is precisely needed from it. Specifically, some of the questions that arise in this regard are: (i) what is the nature of challenges in different enterprises, products and locations that agricultural research system should address to impart competitive strength to Indian agriculture comprising dominantly small and marginal farmers; (ii) what are the desirable attributes to make our products competitive; and (iii) what are the institutional and policy imperatives?

Table 29.2 Export Target and Achievement (US $ Billion)

year	*Export*	
	Projected	*Actual*
2004-05	75	83.54
2005-06	100	103.09
2006-07	125	126.41
2007-08	160	163.13

2008-09	200	185.29
2009-10	175	178.75.
2010-11 (P)	200	251.14
2011-12 (April- Dec)	300	217.66

Table 29.3 Performance of Indian Foreign Trade **(**Values in Rs. Crores)

S.No	Year	Exports	per centGrowth	Imports	per cent Growth	Trade Balance
1.	2004-2005	3,75,340	27.94	5,01,065	39.53	-1,25,725
2.	2005-2006	4,56,418	21.6	6,60,409	31.8	-2,03,991
3.	2006-2007	5,71,779	25.28	8,40,506	27.27	-2,68,727
4.	2007-2008	6,55,864	14.71	10,12,312	20.44	-3,56,448
5.	2008-2009	8,40,755	28.19	13,74,436	35.77	-5,33,680
6.	2009-2010	8,45,534	0.57	13,63,736	-0.78	-5,18,202
7.	2010-2011 (Provisional)	11,42,649	35.14	16,83,467	23.45	-5,40,818
8.	2010-11 (Apr-Dec)	7,89,069	--	12,28,074	--	-4,39,006
9.	2011-12 (Apr-Dec)	10,24,707	29.86	16,51,240	34.46	-6,26,533

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30

Indian Seafood industry and post WTO – A Policy Outlook

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Introduction

India plays a major role in the global seafood export among the Asian countries. The marine products exports from India reached 8 lakh tonnes worth 2.8 billion US $ in 2010-11 and registered an impressive double digit growth rate since 2007-08. India exports frozen shrimp, squids and finfish in dried, live and chilled forms to different destinations. With the current demand pattern of major seafood markets and with modern machinery for freezing and processing, several exporting firms have started development and exports of processed value added products. Among the different items exported, frozen shrimp and frozen fin fish accounted for about 75 per cent of the total volume of sea food exports from India. Even though frozen shrimp contributed only 19.24 per cent of the total volume of seafood exports, its share in the total value was 41.62 per cent in 2010-11. Frozen fish occupies prime position in terms of quantity, however its share in the total value is only 20.38 per cent showing low unit value realization (Rs. 84.16 per kg) (MPEDA, 2011). The seafood export trade performed well in the past decades amidst stringent trade liberalization measures and economic recession which affected many Indian buyer countries. In India storage, processing and transport, grading and quality control facilities are mostly oriented towards the export market even though more than 80 per cent of the fish production is channeled in the domestic markets. Seafood trade influences the domestic markets significantly by way of affecting the supply -demand situation of many high valued fishes, competition for small scale traders and rise in prices in the domestic markets

The sector is poised for a robust growth of one million tonnes and an anticipated forex earning of 4 billion dollars during 2011-12 .This assumes significance during the period of continued recession among the major buyers. The major buyers including the US, EU and Japan are affected with severe recession related economic indicators like lack of investment, lower purchasing power, acute unemployment etc. Amidst the impressing performances the export sector is grappled with demand and supply side constraints. The export sector is facing constraints on account of timely availability of raw material, low capacity utilization; high cost of production on account of heavy price of raw materials, high cost of compliance for meeting the quality standard of the buyer countries, incidence of alert and rejections and continued trade impediments.

On the brighter side there exists a huge domestic demand evident from the high domestic prices and consumer's preferences towards fish and fish related products. The

export markets are buyer driven with buyers being the 'price makers'. In the context of numerous trade limiting impediments and stringent quality control, the continued spurt in domestic demand would definitely increase the options available with the exporters to harness on added revenue with minimal transaction cost.

The paper analyses the Indian seafood industry in the wake of WTO with the emerging paradigms and different perspectives by analyzing the seafood trade in terms of performance and highlights the various bottlenecks facing the sector. The paper also suggests guidelines for the future through an efficient value chain model incorporating the domestic markets

Data and Methodology

SWOL analysis

SWOL analysis (Strengths, Weaknesses, Opportunities and Limitations) was done to assess the strengths, weaknesses, opportunities and limitations of fisheries trade in India which would give the present status and help in prediction of the future potentials of fisheries trade. The SWOL ultimately help in enhancement of trade domains and to exploit diversified commodities and with newer trade partners. The Strength and weakness are inherent to the system and showcase the present state of affairs whereas the opportunities and limitations highlight the future. The analysis of the strengths, weaknesses, opportunities and limitations are very important to upgrade the capacity of the export trade sector, since it helps in problem identification, planning, decision making, appropriate technology implementation, precautionary measures for accelerating fish production at sustainable level etc. The analysis of the strengths, weaknesses, opportunities and limitations are very important for improving, upgrading and revamping the fish trade scenario since it helps in problem identification, planning, decision making, adoption of appropriate technologies and developing measures for long term sustenance of the sector.

Different types of data consisting of time series data for marine product exports collected from MPEDA, cross sectional data on exporter's responses and panel data for domestic prices of marine fishes were collected. Appropriate econometric tools were employed to substantiate the results.

Reflections and Perspectives :

The reflections and perspectives under the SWOL framework is discussed under the following heads . The strengths, weaknesses, opportunities and limitations of fish trade in India based on various econometric analysis and observations are discussed in this section.

Strengths	**Weakness**
(i) Resource abundance / endowment (ii) Increased commodity diversification (iii) Improved geographic concentrations (iv) Strong institutional support and linkages	(i) Exorbitant cost of production (ii) Low capacity utilization (iii) Constraints in value addition (iv) Deficiencies in the value chain constituents
Opportunities	**Limitations**
(i) Emergence of candidate species (ii) Augmented domestic market (iii) Changed world economic order	(i) Unsustainable fishing practices (ii) Technological constraints in aquaculture

(iv) Ecolabelling and certification	(iii) Continued trade impediments (iv) Poor market information system

A. Strengths

i) Resource abundance /endowment

India possesses abundant and varied resources both in marine and inland sectors. The fish production in the country has increased from 0.75 million tonnes (1950-51) to 7.85 million tonnes (2010-11) with increase in production of cultured fish and shrimps (Figure 1). The marine fisheries sector indicates a tropical environment with multi species-multi - gear fishery. The marine fisheries landings increased from 3.73 lakh tonnes in 1947-48 to 3.32 million tonnes in 2010 .The contribution analysis of the landings indicated that the West coast contributed 67 per cent and the East coast at 33 per cent. The contribution from the four regions indicated that the North East contributed 11.4 per cent , South East 22.0 per cent ,South West 35.2 per cent and North West at 31.40 per cent .The species wise contribution indicated that the pelagic fin fishes constitute 55 per cent followed by demersals (26 per cent) , crustaceans (15 per cent) and molluscans (4 per cent).

The aquaculture sector of the country also witnessed boom with increased production of *P.monodon* and introduction of exotic species like *P.vannamei*. Eventhough the export market was initially oriented towards shrimps, lobsters and cephalopods, commodity and market diversification opened up opportunities for exports of finfishes. Groupers, mackerels, tunnies, barracudas, pomfrets, seerfishes, ribbon fishes and other fresh water fishes found a place in the export market and the finfish exports now occupy around 40 per cent of the total export volume. Expansion of fishing grounds with advancement in harvest technologies and possible fishing down the web led to capture and marketing of new varieties like puffer fish (*Lagocephalus inermis)*, yellow fin tuna and some varieties of sharks with good export potential.

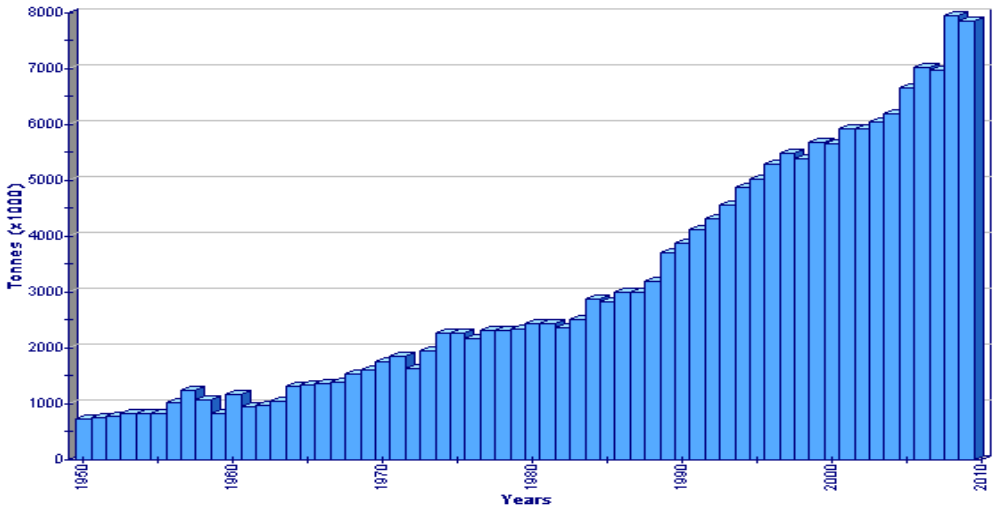

Figure 30.1 . Fish production in India (1950-2010)

ii. Increased commodity diversification

The one country- one product misnomer no more exists with the Indian sea food export which has been the single largest factor contributing to the augmented export earnings .The increased commodity diversification has been one of the major strength achieved over the years. The decadal commodity diversification analysis was done for 1990, 2000 and 2010 (Figure 2) .The results indicated that the share of frozen shrimp declined from 46 per cent to 19 per cent during 1990-2010 whereas the share of frozen fish increased from 28 per cent to 45 per cent during 1990-2000 and then declined to 38 per cent in 2010. The live and chilled items also found a place in the export basket in the past decade. The disaggregated analysis of the commodity diversification also indicated that the number of species/ product / form under each commodity also improved considerably thereby reducing the pressure of meeting buyers' requirements.

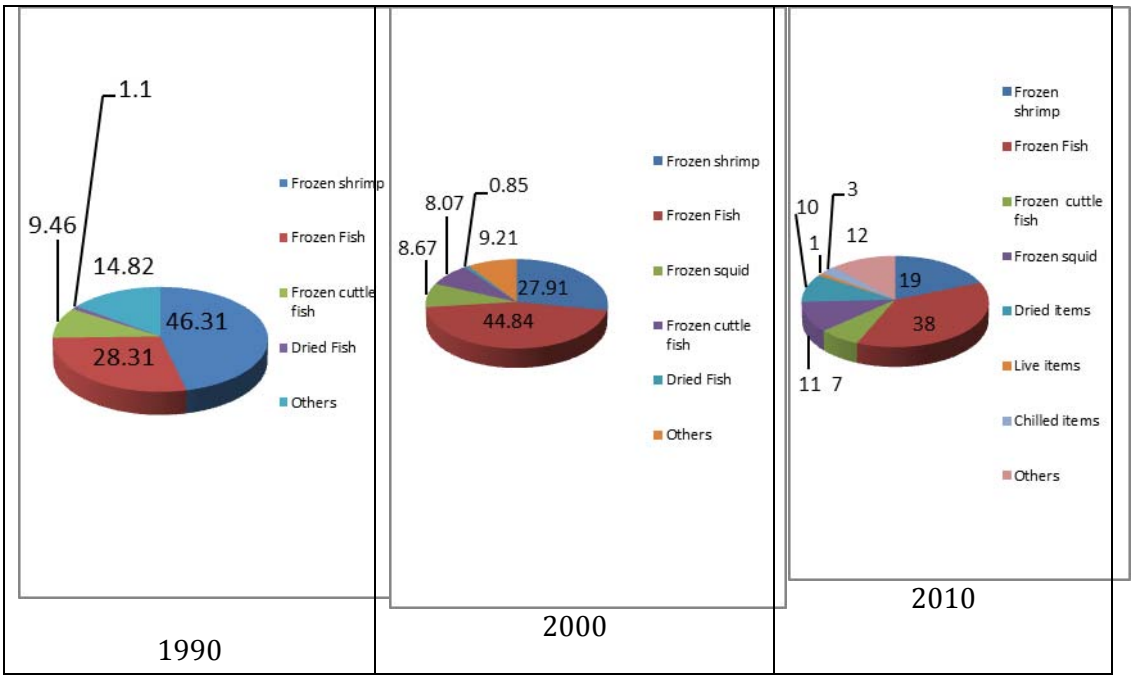

Figure 30.2 Commodity diversification for Indian exports

(iii) Improved Geographic concentrations

Indian seafood products had wide spread acceptance in many of the countries like EU, US , China and other countries. Japan, USA and European Union or Western Europe were the major fish importers from India, which accounted for about 60 to 65 per cent of the volume and about 70-75 per cent in value of Indian seafood exports. Strict quality regulations imposed by US and EU and commodity diversification with finfish and other value added products led to geographic diversification and market opportunities emerged in countries like Middle East, China and South East Asian countries. Even though geographic diversification emerged with countries like Middle East and China with the strict quality regulations in US or EU, they still account for a major share (70-75 per cent) in the foreign exchange earned through our export.

The decadal geographic diversification analysis was done for 1990, 2000 and 2010 (Figure 3) and the results indicated that the share of European countries in the total volume of trade declined from 32 per cent in 1990 to 10 per cent in 2000 and again increased to 21 per cent in 2010. The share of Middle East countries increased from 4 per cent to 49 per cent during 1990-2000 and then declined to 20 per cent in 2010. The share of US declined from 12 to 6 per cent and that of Japan from 24 per cent to 9 per cent during 1990-2010 period. The improved geographic concentration offer better competitiveness for Indian seafood exports and opportunities to thrive under changed economic environment in buyer countries.

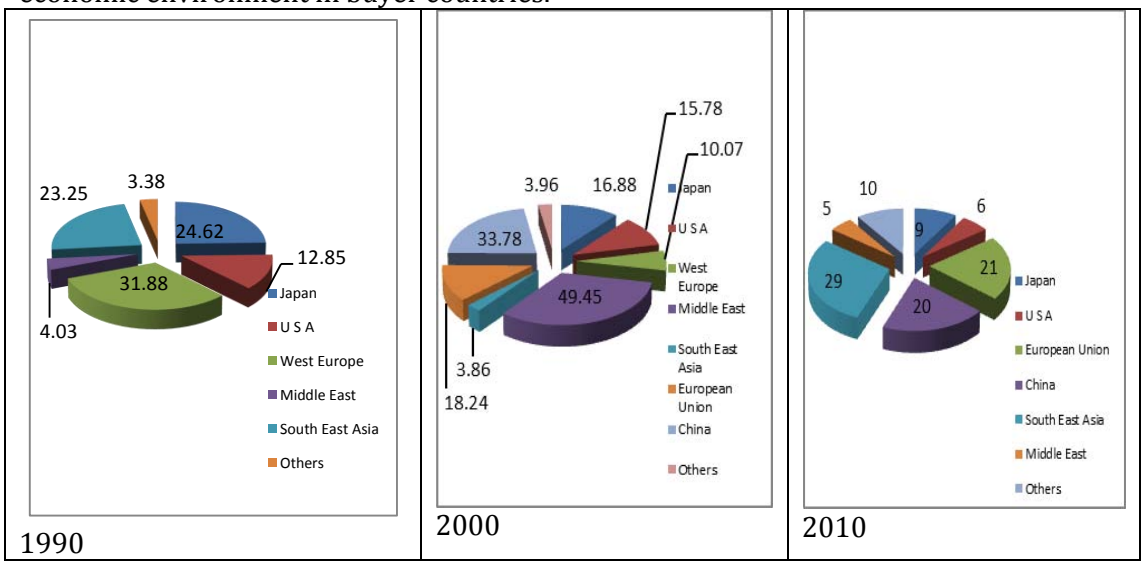

Figure 30.3 Geographic diversification for Indian exports

iv) Strong institutional support and linkages

Indian seafood industry is well supported by various institutional agencies with regard to technological, marketing and financial requirements. The Marine Products Export Development Authority(MPEDA) is the nodal agency in promoting seafood exports through various activities like registration of infrastructure facilities for seafood export trade, collection and dissemination of trade information, projection of Indian marine products in overseas markets through participation in overseas fairs and organizing international seafood fairs in India, promotion of aquaculture for production of shrimp and prawn for export, promotion of value added seafoods and promotion of tuna fishery. In addition, it also undertakes various development measures like distribution of insulated fish boxes, putting up fish landing platforms, improvement of peeling sheds, modernization of industry such as upgrading of plate freezers, installation of IQF machinery, generator sets, ice making machineries, quality control laboratory etc. for ensuring better quality products in the export markets. The marine fishing regulation act, the aquaculture authority act and several other legislations in the country has supported the seafood export industry by way of promoting sustainable fish production. The Coastal Aquaculture Authority (CAA) has recently granted permission for culture of specific pathogen free (SPF) *L. vannamei* which is expected give an impetus to the aquaculture sector in the country in the near future.

In addition, the country has a wide network of research and development organizations which significantly contributed for the progress of the sector. There are about 8 fishery research institutes two deemed universities and a number of fisheries colleges engaged in technology development and dissemination in fisheries sector. Various research

institutions like CMFRI, CIFT, CIBA, CIFRI, CIFA etc provide technological support to the seafood industry. In addition, National Fisheries Development Board, Aquaculture authority, MPEDA, NIPHATT, fisheries departments of various states and other organizations work together for the promotion of the sector. The linkages between these research organizations and development departments facilitated supply of quality products, packaging materials, raw materials and market intelligence for boosting the seafood exports in the country.

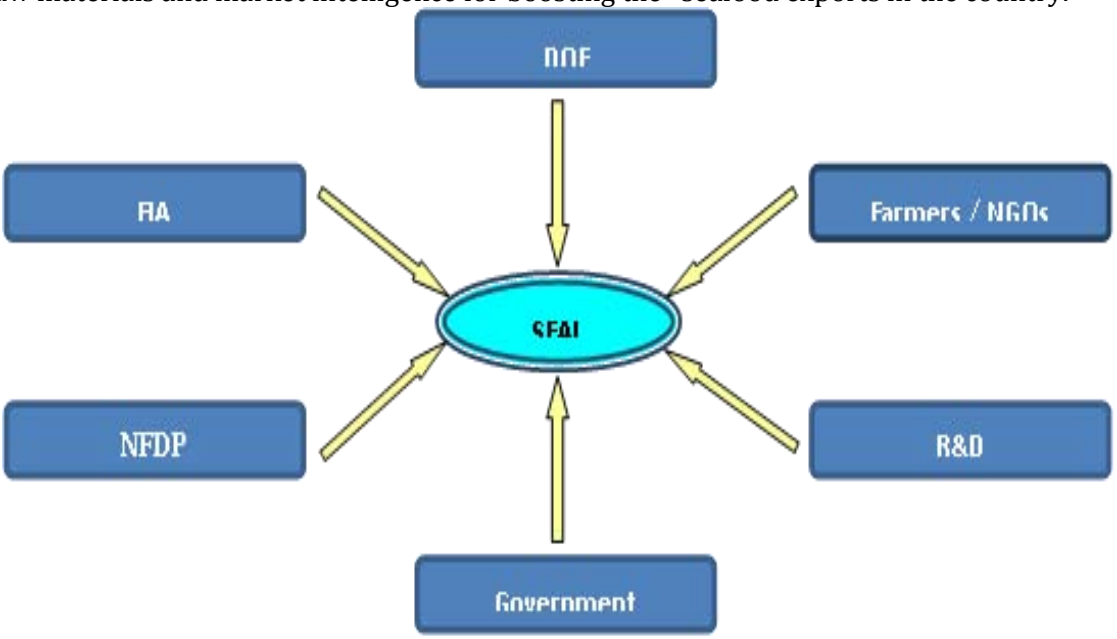

Figure 30.4 Institutional supports and Linkages developed

B. Weaknesses

(i) High cost of production

There exists severe paucity of raw material due to depleted landings in marine sector and disease incidence in culture sector. The major exportable species like shrimps, lobsters and high value fishes registered a downward trend in ladings over the years. There has also been a significant reduction in shrimp production due to disease outbreak and huge cost of shrimp farming. The reduction in landings coupled with geographical separation of landings often results in irregular supply of raw material thereby resulting in non-realization of economies of scale to the different exporters. In addition, the seasonal variations in marine catches constrain the operations of the firms. During lean seasons, majority of the firms face shortage of raw materials resulting in low capacity utilization. The bigger firms either having access to backward integration or owning fishing vessels may operate to some extent but the smaller firms either lay idle or limit their operations. The peak landings in the marine capture sector generally coincide with the peak season for exports. More than 60 per cent of the landings occur during the post monsoon period which coincides with the highest export demand. Thus to restore parity between the demand and the supply, the raw materials are often purchased at exorbitant prices with even forward marketing with the boat owners . There can be chances of deterioration in quality due to non-availability and that too at affordable prices.

The increasing demand for fish in the domestic market as a result of population and percapita income growth rates pushed up prices of many of the exportable fish varieties.

The high purchase prices of the exportable species and other operating expenses like labour cost, water and electricity charges caused the cost of production to increase at exorbitant levels. In addition, the high cost of compliance for EU approval, high cost incurred for purchase at distant markets, establishment cost all resulted in higher unit cost of production and lower profit margins. The establishment cost of a processing plant increased considerably over the years due to stringent quality standards set by international trade regulations. The compliance cost for EU approval also increased manifold thus resulting in huge cost of establishment. The overall compliance cost for meeting the EU norms has been estimated at 15 to 40 per cent of the FOB value. Often the cost of investment is so huge that the break evens aren't even attained after a decade of continuance in business. The analysis of the short run and long run gains on the SPS and compliance measures by the exporter's indicated that with the huge cost of investment required for the compliance of EU approval and HACCP implementation, the gains weren't significant due to non-capacity utilization of the processing plant and lack of raw materials. The processing plants which have implemented the compliance requirements for the EU approval are yet to break even their cost of investment even after 8 -10 years on account of processing capacity utilization to the tune of 22-25 per cent.

There exists uncertainty in prices in the international market with the economic recession spreading to most of the target markets. The price uncertainties lead to delay in payments, loss in revenue and delay in realizing new markets. The uncertainty in prices often lead to additional cost of storage and the material getting delayed in shipment and increased demurages. In addition, ecolabelling and other private standards by international retailers for environmental and social purposes also results in high costs and low margins.

ii. Low capacity utilization

Realization of capacity utilization of processing / exporting units was the major problem faced by many of the exporters. The reduction in landings coupled with geographical separation of landings often results in irregular supply of raw material and poor capacity utilization. In addition, seasonal variations in marine catches constrain the operations of the firms. During lean seasons, majority of the firms face shortage of raw materials resulting in low capacity utilization. The bigger firms either having access to backward integration or owning fishing vessels may operate to some extent but the smaller firms either lay idle or limit their operations. The average capacity of processing plants was found to be 32.12 tonnes whereas the utilization was only 12.10 tonnes (37.70) per cent. Analysis for the capacity utilization across different quarters showed that during the period from October - December months it was 30.39 per cent followed by January- March at 28.29 per cent. The processing plants processed minimal quantities during July-August and April-June. The average quantum of marine fish products processed per processing plant was found to be 2,781.70 tonnes per annum.

A Snap Shot on the Capacity Utilisation

- *Average capacity - 32.12 tonnes/day*
- *Average capacity - 12.10 tonnes (37.7 per cent) utilization*
- *Average Quantity processed- 2781.70 tonnes*
- *The average number of processing days -230 days per annum.*
- *Peak Operations - October to December (30.39) January- March (28.29)*

iii. Deficiencies in the value chain constituents

Absence of quality control at primary production centres (landing centres) often results in poor quality of the products. Even though there occurred drastic changes in the marine fishing sector with advancements in harvest technologies, the facilities for onboard storage, freezing or processing are still lacking. In addition, many of our landing centers lack basic amenities including hygienic auctioning platforms, quality ice and packaging material. The quality deterioration and discard losses hinder our exports through reduced supply of raw materials.

Even though our export supply chain is well developed with good storage, processing and transport infrastructure when compared to the domestic marketing system, it is nowhere comparable with that of developed countries. The imports of fishes from other countries and re-exports which was a viable option for the exporting firms to realize capacity utilization couldn't gain momentum in the Indian seafood export industry due to import restrictions for many of the items and other factors limiting the imports. The freezing and cold storage facilities available at present in the country is not sufficient for promoting large scale imports. There are other limitations like high cost of imports and distance of warehouses from ports which restricts imports.

(iv) Constraints in value addition

The international trade scenario is changing fast and the importers are insisting on stringent quality standards and newer types of value added and ready to eat products. Introduction of diversified seafood products in the export front has improved product acceptance and better unit value realization for our sea food products. A variety of value added products such as fish balls, soup powder, fish cutlet, fish finger, fish flakes, fillet and fillet blocks, fish steaks, ready to serve fish curry, minced meat, surimi and extruded products, fish sauce and fish salad, IQF and AFD products and coated seafood products are now exported from the country.

There is need for new innovative products catering to the demands of the domestic as well as overseas consumers to boost our seafood trade and enhance earnings. In India, about 80 per cent of the catch is now utilized as fresh or chilled, 6 per cent as dried or cured, 4.7 per cent for fish meal preparation and 5.3 per cent for freezing and export (Ministry of food processing industries, www.mospi.in). In addition there is scope for production of a number of marine byproducts with pharmaceutical or industrial uses which could fetch very

high prices in the overseas markets. However the potential for value added and marine byproducts is not fully utilized in the country even though it is endowed with abundant cheap resources, labour and infrastructural facilities. There is need for development and promotion of value added products and marine byproducts to enhance our export earnings. Even though the share of value added and marine byproducts in the total export increased over the years, the decadal average shows a meager ten per cent share in the total volume of sea food exports. However the last three years showed significant share of around 12.5 per cent.

B. Opportunities

i. Emergence of candidate species

Indian sea food sector has better opportunities with capture and trade of candidate species like puffer fish, yellowfin tuna, certain species of sharks having good export demand. Puffer fish which was a menace to the gears had been identified as a deliquacy in the Far East fetching around a couple of dollars per kg. The success in mariculture technologies for export oriented varieties like Cobia (*Rachycentron sp)*, lobsters and open sea cage farming offer vast scope for augmenting fish production in the future. In addition, the aquaculture sector of the country is also witnessing a boom with introduction of exotic species *L. vannamei* in the culture system which yields better returns. Enhancing production of *L. vannamei* which is a preferred item in the European markets may improve the performance of the seafood export industry which suffers setback from reduction in capture and culture based shrimps. White shrimps yields better returns with per hectare production of up to 20 tonnes/ha when compared to 2-3 tonnes/ha for black tiger shrimp. The culture duration is 3 months only as compared to the duration of 5 months of tiger shrimps and yields better returns under intensive and semi intensive farming.

ii. Augmented Domestic market

The domestic fish market is growing in leaps and bounds with population and percapita income growth rates, changes in food habits, increasing awareness on nutritional qualities of fish, improvements in transport, storage and processing facilities and access to quality fish. The exports of high value fishes like seerfishes and pomfrets declined even with increase in landings and it shows the competitiveness of the domestic market and affordability of these fishes to affluent domestic consumers. Analysis of price changes in the past decade showed that for many of the high value fishes, the price increase in the domestic market was more than that of the export market. The strong domestic market offer promising scope for the export sector in the country by utilizing the existing infrastructural facilities for developing products suited for the domestic sector and achieving economies of scale.

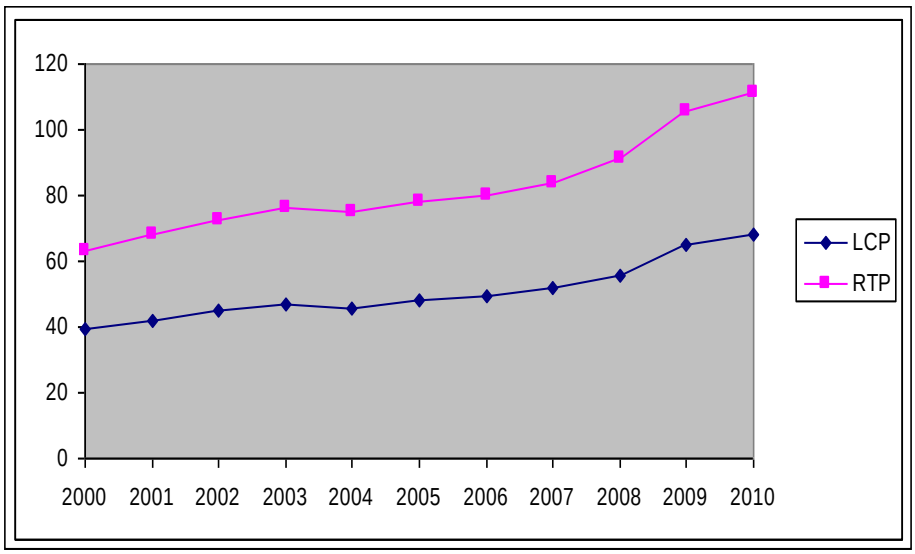

Figure 30.5 Growth in doemstic marine fish prices at first and last sales(2000-10)

In addition, the increase in the prices of the high value exportable fin fish species like pomfrets, seerfishes, tuna, ribbon fishes and snappers in the domestic market was very much higher than that of the export market. The avaerge reatil price realised per kg for seer fishes and pomfrets were even higher than that of the unit value realised in the export market indicating the competitiveness of the domestic market (Table 1). The augmented doemstic market offer promising scope for the export sector to develop quality products which cater to the needs of the domestic consumers by utilzing their existing capacity.

Table 30.1 Comparative analysis on the Export and Domestic price of exportable varities/ species

Name of fish	Export price			Domestic price		
	1997-98	2007-08	per cent increase	1997-98	2007-08	per cent increase
Ribbon Fish	27	52	92.59	16	50	212.5
Pomfrets	172	228	32.56	120	248	106.67
Tuna	38	58	52.63	25	49	96
Mackerel	40	64	59.1	30	59	96.67
Sardine	34	21	-38.5	25	42	68
Seerfish	67	133	98.51	73	265	263.01
Snappers	51	132	159.14	38	62	63.16

iii. Changed world economic order :Trade agreements like SAPTA and ASEAN and global recession

Indian sea food export sector performed well under the changed world trade scenario with new free trade agreements like ASEAN and SAPTA and under global economic recession which is evidenced by the marked increase in quantity, value and unit value realized during the period 2007-11.

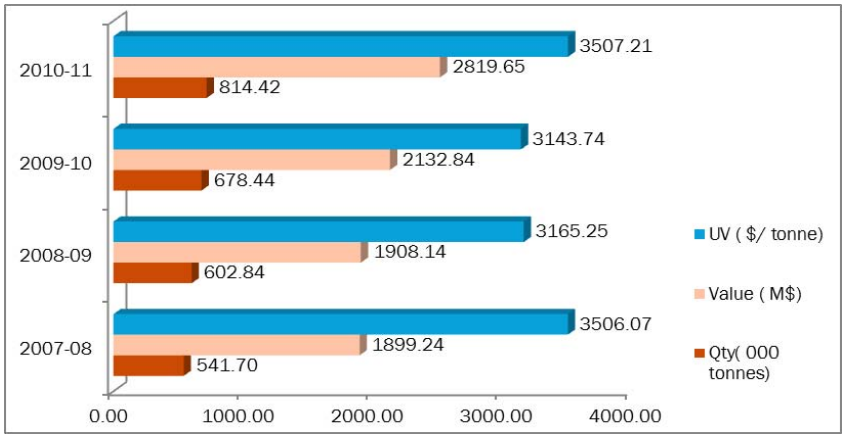

Figure 30..6 Performance of the seafood exports during 2007-2011

The ASEAN free trade will provide with an opportunity to reap in the export economies of scale through the timely and incessant availability of raw materials thereby increase export domain and realm of operations. The ASEAN provides additional market access to Indian exporters and opportunities for new investment. In addition, the expected increased volume of trade will provide gainful direct and indirect employment in sector. There also exist possibilities of outsourcing products from overseas at competitive prices from the ASEAN members. In the short run due competitiveness, processors will start to strengthen their plants by producing value added products and improve quality for their products. The results of impact analysis from exporters and processors are presented in Table 2 and 3.

ASEAN Agreement is India's first multilateral trade agreement which opened a 1.70 billion consumer market to the member countries with a combined GDP of $ 2.3 trillion. The Agreement provides an array of business opportunities that will brighten the economic sentiment of the ASEAN business community.The expected trade is $ 60 billion by 2011-12 and China has already an FTA with ASEAN, perhaps on more favourable terms. By this FTA, India, though not by way of competition, will have access to this flourishing market . ASEAN will reduce its heavy dependence on China .FTA can be extended to service sector anjd whose dialogues are in process . Between 1997 and 2006 China's free trade with ASEAN increased from 3.7 to 11.4 per cent whereas for India, it is 1 to 1.6 per cent. So India has huge potential to raise its trade with ASEAN due to this FTA . ASEAN is India's 4th largest trading partner after the E.U., USA and China. The FTA with ASEAN will lead to closer economic integration. Prospect $ 3.3 US billion fisheries export to various ASEAN members due to its geographical advantage, less freight charges, commonality of consumables and less stringent measures.

The important weaknesses and threats anticipated include exchange rate fluctuations- huge with ASEAN countries ,huge difference in productivity, labour cost and inputs, dumping of 177 species of fish from Thailand and Vietnam. comparative advantage in farmed shrimp in countries like Thailand and Vietnam, ornamental fish from Singapore and Malaysia and yellow fin tunas from Indonesia. There exist huge amount of subsidies by ASEAN – India hardly 0.5 per cent. The imports of cheaper varieties will result in crash of prices which may forcing fishers to give up fishing. The FTA is likely to permit zero tariff imports of sardines, mackerels, anchovies and crabs.It is also feared that cheaper imports of local popular varieties will spell doom to fishing communities. The sector that is going to be hit worst is fisheries - particularly artisanal fishing which will be unable to compete with the factory fishing carried out by such countries as Thailand. There is a fear that new forms of trade barriers (251 notifications) by ASEAN will further dampen trade. Further liberalisation in fisheries sector to increase trade will precipitate debt trap and related problems of the fishing community

The Possible impact of ASEAN agreement was analysed on different stakeholders/resources
1.Consumers
2. Exporters
3. Processors
4. Resources
5.Primary stakeholders
6.Market functionaries

1 Impact on consumers

The consumer will in a way be benefited by the FTA on account of ensuring year round availability, price stabilization and affordability providing commodity diversification, meeting taste and preferences, parity on demand and supply and thereby enhancing nutritional security. The results of impact analysis from consumers are presented in Table 30.2 The impact study revealed that free trade agreement leads to year round availability of fishes which was opined by 204 out of 240 consumers (85.2 per cent) and 75.2 per cent of consumers ensured that there will be price stabilization and affordability in the fish market due to free trade agreement. 63.2 per cent of consumers responded that free trade agreement helps to commodity diversification of fishes.

Table 30.2 : Impact analysis of fish consumers

Impact factors	Response (Per cent)
Parity on demand and supply	102 (42.5)
Price stabilization and affordability	180 (75.2)
Providing commodity diversification	152(63.2)
Meeting taste and preferences	78 (32.5)
Ensuring year round availability	204 (85.2)
Enhancing nutritional security	84 (35.2)

2 Impact on exporters

ASEAN with 600 million people against India's billion plus presents a substantial opportunity for Indian exporters and businessman. The ASEAN free trade will provide with an opportunity to reap in the export economies of scale through the timely and incessant availability of raw materials thereby Increase export domain and realm of operations. The ASEAN provides additional market access to Indian exporters and opportunities for new investment. In addition the expected increased volume of trade will provide gainful direct and indirect employment in sector. There also exist possibilities of outsourcing products from overseas at competitive prices from the ASEAN members. In the short run due competitiveness, processors will start to strengthen their plants by producing value added products and improve quality for their products. The results of impact analysis from exporters and processors are presented in Table 3 and 4. 45 exporters out of 50 exporters (90.0 per cent) opined that there would be more export economics of scale due to free trade agreement. 89.0 per cent of exporters agreed that free trade agreement leads to timely and incessant availability of raw materials. 75.0 per cent of exporters felt that free trade agreement would increase export domain and realm of operations related to fish exports. (Table 30.3)

Table 30.3 : Impact analysis of fish exporters

Impact factors	Response (Per cent)
Reaping export economics of scale	45 (90.0)
Increase export domain and realm of operations	37 (75.0)
Timely and incessant availability of raw materials	44 (89.0)
Additional market access to Indian exporters	28 (56.0)
Opportunities for new investment	15 (30.0)
Providing gainful employment 1 tonne – 200 mandays	33 (65.0)

3 Impact on processors

The impact study of processors revealed that there would be Higher capacity utilization of processing plants due to free trade agreement.(92 per cent) and 85.0 per cent of the processors agreed that there would be more economics of scale. 75.0 per cent of (37 processors) opined that free trade agreement leads to direct and indirect employment in sector. (Table 30.4)

Table 30.4 : Impact analysis of fish processors

Impact factors	Response (Per cent)
Higher capacity utilization of processing plants	46 (92.0)
Economics of scale	43 (85.0)

Outsource products from overseas at competitive prices from the ASEAN members	26 (53.0)
Direct and indirect employment in sector	37 (75.0)
Due to competitiveness, processors will start to strengthen their plants by producing value added products and improve quality for their products	25 (50.0)

4 Impact on resources/environment

The marine fisheries sector in India is stagnating with marine fish landings over the period of years shows depletion of resources. The over fishing in India has lead to the depletion of fishery resources which in turn affect environment. With this agreement, importing such depleting items from ASEAN countries would reduce negative impact on environment. Also there exists the possibility of "Fishing holidays" to replenish and rejuvenate fisheries stock and to avoid negative environmental impact. During these period import can be done to meet local demand.Impact on environment was studied based on Kerala's fisheries production over the period of years shows depletion of resources , over fishing in India leads to depletion of fishery resources which in turn affect environment, with this agreement, negative impact on environment would be reduced by importing such depleting items from ASEAN countries."Fishing holidays" to replenish and rejuvenate fisheries stock and to avoid negative environmental impact and during these period import can be done to meet local demand .

5 Impact on primary stakeholders

Impact on primary stakeholders was based on the fact that dependents for livelihood. Since 50 per cent of fishermen community (non mechanized and motorized) earn their livelihood from only 20-25 per cent of total catch. There exists high cost of fishing and decreasing CPUE (Catch Per Unit Effort) and geographical similarities between ASEAN and Kerala marine ecosystem leads to negative impact. The major countries like Thailand and Vietnam may dump 177 species of fish in the Indian market which will threaten livelihood security of fisherman and if the FTA allows Thai fishing vessels access the Indian territorial waters, it leads to over-fishing and the damage to fish stocks , Highly disorganized fish marketing systems where the price spread accounts to more than 40 per cent and fresh catch of anchovy, lobster, crab, sardine, mackerel, shark, shrimp and squid may be replaced by refrigerated cheap imports. Further liberalization of fisheries sector to increase trade will precipitate the problems of fishing community and cant stand the factory fishing of some of the ASEAN countries like Thailand and Vitenam

Bottlenecks in ASEAN agreement include agreement was only for trade-in-goods and did not include software and information technology and the rules of chances of Chinese fish into India through ASEAN isn't discussed and there exists a lack of clarity and over lapping in the negative list with respect to different processed form .And according to GATT agreement 24, it is mandatory for WTO signatories to open up trade. So products can't be maintained in the negative list for longer period.

The biggest apprehension exists with the primary stakeholders since 50 per cent of fishermen community (non mechanized and motorized) earn their livelihood from only 20-25 per cent of total catch are already suffering from increasing cost of fishing and

decreasing CPUE (Catch Per Unit Effort). The preset system of fish marketing is highly disorganized where the price spread accounts to more than 40 per cent. Fresh catch of anchovy, lobster, crab, sardine, mackerel, shark, shrimp and squid may be replaced by refrigerated cheap imports. Further liberalization of fisheries sector to increase trade will precipitate the problems of fishing community. (The Hindu, 2009). It will be also difficult for the traditional sector to coup up with the factory fishing of some of the ASEAN countries like Thailand and Vietnam. Primary stakeholders fear that free trade agreement leads to distress sale due to low volumes.

Case study of sardine was conducted in Kochi. Comparison of landing centre price and export price of sardine revealed that landing center price of sardine was Rs. 15 per kg and export price was Rs. 17.5 per kg. So landing center price was competitive than export price Fears and apprehensions of primary stakeholders about Indo-ASEAN free trade agreement are only illusion and there would not be any negative impact due this agreement. In addition quality, freshness and timely availability will add to the advantage. Finally fishermen are not at a loss due to free trade agreement. The details are presented in Table 30.5.

Table 30.5 : Comparison of landing centre price and export price of sardine

Item	Price (Rs/kg)
Landing center price of sardine	15.0
Export price	
1. Price of sardine	5.0
2. Freight charges	7.5
3. Other charges (transportation/ processing/value addition/ berthing)	5.0
Total export price of sardine	17.5

6 Impact on market functionaries

Market functionaries will be having an added advantage of reaping in market economies of scale. The import of fish into the country is to provide ample opportunities in marketing and improving the market structure.

Conclusion:

ASEAN agreement is not a myth but a stark reality. The Agreement provides an array of business opportunities that will brighten the economic sentiment of the ASEAN business community. The expected trade is to the tune of $ 60 billion by 2011-12. It is important to note that China has already an FTA with ASEAN, perhaps on more favourable terms. By this FTA, India, though not by way of competition, will have access to this flourishing market. In addition it is anticipated that the free trade agreement will reduce ASEAN's heavy dependence on China. The Free Trade Agreement will be extended to the service sector whose dialogue are in progress and is expected to have its take off by December 2011

The strategies which were cited include **p**rovision of Minimum Support price for fish species, possibilities of an anti- dumping duty ,siphoning off positive terms of trade from other sectors to fisheries to create investment opportunities. micro losses for macro gains . Increasing investment to create multiplier effects and periodic monitoring and evaluation of negative list/ highly sensitive list

iv. Ecolabelling and certification

The sustainable fishery management certification, labelling of fish and sea food products, allowing consumers to use their choice and buying power to select eco-labelled products are innovative approaches necessary for the marine fishing industry to survive in the future. These arrangements will provide a driver for generating a market incentive for the products. An "ecolabel" is a label which identifies overall environmental preference of a product or service within a specific product / service category based on life cycle considerations. The International Organization for Standardization (ISO) has identified three broad categories of Voluntary Environmental Performance Labels, with Ecolabelling fitting under the Type-I designation. Type-I clarified environmental labels as a voluntary, multiple criteria based, third party programme that awards a license that authorizes the use of environmental labels on products indicating overall environmental preferability of a product within a particular product category based on life cycle considerations. Ecolabelling although not yet become an established trade measure, may impact Indian seafood trade in the near future with consumer preference and better prices in overseas markets. Indian fish production and trade sectors may be able to reap the benefits with ecolabelling gaining importance in the International trade arena due to its subsistence nature and ecosystem conservation measures.

Country Of Origin (COO) is the country of manufacture, production, or growth where an article or product comes from. From a marketing perspective, country of origin is a way to differentiate the product from the competitors. The country of origin has an impact on consumers' quality perceptions of a product, as well as ultimately preference for and willingness to buy that product. The concept of country of origin had been a long pending boon for the Indian fisheries products. There occurs significant re-exports from South East Asian countries and China into the US and European markets .The country of origin clause and the catch certificate indicating the region form where it is being caught will potentially benefit the Indian products in the international market

Limitations

(i) Unsustainable fishing practices

Even though our capture fisheries production has increased over the years, overexploitation and targeted fishing led to declining catch trends in most of the west coast states like Maharashtra and Gujarat and stagnating catch levels of demersal resources in Kerala. The increased export demand led to the targeted fishing of varieties like shrimps, cephalopods, pomfrets etc and decline in their landings. In addition, destructive fishing methods like trawling and use of engines with huge capacities contributed to the depletion in the stock of certain resources. In addition losses due to bycatch, discards and juvenile fishing are other major factors limiting the sustainability of fish production in the country. Eventhough the situation has not reached an alarming level, unless the fishery is

conserved through following responsible fishing practices it will become a serious threat to the fish production and trade in the country.

(ii) Technological constraints in aquaculture/ mariculture

Eventhough the aquaculture sector is expecting a boom with introduction of disease tolerant *vannamei*, it also faces several technological constraints like deficiency in supply of quality seeds, lack of expertise in hatchery and farming practices, shortage and high cost of labour, costs for pollution abatement and other environmental requirements, social risks and market failure. In the mariculture sector also there are several limitations like absence of proper water leasing policies in most of the states, suitability to different locations, shortage of trained manpower, risks due to environmental variations and climate change, poaching and huge investment costs.

(iii) Continued trade impediments

The stringent measures set by WTO and also by private retailers at international market for social and environmental purposes like protection of labour rights, elimination of child labour, environmental pollution , ecosystem/resource conservation etc affect our sea food trade in the future which may require reorientation of our capture and culture fisheries production and trade sectors through macro level policies. In addition, the implementation of IUU Regulations may adversely affect our exports from capture fisheries sector at least in the short run because of it being open access and unregulated. Uncertainty in prices in the international market with economic recession spreading to most of the target markets lead to delay in payments, loss in revenue and delay in realizing new markets. The uncertainties in prices often lead to additional cost of storage and delayed shipments and increased demurrages.

There is widespread concern in exporting countries about the impact of the new traceability requirements introduced in 2010 in major markets to prevent Illegal, Unreported and Unregulated (IUU) fishing. The FAO Conference of the Agreement on Port State Measures also has given approval to prevent, deter and eliminate IUU fishing. This has got serious implication in the Indian seafood trade as the marine capture fishery in the country is primarily open access and regulations exist only in the form of seasonal bans and mesh size regulations. Elimination of IUU fishing requires imposing regulations in capture fisheries sector for product acceptance in global markets. Regulating the capture fisheries sector in the country is a difficult task and may raise serious several issues from nature of regulations, ownership rights and on transaction costs of implementation.

(iv) Poor market information systems

The lack of market and product information leads to demand and supply constraints. The taste and preference of the buyers are ever changing that it becomes difficult to cope up with their demand. Often the demand for the product forms changes with income and seasons. On the supply side, the awareness on ecolabelling, catch certificate and numerous trade regulations and quality standards becomes important. The lack of proper market intelligence and poor market news leads to lag in equipping the seafood traders. In addition, lack of proper forward and backward market linkages in both capture fisheries and aquaculture sectors affects the efficiency and viability of most of the exporting firms

through low capacity utilization, high costs of procurement, storage, transport and processing.

Based on the SWOL analysis, the value chain interventions for profitable and sustainable seafood marketing is depicted in the flow diagram (Figure 8). The flow diagram indicates three levels of interventions viz., procurement of raw material, product development, and market capitalization. All these interventions require concerted efforts in the different constituents of the value chain. The value chain also suggests harnessing the potential of domestic markets on account of higher purchasing power and willingness to pay for some of the exportable species in the domestic market.

Conclusion

The marine products exports from India continue to surge up new heights and unabated by global recession. During 2011-12 the quantum of exports surpassed 8.10 lakh tonnes with a forex earning of 2.85 billion dollar. the appreciation of the Indian rupee hasn't much affected the export earnings. The reason for the sustained increase in export is due to the demand for raw fish rather than value added products from the retail outlets as the buyers opted for cheaper fish on account of lower income and increasing unemployment. Nevertheless, being a heavy export earner the fisheries sector is facing numerous problems on account of economic shortcoming, technical constraints, institutional limitation, trade restrictions and marketing lacunae. Severe competition exists between the different competitors like Thailand, China and South East Asian countries for sustaining the market share by product diversification. The sea food industry in many countries are undergoing a rapid change to process more and more "ready to cook" and "ready to eat" in convenient packs. India's predominant position in shrimp market is being eroded due to the sudden spurt in farmed shrimp production in china, Indonesia, Thailand, Vietnam etc. the problems were again complicated with the restriction placed by USA through imposition of antidumping duties which has been discussed at length in the appellate body but continues to haunt the export industry . Situations aren't rosy with European Union countries with changing quality standards and cases of rejection and alerts. The SWOL analysis of the Indian export sector reveals that it had confronted the asymmetric trade opportunities impressively while competing in the world market impressively and poised for a million tonne export and four billion dollar revenue earnings in the near future .

In the wake of an emerging domestic market the export policy framework for efficient and sustainable seafood markets integrating domestic markets is required.

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31

Biodiversity issues in the trade of Wildlife fauna and Flora-The way forward in the Indian context

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Introduction

Biodiversity is defined as the variability among living organisms from all sources including iteralia terrestrial, marine and other aquatic systems and the ecological complexes of which they are part (CBD). It means the variability of biological resources from genes to ecosystems. Three major components of this diversity are species diversity, ecosystem diversity and genetic diversity. A clear distinction has to be made between biological diversity and biological resources. A biological resource is a given example of a gene, species or ecosystem. From the definition it may be clear that biodiversity is a complex because of diversity is multidimensional and involves several components. The CBD seeks the goal of (i) the conservation of biological diversity (ii) sustainable use of its components (iii) the fair and equitable sharing of the benefits arising from the use of genetic resources. Determining the priorities for conservation of the biological resources, a thorough knowledge about diversity is essential.

Fishes and marine organisms in the ecosystem provide number of ecosystem goods and services to humans. Fish serve as food, medicine, ornamental purposes and used for recreational purpose also. The fauna and flora of marine ecosystems provides services such as water and air purification, seed dispersal, flood control, shoreline protection, nutrient cycling, waste decomposition and transformation. Ecosystem services are directly related to biodiversity present in the natural system. The abundance or depletion of a species from the system eliminates the ecosystem services that species provides.

Marine Biodiversity of India

India is blessed with vast regions of mangroves along the coast of West Bengal, Orissa, Andhrapradesh, Tamilnadu, Maharashtra, Gujarat and the Andaman islands with a total area of about 682000 ha. Coral reefs are found in the Gulf of Kutch along the Maharashtra coast, Kerala coast, in the Gulf of Mannar, Palk Bay, the Wadge Bank, the Tamilnadu coast and around the Andaman and Lakshadweep islands. These regions support very rich fauna and flora and constitute rich and varied floral and faunal assemblages. The coastal areas all along the country's coastline are rich in biodiversity. Most of these regions face grave threats due to increasing human intervention characterized by pollution, deforestation. indiscriminate exploitation, dredging quarrying and other activities\ leading

to environmental degradation, which in turn affects biodiversity. After the 1992 Rio UN Conference on Environment and Development (UNCED), increasing attention is being paid to protect biodiversity all over the world. The ability to address the needs of biodiversity conservation and protection depends largely on the knowledge of taxonomy of the flora and the fauna constituting the biodiversity the species interactions and ecology. In order to achieve improved returns while protecting the environment, a suitable policy needs to be formulated to exploit the resources on sustainable levels, to extract the drugs indigenously, basically for domestic use and for limited export. There is a natural urge for intensive exploitation of exportable commodities, but the country cannot lose sight of the need to protect biodiversity and meet domestic requirements in its bid to increase foreign exchange earnings.

The Government of India has brought into force a number of laws for conservation of living organisms and their habitats. There are several species of sponges and gorgonids occurring along the Indian coast which yields chemical compounds of economic importance. Indian Wild life Protection Act, 1972 with its subsequent amendments accords the protection to all the marine mammals, five species of marine turtles, 50 species of molluscs, ten species of elasmobarnchs, all species of seahorses, holothurians, gorgonids and corals. Various Marine Fisheries Acts (MFRA) were enacted by the maritime states of the country under a government of India order in 1979 aims to safeguard the marine resources through craft and gear regulation and licensing of fishing activity. Also the state governments impose ban on trawling lasting two months during monsoon to protect spawners and juveniles.

International trade of Wildlife

International trade of wildlife is estimated to be worth billions of dollars which involves live animals, plants and a vast array of wild life products derived from them. Some of the animal and plants are heavily exploited for the high trade in them, faces natural problem of habitat loss, depletion of population leads to extinction of the species. Some of the species are not endangered now, but existence of an agreement to ensure the sustainability of the trade is important to protect these resources for the future generations. The WTO and other agreements increase the international trade of many biological resources including the fishery resources during the last decade. At the same time there are several international organizations and conventions which control the international trade of vulnerable and endangered species to avoid biodiversity loss which ends in the extinction of the species. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between government and it aims to ensure the international trade in species of wild animals and plants dose not threat the survival.

As the trade in wild species cross borders between countries, the effort to regulate it requires international co-operation and CITES was formed for such co-operation. CITES was formed as a result of resolution adopted in 1963 at a meeting of members of IUCN (International Union for the Conservation of the Nature). On 1 July 1975 CITES entered in force and it has become one of the largest conservation agreements with membership of 175 countries. CITES is essentially an international agreement to which countries adhere voluntarily. States have agreed to be bound by the convention are known as parties for implementing the convention and it does not take the place of national laws. It provides a frame work to be respected by each party which has to adopt its own domestic legislation to ensure that CITES is implemented at the National level.

How CITES works

CITES works by controlling the international trade in specimens of selected species to certain controls. All export, import, re-export and introduction through a system of licensing. Each party of the convention must designate Management Authorities for licensing system and Scientific Authorities to advise them on the effects of trade on status of the species. The species covered by CITES are listed in three Appendices according to the degree of protection they need. About 35000 species were listed under the three appendices of CITES (Table 1).

Appendix I: Includes the species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
Appendix II: Includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization in compatible with their survival.
Appendix III: This Appendix contains species that are protected in at least one country, which has asked other, CITES parties for assistance in controlling trade.
The Conference of Parties (CoP) which is the supreme decision-making body of the convention and comprises all the member countries. They have agreed in resolution on a set of biological and trade criteria to help determine whether a species should be included in the Appendices I or II or III. Parties submit proposals based on those criteria to amend these two appendices. Those amendment proposals are dismissed and then submitted to vote. A specimen of CITE –listed species may be imported or exploited (re-exploited) from a country party to the convention only if the appropriate export/import permit has been obtained and presented for clearance at the part of entry or exit. There are some variations of requirements from one country to another and it is always necessary to check as the national laws that may be strict, but basic condition that apply for appendices I, II and III.

The CITES Species

About 5000 species of animals and 29000 species of plants are protected by CITES against overexploitation through international trade. The species are grouped in the appendices according to how threatened they are in international trade. They include some whole groups, such as primates, cetaceans (whales, dolphins and porpoises), sea turtles, parrots, corals, fishes (Table 2) and orchids. But in some cases only subspecies or geographically separate population of species is listed. Any type of wild plants or animal may be included in the list of species protected by CITES and the range of wildlife species included in the Appendices extends from leeches to lion and from pine trees to pitcher plants. Organism like bears and whales are the better known examples of CITE species and most numerous groups include many less popular plants, mussels, frogs, corals and sea cucumbers (Table 3).

Non-Detriment Findings

CITES scientific Authorities of exporting countries and sometimes also from importing countries are continually challenged to determine whether a particular export will be detrimental to the survival of a species and define which information and parameters are relevant to determine this. Hence it is important to provide some basic criteria and guidelines, and well documented methodologies to facilitate the formulation of Non-Detrimental Findings (NDF) to make more complete and scientifically sound information are required to implement the convention.

NDF for the European Eel

The European eel (Anguilla anguilla) showed decline from the late 19th century due to overfishing, migration obstacles, turbine mortalities, persistent pollutants, fluctuations in ocean currents and general decrease in accessible growing areas. The eel has now become red listed as CR (critically endangered) internationally since 2008. It was listed in Appendix II species by CITES from March 2009.

Back ground information on the taxa needed for NDF are

1. Biological data
2. Species management within the country for which case study is being presented
3. Utilisation and trade for range state for which case study is being presented.

It includes all aspects of distribution, biological characteristics, population and conservation status. Data on life history characteristics of the species, habitat types, role of species in its ecosystem, global population size, global and national conservation status and main threats within the states are essential for NDF. Species management aspects like history of management, purpose of management, restoration measures and harvest details also needed for better NDF (Table 4).

After concluding an initial NDF during 2008 it was decided that trade within EU will not influenced directly by CITES listing but to be allowed to export to third countries i.e. outside E U, or between non-EU countries on NDF has to be found – a scientifically based permit stating that the specimens was legally obtained and that export will not be detrimental to the survival of the species. Detailed data on the population of *Anguilla anguilla* are scarce today and European Union regulation demands much more data to be collected not only on biology and trends but also concerning fishing efforts and trade.

Biological characteristics: Basics of life history characteristics indicate the likely sensitivity of a species to harvest. For example the K-selected species with a high intrinsic rate of increase are likely to be less risk from harvest than R- selected species which mature slowly and have low reproductive rates.

Ecological adaptability: Ecological adaptability indicates the likely sensitivity to harvest and encompasses factors such as the species breadth of habitat use, dietary breadth and environmental tolerance. These factors are divided into the broad categories of generalists and specialist. Generalist can switch prey or habitat types relatively easily and are likely to be less affected by disturbances in their range than specialists occupy a narrow ecological niche. A specialist with a low level of ecological adaptability is somewhat more likely to be negatively impacted by harvest for the trade than generalist. For example, a given predator population at the top of food chain is likely to be more sensitive to harvest than a given herbivorous population lower in the food chain.

Dispersal efficiency: Species which have mechanism that ensure a wide dispersal of individuals during some part of their life history may be less susceptible to effects of harvest than similar species. Large number of marine organisms depends on the dispersal of large number of widely distributed planktonic larvae and so many are able to re-colonise habitats from which the more sedentary adults have been overfished.

Interaction with humans: The tolerance of a species to human activity may indicate its likely sensitivity to effects of harvest. Species mostly tolerant of human intervention are also likely to be least affected by the harvest. Pests, which people have difficulty in eradicating and commercial species that benefit from the spread of human

induced environments such as agricultural are likely to be least sensitive to harvest. For example modified habitats in oil palm plantations in Indonesia support much higher populations of rodent prey and consequently of blood pythons than an equivalent natural habitat.

National status: The pattern of distribution of a species provides some indication of a species sensitivity to harvest. Wide spread species with a continuous distributions at the national level are likely to be less sensitive to harvest. Population fragmentations may leads to sub-populations, adapted to a specialized habitat are not viable for effective harvest. Species occur in a few locations at the national level could be particularly at risk from unmanaged harvest.

Harvest management: The total harvest of the population at the national level must be estimated assessing both unmanaged and illegal off-trade. Illegal harvest some assessment has to make to get an idea about illegal trade-off.

CITES in India

International trade in all wild fauna and flora in general, and the species covered under CITES is controlled jointly through the Wild life (Protection) Act 1972, Amendment Act, 2002, the Foreign Trade (Development regulation) Act 1992, the Foreign Trade Policy of Government of India and Customs Act, 1962. The Director of Wildlife Preservation, Government of India is the Management Authority for CITES in India. Import of animals and their parts and products for zoological parks and circuses or for research may be permitted subject to the provisions CITES and on the recommendations of the Chief Wildlife Warden of the States and Union Territories under license from Director General of Foreign Trade (DGFT). Import of wild animals as pests in the personal baggage of a passenger is also subject to the provisions of CITES in accordance with the Ministry of Commerce's rules. All imports and exports of wild animals including marine species and plants are permitted only through the Customs points at Mumbai, Kolkata, New Delhi, Chennai, Cochin, Amristar and Tuticorin according to the rules (Table 5). Two essential conditions governing the import and export of Wildlife and the derivatives are (i) compliance with the provisions of CITES (ii) inspection of the consignments by the Regional Deputy Directors of Wildlife Preservation at the Customs points. In case of items covered under CITES, an endorsement is made on the relevant CITES export permit. All marine species that have been included in the Schedules of the Wild Life (Protection) Act, 1972 are not permitted for export. All Holothurians are included in the Schedule 1 of Wild Life (Protection) Act, 1972.

Authorities of CITES

India is a signatory to CITES since 1976. The Additional Director General (Wildlife) cum Director, Wildlife Preservation, MOEF, Government of India is the Managing Authority, CITES India. Scientific authorities deal with the CITES related matter in the Country are Directors of zoological, botanical, marine and wildlife Institutes of India. Considering the seriousness of organized wildlife crime having an inter-state and international ramification and illegal trade of the Wildlife and products, the Wildlife Crime Control Bureau was created in 2007 under the provisions of the Wildlife Protection Act 1972. The Wildlife Crime Control Bureau, Head quarters at New Delhi and regional offices at New Delhi, Kolkata, Mumbai, and Chennai. The enforcement of CITES provisions is presently being carried out by the Customs officials and Regional Deputy Directors, Wildlife Crime Control Bureau through the Customs Act, 1962 at the point of import/export and by the State Wildlife Departments headed by Chief Wildlife Wardens under Wildlife (Protection) Act, 1972.

Table 31. 1 Number of species and subspecies included in the appendices of CITES

Organisms/appendices	Appendix I	Appendix II	Appendix III
Mammals	297 species 23 sub species	492 species 5 subspecies	44 species 10 sub species
Birds	156 species 11 subspecies	1275 species 2 subspecies	24 species
Reptiles	76 species 5 sub species	582 species	56 species
Amphibians	17 species	113 species	1 species
Fish	15 species	81 species	-
Invertebrates	64 species 5 subspecies	2142 species 1 subspecies	22 species 3 subspecies
Plants	301 species 4 subspecies	29105 species	119 species 1 subspecies
Total	926 species 48 subspecies	33790 species 8 sub species	266 species 14 subspecies

Table 31. 2 List of fish species in the CITES appendices

Appendix I	Appendix II	Appendix II
	Cetorhinus maximus (Basking shark)	
	Carcharodon carcharias (Great white shark)	
	Rhincodon typus (Whale shark)	
Prsitida spp. (Saw fishes)		
	Pristis microdon (Saw fish)	
	Acipenseriformes spp. (Paddle fishes and sturgeons)	
Acipensor brevirostrum (Sturgeons)		
Acipenser sturio (Sturgeons)		
	Anguilla anguilla (Eel)	
Chasmistes cujus (Cui-cui)		
Probarus jullieni (Blind carp)	*Caecobarbus geertsi*	
Scleropages formosus	*Arapaima gigas*	
	Cheilinus undulates (Napoelon fish)	
Totoaba macdonaldi		
Pangasianodon gigas (Pangasid catfish)		
	Hippocampus spp.	
	Neoceratodus forsteri	
Latimeria spp.		

Table 31.3 List of Sea cucumbers and corals in the CITES appendices

Appendix I	Appendix II	Appendix II
Sea cucumbers		
		I*sostichopus fuscus*
Corals		
	Antipatheria spp. (Black corals)	
		Corallium elatus
		Corallium japonicum
		Corallium konjoi
		Corallium secundum
	Helioporidae spp. (Blue corals)	
	Scleractinia spp. (Stony corals)	
	Tubiporidae spp. (Organ-pipe coral)	
	Milleporidae spp. (Fire corals)	
	Stylasteridae spp. (Lace corals)	

Table 31. 4 Format for evaluation to assess the Non-Detriment Findings

Question Number	Question Category	Question	Responses 1 to 5
2.1	Biology	BIOLOGY-Life history	
2.2		BIOLOGY-Niche breadth	
2.3		BIOLOGY-Dispersal	
2.4		BIOLOGY-Human tolerance	
2.5	Status	STATUS- National distribution	
2.6		STATUS-National abundance	
2.7		STATUS- National population trend	
2.8		STATUS-Information quality	
2.9		STATUS-Major threat	
2.10	Management	MANAGEMENT- Illegal off-take	
2.11		MANAGEMENT- Management history	
2.12		MANAGEMENT- Management plan	

2.13		MANAGEMENT- Aim of harvest	
2.14		MANAGEMENT- Quotas	
2.15	Control	CONTROL- Harvest in PA	
2.16		CONTROL-Harvest in strong tenure	
2.17		CONTROL-Open access harvest	
2.18		CONTROL-Confidence in harvest mgt	
2.19	Monitoring	MONITORING-Monitoring method	
2.20		MONITORING-Confidence in monitoring	
2.21	Incentives	INCENTIVES-Effect of harvest	
2.22		INCENTIVES-Species conservation incentives	
2.23		INCENTIVES-Habitat conservation incentives	
2.24	Protection	PROTECTION-Proportion protected from harvest	
2.25		PROTECTION-Effectiveness of protection	
2.26		PROTECTION-Regulation of harvest	

Table 31. 5 List of marine species and their export status in India

Item	HS CODE	Export policy	Nature of restriction
Marine species and products except the following	0300 00 00	Free	Subject to pre-shipment quality inspection as many be specified by the Government through notification
(a) those species (and their parts products and derivatives) mentioned in the Schedules of the Wildlife (Protection) Act, 1972	0300 00 00	Prohibited	Not permitted to be exported
Fresh or Chilled or Frozen silver pomfrets of weight less than 300 gm	0302 69 30 0303 79 50	Restricted	Export permitted under license
Beche-de-mer	0303 79 99	Prohibited	Not permitted to be exported irrespective of its size
Lobsters except undersized rock lobster and sand lobster			
Panulirus polyphagus 300 gm as whole chilled live or frozen, 250 gm as whole cooked; 90 gm as tail	0306 11 00 0306 21 00	Prohibited	Not permitted to be exported
Panulirus homarus 200gm as whole live, chilled or frozen, 170 gm as	0306 11 00 0306 21 00	Prohibited	Not permitted to be exported

whole cooked, 50 gm as tail			
Panulirus ornatus 500gm as whole live/chilled or frozen; 425 gm as whole cooked; 150gm as tail	0306 11 00 0306 21 00	Prohibited	Not permitted to be exported
Thenus orientalis 150 gm as whole; 45 gm as tail	0306 12 10 0306 12 90 0306 22 00	Prohibited	Not permitted to be exported

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32

Ecolabelling in Fisheries: Boon or Bane in improving trade?

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Introduction

This document is a collation of information, mainly from FAO documents on fisheries ecolabelling (FAO, 2001; Sainsbury, 2010; Washington andAbabouch, 2011). Fish is one of the most highly traded commodities in the world, and as a natural resource, there is worldwide concern about long-term sustainability of the resources. Ecolabels are a new and growing feature of international fishtrade and marketing. They have emerged in the context of increased demand for fish and seafood, and a perceptionthat many governments are failing to manage the sustainability of marine resourcesadequately.Many mechanisms to ensure the sustainability of fish stocks have been introduced byinternational bodies which are binding on national governments. These include:

- The United Nations Convention on the Law of the Sea (UNCLOS) (1982);
- The FAO Code of Conduct for Responsible Fisheries (the Code) (1995);
- The United Nations Fish Stocks Agreement (1995); and
- Various regional fisheries management organizations (RFMOs).

The RFMOs facilitate international cooperation at the regional level for theconservation and management of highly migratory and straddling fish stocks. At thenational level, governments are attempting to embed the principles and goals of theCode – now in its second decade of implementation – into their national fisheriesmanagement policies (FAO, 2009a). However, they are having varying degrees ofsuccess. Disappointment with the pace of regulatory measures to curb overfishing and toimprove fisheries sustainability has led environmental groups to develop alternativemarket-based strategies for protecting marine life and promoting sustainability. Theseprivate market mechanisms are designed to influence the purchasing decisions ofconsumers and the procurement policies of retailers selling fish and seafood products,as well as to reward producers using responsible fishing practices. Ecolabels are onesuch market-based mechanism.

The FAO Guidelines for the Ecolabelling of Fish and Fishery Products from MarineCapture Fisheries state that voluntary standards, including environmental standards,should not distort global markets and should not create unnecessary obstacles tointernational trade. Under the general principles and definitions, they state that anyecolabelling scheme should be consistent with inter alia the World Trade Organization(WTO) rules and mechanisms.

What is an Ecolabel?

Ecolabelling is a market-based tool to promote the sustainable use of naturalresources. Ecolabels are seals of approval given to products that are deemed to havefewer impacts on the environment than functionally or competitively similar products. The ecolabel itself is a tag or label placed on a product that certifies that the productwas produced in an environmentally friendly way. The label provides information atthe point of sale that links the product to the state of the resource and/or its relatedmanagement regime.Sitting behind the label is a certification process. Organizations developing andmanaging an ecolabel set standards against which applicants wishing to use the labelwill be judged and, if found to be in compliance, eventually certified. The parentorganization also markets the label to consumers to ensure recognition and demandfor labelled products. The theory is that ecolabels provide consumers with sufficientinformation to enable them to recognize and choose environmentally friendly products.

A range of ecolabelling and certification schemes exists in the fisheries sector, witheach scheme having its own criteria, assessment processes, levels of transparency andsponsors. What is covered by the schemes can vary considerably: bycatch issues,fishing methods and gear, sustainability of stocks, conservation of ecosystems, andeven social and economic development. The sponsors or developers of standards andcertification schemes for fisheries sustainability also vary: private companies, industrygroups, NGOs, and even some combinations of stakeholders. A few governments havealso developed national ecolabels.

The first fisheries ecolabelling initiatives appeared in the early 1990s and were largelyconcerned with incidental catch, or bycatch, during fishing. For example, the "DolphinSafe" label was based on standards developed by the United States NGO EarthIsland Institute and is focused on dolphin bycatch in the tuna industry (rather than thesustainability of tuna stocks).

Marine Stewardship Council (MSC)

One of the first scientifically developed ecolabelling schemes, the MSC was set up by the WWF and Unilever in 1997, but hasbeen independent of them for more than ten years. The MSC is arguably the mostcomprehensive fisheries certification scheme in that it covers a range of species anddeals with all aspects of the management of a fishery. MSC sets the standard for the ecolabel throughits board, supported by a Technical Advisory Board.

The MSC has qualified formembership of the ISEAL (International Social and Environmental Accreditation andLabelling Alliance) as being consistent with its "Code of good practice forsetting social and environmental standards".The MSC has two standards: on "sustainable fishing" and on "seafood traceability".The MSC owns the standards against which independent third-party certifiers assessconformance. Its "Fisheries Assessment Methodology", and "standardized assessmenttree" focus on three pillars: independent scientific verification of the sustainabilityof the stock; the ecosystem impact of the fishery; and the effective management ofthe fishery. All three pillars are assessed on the basis of a range of indicators. Aspectsrelated to the species, the fishing gear used, and the geographical area, are all included inthe assessment. A study by Caswell and Anders (2009) concluded that it is the schememost often referred to in the seafood industry media, and has variously been describedas the "industry standard". Another recent study (MRAG, 2009) revealed that asignificant number of retailers and brand owners refer to the MSC in their seafoodsustainability procurement policies.

Some 150 fisheries around the world are engaged in some stage of the MSCassessment process (including pre-assessment) (MSC, 2009). Fifty-six fisheries haveso far been certified. The MSC claims to cover "about 7 per cent of the annualglobal wild harvest" of fish and seafood, accounting for 42 per cent of the global wildsalmon catch and 40 per cent of the global white fish catch. However, not all fish froma certified fishery will end up with the MSC label attached. The actual volume ofMSC-labelled product on the market as a proportion of overall traded fish productsis likely to be considerably less significant in terms of global trade. While there are norobust statistics on the proportion of MSC-labelled products on the global market,FAO estimates suggest that the volume of MSC-labelled products on the marketmay only be statistically significant in the context of specific European markets. Ina study carried out for FAO in 2007, Poseidon Ltd. estimated MSC products as thenaccounting for 0.3 per cent of globally traded seafood by value. Sales of MSC-labelledfish and seafood of an estimated US$1.5 billion is minor when seen against a fisheriescommodity market amounting to US$101 billion in global export sales (FAO, 2010).

As of late 2009, more than 2 500 MSC-labelled products were available on themarket (MSC, 2009); this is double the number (1 200) on sale at the beginning of 2008,and more than four times the number (600) available in early 2007,24 showing just howdynamic the market for certified fish and seafood is. Today, MSC products are sold in52 countries around the world.

Friend of the Sea

Friend of the Sea (FOS) has its origins in the Earth Island Institute. Set up in 2006, itsfounder is also the European Director of Dolphin Safe. It covers both wild and farmedfish and its criteria also include requirements related to carbon footprint and "socialaccountability". Certification is based on the sustainability of the stock, rather than whether thefishery is sustainably managed. Its certification methodology is based on existingofficial data in terms of stock assessment. Friend of the Sea says it will not certify stocksthat are "overexploited" (based on FAO definitions of levels of exploitation), fisheriesusing methods that affect the seabed and those that generate more than 8 per centdiscards. Certification is undertaken by independent third-party certifiers.Friend of the Sea claims to be "the main sustainable seafood certification scheme inthe world" covering some 10 per cent of the world's wild capture fisheries. It shouldbe noted that 80 per cent of the 10 million tonnes of landed FOS certified productfrom capture fisheries (8 million tonnes) comes from Peruvian anchovies. Again, itis unclear what proportion of that product ends up as labelled products for retail sale.There are about 600 FOS products (including fish oil and omega-3 supplements)sold in 26 countries28 and covering 70 species both from wild capture and aquaculture.

Marine Aquarium Council

The Marine Aquarium Council (MAC) was established in 1998 and by 2001 hadadopted a standard and process to certify the wild capture and subsequent treatmentof fish for the ornamental aquarium trade. In 2004, a standard forlive fish for human consumption was developed because many of the operators andcommunities involved with the aquarium trade are also involved in the trade of livefish for consumption. However, this standard for live fish for human consumptionwas not formally adopted by the MAC and no fisheries have been certified forthis trade.

Other NGO schemes

Other NGO-driven schemes include KRAV, a Swedish NGO that specializesin organic farming but which has recently developed a "standard for sustainablefishing" and Naturland

in Germany also with a background in certifying organicfarmed seafood but now with a "Scheme for the Certification of Capture FisheryProject", which includes social, economic and ecological sustainability criteria. Todate, Naturland has only certified one fishery (Nile perch from Buboka in the UnitedRepublic of Tanzania).

Fishing company in-house ecolabels

A few individual fishing companies have created their own ecolabels. For example,the Spanish group Pescanova, one of Europe's largest fishing companies, which fishesglobally and has interests in the processing sector, has created a logo that appears on alimited range of its packaged products. The logo states that the fish concerned has beencaught in a way that "preserves the aquatic and marine ecosystem for maintaining thequality, diversity and availability of fish resources for today and future generations".This in-house scheme claims to be based on the Code.

Fishing industry association ecolabelling schemes

The Japan Fisheries Association, an umbrella group for some 400 fishing companies,founded the Marine EcoLabel-Japan (MEL) in December 2007. The MEL operatesas a non-profit part of that association. It could be seen as a response to a developinginterest in ecolabelled fish and seafood in the Japanese market. Indeed the statedrationale behind the label was to "respond to the situation proactively and establishtheir own ecolabelling scheme, which is most suitable to the situation of the Japanesefisheries". As of January 2010, only three fisheries have been certified to the fledglinglabel. It is likely to have significance only in the Japanese market.

Public ecolabelling schemes

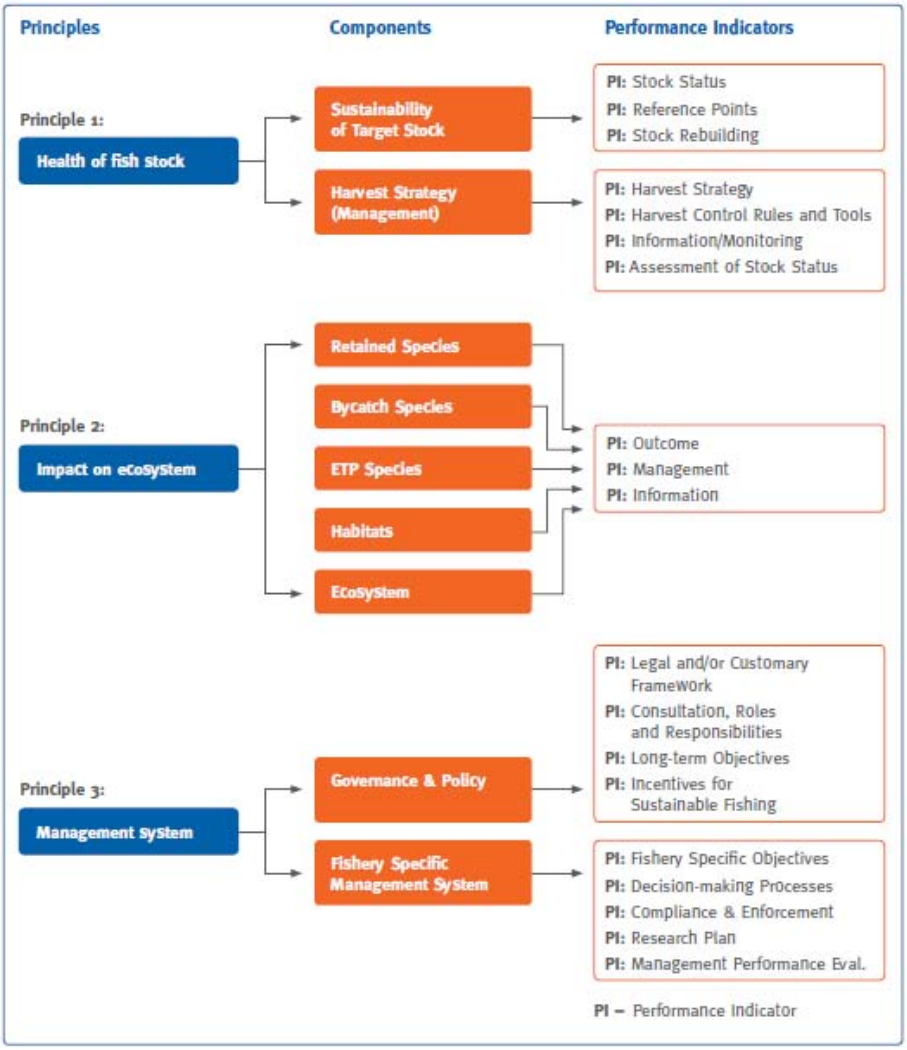
Recently, some public authorities, most notably the Government of France andIceland, have set up their own ecolabels.The Government of France has chosen to create its own national ecolabel and relatedcertification scheme. This decision was based on a feasibility study undertaken in2008 by the French authority, FranceAgriMer. As part of that process, it examinedexisting private ecolabels, including for consistency with the FAO Guidelines for theEcolabelling of Fish and Fishery Products from Marine Capture Fisheries. It concludedthat, of the existing ecolabels, only the MSC was fully compliant with those guidelines.However, it also concluded that the MSC model would not fit all fisheries. It decidedto adopt a public framework to meet the needs of its fishing industry as defined bythe feasibility study; a scheme that was less costly than the MSC, easily recognized by consumers, and onethat was consistent with the FAO guidelines but went beyond them with the inclusionof social and economic criteria.

The public label does not preclude the certification of French fisheries to otherprivate ecolabels. Indeed, certification to other labels has been encouraged; a number ofFrench fisheries are currently in assessment with the MSC.

Most of the descriptions provided in this document refers most often to the MSC and FOS, as the twoschemes that – on the basis of their international scope, the number of fisheries certifiedand the claimed volumes of certified fish and seafood products entering internationalmarkets – stand out as the most internationally significant private voluntary ecolabellingschemes.

Principles and Criteria for Sustainable Fishing of MSC

Fig. 32.1 Principles and Criteria for Sustainable Fishing of MSC



At the centre of the MSC is a set of Principles and Criteria for Sustainable Fishing which areused as a standard in a third party, independent and voluntary certification programme. These were developed by means of an extensive, international consultative process through which the views of stakeholders in fisheries were gathered.

These Principles reflect a recognition that a sustainable fishery should be based upon:

- The maintenance and re-establishment of healthy populations of targeted species;
- The maintenance of the integrity of ecosystems;
- The development and maintenance of effective fisheries management systems, taking into account all relevant biological, technological, economic, social, environmental and commercial aspects; and
- Compliance with relevant local and national local laws and standards and international understandings and agreements

MSC's Risk Based Framework

The MSC began work to develop suitable methodology toassess data-limited fisheries in 2005. A series of expert workshops and consultations wereundertaken. These led to the development of a set of risk-based tools referred to at the time asthe Guidance for the Assessment of Data-Deficient and Small-Scale Fisheries. In early 2008, apilot project commenced to test these tools using seven pilot fisheries from around the globe,resulting in the Risk-Based Framework (RBF).In February 2009, Version One of the RBF was released for public consultation andprovisional use by certifiers. Following this consultation and a subsequent final revision, theRBF was integrated into the MSC Fisheries Assessment Methodology (FAM), Version Two,and approved by the MSC Technical Advisory Board and MSC Board of Trustees for officialuse as of 31 July 2009.The RBF can now be used in any fishery assessment that uses the default assessment treein the FAM as its basis.

Criteria for FOS Ecolabel

Friend of the Sea Criteria are categorical in nature and based on the most restrictiveand worldwide acknowledged and accepted definition of 'sustainable fisheries'. On thismatter Friend of the Sea has taken in due consideration requests from stakeholders,such as NGOs and traditional and artisanal fisheries, for a more limitative definitionof 'sustainable fisheries'.

A Sustainable Fishery, of FOS is one that:

1. Does not insist on an overexploited, depleted or data deficient stock;
2. Has no impact on the seabed;
3. Has lower than average discard level;
4. Complies with all local national and international legislation
5. Apply a management system that assures the respect of above mentioned requirements.

An example of legal criteria of FOS is shown below.

4 – LEGAL CRITERIA: TAC, IUU, FOC and legislation

n°	Requirement	Level
	The fleet fishing the audited product must :	
4.1	Respect Total Allowable Catches (TACs), if in place. Last year's TAC has been respected or, in case it has not been respected, at least 2 out of the past 3 years TACs have been respected.	Essential
4.2	Include NO IUU (Illegal, Unreported, Unregulated) fishing vessels.	Essential
4.3	Include NO FOC (Flag Of Convenience) fishing vessels.	Essential
4.4	Respect national and international legislation, in particular legislation related to the reduction of the environmental impact of the fishery (such as, but not limited to: - vessel registration, - mesh size, - net size, - minimum size, - distance from the coast, - by-catch reduction measures, - no fishing on protected habitat - verify onboard equipment and absence of banned fishing gears and methods, chemical substances, explosives - log book if compulsory)	Essential

Price premium – myth or reality?

There is only spotty evidence of price premiums accruing to certified fish and seafood.Research by the URI Sustainable Seafood Initiative (Asche, Insignares and Roheim,2009) found price premiums at the retail level but acknowledged that this did notnecessarily imply that any premium would accrue to fishers. At the 2009 OECD/FAO Round Table, some participants reported, if not price premiums, then less pricevolatility at the ex-vessel stage of the supply chain. Often, this was related to moredirect supply relationships. The MSC's recent publication, Net Benefits (MSC, 2009),which describes the experiences of the first 42 fisheries to be certified, concludes thatthe main beneficiaries of price premiums have been smaller-scale artisanal fisheries (allin developed countries) selling into niche markets. The price premiums described areall associated with more secure supply relationships, either with restaurants or, to alesser extent, supermarkets.

Impact of Ecolabels on trade

It is difficult to estimate the volume of ecolabelled certified products on theinternational market. The MSC and FOS claim 7 per cent and 10 per cent respectivelyof world's capture fisheries – when put together they account for less than one-fifth ofwild capture product. It is certain that the real volume of traded ecolabelled productsis significantly less than that. Indeed, of the MSC's 6 million tonnes of seafood landedfrom certified fisheries, only about 2.5 million tonnes ends up carrying the MSC label(MSC, 2009). A significant proportion of FOS-certified fish goes into products such asfishmeal and fish food that will not end up as labelled products on supermarket shelves(although the farmed fish they feed may do). Other schemes in existence currentlycover fairly insignificant volumes of product.Overall, the market presence of ecolabelled products is likely to be modest, andsignificantly lower than the publicity surrounding such products would suggest (Washington andAbabouch, 2011).

Boon or Bane?

In a world in which the demand for fishery products are increasing in leaps and bounds, and the pressure on the natural resources are rising, ecolabelling appears to be a possible way to bring about a greater degree of control and sanity in the system. The increasing proportion of aquaculture in the production system for aquatic products is also being addressed by global organizations. Following on from its involvement in the certification of sustainable forestry (ForestryStewardship Council - FSC) and wild-capture fisheries (Marine Stewardship Council - MSC),the WWF has developed standards for aquaculture certification, with an emphasison eliminating the negative environmental and social impacts of aquaculture called the Aquaculture Stewardship Council (ASC). It hasorganized a range of round tables involving aquaculture producers, buyers, NGOsand other stakeholders in an attempt to develop standards for aquaculture certification. The first ASC certificate is expected to be issued in 2012.

A recent study evaluating the effectiveness of certified seafood showed that though there are debatable shortcomings, for a consumer, it is reasonable to buy certified seafood, because the per centage of moderately exploited,healthy stocks is 3–4 times higher in certified than in non-certified seafood (Froese and Proelss, 2012)

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Management of Indian Fisheries – Regulation and Compliance

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Introduction

Many management measures are already in place for the protection and conservation of the Indian fisheres resources. The Wildlife (Protection) Act, 1972 provides legal protection to many endangered and threatened organisms. Marine mammals, turtles, some of the sharks, fishes like the giant grouper and sea horse, corals, sea cucumbers, gorgonids, some of the molluscs etc. come under the Wildlife Protection Act and therefore there exists strict enforcement of rules against capture and possession of the protected animals.

It is widely quoted that the depletion is due to the introduction of trawler fishing techniques, which are scrape, the bottom of the sea and end up catching juvenile fish. A lot of research conducted by many fisheries research firms does not deny the fact that there is a definite threat to the fishing resources. In viewing this problem of over fishing (by the trawlers) as a negative externality to the traditional fishing community, the best way to internalize the social cost inflicted by the people who over fish is the question that this study attempts to seek the answer for. One of the most commonly practiced techniques to sustain the fisheries resource is the blanket ban on fishing during specific months of the year, like the one practiced in the coastal regions in India.

It will be appropriate to look in to the history of introduction of mechanised trawling before examining the reasons for depletion of fisheries wealth. Around 1890, trawler fishing developed in Europe and over the years this technology was transferred to India. The first two Five Year plans emphasised the need for an expanding fishery to provide an inexpensive protein source to improve the health of the Indian poor. (Salagrama, 2002). This was carried out by projects like the Indo– Norwegian programme in order to provide food for the masses and to boost the national economy, by stimulating the mechanisation of the fisheries sector. Initially, the mechanisation was in the form of motors, for the traditional crafts. However the government initiated development programs switched to European type boats small boats with in board motors, the so-called mechanised boats.

At the outset of mechanisation, the gear was still the same old gill nets but they were now nylon nets as opposed to the conventional cotton, hemp, and linen yarn. Later, the introduction of trawlers became prominent. This improvement in the gear and the vessels saw an increasing U.S and Japanese demand for the Indian prawn. The returns were impressive and this led to the introduction of mechanised vessels on a larger scale and

modernization of the indigenous crafts for the development of marine fisheries. These proved to be an important source of foreign exchange. The third Five-Year plan and the ones that followed shifted the focus from the development of fisheries to help the poor to increasing production for export (Salagrama, 2002).

It is well understood that any management measure should be directed towards sustainability of concerned resources. There is no doubt that a resource which is alarmingly declining has to be restored by adopting all the management measures including total ban. The vital issue is that realistic database should be available to consider a species or group to be included in the Schedule. The database on the different resources should be updated annually. Such a database will help in a long-term to evolve appropriate management measures. It is felt that the current management measures are adopted without a realistic and strong database regarding the status of the resources. Such types of management measures create lot of livelihood issues and hence will become redundant.

Code of Conduct for Responsible Fisheries

With this situation in mind, more than 170 Members of the Food and Agriculture Organization of the United Nations (FAO) adopted the Code of Conduct for Responsible Fisheries in 1995. The Code is voluntary rather than mandatory, and aimed at everyone working in, and involved with, fisheries and aquaculture, irrespective of whether they are located in inland areas or in the oceans. Because the Code is voluntary, it is necessary to ensure that all people working in fisheries and aquaculture commit themselves to its principles and goals and take practical measures to implement them. The Code of Conduct, which consists of a collection of principles, goals and elements for action, took more than two years to elaborate. Representatives from members of FAO, inter-governmental organizations, the fishing industry and nongovernmental organizations worked long and hard to reach agreement on the Code. It is therefore a result of effort by many different groups involved in fisheries and aquaculture. In this respect the Code represents a global consensus or agreement on a wide range of fisheries and aquaculture issues. Governments, in cooperation with their industries and fishing communities, have the responsibility to implement the Code. FAO's role is to technically support their activities but it does not have a direct responsibility for implementation because FAO does not have a responsibility for the development and implementation of national fishery policies. This is the sole responsibility of governments. Implementation of the Code will be most effectively achieved when governments are able to incorporate its principles and goals into national fishery policies and legislation. To ensure that there is support for these policies and legislative changes, governments should take steps to consult with industry and other groups to promote their support and voluntary compliance. In addition, governments should encourage fishing communities and industry to develop codes of good practice that are consistent with, and support, the goals and purpose of the Code of Conduct. These codes of good practice are another important way of promoting the implementation of the Code.

The Code advocates that countries should have clear and well-organized fishing policies in order to manage their fisheries. These policies should be developed with the cooperation of all groups that have an interest in fisheries, including the fishing industry, fish workers, environmental groups and other interested organizations. When cooperation among countries in fishery conservation and management is necessary due to fishery resources are shared among countries, the Code calls for new regional fishery organizations to be established or for existing organizations to be strengthened. Cooperation in this way is the only realistic approach to achieving the long-term goals that were discussed in the preceding section of this booklet. The role of regional fishery organizations is considered further in the section relating to Regional and International Cooperation. It is important that fishing industries at all levels operate within a clear fisheries management and legal

framework so that everyone involved in fisheries has a clear understanding of the rules to be followed.

Fisheries should be managed to ensure that fishing and fish processing are conducted in ways that minimize negativeimpacts on the environment, reduce waste, and preserve the quality of fish caught. Fishers should keep records of their fishing operations. Governments should have enforceable laws with procedures for determining and punishing violators. Punishment for violations could include fines or even the removal of fishing licences if violations are severe. When developing fisheries policies, it is important to consider a number of issues. These include, among other things, the costs and benefits of fishing and the environmental and social impacts of fishing.

In preparing these policies, countries should use the best scientific information available while taking into account traditional fishing practices and knowledge where it is appropriate to do so. In the absence of adequate scientific information, countries should act more cautiously in setting fishing limits. All people and organizations concerned with fishing should be encouraged to share their views and opinions on fishing issues. Particular attention should be given to the needs of local people who depend upon fisheries for their livelihoods.

Countries should strive to educate and train fishers and fish farmers, so that they can be involved in developing and implementing policies to ensure sustainable fisheries now and in the future. To protect fish resources, dynamiting, poisoning and other destructive fishing practices should be prohibited in all countries. Countries should ensure that only fishing vessels permitted fish in their waters. Such fishing should be done in a responsible manner and in accordance with any rules, regulations or laws that may be applied by a country. To avoid overfishing (taking so much fish that the fish stocks will decline in the future), the size of the fishing fleet should not be too large for the natural supply of fish. In addition, the effects of fishing gear on the environment (impacts on coral reefs, for example) should be understood before using a new fishing gear. Fishing methods and gear should be selective, and designed to minimize waste and promote high survival rates for escaping fish. Gear should also minimize the catching of fish species that are not wanted (non-target or by-catch fish) or that are endangered. Fishing gear and fishing methods that are not selective or which cause high levels of waste should be phased out.

Vessel supplies should be purchased with a view to minimizing waste and garbage. The owners and crew of fishing vessels should ensure that discharges of waste do not cause major pollution. To protect air quality, countries should adopt guidelines that aim at reducing the release of dangerous exhaust gas and the release of ozone-depleting substances found in the refrigeration systems of some fishing vessels. These substances should be phased out. Important fish habitats such as wetlands, mangroves, reefs and lagoons, should be protected from destruction and pollution. Where natural disasters harm fisheries resources, countries should be prepared to take emergency conservation and management measures when necessary.

As a renewable natural resource, fish can be harvested year after year if countries have wise policies in place and if responsible fishing and utilization practices are followed. Similarly, with aquaculture, fish farming that does not harm the environment should be promoted because this type of culture will make important social and economic contributions to farming communities and the economies of their countries. If the Code of Conduct for Responsible Fisheries is implemented successfully by all people who are involved in fisheries and aquaculture it can be expected that fish and fisheries products will be available for consumption by present and future generations. In fact, current generations

have a moral obligation to ensure that they do not reduce the supplies of fish available for future generations by careless and excessive use today.

The Code of Conduct for Responsible Fisheries urges countries and their citizens to implement comprehensive and integrated policies in the fisheries sector so that a healthier, more robust sector will result. In the longer-run such responsible behaviour will give good results in terms of the improved status of fish stocks, a more reliable contribution to food security and sustained income-earning opportunities. If all the world's nations unite in pursuing responsible fishing practices, there will be ample fish supplies for many generations to come. The Fisheries Department of FAO hopes that you have found this booklet informative and that you will contribute to ensuring that the world's fisheries and aquaculture are developed and managed in a responsible way.

In the year 2006, an estimation of compliance of the fisheries of India with Article 7 (Fisheries Management) of the FAO (UN) Code of Conduct for Responsible Fishing was done.

Marine ornamental fish trade

Global marine ornamental fish trade is expanding rapidly in recent years. The global annual marine ornamental fish trade is estimated at US$ 200-330 millions (Chapman and Fitz-coy, 1997; Larkin and Degener, 2001). Annual global trade is about 20-22 million number of marine ornamental fish. Nearly 1.5-2.0 million people world wide (half in United States and one-fourth in Europe) keep marine aquaria (Green, 2003). According to the data provided by the exporters, the Philippines, Indonesia, the Solomon Islands, Sri Lanka, Australia, Fiji, the Maldives and Palau together supplied 98 per cent of total number of fish exported. According to Global Marine Aquarium Data base (GMAD) trade records from importers for the year 1997-2002, the United States, the United Kingdom, the Netherlands, France and Germany were the most important countries of destinations comprising 99 per cent of all import of ornamental fish (Wabnitz *et al*., 2003). In India, till date no organized trade of marine ornamental has been initiated. India has a wealth of marine ornamental fish. It has the potential to develop a lucrative marine ornamental fish trade.

Nearly 98 per cent of the marine ornamental species are wild collected mainly from coral reefs of tropical developing countries, which raises doubts regarding its sustainability (Inskipp, 2003). In recent years aquarium industries has attracted much controversy. Opponents to the trade draw attention to the damaging techniques. High level of mortality is associated with insensitive shipping and poor husbandry along the supply chain (Oliver, 2003; Balboa, 2003). Aquarium species are typically gathered by local fishers using live capture technique (such as slurp guns or barriers and hand nets) or chemicals such as Sodium cyanide. This adversely affects the overall health of specimens, as well as killing non-targeted organisms(Erdmann, *et al*.,2000) Consequently the marine aquarium trade is frequently referred to a major contributing cause to the global decline of coral reef. The over harvesting of targeted organisms is another aspect of concern (Moore and Best, 2001).

Supporters of aquarium industry maintain that it is potentially highly sustainable, that proper collection techniques have minimal impact on the coral reefs and it is relatively low volume but very high value. This arise a need to evolve biologically sustainable management measures for marine ornamentals. Some management strategies are: establishing marine reserves where illegal collections is taking place, restricting access to marine ornamental fishing, setting up of quotas, size limits, temporary closures, and species which are unsuitable for aquaria should not be harvested (Wabnitz *et al*., 2003). The permanent solution to a long term sustainable trade of marine ornamental can be achieved only through the development of culture technology. According to data held in GMAD a total of 1,471 species of fish are traded globally. Out of these more than 84 species are reared in

captivity, majority of species reared are from the family Pomacentridae (Wabnitz *et al*., 2003).

The ideal way of managing Indian fisheries to follow the code of conduct for responsible fisheries and to adopt the culture technologies for the available marine species and to strictly follow the certification procedures in wild collection

Mariculture on marine food, shell and ornamental fish

Mariculture can be an environmentally sound way to increase the supply of food, shell and ornamental fish, by helping reduced pressure on wild fish population and producing juvenile and market size fish of a wide variety of species year round. It is hoped that much of the market demand for the more popular fishes may eventually be satisfied by cultured fish, once culture technologies have been established successfully. However, in reality most marine ornamental aquaculture remains comparatively problematic, both from a technical and socio-economic point of view. Attempts at closing life cycle, i.e. spawning, rearing and mating, repeatedly in closed system have proved technically challenging for most species and existing mariculture project have been developed on a relatively small scale (Wabnitz *et al*., 2003). Some mariculture interventions are:

i) Broodstock bank for tank reared food, shell and ornamental fish

It is practically difficult and costly affair for a fish farmer/entrepreneur to maintain the broodstock. The broodstock is essential for hatchery technology; hence there is a need to establish a broodstock bank for the proved fish species on culture technologies. Central Marine Fisheries Research Institute (CMFRI) can take up a lead role in establishing and maintaining fish broodstock bank.

ii) Small-scale marine food, shell and ornamental hatchery technology

Small-scale hatchery technology is highly recommended because the capital costs and technologies are accessible at relatively low cost, which can be affordable for fisherfolk/entrepreneur. It focuses on the larval rearing and nursery aspects of fingerling production. Small scale hatcheries do not hold broodstock, instead they purchase fertilized eggs or newly hatched larvae from larger hatcheries (Sim *et al.,* 2005).

A typical small-hatchery unit consists of the following feature:

- Two indoor larval rearing with 10 m^3 capacity
- One sand filter (8-10 m^3)
- Outdoor live food production tanks (2-3 units each of micro-algae and zooplankton tanks, with 10 m^3 and 5 m^3capacity, respectively)
- Flow-through water supply system with regular water exchange
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Advantage of Small-scale hatcheries

Low capital inputs, simple construction, ease of operation and management, flexibility and quick economic returns.

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Need for Certification for wild collection

Commercial level breeding technologies of all the species will take a very long time. If we wait till then, we may fail to enter into this lucrative global trade in the near future, because fish trade is based on varieties. It is suggested that a few number of entrepreneurs can be licensed to collect suitable ornamental fish species from selected area using eco-friendly collection methods. Availability of necessary infrastructure and technical know how

for conditioning and maintaining of harvested species should be one of the prerequisites for issuing license to an entrepreneur (Gopakumar and Ignatius, 2006).

Certification and standards in similar lines with Marine Aquarium Council (MAC) on Ecosystem and Fishery Management (EFM), Collection, Fishing and Holding (CFH), Handling, Husbandry and Transport (HHT), Mariculture and Aquaculture Management (MAM) can be developed and implemented jointly by Central Marine Fisheries Research Institute (CMFRI) and National Bureau of Fish Genetic Resources (NBFGR) (Gopakumar and Ignatius, 2006). The use of approved training course in the above said areas should be a mandatory requirement for certification. The impact of exploitation has to be closely monitored by scientific agencies at periodic intervals and required management measures have to be implemented as and when required (Gopakumar and Ignatius, 2006).

On 25th January, 2010 Marine Products Export Development Authority (MPEDA) has finalized and submitted the guidelines for green certification or eco-labelling of ornamental fish to ensure its environmental and socio-economic sustainability. It is worth knowing the principles, standards and procedure followed by Marine Aquarium Council. The below mentioned information was downloaded from www.aquariumcouncil.org.

The Marine Aquarium Council (MAC)

Principles and criteria that have been developed by the Marine Aquarium Council follow four Standards:

The **Ecosystem and Fishery Management (EFM) Standard** addresses in-situ habitat, stock and species management and conservation by verifying that the fishery and its marine aquarium organisms are managed according to the principles of ecosystem health, biological diversity, and sustainable use.

The **Collection, Fishing and Holding (CFH) Standard** addresses harvesting of fish, coral, live rock and other coral reef organisms, handling prior to export, holding, plus packaging and transport to ensure ecosystem health, biological diversity, sustainable use, and proper animal husbandry.

The **Handling, Husbandry and Transport (HHT) Standard** addresses the handling of marine aquarium organisms during export, import, and wholesale operations to ensure optimal health and traceability through the chain of custody.

The **Mariculture and Aquaculture Management (MAM) Standard** addresses the propagation, collection, and culturing of marine aquarium organisms to ensure ecosystem health, traceability, and proper mitigation of environmental and social impacts.

Detailed information about MAC certification and standards can be downloaded from the website www.aquariumcouncil.org.

Extension Programme

I. Creating Awareness:

Public and private extension services should give wide and well planned publicity about eco-friendly method of wild collection, conservation and culture technologies through mass media and information technology. They should motivate the fisherfolk/entrepreneur to go for licensed eco-friendly collection method and wherever possible to establish small-scale fish hatcheries. Information technology is a powerful tool. In India, majority of population own mobile phones. Hence creating awareness on above issues through message service will be a right strategy. Creation of website on these issues will also give timely and updated information. Production of Video films/CDs and publishing in dailies and

magazines on success stories of eco-friendly method of wild collection, conservation and culture technologies will create awareness among the public.

Special programmes in Doordarshan and private channels on eco-friendly method of wild collection, conservation and culture technologies may be telecasted to create awareness among the public.

II. Education:

Education is a powerful tool, which can bring desirable change in the behavior of an individual. Public and private extension services should conduct frequent campaign covering all coastal districts focusing on eco-friendly method of wild collection, conservation and culture technologies. Regular follow-up should be undertaken periodically.

III. Training:

Creating awareness and educating fisher folk will induce interest among them. Once interest aroused, they will be eager to know more about that. Hands on training on eco-friendly method of wild collection, conservation and culture technologies will help them to learn and practice in day to day life. Information on certification, marketing and financial assistance may also be provided during training. Regular follow-up should be undertaken periodically.

IV. Agricultural Technology Management Agency (ATMA) – (Proposed for small-scale marine fish hatcheries)

After training and visit system, a key concept to decentralize decision making at the district level is through the creation of ATMA. It is a registered society responsible for technology dissemination at district level. It links with all line departments, research organizations, non-governmental organizations and agencies associated with farming development in districts. In ATMA, villages play crucial role in program planning and resource allocation.

Fishermen/women who can establish small-scale marine fish hatchery at village level can organize into a group called Fish Farmer Interest Groups (FFIG). Each ornamental fish farmer interest group comprise of 10-15 fish farmers interested in ornamental fish culture. FFIGs are grouped in the line of fish culture as Fish Farmer Association (FFA) at block/*mandal* level. FFAs are grouped as Fish Farmer Federation (OFFF).

Structure of ATMA: It is well structured with various committees' viz., Governing Board (GB), and ATMA Management Committee (AMC) at the district level. Fish Farmer Advisory Committee (FFAC-It comprises the heads of FFIGs from different village in that block) and Block Technology Team (BTT- It comprises few Subject Matter Specialists) at block level and Fish Farmer Interest Groups (FFIG).

ATMA functions by preparing and implementing the Strategic Research and Extension Plan (SREP). AMC constitutes a team of heads of all line departments for the purpose of preparation of SREP. SREP is a comprehensive document identifying research/ extension priorities for district, keeping in mind agro-ecological conditions and existing gaps in technology generation and dissemination in marine ornamental fish culture. SREPs will be prepared for new districts in coordination with the line departments, Krishi Vigyan Kendras (KVKs), Panchayati Raj Institutions (PRIs), Private Sector, farmers and other stake-holders at the district level.

Steps may be followed in implementing ATMA- Small-scale marine fish hatchery

1. ATMA organizes Participatory Rural Appraisal (PRA) a data collection tool and then AMC develops SREP on marine ornamental fish culture for the district.
2. Identify market for ornamental fish species.
3. BTTs organize FFIGs and assess interest in marine ornamental fish culture.
4. Consult with research institutes and KVK to test new technologies.
5. FFIG leaders oriented through exposure visits on successful enterprises.
6. ATMA facilitates contracts between FFIGs and buyers.
7. Train FFIGs members on marine ornamental fish culture.
8. Arrange for broodstocks, seeds and inputs needed to establish small-scale marine ornamental fish hatchery.
9. FFIG members produce fish; BTT and/ or buyers staff members supervise production and provide technical support as needed. FFIG members harvest, handle and market the product to the buyer's specification.

V. Entrepreneurship Development

Ornamental fish culture is an entrepreneurial activity which can be viewed as a process consisting of three broad phase;

1. Stimulatory Phase: Identifying and selecting potential entrepreneur is an important exercise which can be carried out through TAT (Thematic Apperception Test). The identified potential entrepreneur should be trained well to develop his technical competence.

2. Support Phase: Support activities provide infrastructure facilities, resources, abilities and skills to entrepreneur for enterprise launching and management.

3. Sustaining Phase: It refers to all such efforts that facilitate growth and continuity through expansion, diversification and technology up gradation of on going enterprises.

VI. Roles of extension personnel in light of market led extension

• SWOT analysis of the market: Strengths (demand, high marketability, good price etc.), Weaknesses (the reverse of the above), Opportunities (export to other places, appropriate time of selling etc.) and Threats (imports) need to be analyzed about the markets. Accordingly, the fish farmers need to be made aware of this analysis for planning production and marketing.
• Organization of Fish Farmers' Interest Groups (FFIGs) building their capabilities with regard to ornamental fish culture.
• Supporting and enhancing the capacities of locally established groups under various schemes / programmes. These groups need to be educated on the importance, utility and benefit of self-help action.
• Enhancing the interactive and communication skills of the fish farmers to exchange their views with customers and other market forces (middlemen) for getting feedback.
• Advice on product planning: selection of fish species and marketability will be the starting point of the enterprise.
• Direct marketing: fish farmers need to be informed abut the benefits of direct marketing.
• Capacity building of FFIGs in terms of improved production, handling, husbandry and transport.

• Acquiring complete market intelligence which includes likely price trends, demand position, current prices, market practices, communication network, etc besides production technologies regularly on various aspects of markets.
• Regular usage of internet facility through computers to get updated on market intelligence.
• Publication of market information in news papers, radio and Television besides internet.
• Organization of study tours of FFIGS: to the successful enterprises for various operations with similar socio-economic and farming systems as the fish farmers learn more from each other.
• Creation of websites of successful FFIGs in the field of agribusiness management with all the information to help other FFIGs to achieve success.

Conclusion

In India, fisheries management is often intertwined between formal and informal or traditional management systems (Pido *et al.* 1996). The formal management system declared by the government centralizes the administration of the resource exploitation under the department of fisheries. While on the other hand the traditional fishing communities have a strong adherence to existing traditions and customs of the fishing community. Given the heterogeneity of the fishing customs amongst the villages, there is an inevitable clash of interests. This discrepancy between numerous local agreements impeded the uniform regulation of fisheries, sought by the government. Further, the increasing divide between the traditional and mechanized fishermen lead to a lot of conflicts during the late 1970's.

Another vital aspect is to review the quality and availability of resources and ecosystem services after the implementation of the management measures in order to compare it with the pre-management scenario. This should be given topmost priority and suitable agencies should be identified and the data should be collected to get a real picture. It is well understood that the marine resource assessment is a process where lot of assumptions are made to estimate the stock. However, the methodology adopted and the samplings made should be scientifically well accepted.

There is also a lack of coordination in the implementation by different managers. The contradiction is mainly due to the fact that certain resources of conservation importance are coming under the Forest Department whereas the fishery resources of the area come under the Fisheries Department. Here a proper co-ordination and interaction between the agencies are almost lacking. Consequently, the different type of fishing methods which are being practiced in the region destroys a lot of biodiversity, which is a matter of concern. At the same time, small-scale exploitation of a resource for livelihood (eg. sea weed collection) is given alarming significance.

It is well known that for any management measure which is affecting the livelihood of a sector, it is better to have a participatory conservation approach. The current management scenario has not made enough scope for this vital aspect.

It is evident from the above that certain improvements are essential for the development of effective management measures and its implementation in the region. The hard core conservation measures have to be reconsidered. The sustainable exploitation of resources from the area can be practiced whereas destructive practices have to be effectively curbed. On a global basis also, the coral reef ecosystem are permitted for sustainable exploitation, which can substantially contribute to the economy. The policy of total ban should be resorted only when it is absolutely warranted based on the database created through careful scientific studies. Otherwise a lot of illegal exploitation of the resources is bound to happen, which is more disastrous and harmful to the ecosystem.

We have reached a necessity in evolving marine fisheries policy in our country for developing an organized trade of marine ornamentals. Though it is suitable to develop a sustainable trade of marine fishes through reared species, but commercial level breeding technologies of all the species of demand will take a very long time. If we wait till then, we may fail to enter into this lucrative global trade in the near future. A small scale marine fish hatchery technology for proved successful fish species can be established in large numbers wherever possible. Though it takes long time for establishment of large scale units, as we progress one day we can substantially reduce the load of wild collection and replace with hatchery produced species in marine fish trade. Extension programmes will play a crucial role in implementing licensed eco-friendly method of wild collection, conservation and culture technologies among marine fisherfolk/entrepreneur.

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34

Responsible fisheries and International trade- A prelude

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The Code of Conduct for Responsible Fisheries (CCRF) of the FAO underscores in Article 6.4 that "International trade in fish and fishery products should be conducted in accordance with the principles, rights and obligations established in the World Trade Organization (WTO) Agreement and other relevant international agreements. States should ensure that their policies, programmes andpractices related to trade in fish and fishery products do not result in obstacles to this trade, environmental degradation or negative social, including nutritional, impacts."

There are specific articles in CCRF (Article 11.2 and 11.3) guiding the Member countries on the way in which their trade should be conducted respecting the spirit of responsible fisheries.
FAO has published a Technical Guideline on Responsible Fisheries Trade in 2009. It elaborates the specific articles related with responsible fish trade.

Technical Guidelines are particularly important because

1. Fish and fish products are among the most traded agricultural and food commodities with more than one third of production entering international trade. This makes it especially important to ensure that all those involved in the sector operate according to the same set of rules.
2. Trade in fish and fish products is also very important for developing countries. Fifty per cent of international trade in fish and fish products originates from developing countries. This is an important source of revenue, employment and foreign exchange for these countries.

Responsible Fisheries-The key points to remember

1. The code symbolizes the international consensus arrived through consultation on the need to conduct fisheries in a responsible manner.
2. The driving philosophy is the Precautionary Principle (Better Safe than Sorry)
3. Code is a voluntary instrument.

4. The Fisheries Division of FAO is vested with the responsibility to monitor the status of the implementation of the code. The status is reviewed by the Committee on Fisheries (COFI) where member countries meet.

International Trade and Responsible Fisheries

Fish and fishery products are among the most traded agricultural and food commodities with more than one third of production entering international trade. A specific feature of fish trade is the wide range in product types and markets. Significantly, one half of international fish trade originates from developing countries for which fish is an important earner of foreignexchange. Developed countries accounted for about 80 per cent of the total value of imports of fish products.

Expansion of the global market for fish and fishery products is the prime cause for expansion of fishing activity. Trade in fish and fishery products, is dynamic. Capture fisheries are levelling off while aquaculture continues to rise, thus affecting the nature of the sector's supply. The distribution chain, including the location and nature of processing activities, is constantly adjusting itself to changes in technology, communication and transportation. Freer trade and liberalized markets also increase the global nature of the sector. Trade is therefore more responsive to global, regional and national changes in supply and demand characteristics. The demand for fish and fishery products reflects changing consumer preferences and purchasing power, as well asdemographic changes.

Currently the main barriers to trade are tariffs and non-tariff barriers, including technical issues related to safety and quality, certification and traceability. Other issues that continue to be of concern and have an impact on trade aresubsidies that are prejudicial for trade and the environment. The improper use of anti-dumping, countervailing and safeguard measures is also a concern. In addition, producers and traders in developing countries are oftenin a disadvantaged position because of difficulties in obtaining market information.

Under COFI (established in 1965) there is a FAO Sub-Committee on Fish Trade of the Committee on Fisheries , which was established in 1985,providing a forum for Member States to consult on technical, economic and environmental aspects of international trade in fish and fishery products, including production and consumption aspects. It also deals with issues related to technical cooperation. On a global level, the WTO and organizations of the United Nations (UN) system, in particular the FAO, are the main actors shaping the global traderegime for fishery products. UN organizations address issues related tosustainable development, environmental conservation, food safety andquality and food security. The rules governing international trade, embodiedin the WTO agreements, are negotiated in the WTO.

Together, the WTO, FAO and other organizations provide a frame of reference for States tocooperate in the formulation of appropriate rules and standards forinternational trade, including trade in fish and fishery products.

The WTO system is based on a series of agreements whose aim is toestablish a rules-based framework for trade and the liberalization ofinternational markets for goods, services and investments. The GeneralAgreement on Tariffs and Trade (GATT) provides for the liberalization oftrade in goods through gradual reduction of tariffs, conversion of non-tariffimport restrictions into tariffs (tariffication) and elimination of tradedistortingdomestic support. Developing States are given specialconsideration under

GATT. They are given more time to reduce their tariffsand other obstacles to trade, and there are other special provisions designedto help them adapt to the liberalization of trade.

The Codex Alimentarius Commission was created in 1963 by FAO and theWorld Health Organization (WHO) to develop food standards, guidelinesand related texts such as codes of practice under the Joint FAO/WHO Food Standards Programme. The main purposes of this Programme are protecting the health of the consumers, ensuring fair practices in the food trade, and promoting coordination of all food standards work undertaken by international governmental and non-governmental organizations.

The World Organisation for Animal Health (OIE) was created in 1924 to ensure global transparency in relation to animal diseases. The OIE collects, analyzes and disseminates veterinary scientific information and provides expertise in the control of animal disease. The OIE develops rules and standards that can be used for protection against the introduction of diseases and pathogens. OIE standards are recognized by the World Trade Organization as the reference for international sanitary rules. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) regulates international trade in species that are threatened with extinction at the species level or that may be threatened as a result of international trade in specimens of the species. Several fish and shellfish species are listed under CITES Appendices.

(CITES lists nominated species under one of three appendices. Appendix I lists species that members have agreed are most at risk of extinction. Trade in specimens from the wild of these species is usually prohibited. Appendix II lists species that members have agreed may be threatened unless international trade in wild specimens is controlled. Trade in Appendix II listed species is therefore generally permitted under specified conditions including documentation and possibly agreed limits of total numbers of specimens permitted to enter international trade. CITES members can also list species unilaterally under Appendix III. This requires all CITES members to document trade in such species and report trade to the CITES Secretariat, but no limits on trade are imposed at a global level. CITES has adopted revised criteria for listing commercially exploited aquatic of species on its Appendices. The revised criteria were developed in consultation with the FAO and explicitly address the listing offish species).

Challenges

Fish trade can be useful as a means of generating revenues, but it can also have many other kinds of impacts, positive and negative. For example, fish trade can affect food security, the environment, the quality and quantity of employment opportunities, the economic and power gaps between the trading parties, etc. All of these should be taken into account. Fish trade must be conducted in a manner that respects all human rights.

All affected parties should have the opportunity to participate in decision-making regarding fish tradeTo facilitate participation, fish production, processing, and marketing should be highly transparent. To the extent feasible, information on prices and volumes should be publicly accessible for the entire chain of production-processing-marketing-consumption.

Public agencies at both national and international levels should oversee trading activities to assure that the public interest is served.Public agencies should provide incentives to private parties involved in fish trade to enhance the likelihood that their activities will serve public interests. This can include both regulations and positive incentives.

Trade is not something that should simply be maximized, as if it were an unqualified and unlimited good. Rather, trade should be optimized, with consideration given to a broad range of impacts on many different parties. Moreover, clear distinctions should be made between the roles of private parties involved in trade, and those of governmental and nongovernmental organizations that may be involved.

The primary function of public agencies is not to subsidize private interests, but to promote the full range of interests of the general public, particularly the most needy among them. Public agencies can do this by facilitating the articulation of appropriate norms for the behavior of governmental and private parties, particular in relation to their obligations with regard to human rights.

Public agencies should also go further, beyond articulating norms, to assure that there are appropriate institutional arrangements to assure that human rights are realized. There is a clear need for institutional mechanisms of accountability at the global level to assure that fish trade makes a positive contribution to food security, especially for those who are most vulnerable.

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35

Policy initiative required for export trade in the wake of WTA- An Exporters perspective

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Indian seafood exports are less than the global average, with about 12 per cent of its total fish production (wet weight equivalent) entering world trade. About 6.7 mln. people depend on fisheries for a livelihood. There are also about 300,000 people employed directly in the shrimp aquaculture sector and about 700,000 people in ancillary units.
More than 3 per cent of India's exports are marine products.

Implication of Tariff barriers for India

EU is India's largest trading partner. According to the Indian Export-Import Policy 2002-2007, all marine products with a few exceptions under the Wildlife Protection Act 1972, can be exported free subject to pre-shipment quality inspection. 90 per cent of Indian seafood exports comprise frozen fish, shrimp and cephalopod. The average tariff rate in Japan, the biggest Indian seafood market, is 4.1 per cent. US, the 3rd biggest market for Indian seafood, has just a nominal 1 per cent tariff duty. EU, the biggest importer, has an average tariff duty of 10.2 per cent, followed by China, the fourth biggest, which has a bound tariff rate of 18 per cent. The EU, Japan and the US extend preferential tariff treatment under Generalized System of Preferences (GSP) to Indian products including seafood. In general, tariff measures are not seen as a trade barrier by the Indian seafood industry to the US and Japanese markets. However, it is seen as a barrier to access some of the markets in developing countries, including China, as well as the EU market. India is still in List 1 of Annex 1 of the EC Decision 97/276/EC, amended by 99/136/EC, whereby all organizations exporting seafood to the EU require export-worthy certification of their processing facilities by an EU-nominated inspection agency. In the case of India, that agency is the Indian Export Inspection Council (EIC).

Implications of Non-tariff barriers for India

There were several cases of rejection of Indian Seafood imports in the EU market on account of detecting traces of prohibited carcinogenic antibiotics like nitrofuran and chloramphenicol as well as other bacterial inhibitors like amino-glycosides and macrolides. Following the EU requirements, on 17 August 2001 India issued a notification specifying the limits for various antibiotics, pesticide and heavy metal residues in seafood products,. International Organization of Standardization (ISO) 9000 is recognized under the Export-

Import Policy of Government of India. Firms, including seafood firms, enjoy certain privileges if they are ISO 9000 firms. Under the 1997-2002 Export-Import Policy, Government of India, exporters with ISO 9000 were given Special Import License (SIL) up to 5 per cent of f.o.b. value. Certification against ISO 9000 is beginning to emerge as a major industry in India. There are many auditors with experience in assessment of quality management against ISO 9000, and the certifiers in India with the highest credibility in the international market are those under multinational companies.

Implication of Subsidies for India

Within the framework of the SCM Agreement, only export subsidies are to be treated as prohibited ones. Even if we treat the entire annual budget of Marine Products Export Development Authority (MPEDA) as a prohibited subsidy, which may not be the case if we do a careful analysis of all their schemes, it amounts to less than half per cent of the annual seafood export value. Even though fisheries subsidies are small, from an overcapacity and over-fishing point of view, their role is to be better recognized in India. Fuel subsidies in terms of tax revenue foregone are extended in several Indian States to the fishing industry and it has become an important consideration for trawler operators to decide whether or not to undertake a particular fishing trip. Also, the criteria for subsidy schemes are often based on political, not legitimate social, considerations. In India, there are instances of misuse of subsidy schemes by fishermen themselves. The vessel owner would sell his fuel quota illegally in the open market and he would buy fuel for his fishing operation from the open market. The net benefit in such a transaction is in favour of the owner since the fuel quota is in his name, whereas the operational costs of fishing are collectively shared between the owner and crew. The owner thus privatizes his benefits by exclusively enjoying the proceeds of the sale of his fuel quota in the open market, and socializes his costs since running costs of a fishing operation, including costs of fuel, are shared among the owner/s and workers and treated as common expense. In this case, the owner of the fishing vessel is only partially bearing the burden of costs of fishing operation.

Under the SCM Agreement perhaps the most important aspect to consider in relation to fisheries subsidies in the Indian context, arguably in developing countries in general is the revenue foregone rather than government financial transfer. Irrespective of the nature of the fisheries, whether or not targeting high-value-low-volume, or low-value-high volume fisheries, there are no fee either to enter the fishery or to access fisheries resources, both for the rich and poor fishers.

In the light of recent changes in legal regimes for foreign investment in India, it is possible for excess fishing capacity in other countries to end up in the Indian EEZ. Vessel buyback schemes with the intent of reducing domestic fishing capacity (e.g. South Korea and Taiwan) could result in such fishing capacity ending up in Indian waters if subsidies are provided to vessel owners of distant water fishing nations to transfer their excess fishing capacity to Indian companies. They could effectively end up competing for the same fisheries resources with the domestic sector, mainly comprising fishing vessels below 20 m length. This can deny a level playing field to Indian fishing vessels and it could also give rise to fishing conflicts in the EEZ. There should also be protective measures within national legislation to prevent subsidized distant water fishing vessels from gaining unfair access to the national resources.

Implications of Eco-labeling for India

There are several concerns about ecolabeling in developing countries and specifically India. Firstly, there is fear of losing access to market if eco-labeled fish and fish products gain greater preference in import markets. Secondly, there is worry about the affordability of costs associated with adjusting fisheries to comply with ecolabeling standards, and about costs of certification and chain of custody and whether or not the market, if they go for certification, can adequately compensate their higher costs. Thirdly, there is apprehension that fishers in the small-scale artisanal sector would lose their autonomy if they have to comply with standards that are developed and applied by external agencies to their fish exports without taking into account the specific aspects of their fisheries. Fourthly, there are doubts about the practicability of eco-labeling in multi-species, multi-gear fisheries since the unit of certification is the fishery in its entirety. Apart from the above, several concerns about the implications of voluntary ecolabeling for the artisanal and small-scale fisheries in developing countries have been expressed, particularly in the context of the ecolabeling programme in fisheries, viz., the MSC, which was established in 1997, ICSF (1998). In the history of MSC from 1997 to 2002, for example, there are no fisheries from developing countries that have been certified, although there are potential candidates for MSC certification from developing countries including a couple of village-specific crab, mackerel and sardine fisheries from Tuticorin in Tamilnadu.

Following Policy Implications emerge from the above discussions

The livelihood of vast masses of poor people is threatened by the ongoing negotiations in NAMA, most importantly of those involved in fishing. Any drastic changes in tariff or other rules of market access will have direct consequences for them. The Government must therefore give special consideration to this fact and any deliberation on NAMA must entail special discussions on the impact on employment and livelihood in such sectors. Unfortunately the Indian government has virtually accepted the contents of the earlier discredited as the basis for NAMA negotiations. The majority of WTO members in Cancun had rejected that historically, all late industrializes including the USA developed their industry behind high protection. The key issue concerning NAMA is that while developing countries protect their markets through higher tariffs, the main mode of protection for the developed countries is through non-tariff measures, particularly through the use of technical barriers. Such barriers in the developed countries are not being discussed simultaneously or with the same priority. Therefore a further reduction in tariffs as is being negotiated in NAMA will not lead to any greater market access for the developing countries including India but will certainly ensure greater market access for the developed countries. Any further steep reductions in tariffs on industrial products will accentuate the process of de-industrialization of fishing sector, which has already commenced with tough import competition being faced by many sectors in small and medium industries. Indian Government's mandate at such future negotiations must be comprehensively debated and decided by an explicit consensus to be evolved in the Parliament.

The major fishing companies in developed countries use massive factory ships to process their catch. Thus small countries, whose waters are the source of the fish gain donot benefit through jobs and development of local industry. The companies have been pressing their government to cure commitments on 'services related to fisheries' in the GATS negotiations that will entrench their control over processing of the resource and of its global marketing and prohibit the source countries from reasserting control over the benefits from the resource. Small-scale fishers in India point out that their problems arise from the open

access regime for foreign trawlers, not from subsidies. From their perspective, blanket rules that prohibit subsidies would restrict the right of governments to support small fishers and protect the food security of coastal communities.

In lieu of meeting the costs of fisheries management, seafood exporters should demand a reduction in tariffs on Indian seafood imports in EU and Japanese markets, where the average tariffs are 10.2 per cent and 4.1 per cent respectively. EU and Japan are already in the process of rewarding better fisheries management regimes in their seafood import markets. A one per cent tax on exports can fetch US$12 mln. per year at current levels of export revenue earnings, which could provide sufficient financial resources to introduce fisheries management measures. A verifiable environment management system, under the ISO 14000, can be adopted in marine fisheries and shrimp aquaculture to demonstrate effective fisheries and aquaculture management measures to the import markets. As long as fishmeal continues to be the main feed, and brood stock comes from the wild and post larvae are collected from the coastal waters, shrimp aquaculture should be treated as a subset of marine fisheries.

Some of the HACCP measures are difficult for small-scale beach-based fishers to meet and hence they will not be in a position to access the international market. Similarly, unless the State invests on behalf of the industry in expensive quality control measures, high compliance costs with seafood safety standards could push out small processors and exporters from business. How best the benefits of tariff reductions compare with the costs of non-tariff measures should be looked into in the context of small producers and exporters of seafood. Being a highly sensitive item from the health and environment point of view, compliance costs of the seafood industry are bound to be quite high in relation to other durable exports from developing countries. US lost the case at WTO when India and other affected countries challenged the ban. However, the ban since 1996 adversely affects the Indian shrimp exports.

Although there have been significant impacts on the fishing industry as a result of turtle protection measures there does not seem to be any significant impact on the exports of India as a result of MEAs. It is quite likely that, in future, MEAs might play a major role in the seafood exports of India if MEA obligations are to be met to maintain market access. In fact, fish trade is fast emerging as an area with potential conflicts between MEA obligations and trade rules.

In developing countries, the fisheries administration is fragmented, with responsibility divided among such an array of actors (In India, around 11 ministries across the central and state governments) that any sectoral coherence in policy is very difficult to secure. Similarly, there is usually no clear policy to address the problem of over-capacity. For instance, the State of Goa has 1128 registered trawlers and this is far above the saturation point compared to the fact that the Food and Agricultural Organization of the United Nations following a study recommends 30 trawlers per 10 kilometres of coastline. Given that Goa has 105 kilometres of coastline the number of trawlers should have been around 315 but it has instead 1128 of them. A comprehensive central policy in this regards need to be immediately evolved.

India should start in earnest putting in place a fisheries management plan. Subsidies to the industry to adopt and implement such a plan should be defended as non-actionable subsidies. The EC position on non-actionable subsidies is also of relevance to developing countries like India since several of the proposed subsidies in this category can also be defended within the framework of special and differential treatment of developing countries.

Under Article 4 of Agreement on Sanitary and Phytosanitary Measures, members are in the process of bilateral determination of the equivalence of SPS regulations and regulatory processes between importing and exporting nations. (While the international standards of US, EU and Japan are more an extension of their domestic standards, such standards in India are exclusively applied to its export market. India, for example, does not have any quality standard for seafood for its own domestic consumers and needs to establish the equivalent.

Emerging Issues:

1. Issue of Detection of Ethoxyquin, an antioxidant found in the consignments to Japan and the impact of the same on Indian Industry.

Ethoxyquin : India's shrimp exporters are concerned by a new move by Japanese food safety regulators to lower the acceptable levels of a key antioxidant used in fish meal. Earlier this month Japans food safety commission announced new regulations that would impose compulsory testing for ethoxyquin in shrimp consignments from India on the basis of the default standard of 0.01 ppm. The detection of Ethoxyquin, an antioxidant, in the shrimps exported to Japan has badly hit India's export. Japan had already rejected more than 52 consignments of shrimps exported from India in the recent week, over 150 consignments are lying in various ports in Japan waiting for test result. There have been a lot of cancellations of export orders from Japan and this has badly affected exporters based in Odisha and West Bengal. The problem has also caused a drastic reduction in the prices of farmed shrimp in the Indian market. Ethoxyquin is a quinolone based antioxidant and an important ingredient in shrimp feed with almost all shrimp units in India using it .Japans permits a minimum residue level of 1 ppm for fish. The Indian seafood exporters feels that standards baseless and damaging to the country seafood export market. This will affect almost 100,000 households involved in aquaculture. Odisha and West Bengal regions are the most affected areas as around 80 per cent of the black tiger variety of shrimp produced in these regions is exported to Japan. The aquaculture sector in Odisha and West Bengal is in crisis as the prices had dropped heavily. Already importers have been asked not to ship the cargo until the issue is sorted out. Due to this India suffered a serious setback in marine product exports during the April-August period of the current financial year as the country's products lost their sheen in major export markets like Europe and Japan.

2 **FDA Food Safety Modernization Act (FSMA) of Unisted States amendment**

Food Safety Modernization Act (FSMA) of Unisted States amended amends the existing Federal Food Drug and Cosmetics Act (which in turn had amended Bio-Terrorism Act of 2002). Several provisions of the law can be traced to original Bio-Terrorism Act. FAQs on all aspects of the bill, as also available on the FDA website, are attached for information. The FSMA will increase frequency of inspections, tighten recordkeeping, extended oversight and mandate product recalls if voluntary recalls are not issued. Facilities will be required to conduct an analysis of the most likely hazards and design and implement risk-based controls to prevent them. The FSMA also mandates increased scrutiny of food imports. Food import shipments will have to be accompanied by documentation that they can meet safety standards that are at least equivalent to U.S. standards. Foreign governments might provide such certifications or other so-called third parties accredited in advance. FSMA also contains provisions for certifying or accrediting laboratories, including private laboratories, to conduct sampling and testing of food, among other provisions .While inspection related provisions of the law came into operation last year, the key aspects relating to re-registration of foreign food suppliers becomes operational during **1 October-**

31 December 2012. In this regard, the following, as might be applicable to foreign food suppliers (including Indian companies) needs to be mentioned:

Section 102 of the FSMA requires domestic and foreign facilities to register every two years during the period of October 1 and ending December 31 in even numbered years; previously renewal was not required and facilities only needed to update the FDA of changes. The re-registration will first occur October-December 2012. Each and every food company will have to register afresh with USFDA between October 1 and December 31, 2012**.** Currently, all foreign food facilities exporting into U.S. are registered under Bio-Terrorism Act. Now each one of them will have to re-register between October 1, 2012 – December 31, 2012. We understand that currently there are over 275000 foreign food facilities registered with the FDA, out of which the Indian companies number around 6785. From our interaction with various business firms, we understand that several hundred companies may already be working on their re-registration.

One of the requirements of registration under the old Bio-Terrorism Act, the amended Food Drug and Cosmetics Act and the new FSMA remains appointment of a "**US Agent for communications with FDA".** The key responsibility of this agent has always been to act as a channel of communication between the foreign food supplier and the U.S. FDA. We understand that in most cases, the Indian companies tend to appoint the US importer also as US agent for communication with U.S. FDA. However, in FSMA, U.S. agent may also be liable for re-inspection/food recall costs of the foreign facility, which for 2012-2013 have been announced at **$ 289 per hour.** The first inspection would be free but re-inspection [if required] cost, including international airfare, would have to be paid for by the foreign facility. Some industry sources tell us that because of this potential liability for bearing the re-inspection costs of the foreign facility, the U.S. importers may no longer be willing to be designated as U.S. agent for a foreign supplier (in this case Indian company). Naturally, this role will begin to get filled up by professional service provider who will handle (i) re-registration (ii) Act as U.S. agent of foreign food supplier (iii) guide them through the process of U.S. FDA inspection/ re-inspection. While the individual companies charge differently, we understand from businesses that the going rate is **$ 495 per year for U.S. service provider, including the cost of re-registration** to foreign food supplier; and fee to act as its U.S. agent for communication with U.S. FDA.

The procedure for re-registration remains the same as before. Online registration is instantaneous. Registration by paper and fax is also possible. The Step by step procedure for re-registration of foreign facility (as per the existing law, each facility i.e. manufacturing, storage, and distribution has to be registered separately even if belonging to the same company) will be available with the following link: line Registration link(preferred mode): http://www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/RegistrationofFood Facilities/OnlineRegistration/ucm073706.htm. In addition companies can also do paper registration through mail or fax. The form for paper registration is attached. Other key aspects of the bill, which are still not operational, include section §103 of the new law through which the FDA is charged with developing regulations that would require registered facilities (domestic and foreign) to: evaluate hazards that could affect food processed, manufactured or held at the facility , identify and implement preventive control to minimize those risks; and monitor and maintain records on the effectiveness of those controls. This rule could add significantly to the responsibilities incumbent upon registered facilities. However, FDA has yet to even propose a rule yet. Once the draft rule comes out, it would be available for public comment and subject to revision before finalization. Until that occurs, however the additional §103 requirements will not affect registered facilities.

3. The Foreign Supplier Verification Program (FSVP):

Like the additional §103 requirements, the FSVP authorized under §301 of FSMA requires implementing regulations. Also like §103, the regulations for this provision are unpublished, still in the proposed stage and past due. The program is designed to ensure that importers have in place internal controls to verify that the food they bring into the United States is unadulterated and produced in accordance with the hazard analysis and preventive control requirements of §103. While the administrative burden is placed on the importer, the purpose is to verify activities on the part of the food supplier. Furthermore, the implementing rule, though still unreleased has been identified as being particularly expensive. The expectation is that the law's stringent requirements may result in significant new expenses for importers, which in turn have the potential to impact foreign exporters. . While §301 is quasi-self-implementing in that it "takes effect" this January, without a finalized rule in place importers are unlikely to have to undertake many new actions. Without formal direction from the FDA it is conceivable that an importer's FSVP may consist of inquiring with his foreign suppliers as to whether they are complying with §103. Though unclear, this may happen on self-certification basis. Still, although this provision may not have an immediate impact on importers or exporters, the ultimate consequences of a finalized rule may be significant. Those interested in submitting comments will have an opportunity to do so after the proposed rule clears OIRA and is published, almost certainly after the election and quite possibly not until next year.

4. **Trade issues with China**

Our exporters to China are facing serious difficulties in meeting the requirements of parameters prescribed by China for export. On-going through their requirements, we find that a few parameters which have been prescribed for aqua culture material is provided for testing of captured products. Attach herewith a communication from EIC regarding parameters to be tested for obtain health certificate for export of fishery products to P.R. China.

The value per container exported is very low and the quantity that is exported to China of low value products is extremely high. The cost of conducting these tests for meeting the requirements is high and works out to about Rs.20,000 per container. This is in addition to the EIC Fee of 2 per cent. Not only this, the time taken for getting the results of these tests before shipment will be creating a major bottle-neck in carrying out the export of products like Ribbon and other cheap fish products.

In this regard if every consignment has to tested with all given parameters of Table ,1 , 2 it will take about 10 days to get the test reports from even from an EIC approved lab labs. Nobody can predict how much time it will take to get the report from an EIA lab, which already under staffed.. As everybody is aware consignments to China now- a- days reaches in 15 to 20 days irrespective of any destination due to direct voyage of vessels to Chines ports. As the situation is so, it is sure that the shipment documents cannot be reached before the container reaches the destination and definitely it is going to attract huge demurrage and detention charges. The volume of Export to China is so huge that the delay in sending the Health Certificate may cause delay in release of cargo, congestion in the destination ports and it will ultimately affect the shippers and shipping line.

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36

Trade Related Investment Management Measures and Fisheries: The Indian perspective

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The WTO Agreements aim to expand, promote and liberalize trade. One of the underlying objectives is to "increase economic growth among trading partners, while ensuring free competition" (http://www.wto.org). In the process of ensuring fairness in competition various agreements were put in place. This includes agreements to reduce tariffs, providing increased market access etc. Most of the Agreements came into force on January 1, 1995 with the establishment of the WTO after the Uruguay Round of discussions, with special concessions provided with extended time lines for developing and least developed nations.

However it has been recognised that trade distortion can take place due to a various provisions. It could be in the form of Non-Tariff Measures or Sanitary and Phyto Sanitary Standards or in the form of regulation of investments in the domestic sector that could be trade restrictive and trade distorting. The regulation of investment measures of member countries that can result in trade distortions and prevent free and fair trade was the premise for the Trade Related Investment Measures or TRIMs Agreement. It does not directly deal with the right of a country to have regulations for investments in place but only to the possible impacts.

About TRIMs

TRIMs relate to only trade in goods and does not cover trade in services. The TRIMs Agreement is detailed in nine Articles, including Committee on TRIMs and Dispute Settlement and constitution of the Committee. The number and title of the articles are given in Table 36.1

Table 36.1: Articles under TRIMs Agreement

Article	Title
1	Coverage
2	National Treatment and Quantitative Restrictions
3	Exceptions
4	Developing Country Members
5	Notification and Transitional Arrangements
6	Transparency
7	Committee on Trade-Related Investment Measures
8	Consultation and Dispute Settlement
9	Review by the Council for Trade in Goods

In Article 2 of the TRIMs Agreement 'National Treatment and Quantitative Restrictions' relates in particular to provisions that violate Article III and XI of the General Agreement on Tariffs and Trade (GATT), 1994.

Article III of GATT refers to 'National Treatment on Internal Taxation and Regulation'. Under this Article there should not be any domestic taxes, charges, laws, regulations and requirements that would be protectionist to the domestic production and the imported product will not be subject to any additional taxes, charges etc.

Article XI of GATT refers to 'General Elimination of Quantitative Restrictions', which was the basis for reduction and elimination of restrictions, other than duties, taxes or other charges. Specifically it ensures elimination of quotas, import or export licenses and any such measures. All exceptions allowed under GATT are applicable for TRIMs as well. For example prohibition of certain exports due to reasons of food security, for the implementation of SPS measures etc. Import restrictions may be also enforced for agricultural or fisheries product for restrict the production and marketing of the product, to remove a temporary surplus.

In effect the TRIMs Agreement draws very heavily on the GATT Articles, as it is the main focus of the Agreement. As can be seen later, most of the disputes under TRIMs comes under the Article 2, that directly draws from GATT.

Members were given two years from January 1, 1995 to eliminate all notified TRIMs. In the case of developing countries the period was five years and for least developed countries seven years. In effect all members are now covered under the TRIMs Agreement. However, a further transition period extension was applicable to developing and least developed countries, if they were able to show the difficulties in implementation of the provisions under this Agreement. Disputes under this Agreement will also follow the Dispute Settlement Mechanism of the WTO as under Article XXII and XXIII of GATT 1994.

The trade-related investments that are likely to be trade restrictive are difficult to define (Moran, 1992) and only an illustrative list (Table 2) that could be TRIMs, was provided in the Agreement that was arrived at by the member countries. Broadly incentives given for investments, licensing, forex restrictions, limits to manufacturing, transfer-of-technology, domestic sales requirements, trade-balancing requirements, local content requirements, export requirements and import substitution requirements are some of the areas where the provisions can come under TRIMs. For instance, if there is an obligation for use of products of domestic origin or if there is a restriction on the volume or value in relation to a domestic product it is seen to be a violation of the Article III of the GATT as in giving 'National Treatment' andmay become a quantitative restriction . According to Moran (1992) four broad categories of TRIMs could be incentives, performance requirements, corporate measures and home country measures. An UNCTAD (2007) report underlines the fact that TRIMs can be for promoting exports from the host country (export performance requirements and trade balancing requirements); reducing imports by the foreign investor (local content requirements); advancing economic and social policy goals, including job creation; and technology transfer.

Table 36.2: Prohibited TRIMs in the Agreement (illustrative list)

Para 1 (a)	Local content requirements	The purchase or use by an enterprise of products of domestic origin or form any domestic source	Internal measure in violation of GATT art, III (national treatment)
Para 1 (b)	Trade balancing requirements	An enterprise's purchase or use of imported products is limited to an amount related to the volume or value of local products that it exports	Internal measure in violation of GATT art. III (national treatment)
Para 2 (a)	Import restrictions generally; Trade balancing requirements	General import restrictions related to product used in local production; Import restrictions related to the enterprise's volume or value of local production that it exports	Border measure in violation of GATT art. IX (quantitative restriction)
Para 2 (b)	Foreign exchange balancing requirements	Measures that restrict an enterprise's access to foreign exchange for imports to an amount related to the foreign exchange inflows attributable to the enterprise	Border measure in violation of GATT art. IX (quantitative restriction)
Para 2 (c)	Domestic sales requirements	The exportation of product is restricted in terms of particular products, volume or value of products, or volume or value of local production	Border measure in violation of GATT art. IX (quantitative restriction)

Source: UNCTAD

Disputes under TRIMs

As on September 2012, 34 cases of disputes have been brought up at WTO under TRIMs. Most of the cases have been under Article 2, National Treatment and Quantitative Restrictions, indicating that investment measures that have some difference for domestic as well as outside investments exist in these cases.

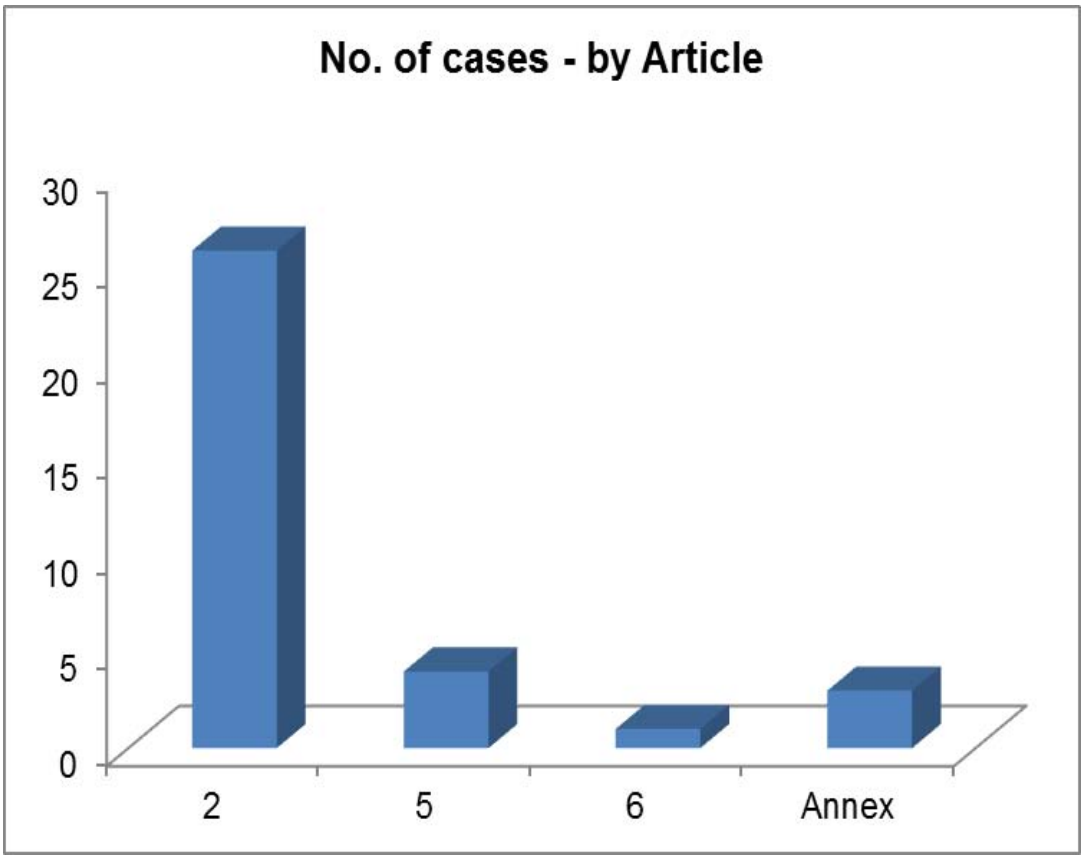

Fig 36.1 TRIPS and No of cases by articles

TRIM disputes tends to be concentrated in specific industries, and are mainly seen in the automotive, chemical and petrochemical and computer/ informatics sectors.

India and TRIMs

India has been part of the disputes arising regarding TRIMs as a respondent in two cases and as a third party in several others. The list of disputes in which India is involved is given in Table 1. It is clear that most of the cases relate to motor vehicles.

Table 36.3 List of disputes

S.No.	Countries and cases	*Year*
1.	European Communities — Regime for the Importation, Sale and Distribution of Bananas(Complainants: Ecuador; Guatemala; Honduras; Mexico; United States)	1996
2.	Indonesia — Certain Measures Affecting the Automobile Industry (Complainant: European Communities)	1996
3.	Indonesia — Certain Measures Affecting the Automobile Industry (Complainant: Japan)	1996
4.	Indonesia — Certain Measures Affecting the Automobile Industry (Complainant: United States)	1996
5.	Indonesia — Certain Measures Affecting the Automobile Industry (Complainant: Japan)	1996
6.	Canada — Certain Measures Affecting the Automotive Industry (Complainant: Japan)	1998
7.	Canada — Certain Measures Affecting the Automotive Industry (Complainant: European Communities)	1998
8.	India — Measures Affecting the Automotive Sector (Complainant: European Communities)	*1998*
9.	India — Measures Affecting Trade and Investment in the Motor Vehicle Sector (Complainant: United States)	*1999*
10.	Philippines — Measures Affecting Trade and Investment in the Motor Vehicle Sector (Complainant: United States)	2000
11.	Canada — Certain Measures Affecting the Renewable Energy Generation Sector (Complainant: Japan)	2010
12.	Canada — Measures Relating to the Feed-in Tariff Program (Complainant: European Union)	2011

The two cases that India is a respondent, also relate to the automotive sector with United States and European Union being the complainants. In both the cases, Article 2 of the TRIMs Agreement was invoked - National Treatment and Quantitative Restrictions. In this case there was a local content requirement (indigenization) as well as a trade balancing requirement (import value to be equal to the export value, ie, import to be restricted to an export commitment) for cars and other components. The Panel set up found that it was a violation under both the articles and the report was adopted in March 2002.

TRIMs and Fisheries

The proposals of a Multiple Agreement on Investment (MAI) spell concern for fisheries sector. The provisions of MAI would fundamentally alter the climate for international investment by preventing governments from providing more favourable conditions for their citizens and domestic companies than for other investors. Under new regime, countries would be required to treat foreign investors no less favorably than domestic ones. It allows foreign fishing fleets the same access to domestic waters that local enjoys.

One of the most contentious aspects of fisheries management is the allocation of the total allowable catch (TAC). Most countries give preferential access to their domestic fishermen, only allowing others in for those species which are not fully utilized. If all foreign investors are to be treated at least as favourably as domestic companies it may not be

possible to give continuous support to our poor fisher folk. Further, governments and regional management organizations usually set the TAC based upon some variant of Maximum Sustainable Yield as a target. There are many other possible targets, though, based upon other biological or even economic criteria. If, as a conservation measure, a country wishes to maintain fish stocks at somewhat greater abundance, it may not be possible to do so under the provisions of MAI. Thus, WTO has great impact on the global fishing industry, the conservation of fisheries resources and the communities who depend upon them.

Fish and fish products come under NAMA and are considered 'goods' for trade purposes. Therefore production of fish and fishery products will be covered under the TRIMs Agreement. Till date no issue has arisen in fisheries under this Agreement. Since the Indian seafood industry is largely export oriented and the policies so far have been oriented towards exports, most of the provisions will not have much impact, especially form the domestic requirements aspect, where most of the disputes seem to arise. There is also no competition between export oriented and the domestic industry (Cuyvers et.al., 1996) as far as the sector is concerned. There are no apparent issues with regard to the other regulations like local content or trade balancing requirements etc.

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37

Data base management for World Trade: Indian and Global perspectives

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Introduction

Globalization is an unavoidable fact. It has been going on since the beginning of time, and as the cost of trade falls, international trade will only increase. Countries that have been successful at developing have often relied on international trade as the engine for their growth. Trade is also a measure of health of the Global Economy. International trade forms an important part of the world economy and, as such, must be measured reliably and the relevant statistical data should be comparable and widely disseminated. International trade statistics are an important primary source for most public- and private-sector decision-makers. The Trade database empowers organizations to leverage invaluable global trade information to strengthen and grow their business. Access to comprehensive import and export statistics will enable companies to make more informed decisions, leading to more successful results. Availability of timely and high quality trade statistics becomes a precondition for an in-depth analysis of the production, consumption, employment, income and overall welfare both at the country and global level.

Trade statistics are compiled to serve the needs of many users, including governments, business community, compilers of other economic statistics such as balance of payments and national accounts, various regional, supranational and international organizations, researchers and the public at large. Different users need different data, ranging from data sets of varying detail by country and commodity to aggregated figures. The uses include development of national, regional and international trade policy, including policies on sustainable development, fiscal, monetary, structural and sectorial matters as well as addressing issues of environmental and health concerns.

The global trade database will bring vital information to organizations that fulfill a role in the international transportation/supply of goods. Access to this information will directly impact the quality of your operational and marketing decisions. Together with other market databases, the trade database provides detailed information on the behavior and trends of markets. Data can be extrapolated from the database and used for forecasting purposes. These forecasts will allow you to be better prepared to react to emerging trends in the marketplace.

National trade database is essentially to pool up the extent of ongoing trade and envisage the future trade based on the demand-supply existing in domestic as well as international markets. The vision and planned budgets of the nation at large is based on the national databases generated over a period of time. The infrastructure required, provisions for subsidy, policy decisions and human resource development are decided based on national databases.

Local trade databases are indicators of ground truth reality and are dynamic in nature. They provide the real field data which basically support the domestic markets and global suppliers who intend to purchase from domestic markets.

Global trade databases

1) Trade Codes

In international trade, codes are used to identify, classify, and record data for every product. Though there are many international trade coding systems, the Harmonized Commodity Description and Coding System (otherwise known as the Harmonized System, HS, or HTS) is generally the most applicable and available for fish/seafood trade. While other coding systems such as the Standard International Trade Classification (SITC) and the Standard Industrial Classification (SIC) are available, they are all derivatives of HS, which stands as the core classification for goods internationally (Wang, 1999). For this reason, it is generally best to use the Harmonized System for fisheries data collection.

The Harmonized System (HS) is maintained by the World Customs Organization. Approximately 170 countries use HS worldwide for customs tariffs and trade statistics. This accounts for about 98 per cent of world trade. The UN Statistical Commission has adopted HS and all of the UN's own classification systems correlate with HS. The classification consists of 21 Sections, each containing a varying amount of chapters. For the purpose of fisheries trade, Section I, Chapter 3 (which consists of fish and crustaceans, molluscs and other aquatic invertebrates) is the applicable Section and Chapter (World Customs Organisation, 2007).

An illustration is given for reading a trade code with the example of a 6 digit HS code: 030378

The first two numbers signify the chapter. In this case, it is Chapter 3, which covers 'fish and crustaceans, molluscs and other aquatic invertebrates.

The second two numbers are the heading under that chapter. In this case '03' signifies 'Fish, frozen, excluding fish fillets and other fish meat of heading 0304'. The last two numbers are a subheading which generally identifies a species of fish or parts of a fish and whether they are live, frozen, chilled, or in some way preserved.

In many cases, these codes can go beyond the six digits in the example above. Eight and ten digit codes exist as well. However, the treaty which sets out the guidelines for use of the HS system specifies that only the first six digits will be internationally standardized (World Customs Organisation, 1983). This means that each country is able to use the last four digits to create subheadings as required (Table 2), or even not use them at all. It is important to remember this when comparing export data from one country with import data from another country, as the same eight or ten digit code may not refer to the exact same product.

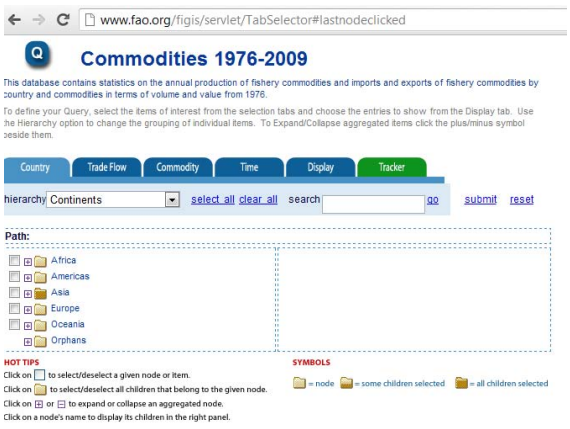
Table 37.1: HS Codes Sub-Heading used in international fish trade

Code	Description
0301	Harmonised Codes of Live fish
0302	Harmonised Codes of Fish, fresh or chilled, excluding fish fillets and other fish meat of heading 0304, salmonidae, excl
0303	Harmonised Codes of Fish, frozen, excluding fish fillets and other fish meat of heading no.0304, pacific salmon (oncorhy
0304	Harmonised Codes of Fish fillets and other fish meat (whether or not minced), fresh, chilled or frozen
0305	Harmonised Codes of Fish, dried, salted or in brine; smoked fish, whether or not cooked before or during the smoking pro
0306	Harmonised Codes of Crustaceans, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine; crust
0307	Harmonised Codes of Molluscs, whether in shell or not, live, fresh, chilled, frozen, dried, salted or in brine; aquatic

(2)Food and Agriculture Organization of the United Nations- Fisheries and Aquaculture Department

The FAO Fisheries and Aquaculture Department provides advice and objective information to Members to help promote responsible aquaculture and fisheries. To fulfil this role, the Department compiles, analyses and disseminates fishery data, structured within data collections.

Fishery Statistical Collections: Fishery Commodities and Trade



This database contains statistics on the annual production of fishery commodities and imports and exports (including re-exports) of fishery commodities by country and commodities in terms of volume and value from 1976. Online queries are available and you can select items of interest from the selection tabs and choose the entries to show from the Display tab.

You have the option to select the country, trade flow(export, import, production and reexport), commodity, time, display options and tracker facilities available in the online database query. In the commodity menu you can have trade Crustaceans Fish Fish, crustaceans, molluscs and other aquatic invertebrates Molluscs, aquatic invertebrates.

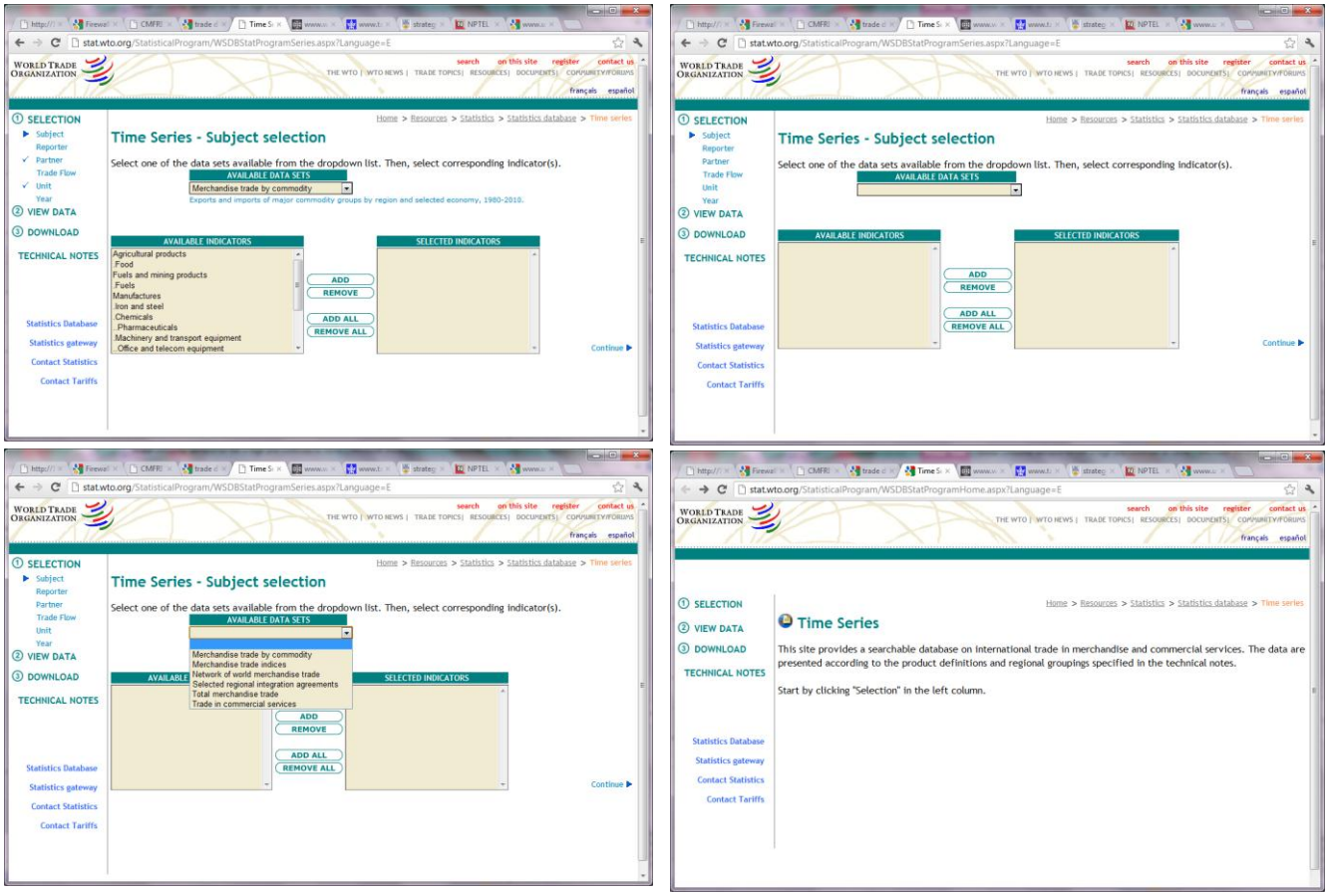
2) WTO statistics database

(http://stat.wto.org/StatisticalProgram/WSDBStatProgramHome.aspx?Language=E)

WTO statistics database allows you to retrieve statistical information. The Trade Profiles provide predefined information leaflets on the trade situation of members, observers and other selected economies;

- The Tariff Profiles provide information on the market access situation of members, observers and other selected economies;
- The Services Profiles provide detailed statistics on key infrastructure services (transportation, telecommunications, finance and insurance) for selected economies;
- The Time Series section allows an interactive data retrieval of international trade statistics.

This site provides a searchable database on international trade in merchandise and



commercial services. The data are presented according to the product definitions and regional groupings specified in the technical notes. Start by clicking "Selection" in the left column. Select one of the data sets available from the dropdown list. Then, select corresponding indicator(s) (Fig.1)

Fig 37.1: Screen prints explaining time series interactive data retrieval from WTO statistics data base

3) UN Comtrade

The United Nations Commodity Trade Statistics Database (UN Comtrade) contains detailed imports and exports statistics reported by statistical authorities of close to 200 countries or areas. It concerns annual trade data from 1962 to the most recent year. UN Comtrade is considered the most comprehensive trade database available with more than 1 billion records. A typical record is – for instance – the exports of cars from Germany to the United States in 2004 in terms of value (US dollars), weight and supplementary quantity (number of cars). The database is continuously updated. Whenever trade data are received from the

national authorities, they are standardized by the UN Statistics Division and then added to UN Comtrade.

Limitations:

UN Comtrade is available to the general public and should be used with good knowledge of its limitations. Please read the following points very carefully before extracting and using data:

1. The values of the reported detailed commodity data do not necessarily sum up to the total trade value for a given country dataset. Due to confidentiality, countries may not report some of its detailed trade. This trade will - however - be included at the higher commodity level and in the total trade value. For instance, trade data not reported for a specific 6-digit HS code will be included in the total trade and may be included in the 2-digit HS chapter. Similar situations could occur for other commodity classifications. Detailed data processed after 1. January 2006 and published in HS will sum up to the respective totals due to the introduction of adjustment items with commodity code 9999 and 999999.
2. Countries (or areas) do not necessarily report their trade statistics for each and every year. This means that aggregations of data into groups of countries may involve countries with no reported data for a specific year. UN Comtrade does not contain estimates for missing data. Therefore, trade of a country group could be understated due to unavailability of some country data.
3. Data are made available in several commodity classifications, but not all countries necessarily report in the most recent commodity classification. Again, UN Comtrade does not contain estimates for data of countries which do not report in the most recent classification.
4. When data are converted from a more recent to an older classification it may occur that some of the converted commodity codes contain more (or less) products than what is implied by the official commodity heading. No adjustments are made for these cases.
5. Imports reported by one country do not coincide with exports reported by its trading partner. Differences are due to various factors including valuation (imports CIF, exports FOB), differences in inclusions/ exclusions of particular commodities, timing etc. The recommendations for international merchandise trade statistics can be found in the International Merchandise Trade Statistics: Compilers Manual). Additional methodological information can be found on the same web page.
6. Almost all countries report as partner country for imports the country of origin (see Metadata & References > Explanatory Notes) which is determined by the rules of origin established by each country (see International Merchandise Trade Statistics, Concepts and Definitions, Rev.2, para. 139 and 140). Hence, the term 'partner country' in the case of imports does not necessarily imply any direct trading relationship.

The International Trade Databases can be combined with the other databases to provide a comprehensive understanding of the impact of international trade on economic and financial markets. One important use of international trade statistics in the majority of countries is to provide a data source for the estimation of those components of the balance of payments and the national accounts which relate to trade in goods.

4) World Integrated Trade Solution

World integrated Trade Solutions (WITS) gives access to international trade and protection related data and offers built-in analytical tools allowing users to assess the impact of tariff changes. WITS provide users with capabilities to retrieve and analyze trade and tariff data; convert data between different nomenclatures; customize country and

product groups; and download data. WITS also includes simulation tool to calculate the impact of tariff changes on trade flows (trade creation and diversion), tariff revenues, and consumer welfare using partial equilibrium modeling tools.

5) United Nations Conference on Trade and Development (UNCTAD) – Trade analysis branch

The Trade Analysis Branch (TAB) of the Division on International Trade in Goods and Services, and Commodities undertakes policy-oriented analytical work aimed at improving the understanding of relevant and emerging issues in international trade. It also focuses on policy issues of particular importance for developing countries. The work program responds to priority areas as identified by member States and follows the guidelines of the Accra Accord which has reinstated the importance of economic analysis and statistical tools for improving trade policy decision-making in developing countries. The Trade Analysis Branch consists of three sections: Global and Regional Trade Policy Analysis, Trade Policy Research, and Trade Information; and one unit: Creative Industries.

6) Asia Pacific Research and Training network on Trade

The Asia-Pacific Research and Training Network on Trade (ARTNeT) is an open regional network composed of leading trade research institutions across the UNESCAP region which is supported by the International Development Research Centre (IDRC), Canada.

International Fisheries Organizations vis-à-vis trade

There are various fisheries organizations with databases relevant to international fisheries resources having relevance to trade. Few are compiled with their relevance in Table 1 given below:

Table 37.2 Various organizations maintaining databases with relevance to international fish resources, conservation and sustainable usage

Organization	Web address
Conservation of Arctic Flora and Fauna(CAFF)	http://www.grida.no/prog/polar/caff
Convention on the Conservation of Antarctic Marine Living Resources(CCAMLR)	http://www.ccamlr.org/
Commission for the Conservation of Southern Bluefin Tuna(CCSBT)	http://www.ccsbt.org/
Food and Agriculture Organization of the United Nations(FAO)	http://www.fao.org/
Inter-American Tropical Tuna Commission(IATTC)	http://www.iattc.org/
International Commission for the Conservation of Atlantic Tunas(ICCAT)	http://www.iccat.int/
International Council for the Exploration of the Seas(ICES)	http://www.ices.dk/

Indian Ocean Tuna Commission(IOTC)	http://www.iotc.org/English/index.php
International Pacific Halibut Commission(IPHC)	http://www.iphc.washington.edu/
International Whaling Commission(IWC)	http://www.iwcoffice.org/
Northwest Atlantic Fisheries Organization(NAFO)	http://www.nafo.int/
North Atlantic Salmon Conservation Organization(NASCO)	http://www.nasco.int/
North-East Atlantic Fisheries Commission(NEAFC)	http://www.neafc.org/
North Pacific Anadromous Fish Commission(NPAFC)	http://www.npafc.org/
North Pacific Marine Science Organization (PICES)	http://www.pices.int/
Secretariat of the Pacific Community(SPC)	http://www.spc.int/
Western and Central Pacific Fisheries Commission (WCPFC)	http://www.wcpfc.int/

National trade databases

1) **Export Import Trade Intelligence (**InfodriveIndia.com)

The theme database nationally on export import trade intelligence is illustrated with the example of Infodrive India, which is a 15 year old market leader in providing Competitive Business Intelligence on Exports Imports. Website evolved itself as a company with a unique blend of knowledge of practical requirements of Exporters Importers, an International Network of Trade data sources and high end IT technologies to deliver Export Import Business Intelligence Information in most user friendly & cost effective manner.

The information provided includes:

- Online India Export Import Data
- Online Exim Policy Portal
- Custom Duty in Export Import Data
- Export Import Trade Intelligence of 12 countries

2) **Indiastat.com**

It provides depth of India specific, socio-economic statistical facts and figures culled from various secondary sources it is a portal of state specific sites which provide statistical data for all the major socio-economic parameters of the Indian States. District level data where ever available can also be viewed. Through this exhaustive compiled data can be accessed and download in MS-Excel/HTML formats. The database creates substantial value through the following benefits:

- Support decision-making processes:
- Enhance Forecasting:
- More Effective Sales Approaches:

- Calculate Market Share:
- Identify New Business Potential:
- Analytical Tools
- Reliable Data:Access to this information will directly impact the quality of your operational and marketing decisions. Together with other market databases, the trade database provides detailed information on the behavior and trends of markets.
- Enhance Forecasting: Data can be extrapolated from the database and used for forecasting purposes. These forecasts will allow you to be better prepared to react to emerging trends in the marketplace.
- More Effective Sales Approaches: Providing business intelligence tools to your sales staff is an essential element of creating strategic sales opportunities. The trade database will give your sales staff the vital information they need. Furthermore, it can easily be made available to all your sales and marketing staff worldwide.
- Identify New Business Potential: Enables you to analyze commodities and value density to understand the attractiveness of new traffic flows.
- Calculate Market Share: Comparing the aggregate market volume with your current business will provide a good measure of your market share and will likely identify opportunities for new business growth.
- Analytical Tools: Enables analysis of the air cargo market on specific origin and destination routes, enabling users to identify air cargo potential that is currently transported by surface. Trends can be studied and used as the basis for forecasting the future market and commodity developments.
- Reliable Data: The data received from customs offices is put through rigorous validity testing to ensure subscribers are provided the most accurate information possible.
-

3) **Ministry of Commerce and Industries Web base (**http://commerce.nic.in/index.asp)

Bilateral agreements are crucial in determining the tariffs as the trade relations differ from country to country. There are comprehensive Economic Partnership agreements (CEPA) that India is having with different countries. So Ministry of Commerce website will give the agreement details which provide us the approximate export-import tariffs for products intended in a trade.

4) **Marine Products Export Development Authority (**http://www.mpeda.com/inner_home.asp?pg=fishery**)**

The various schemes, directory of exporters, EU approved plants and export performance related to the marine products export is available in this web based database which included the list of culture based, resource based and product based catalogues.

Local trade databases

1) **Fish watch (**http://cmfri.org.in/fishwatch.html)

The Central Marine Fisheries Research Institute has been conducting fishery survey along the Indian coast and estimating marine fish landings and effort expended. Gear-wise, species-wise, quarter-wise fish landing data from the year 1962 for each maritime state of the country are being populated periodically at the Data Centre of CMFRI. This unique collation of first hand data based on the FAO approved sampling design has been the backbone of many a scientific endeavour carried out by avid fish researchers across the country and other parts of the globe.

Having blazed an illustrious trail for more than six decades, CMFRI has initiated a new system of field information dispensation on a near real time basis. As the first phase of this effort, the raised landing figures and the landing centre price range of important resources of major fishing harbours of the country are being published here. The landing figures (in kg) indicate the quantity of selected resources which were brought to the respective harbours during a 24 hours period starting from 12:00 noon of the first calendar day to 12:00 noon of the subsequent day. These figures are updated at 1600 h every working day on as and where available base. The archive data can be availed for annual averages and relevant information.

Conclusion

Information pertaining to commodities and its details are relevant in a trade setting. In a globalized market of a perishable commodity like fish, updated information on products, markets, infrastructure, quality checks, tariffs, trade barriers and the like will play a crucial role in deciding the commodity flow. Competing in the international food markets requires strenuous quality checks, failing which the chances of rejection and a ban on a commodity are possible. It is imperative to have a comprehensive knowledge on various quality checks adopted and rejection rates in a trade channel and there are databases supporting these causes as mentioned earlier. It is therefore relevant to know the various databases, its role and accessibility while studying international trade. The present study is a humble attempt in studying the different global databases and there tens of hundreds of websites hosting the information corridors which can pave way for solutions encountering different issues in international fish trade. The guidelines provided here further calls upon a detailed study on more databases and compilation of information to benefit the various stakeholders in international fish trade.

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38

Developing Policy Inputs for Efficient Trade and Sustainable Development Using Data Analysis

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Introduction

Trade forms a vital part of the world economy. The analysis of data on trade and related parameters plays a pivotal role in developing policy inputs for efficient trade and sustainable development. It is evident that the success of any type of analysis depends on the availability of the suitable type of data. In general, time series, cross sectional and pooled data are the three types of data available for trade analysis. Time series data are characterized by observations collected at regular intervals over a period of time while cross-sectional data are data on one or more variables collected at the same point of time. The pooled data is a combination of time series and cross-sectional data. For example, panel data, which is a special type of pooled data is used to study the relationship between trade flows and trade barriers over time. In recent years, the quantitative and qualitative analysis of trade and the effects of policies have grown sharply. This was due to the advances in the theoretical and analytical techniques as well as increased computational and data processing power of computers.

A multitude of analysis tools are available in today's world for a thorough and scientifically valid analysis of data. There are several choices available for the user to choose from – ranging from the general public license packages, analysis packages with statistical add-ons, general purpose languages with statistics libraries to the advanced proprietary packages. Of late, the spreadsheet packages like Microsoft Excel, Corel Quattro Pro etc. have been upgraded to a great extent and as a result, have become quite popular as a data analysis tools. Though the spreadsheet packages provide easy methods for data access and manipulation, but they are not equipped to handle large data sets and advanced statistical data analysis methods.

Statistical Packages

A good statistical software package is one which is compatible with the operating system of the user and strategically addresses the needs of the user with respect to data management and analysis for an affordable cost. There are many proprietary and freeware

statistical software packages designed for different statistical applications, depending on the user's needs.
This lecture note will take a look at some of them listed below which are most commonly used among social science workers.

Proprietary	Open Source / Freewares	Add-ons
❒ SAS	❒ R	❒ XLSTAT
❒ SPSS	❒ gretl	❒ BiPlot
❒ Stata	❒ DAP	❒ XLStatistics
❒ RATS	❒ PSPP	
❒ EViews	❒ Epidata	
❒ Minitab	❒ *G7*	
❒ SHAZAM		

In the following section, features of some of the proprietary statistical packages are briefly highlighted and an illustration of multiple linear regression using SAS is given at the end of the session.

SAS

SAS (pronounced "sass") once stood for "statistical analysis system," and began at North Carolina State University as a project to analyze agricultural research. As demand for such software grew, SAS was founded in 1976 to help all sorts of customers - from pharmaceutical companies and banks to academic and governmental entities.The SAS System provides a powerful framework for statistical analysis. In addition to statistical analysis, it also allows programmers to perform report writing, graphics, business planning, forecasting, quality improvement, project management, and more.

SAS is a good program for the intermediate and advanced user because it is very powerful, can be used with extremely large data sets, and can perform complex and advanced analyses. SAS is run largely by programming syntax rather than point-and-click menus, so some knowledge of the programming language is required. For a new user, learning how to write code and run the appropriate procedures can be daunting. Enterprise Guide enables you to get answers without having to write programs, through a point-and-click interface making selections from a series of menus. As a benefit even for experienced SAS programmers, EG provides a framework within which to organize the data, tasks, and results involved in performing a statistical analysis, through the creation and maintenance of “projects”.

The web site at http://www.sas.com/, gives complete information about SAS. SAS is fully supported on Windows and on UNIX/Linux, and is fully up to date on these two operating systems.

Some of the SAS products...

- Base SAS - data management and basic procedures
- SAS/STAT - statistical analysis
- SAS/GRAPH - presentation quality graphics
- SAS/OR - Operations research
- SAS/ETS - Econometrics and Time Series Analysis
- SAS/IML - interactive matrix language
- SAS/AF - applications facility
- SAS/QC - quality control

SPSS

SPSS, is the one among the popular statistical analysis software used in social science research. Originally it is an acronym of Statistical Package for the Social Science but now it stands for Statistical Product and Service Solutions. The web site at http://www.spss.com has got lot of information about SPSS. It is comprehensive and flexible and can be used with almost any type of file. It can be used to generate tabulated reports, charts, and plots of distributions and trends, as well as generate descriptive statistics and more complex statistical analyses. SPSS provides a user interface that makes it very easy and intuitive for all levels of users. Menus and dialogue boxes make it possible to perform analyses without having to write command syntax, like in other programs. It is also simple and easy to enter and edit data directly into the program. SPSS consists of four windows. A Data Editor, an Output window, a Syntax window, and a Chart Editor. The Data Editor is further divided into a Data view and a Variable view. In the Data Editor you can manipulate data and make commands. In the Output window you can read the results of the analysis and see graphs and then it also works as a log-window. In the Chart Editor you can manipulate your graphs while the syntax window is used for coding your analysis manually. There are a few drawbacks, for example, there is a limit on the number of cases you can analyze.

Capabilities includes.....	
Descriptive statistics	Loglinear
Compare Means	Classify
General Linear Model	Data Reduction
Generalized Linear Model	Scale
Mixed Models	Nonparametric Tests
Correlation/ Regression	Time Series

STATA

Stata is a full-featured statistical programming language that runs on a variety of platforms such as Windows, Mac OS X, Unix and Linux. It can be used for both simple and complex statistical analyses. The web site at http://www.stata.com has quite a lot of information about Stata. STATA uses a point-and-click interface as well as command syntax, which makes it easy to use. STATA also make it easy to generate graphs and plots of data and results. Analysis in STATA is centered around four windows: the command window, the review window, the result window, and the variable window. Analysis commands are entered into the command window and the review window records those commands. The variables window lists the variables that are available in the current data set along with the variable labels, and the results window is where the results appear.

Some of the capabilities...

Basic Statistics	Nonlinear regression	Multivariate methods
Linear models	Time series	Resampling and simulation methods
Generalized linear models	Structural equation modeling	Nonparametric methods
ANOVA / MANOVA	Survey methods	Exact statistics
Longitudinal data/panel data	Multilevel mixed-effects models	Graphics
GMM		

RATS

RATS (Regression Analysis of Time Series) is an econometrics and time-series analysis software package used worldwide by economists and others for analyzing time series and cross sectional data, developing and estimating econometric models, forecasting, and much more. Estima develops and sells RATS. The current release of RATS is Version 8.1, is easier to use than earlier version and offers the most advanced tools available for econometrics research. RATS provides all the basics, including linear and non-linear least squares, forecasting, SUR, and ARIMA models. It support techniques like GMM, ARCH and GARCH models, state space models, and more. RATS also offers support for Vector Autoregression models, and is it also offers spectral analysis capabilities. RATS is available for Windows, Macintosh, UNIX, and Linux, with complete compatibility across platforms. The programs, data files, output, and graph files across any of these platforms can be shared without any translation.

E Views ;

EViews, which stands for Econometric Views, is a new version of a statistical package for analysing time series data. The current version EViews 7 offers an extensive array of powerful features for data handling, statistics and econometric analysis, forecasting and simulation, data presentation, and programming. It makes use of the user-friendly windows environment; most of its operations can be done with the drop-down menus. The information on EViews is given at http://www.eviews.com. In general, EViews can perform the following jobs: Interpolation tools, Whitening,Long-run variances and covariances, Variance ratio tests, Instrumental Variables & GMM, Single-Equation Cointegration, Generalized Linear Models and Diagnostics.

Minitab

Minitab is a statistics package developed at the Pennsylvania State University. The latest version of the software is Minitab 16. Some of the features of Minitab are logically arranged menus and tools, project Manager, ReportPad™ for generating reports, Easily export output to PowerPoint and Word, Clear, comprehensive Help system, StatGuide™ explains output, Tool-specific tutorials, Glossary of statistical terms, Smart Dialog Boxes™ remember recent settings and available in 7 languages. Minitab provides facilities like Data and File Management, Basic Statistics, Graphics, Regression Analysis, Analysis of Variance, Statistical Process Control, Multivariate Analysis, Time Series and Forecasting, Non-parametrics and Simulation and Distributions.

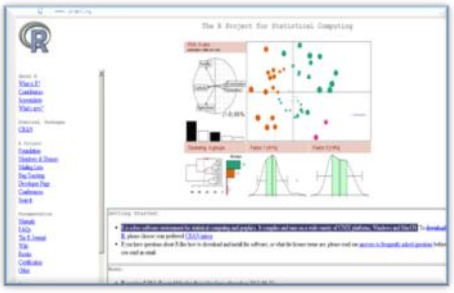
SHAZAM

SHAZAM is comprehensive software for econometrics, statistics and analytics. The primary strength of SHAZAM is the estimation and testing of many types of econometric and statistical models. SHAZAM 11 includes the fully searchable electronic version of the SHAZAM Reference Manual.

SHAZAM offers...		
Data Analysis	Principal Components and Factor Analysis	Statistical Programming
Regression and Time Series Analysis	Univariate and Multivariate Modelling	Matrix Programming
Estimation of Linear and Nonlinear Models	Pooled Time-Series Cross-Section Modelling	Static and Dynamic Forecasting
Hypothesis Testing and Confidence Intervals		Monte Carlo Simulations

The next section gives highlight on some of the commonly used open source and freeware statistical softwares. The Open source software is one which must comply with certain criteria (defined by the Open Source Initiative (www.opensource.org/docs/definition.php)). Notably, the software must be distributed free of charge and the source code must remain public for study and adaptation to other open source uses. If the open source code is used in the development of other software, that software cannot become proprietary. Free statistical software is a practical alternative to commercial packages. In general, free statistical software gives results that are the same as the results from commercial programs, and many of the packages are fairly easy to learn, using menu systems, although a few are command-driven. These packages come from a variety of sources, including governments, non-governmental organisations and also developed by individuls.

R, an open source software for statistical computing and graphics. R provides a wide variety of statistical and graphical techniques, including linear and nonlinear modeling, classical statistical tests, time-series analysis, classification, clustering, and others. R is easily extensible through functions and extensions. Many of R's standard functions are written in R itself, which makes it easy for users to follow the algorithmic choices made. R is highly extensible through the use of user-submitted packages for specific functions or specific areas of study. R is an implementation of the S programming language and due to the S heritage; R has stronger object-oriented programming facilities than most statistical computing languages. The static graphics, which can produce publication-quality graphs, including mathematical symbols is another strength of R. Dynamic and interactive graphics are available through additional packages. R compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. The CRAN page offers a window into the world of R (http://cran.r-project.org).



GRETL

Gretl is a cross-platform software package for econometric analysis, written in the C programming language. It is free, open-source software. Gretl is very similar to EViews. Some of the features of gretl are listed below.

- A wide variety of estimators: least squares, maximum likelihood, GMM; single-equation and system methods

- Time series methods: ARMA, GARCH, VARs and VECMs, unit-root and cointegration tests, etc.
- Limited dependent variables: logit, probit, tobit, interval regression, models for count and duration data, etc.
- Integrated scripting language: enter commands either via the gui or via script
- Command loop structure for Monte Carlo simulations and iterative estimation procedures

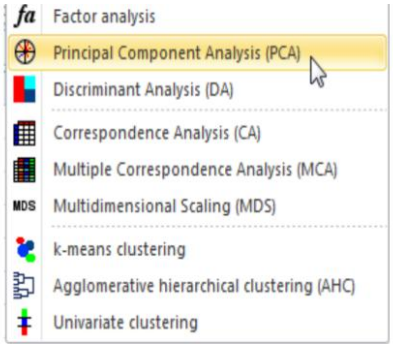
Epidata

EpiData Entry is used for simple or programmed data entry and data documentation. Entry handles simple forms or related systems Optimised documentation and error detection features. EpiData Analysis performs basic statistical analysis, graphs, and comprehensive data management.

G7

G7 is an econometric regression and model-building program for Windows. G7 is developed by Inforum, or the Inter-industry Forcasting Project at the University of Maryland. Inforum provides a wide variety of economic forecasts tailored to the needs of its research sponsors. Forecasts include macroeconomic, industry, demographic, occupational, and international. Inforum also provides models which includes macroeconomic models, macro-industry models, international models, and a demographics model.

XLSTAT



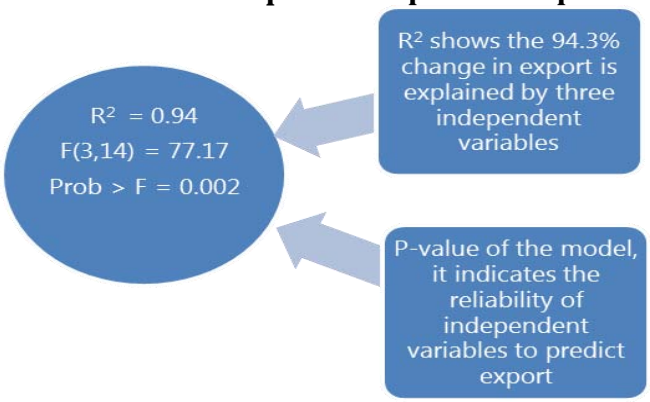
The XLSTAT statistical analysis add-in offers a wide variety of functions to enhance the analytical capabilities of Excel, making it the ideal tool for everyday data analysis and statistics requirements. The multivariate statistical tools available in XLSTAT are given in the figure.

n Illustration

The aim of the analysis is to study the determinants of export volume. The dependent (endogenous) variable is export volume and the independent (exogenous) variables are Transport cost, Exchange rate and Distance.
The SAS codes for fitting a multiple linear regression are as follows.

```
data example;  /*Reading data in SAS*/
proc reg data=example;  /*Fitting multiple linear regression model*/
model expvol = Transport_cost  Exchange_rate  Distance;
run;
```

AS Computer Output - Interpretation



The t values test the hypothesis that the coefficient is different from zero. The higher the t value, the higher the significance of the variable.

Parameter Estimates

Model	Coef	Std Error	t	Sig.
Constant	- 29.45	6.00	- 4.91	0.00
Transport_cost	1.38	0.09	14.87	0.01
Exchange_rate	- 2.31	0.33	- 6.95	0.00
Distance	4.21	0.75	5.59	0.03

Exports = -29.45 + 1.38*Transport cost – 2.31*Exchange rate+ 4.21*Distance + ε_{it}

The above regression equation tells that export volume is expected to increase by 1.38 when the transport cost goes up by one unit while controlling the effects of exchange rate and distance in the model. Similarly, export volume is expected to decrease by 2.31 when exchange rate goes up by one unit and increase by 4.21 when the distance goes up by one unit.

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39

Conflicts in Fisheries: Partnerships & Co-management Paradigms

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Introduction

The open access regime existing in the harvesting of marine fishery resources in our country warrants stronger emphasis on invoking technological innovations as well as management paradigms that reconcile livelihood issues with concerns on resource conservation. Innovations do not happen in a socio-political vacuum. It is the extent of partnership between the research and the client system that decides the fate of any technology in terms of its adoption or rejection. Rational utilization of common property resources for sustainable development without endangering the environment is possible through community participation. For more than 6 million fishers and fish farmers, fisheries are a source of livelihood in India. Fisheries sector has recorded faster growth as compared to the agricultural sector in all the decades and is contributing in a significant way to the economic growth of the nation. The vast Exclusive Economic Zone of 2.02 million sq. km of ocean under the possession of India is more than two third of its land area. Marine fishing has been considered as a primary livelihood option since time immemorial, for the occupants of the coastal belt in India. The marine fishery resources of the country include a coastline of 8129 km with numerous creeks and saline water areas, an Exclusive Economic Zone (EEZ) of 2.02 million km^2 which are suitable for capture as well as culture fisheries. The annual harvestable mairne fishery resources in the Indian EEZ have been estimated at about 3.93 million tones constituting more than 50 per cent demersal, 43 per cent pelagic and 6 per cent oceanic groups. (Rao Syda, 2011) Moreover it supports the deprived coastal community with sufficient nutritional security which is otherwise unreachable for such segment. Currently the marine fisheries sector produces about 2.6 million tonnes (2003) of fish per annum. About 3 million people are employed in the primary, secondary and tertiary sector of marine fisheries which provides livelihood security to about 18 to 20 million people. (Sathiadhas, 2007)

Fisheries development is a state subject in India, but, centre promotes fisheries development through state level programme planning and implementation units. The development plans for the fisheries sector have been aiming at fish production and promoting export. India is blessed with vast and varied fishery resources with great

potential in both coastal and inland areas. But, fisheries production is showing a depleting trend which is adversely affecting the livelihoods of fishers and making a large population vulnerable. Being the open access resource, stock assessment and irreplenishable nature of abundance in stock, conflicts of various types become the part and parcel of the fisheries system in the country. To address the livelihood issue, government introduced regulatory mechanisms such as gear selectivity, seasonal area closures and regulations that control the fishing effort and catching. This is 'top down government driven management approach' through legislation. However, government managed models of management have proved to be unsuccessful as indicated by poor compliance of action and regulations resulting in crisis and adverse affects on the livelihood of fishers.

Conflicts in Capture Fisheries Sector : Marine & Inland fisheries

With regard to conflicts in capture fisheries sector, there are marine and inland fisheries sectors to be considered. In marine sector, each country has their jurisdiction up to 200Nm towards sea. In India concept of Exclusive Economic Zone (EEZ) enacted during 1997. In dealing with management, protection and proper utilisation of living marine resources several conflicts has been raised.

Conflicts between India and neighbouring countries: Some examples

- Primarily arises from fishermen's violations of national jurisdiction while in the pursuit of fish. Fishermen are lacking navigational devices which can forewarn fisherman from trespassing their jurisdiction.
- Political problem between India-Pakistan and Tamil problem causing tensions between India-Sri Lanka.
- Fishermen in Okha in Gujarat accidentally trespassing Indian jurisdiction being caught by Pak navy patrols.
- Fishermen in Rameshwaram in T.N. being caught by Sri Lankan navy.
- Conflicts over marine fisheries India and Bangladesh are rather rare.

Conflicts between states : Some examples

Conflicts occur mainly between southwestern states and south eastern states. (Goa, Tamil Nadu, Karnataka, Kerala.) It essentially is because of differential fishing ban period during monsoon. There is no demarked boundary between states in the marine region. (Each state has their jurisdiction up to 12 nm towards sea)

Conflicts between fishermen using two levels of technology

- Large scale industrial fishing vessel and small scale fishing vessel.
- Inshore and deep sea fishing vessel.
- Trawlers and Purse-seiners.

Today there seems to be change in the direction of conflicts.

Regional conflicts between fishermen

- Between fishermen from one state to the other.
- Between fishermen from one harbour to the other.

Conflicts between fishermen and industries: Example:

- Mangalore coast is conspicuously noted for conflicts of fisherfolk with industries.

- Inland Fisheries: accounted the conflicts in reservoir fisheries and riverine fisheries.
- Culture Fisheries Sector (Aquaculture)

Social conflicts and aquaculture

- Growth of carp culture has led to the conversion of paddy fields to fish ponds.
- Affected poor people who depend on their staple food (cereal).
- Government of A.P. imposed a tax on water use for aquaculture.
- Shrimp farmer and village people.
- Effect of dykes.
- Effect of ponds around creeks.
- Salinization problem

Conflicts between the shrimp farmers and fishermen

The shrimp farms do not provide access to the beach for traditional fishermen who have to reach the sea from the village.

A typology of fishery conflicts

In most fisheries, there appears to be little space available to increase long-term sustainable fishery benefits simply by increasing production. The fishery policy tools are generally limited to

1) Increasing the efficiency of harvesting and of management.
2) Making allocation (distributing) decisions, particularly determining who has the privilege of access to the fish available for capture.

Despite superficial appearances of chaos, the wide range of fishery conflicts (of both the efficiency and allocation varieties) can be organized into a relatively small number of categories, under for inter-related headings.

(1) Fishery Jurisdiction: Involving fundamental conflicts over the who 'owns' the fishery, who controls, access to it, has is the optimal form of fishery management, and what should be the role played by governments in the fishery system.
(2) Management mechanisms: concerning relatively short-term issues arising in the development and implementation of fishery management plans, typically involving fishers/ governments in the fishery system.
(3) Internal allocation: involving conflicts arising within the specific fishery system, between different user groups and rear types, as well as between fishers, processors and other players.
(4) External allocation: incorporating the wide range of conflicts arising between internal fishery players and outsiders, including foreign fleets, aquaculturists, non-fish industries (such as tourism and forestry) and indeed the public at large.

Conflicting fishery paradigms:

While the above typology categorises fishery conflicts, the real roots of the conflicts which le in the underlying systematic differences in priorities pursued by the various fisheries players are to be given prime consideration. For example, everyone wants their fishery to be efficient, but the real meaning of this pleasant-sounding goal depends

entirely on the desired objectives which in turn vary widely with the philosophy and ideology of the fishery players. (Anthony, 1992)

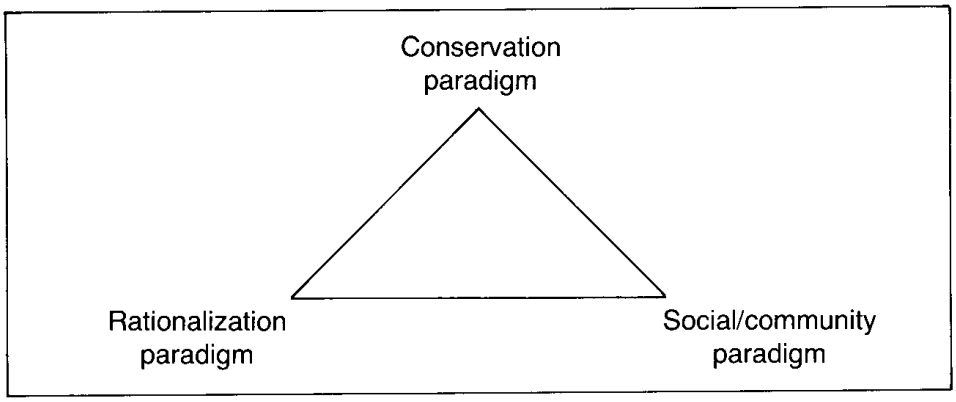

Fig 39.1 Conflicts among the community

Conflicts and wars related to the rights over the use of land and water have been important human issues throughout recorded history. Although many of us are probably more aware of wars fought over religious freedom, political ideologies and social issues, conflicts over fishing rights and resources are just as common, if less reported. Since the Exclusive Economic Zones (EEZ) were established in the 1970s, disputes have become more frequent and more violent than ever before. Due to the establishment of EEZs, access to the world's oceans has been radically reorganized and the access rights of foreign fishing vessels have been curtailed. Negotiations, international fisheries agreements (such as those between European and African countries), and recourse to an international tribunal have sometimes succeeded in resolving conflicts.

Conflict between Philippines and China is essentially due to over access to territorial waters. Thousands of Indonesian fishers have been incarcerated as a result of illegal fishing in Australian waters. While sovereignty issues are generally at the root of such conflicts, they are also the manifestation of competition for access to fish stocks, in coastal waters as much as on the high seas. In addition, the use of flags of convenience serves to exacerbate the problem. The country where a boat is registered does not necessarily identify its country of origin, and this loophole enables fishing companies to flout international fishing and labor conventions with impunity.

Paradigm shift in fisheries governance

There is an extreme necessity to have a paradigm shift in governance of fisheries which enables resource users (communities and fishers) and stakeholders participation at all levels as effective partners in the management process. Management regimes as remedy cover Partnerships, Co-operation, Leasing (Aquaculture) and Co-management paradigms.

Partnership and Co-operations through Fisheries co-operatives and Self Help Groups mobilized in marine fisheries sector do play a vital role in sustainable fisheries management. (Vipinkumar, 2005). Leasing essentially occurs with regard to aquaculture sector. Let's have a look into the policy and programmes for aquaculture development in india.

The registration of open water body farms and government leasing determines the appropriate areas for Mariculture activity, allocating the rights to use the resource and

evaluation of environmental impacts based on certain principles to be considered to frame the Mariculture policy. (Mohamed and Kripa, 2010, Radhakrishnan and Dineshbabu, 2011)

1. Common Property use conflicts: Policy guided by: Use of open water bodies for navigation and fishing should not be hindered by Mariculture. Similarly, Mariculture activities in open water bodies should not cause disturbances to other users. Permitted Mariculture by the state should be afforded complete protection of structure and stock kept in the open water bodies.
2. Carrying capacity: Open water bodies have limits to biological productions and such limits should be defined by the state in consultation with research institutions.
3. Environmental Protection: The polluter pays principle enacted by the CAAI should be applicable to pen water bodies so as to minimise environmental impacts. Pre and Post EIA (Environmental Impact Assessment) is mandatory.
4. Conservation: Aquatic ecosystems are very sensitive to changes caused by human activities and hence all activities should take into consideration conservation of aquatic biodiversity.
5. Zonation: Since Mariculture in open water bodies diverse and region specific, states have to draw-up zonation plans in GIS formats with the help research institutions. Creation of Mariculture parks should be encouraged.

Partnerships and Co-management Paradigms

There are success stories in Asia pacific region where the alternative models have been able to take care of all the parameters of sustainability. One of such fisheries management approaches, as an alternative to the top down government management approach is 'co-management'. This is a partnership arrangement in which the community of local resource users (fishers), government and other stakeholders share the responsibility and authority for the management of fisheries through consultations and negotiations as regards to their roles, responsibilities and rights resulting in development of effective partnerships. This ensures sustainability of the resources as well as improving the livelihood of fishers.

Fisheries Co-management

Fisheries co-management is defined as an arrangement where responsibility for resource management is shared between the government and user groups (Nielson *et al*, 2004). It is considered to be one solution to the growing problems of resource over-exploitation. If the regime is both to be effective and legitimate, introducing a co-management arrangement, which can be defined as a dynamic partnership using the capacity and interest of user-groups complemented by the ability of the fisheries administration to provide enabling legislation? Co-management is also a mean to reorganizing the fisheries management system. Co-management is -from this perspective- an institutional process of integrating and reallocating management responsibilities and competence (legal power) among participants by sharing the costs deriving from fisheries management with the users. Fisheries co-management is based on the following hypothesis. The involvement and participation of user-groups create incentives for cooperation in order to formulate and implement more efficient, equal and sustainable management schemes which would benefit all parties.

Co-management provides some sense of ownership to the fish resources, which makes the user groups far more responsible for obtaining long-term sustainability of the fish resources. It might also be more cost-efficient in terms of administration. Enforcement

than centralized systems, but administration costs may increase in a co-management system, as the process may be rather time consuming, involving several interest groups.

Co-management is often referred to as relations between fishermen and the national administration including fisheries research institutions, mainly concerning regulation methods, quota allocation and stock assessment. However, co-management can also be perceived in relation to market activities, whereby relations between fishermen and buyers come in focus. As market dynamics become more important to fishing activities, it can be expected that coordination of market performance and fisheries management measures will be increasingly important.

Co-management is a set of institutional and organizational arrangements (rights and rules), which determine how the fisheries administration and user-groups cooperate. A co-management arrangement is not a static legal structure of rights and rules, but a dynamic process of creating new institutional structures. A co-management institution can therefore be designed as an entirely new institution or can be based on already established institutional structures. The latter might often be the case in fisheries, where co-management institutions usually evolve as incremental user-group involvement in certain management tasks. The devolution of authority to manage the fisheries, away from the fisheries administration to user-groups, may be one of the most difficult tasks of co-management. On the one hand, the fisheries administration may be reluctant to relinquish their authority, or portions of it, and are often opposed to decentralization. On the other hand, user-groups may neither have the aspiration nor the capabilities to undertake enhanced fisheries management responsibilities.

Advantages of approaching fisheries management as a bottom-up process versus the traditional centralized top-down system may be a high degree of acceptability and compliance with regulation measures, due to the participation of user-groups in the decision-making and implementation process. Once user groups are involved in the decision making and implementation of fisheries management, a spectrum of co-management arrangements can be identified. The figures illustrate the various types of institutional set-up for different co-management arrangements.

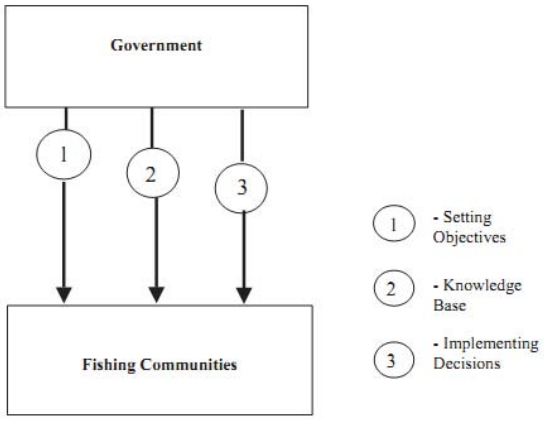

Fig. 1. Modern fisheries management.

In the instructive type, there is only minimal exchange of information between government and users. This type of co-management regime is only different from centralised management in the sense that the mechanisms exist for dialogue with users, but

the process itself tends to be government informing users on the decisions they plan to make.

Co-management can be an innovative change to the modern fisheries management approach as it implies a power sharing arrangement between government and fishing communities to undertake fisheries management. However, the practical adaptation by governments of the co-management approach has most often been limited to involving fishing communities in the implementation process—an 'instrumental co-management' approach

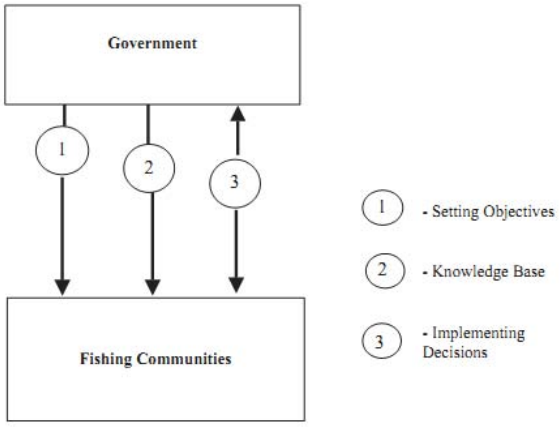

Fig. 2. Instrumental co-management.

Socio-economic considerations are likely to play a more prominent role within an empowering co-management arrangement. Empowerment of fishing communities is a mechanism to give the people within the fishing communities a chance to influence their own future in order to cope with the impact from globalisation; competing use of freshwater and coastal environments; and other fisheries related issues.

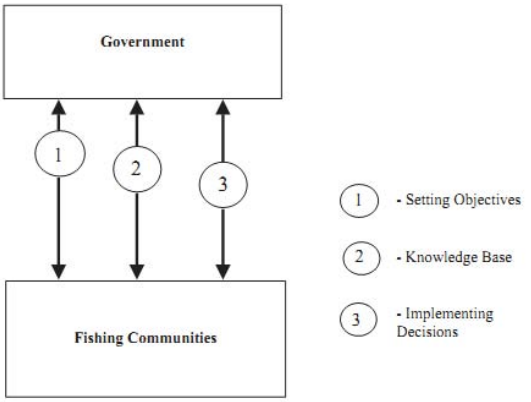

Fig. 3. Empowering fisheries co-management.

The empowering co-management approach is a demanding concept, as it requires:

- A rethink of the logic for management and subsequently a change in the knowledge base for management.
- A major restructuring of the institutional and organisational arrangements supporting management.
- A substantial change in attitudes from both governments and fishing communities towards their role in such arrangements.
- Aspiration from fishing communities and government to proceed along this avenue.
- Capacity building at several levels both within government and fishing communities

Co-management for Fisheries Conservation and Livelihood

- Competitive Fishing needs to be replaced by cooperative fishing to avoid depletion and ultimate extinction of several varieties of our marine flora and fauna
- Fishery resources are renewable but not inexhaustible
- Cooperative fishing minimizes capital investment vis-à-vis cost of production, sustainability of resources and maximizes the earnings and profit
- Cooperative marketing enhances the efficiency of distribution channel and enhances the earnings of real producers

Common property: Management issues

- Common property means no one is having ownership: hence no –management
- The literature on property rights identifies different ideal analytical types of property rights regimes:
- State property: with sole government jurisdiction and centralized regulatory controls;
- Private property: with privatization of rights through the establishment of individual or Company-held ownership;

Co- management: Theoretical Framework

- Co- management is a new alternative management approach with a human face.
- Co-management is an effective process for the collective governance of common property resources.
- Co-operative management or co-management of fisheries can be defined as a partnership arrangement in which the community of local resource users (fishers), government, other stakeholders (boat owners, fish traders, boat builders, business people, etc.) and external agents (non-governmental organizations (NGOs), academic and research institutions) share the responsibility and authority for the management of the fishery.
- The substance of sharing of responsibility and authority will be negotiated between community members and government and be within the boundaries of government policy.
- The term 'community' can have several meanings. Community can be defined geographically by political or resource boundaries or socially as a community of individuals with common interests

  A community is not necessarily a village, and a village is not necessarily a community. Care should also be taken not to assume that a community is a homogeneous unit, as there will often be different interests in a community, based on gender, class, ethnic and economic variations.

  Co-management should be viewed not as a single strategy to solve all problems of fisheries management, but rather as a process of resource management, maturing, adjusting and adapting to changing conditions over time. A healthy co-management process will change over time in response to changes in the level of trust, credibility, legitimacy and success of the partners and the whole co-management arrangement.
- Co-management is also called participatory, joint, stakeholder, multi-party or collaborative management.
- Co-management sharing and decentralization. It attempts to overcome the distrust, corruption, involves aspects of democratization, social empowerment, power fragmentation and inefficiency of existing fisheries management arrangements through collaboration

- Partnerships, roles and responsibilities are pursued, strengthened and redefined at different times in the co-management process, depending on the needs and opportunities
- The process may include formal and or informal organizations of fishers and other stakeholders.
- Fisheries co-management can be classified into five broad types according to the roles government and fishers play (Sen and Nielsen, 1996):
  (1)Instructive: There is only minimal exchange of information between government and fishers. This type of co-management regime is only different from centralized management in the sense that the mechanisms exist for dialogue with users, but the process itself tends to be government informing fishers on the decisions they plan to make.
  (2)Consultative: Mechanisms exist for government to consult with fishers but all decisions are taken by government.
  (3)Cooperative: This type of co-management is where government and fishers cooperate together as equal partners in decision-making.
  (4)Advisory: Fishers advise government of decisions to be taken and government endorses these decisions.
  (5)Informative: Government has delegated authority to make decisions to fisher groups who are responsible for informing government of these decisions.
  Through co-management, equity and social justice in fisheries management is sought. Equity and social justice is brought about through empowerment and active participation in the planning and implementation of fisheries co-management. The mutuality of interests and the sharing of responsibility among and between partners will help to narrow the distance between resource managers and fishers, bringing about closer compatibility of the objectives of management.
- The overall prospects for co-management are good in the Philippines, Cambodia, Indonesia, Thailand, Vietnam, Laos, Bangladesh, India, Malaysia, Sri Lanka, Mozambique, Zambia, South Africa, Malawi and Kenya.
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The Stakeholder analysis

Other than fishers, stakeholders (individuals, groups or organizations who are in one way or another interested, involved or affected (positively or negatively) by a particular action) that derive economic benefit from the resource (for example, boat owners, fish traders, business suppliers, police, politicians, consumers) should also be considered in co-management and the stakeholder analysis can help to identify those stakeholders who should be included in co-management.

A Case study of Co-management in Indian context

There has been an interesting sharing of ideas in recent issues of SAMUDRA *Report* on the experiences and principles of co-management. All over the world, fisher communities are trying desperately to safeguard their access to fish resources, while, at the same time, being driven to catch more in order to keep afloat. The fishers of the Saurashtra coast of Gujarat, one of the foremost fish-producing States of India, are no exception, as a result of the study undertaken on "The Impact of Development on Human Population Dynamics and the Ecosystem" in three locations of the west coast of India, with the help of a grant from the McArthur Foundation. (Nalini and Vijayan, 2007)

One of the study locations was the large fishing harbour town of Veraval in Gujarat. The findings of the study were rather revealing, not only regarding the nature of the decline of the overcapitalized trawl fishery, but also the poor environmental and social indicators in

a place that had a booming fishery for over 25 years through the 1980s and 1990s. In the community feedback workshops held in 2005, people were also taken aback by the findings of the study for a while and they were aware that their fishery was on the downswing, they felt challenged to realize that a large number of the children of the community were not in school, that there was a fall in the female sex ratio, and that there was a rise in the levels of morbidity and demands for dowry at marriages. As a community that is basically business-oriented and with a desire to simultaneously claim progress, they found themselves in a prisoner's dilemma. A challenge of seeking a way out by the project authorities made them interact with them on a longer-term basis.

The fishery in the area is a trawl fishery along a 40-km coastline between the two fishing harbours of Veraval and Mangrol, which account for a third of the fish catches of Gujarat. There is also a vibrant *hodi* fishery of fiberglass-reinforced plastic (FRP) beach-landing craft, interspersed with the trawlers. Authorities got intensively involved in the fishing harbour/community of Mangrol as the community has traditionally been well organized. They were also fortunate to get a local team that the local community agreed to host. In preparation for the work, an intensive training programme was organized for the team. There were also four representatives from Mangrol and Veraval, selected by the community, who participated in the programme. They actually represented the trawl fishery.

Initiating change

Project people did not initially mind this fact as it was this sector that they thought had to be involved in initiating any change in resource management. The boat owners were intensely involved in the training programme and, during the subsequent period, they turned out to be the main agents of change in the community. Besides developing an analysis of the fisheries crisis, they were most intrigued by the connections made to the fall in the female sex ratio, the number of school-age dropouts, the high morbidity rates, and the extensive pollution of water bodies, all in a context where the communities were well organized but totally in the hands of men. The inputs on gender analysis and the patriarchal development paradigm helped them to see the negative side of male-dominated communities, where women have no voice, and, as a consequence, the issues of potable water, sanitation and health receive no priority. In fact, the community organizations had seen to it that entry into the trawl fishery was limited to members of the same caste. Yet just as these caste organizations camouflaged disparities in the community, they were unable to manage the manner in which investments were made in the fishery, which, in turn, aggravated the growing disparities.

The fishery in the area has been kept afloat by, on the one hand, State subsidies on diesel and, on the other, by the opening up of export markets and the development of *surimi* plants. It is otherwise an extremely inefficiently run trawl fishery, which has also contributed to the massive pollution in the harbours. But the government has gradually begun to be less lenient on the diesel subsidies, certain export consignments have been rejected by some importing countries, and the government has begun giving greater importance to developing coastal resources other than fisheries. The fishing communities, therefore, needed to get their act together and think differently about their fishery and its future if they did continue to consider the fishery as a means of livelihood.

Strategies to tackle this problem were developed at the training programme, and a plan was drawn up to set up a coastal area managing council in a year as well as push for co-management of the fisheries. The first step was to develop a general awareness in the community about the inter-relationships among the ocean, the land and the people so that

people understand how these affect one another. This was done at several levels through all kinds of community programmes but the strategy in the first year was to:

- Develop a forum for women where they could discuss and understand these issues and, at the same time, create a collective to gradually represent their cause and themselves in the community organization (*samaj*);

- Create an awareness among the youth and children about the coast and oceans; and widen the understanding of the fishers themselves regarding coastal-area issues, and relate these to their fisheries-management possibilities. For this, efforts were made to also include the elected representatives of the municipality in discussions related to these issues so that they would be taken into consideration in town planning.

- The most interesting results were from an active group of women fish vendors who pressured the municipality and the fisheries department for a better fish market, while another group made a detailed study of the community's problems relating to water, sanitation and attendant infrastructure, which was presented to the members of the *samaj.* In both these cases, the community's men were very responsive and open to the idea that women could also be part of the co-management process.

The discussions on co-management were done separately for the fishing sectors, the community organizations and the women so that all of them could understand the issues and felt free to raise doubts and make suggestions from the point of view of their own sectors. It was clear that there were several areas of conflict.

After the discussions, all the representatives got together to discuss the possibility of a larger plan and who would finally meet the government and scientists to make the proposed presentation on co-management. Importantly, it was the first time that women and men from various sectors, caste and religious groupings had got together to discuss coastal and fisheries issues.

In August 2007, an Expert Consultation on Fisheries and Area Co-management was held in Ahmedabad, the capital of Gujarat, supported by the Fish Code Programme of the Food and Agriculture Organization of the United Nations (FAO), where the State's entire fisheries department was present, together with scientists from the Central Marine Fisheries Institute (CMFRI), the Central Institute of Fisheries Technology (CIFT) and the Fisheries Survey of India (FSI), as well as trader, processor and non-governmental organizations (NGOs) and the Marine Products Export Development Authority (MPEDA).

The community leaders first presented their ideas on co-management, which included both the need for fisheries management and coastal-area management, and articulated why they thought that this was a viable option in their particular context. They requested the government to create a framework of legislation for co-management, where both their rights to the coastal resources and the responsibilities of the government and the various stakeholders would be clearly defined. Subsequently, the experts responded, and a group discussion followed on the action that could be taken. An interesting and heated discussion between the trawl-boat owners, the scientists and the government officials had even the women chipping in, but unfortunately the *hodi* owners remained silent.

The importance of this process has to do with the fact that co-management was proposed by the community representatives from a shore-based fisheries perspective and not a fishing perspective alone. This was possible because of the data available and the focus on the fishery as a means of livelihood that has to be sustained. But this is not an easy

process and it still has to be operationalized. The bank on the tremendous amount of goodwill shown by all the stakeholders, indicates that the stakes in actually managing the fisheries are high.

Conflict resolution though Sui-generis co-management : A case study of '*Kadakkody*' in Kerala

Kadakkody: A linguistic aberration of the Malayalam word *'Kadal-kodathy'* literally meaning sea court. It has legislative, executive and judiciary roles to play in the *Araya* and *Dheevara* communities of Hindu fishermen belonging to *Kasargod* district of Kerala. Kadakkodies make their presence elt strongly in four regions like *Kasargod, Kizhoor, Kodikkulam* and *Bakkalam*. It plays as a community based fisheries management institution. Though functional only in a few pockets of north Malabar coast of Kerala, these age old institutions are similar to many of the Caste Panchayats prevalent in rural India. (Ramchandran, 2004).

Constitution of *kadakkody*: Each *kadakkody* is an adjunct to the temple of the fishermen community in each village. Ruling deity in all these temples is *Kurumba Bhagavathy* who is considered the most worshipped 'mother goddess' (Devi) among Hindu fisherfolk. Each *kadakkody* has three distinct bodies (1) *Sthanikan*(the permanently authorized), (2) *kadavanmar/Sahayiees* (temple messengers or assistant priest and they represent the police) and (3) Temple committee.

Sthanikans are composed for 4 separate constitutional groups namely *Karnavanmar* (4 members) *Achanmar* (6 members), *Kodakaran* (1 member) and *Anthithiriyan* (2 members). *Karanavanmar* are the high priests of the temple and they act as magistrates belonging to 4 *illams* such as *chempillam, kachillam, karillam* and *ponnillam*. *Achanmar* are six in number and are basically oracles (*velichapadan*) at the temple and are assistant magistrates. *Kadavanmar* are the messengers/ police. Temple committee is a democratically elected body. The factors determining the legitimacy of *kadakkody* are divine authority, social embeddedness, systematic procedures and behavioural norms, participatory and transparent process, quick and fair judgements, functional diversity, shared sense of pride etc.

Typological differentiation of 2 forms of co-management: (Ramchandran, 2004)

Charactieristics	***Sui- generis* form of CBCRM**	**State induced/supported CBCRM**
Self Governance	High	Low
Basis of legitimacy	Divine	Legislative
Group of homogeneity	High	Medium
Compliance	High	Low
Social embeddedness	High	Low
Adaptability	High	Low
Ethos	Cosmic	Livelihood
Norms	Uncodified	Codified
Management agenda	Inclusive	Exclusive
Epistemological base	Socially embedded	Mostly officiated version
Ownership over means of production	Exclusive	Inclusive

Perspectives and challenges ahead

Pertinent studies of various co-management implementations have revealed potentials and benefits of co-management, but also many unresolved issues and problems that need to be addressed. There is still a long way to go before a general understanding of various co-management systems and examples of solutions to all the major problems are available. A range of issues and problems need to be addressed: Developing co-management institutions on a larger scale than the local community: Many of the problems and issues facing. Fisheries can only be solved on a provincial, national or even international level. The resource systems on which fisheries rely are in most cases too large to be entirely within control of a few communities, and Fisheries management institutions must therefore be able to address problems of resource access and sharing on that level. The solution to this scale problem may be representation within nested systems, but this raises a new set of problems relating to mechanisms to ensure genuine representivity and to avoid a new process of alienation between communities and management is initiated. Reconciling local and global agendas: International agreements on fisheries and environmental management are a special case of incongruence between scales. Means must be developed by which the governments can serve the double obligation of attending to international agreements while sharing power in setting objectives for fisheries management with the communities. Identifying a knowledge base for management, which is considered valid by stakeholders: The knowledge base for fisheries management should relate to the objectives of management and be considered valid by the stakeholders? A co-management system must develop mechanisms to reconcile formal scientific knowledge and fishers' knowledge about their resource system in a way that maintains scientific validity and wide acceptance. There are no easy solutions to this problem. One approach may be to identify indicators of the status of the resource system that are both supported by science and reflects fishers' observations. Developing approaches to manage conflicts between resource users who have acquired exclusion rights to a resource through the co-management process and those who are excluded: There is a need to understand the mechanisms and actual reasons behind the alienation process of the different user groups in order to manage these conflicts. Developing appropriate approaches for empowering local communities to participate in the setting of management objectives through institutional reform: This may require substantial change in the way management authorities function to provide fisheries management services and changes in perceptions of stakeholders on the roles of fisheries management agencies. These issues must be addressed in practice—in practical experiments with co-management. It is however important that such experiments are documented and the experiences communicated to others who may be in the process of establishing or developing co-management arrangements. It is therefore an inevitable requisite that attempts to implement co-management are associated with independent research to document and disseminate the experiences.

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Shrimp Aquaculture: Diseases, Health Management, Exotic Introduction and Regulations

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History of shrimp farming in India

India has vast natural resources suitable for the development of aquaculture in the marine, brackishwater and freshwater environments. A long coast line 8118 km along with 3.5 million ha of estuaries and 3.9 million ha of backwaters, our potential for the development is immense. It is estimated that an area of 1.2 million ha are suitable for the development of brackishwater aquaculture. A major share of this potential area lies in the states of West Bengal (34 per cent) and Gujarat (32 per cent) where they greatly remain under utilized. Andhra Pradesh has been leading the country with its enterprising farmers both in utilization (50 per cent) of the potential land and in quantity produced. The latest estimates places the total brackishwater area developed for aquaculture at 1,90,000 ha with a national average of 16 per cent.

Despite a moderate increase in the total fish production, it is evident from the catch statistics that the marine shrimp landings from our country has stagnated since 2007. Traditional shrimp farming in Kerala (*chemmeen kettu* and *pokkali* fields), West Bengal (*bheris*) and other coastal states has been practiced for centuries and still continued without much interventions in the technological aspects making them a low cost – low profit sustainable production system. Commercial shrimp aquaculture, which was a late starter in front of rest of the world, had its humble beginning in the 80's, as a result of the enthusiasm of enterprising farmers in Andhra Pradesh along with timely interventions from the agencies like MPEDA and CMFRI. The development of hatcheries for seed production of black tiger shrimp (*Penaeus monodon*), the major species used for aquaculture, ensured timely supply of seeds. Consequent to the development of shrimp aquaculture was the development of accessory industries including feeds, additives, drugs, probiotics and equipments. The Indian corporate houses were actively involved in shrimp farming in this early phase of development, possibly following the profitability of the industry in our neighbouring countries like China and Taiwan. The industry showed a steady growth up to 1995 until it was hit by disease problems as well as legal issues leading to the intervention of the Supreme Court of India.

Major diseases problems

Health management has always played an important role in modern shrimp culture. Shrimps have a primitive immune system compared to fishes and are reared in environments where several pathogens are naturally present. The quality of rearing water

has great role in the survival of the shrimps as major fluctuations in water quality may lead the shrimps to physiological stress and thereby increase susceptiblity to pathogenic attacks. Taiwan was the first shrimp farming country to have met with serious setbacks due to health management issues. Consequent to the intensification of farming practices, the incidence of diseases outbreaks also have increased. Diseases of viral etiology are of more significance and have led to huge economic losses in all shrimp farming regions of the world. There are about 20 viral diseases reported from shrimps and the average annual economic losses are in the tune of 1 billion USD. There are no known drugs for viral diseases in shrimp and attempts to develop vaccines have not provided encouraging results.

World Organisation of Animal Health (OIE) has listed 5 viral diseases important for shrimp.

i) **White spot syndrome virus (WSSV)**: It was first detected in north-east Asia in the 1992-93 period and later spread to the rest of the world. It presently reported from most shrimp growing regions of the world. It affects most cultured penaeid shrimps leading to heavy mortalities in 3 to 10 days. Loose cuticle with characteristic white spots and reddish discolouration of the body are common signs of the disease. The virus is transmitted both horizontally and vertically and a large number of crustaceans act as carriers of the virus and aid in transmission. It is the most dreaded disease in the history of shrimp aquaculture affecting all forms of shrimp farming irrespective of the level of intensification and has toppled *Penaeus monodon* from the principal farmed shrimp in the world.

ii) **Infectious hypodermal and haematopoietic necrosis virus (IHHNV) of penaeid shrimps**: First reported in 1981, the virus is widely distributed in the shrimp rowing regions infecting most cultured penaeid shrimps. The infection is commonly called as runt deformity syndrome.

iii) **Taura syndrome virus (TSV)**: Initially reported from the Taura region of Ecuador in 1992, the disease is limited to Americas in native cultured shrimp. It causes severe infection and mortality postlarvae and juvenile *Litopenaeus vannamei*.

iv) **Yellow-head virus (YHV)**: First reported from Thailand in 1990, YHV believed to be present in southeast Asia and Indo-Pacific regions. Principal host of the virus is *P. mondon* and the infected shrimps have characteristic yellowish swollen cephalothorax and hepatopancres.

v) **Infectious myonecrosis virus (IMNV)**: The infected shrimps shows necrosis of skeletal muscle tissue with persistant mortality throughout culture period. It primarily infects *L. vannamei*, but is can cause infections in *P. monodon* also.

Even though not listed by OIE, Monodon baculovirus (MBV) and Hepatopancreatic parvo virus (HPV) are prevalent in the shrimp populations in India. They seldom cause mortalities in the farms, but lead to stunted growth of the shrimps and increase the susceptibility to secondary infections. Bacterial infections caused by Vibrio spp. which are natural inhabitants of our coastal waters also lead to economic losses in shrimp aquaculture.

Better management practices and Biosecurity

Rampant disease outbreaks and economic losses have forced the farmers to adopt better management practices to ensure environmental as well as socio-economic sustainability, health status of the shrimp, food safety of the consumer and profitability of farming operations. It relies on interventions right from identification of farm site, design, seed production, management of water, feed and health of shrimp, food safety and social

responsibility. These are site specific, simple and practical interventions easily adoptable for small scale farmers.

Principles of biosecurity, a set of practices aimed at reducing the probability of disease occurrence and its spread, was also incorporated into the existing culture practice. Other than stocking disease free seeds, to prevent the entry of pathogen into the culture system, all the possible horizontal routes of transmission have to be closed. Disinfection of pond bottom helps in eliminating pathogens persisting in soil. Disease carriers like crabs, contaminated land animals and birds, contaminated feed, utensils, personnel etc. pose a threat to farming. Fencing to prevent entry of crabs, animals and birds is a common management measure resorted to now. Disinfection of water in reservoir ponds couples with the practice of zero water exchange system helps in preventing pathogen entry through water. Tyre-bath, foot-bath and hand wash are provided to avoid contamination from personnel. WTO has also made it mandatory to document health history and disease status of importing and exporting countries.

Introduction of *Litopenaeus vannamei*

In the last decade the aquaculture production of shrimps peaked in 2007 and later in 2009 fell to levels as low as that in 1995. Farmers lost confidence in the sector leading to a consequent decline in the area utilization along with the fall in production. The impacts of quality stipulations, fluctuating prices and antidumping duties slapped on the Indian exporters have together led to a slump in the rate of progress of the shrimp aquaculture industry. This has further increased the risk in operations in addition to decreasing profit margins.

The search for an alternative shrimp species suitable for farming ended with the specific pathogen free (SPF) *Litopenaeus vannamei* (whiteleg shrimp or Pacific white shrimp), a natural inhabitant of eastern Pacific Ocean along the coasts of South America at a temperature of about 20^{o} C. the national committee on introduction of exotic species in Indian waters approved experimental culture operations the species and it was introduced to India for experimental farming and seed production trials on a pilot scale in 2003 under controlled biosecure conditions. The Ministry of Agriculture, GoI constituted a study group for risk analysis of introduction of *L. vannamei* and as per the recommendations, it was decided to allow registered hatcheries and farms with biosecure facilities to import SPF *L. vannamei*. It is decided to have only single point entry for L. vannamei to ensure safety and the broodstock were quarantined at the centralized facility of Rajiv Gandhi Centre for Aquaculture in Chennai before handing over to the importer. Nine broodstock suppliers were selected by the CAA for procurement of SPF *L. vannamei*. Presently 74 hatcheries are permitted to import brood stock and are supplying seeds to CAA approved farms for culture. The inspection team of CAA has approved 468 farms with a water spread area of 3971.46 ha for culture of *L. vannamei*. With an average production of 7.5 t/ha/year the *L. vannamei* production reached 80717 tons in 2011-12. Small scale farmers have adopted to cluster management by forming cooperatives or unifying under self help groups to obtain approval of the CAA for *L. vannamei* farming.

Regulations in shrimp farming

The dynamics of Indian shrimp farming was always controlled by the enthusiasm of the enterprising farmers. Unlike other sectors of food production, shrimp farmers always went ahead of the scientific community in India and welcomed ideas and technology from foreign experts. The need of regulations in the sector was felt in the early 90's itself, and the

supreme court verdict in 1996 in response to a public interest litigation (PIL) banned all forms aquaculture other than traditional farming within the coastal regulation zone (CRZ) and stipulated compulsory registration of all farms from Aquaculture Authority. Under the Environmental Protection Act, 1986 Aquaculture Authority was set up in 1997 to regulate the sector with its head quarters in Chennai. Considering the need for a stronger legislation to safeguard the interest of all the stakeholders of the coastal areas along with preservation of the fragile ecosystem, the Government of India passed the Coastal Aquaculture Authority (CAA) Act, 2005. The authority is empowered by the provisions of the Act, Rules and Guidelines to regulate coastal aquaculture and to ensure sustainable development without damaging the ecosystem.

The authority can make regulations regarding the construction and operation of farms within the coastal area, inspect the farms for ascertaining environmental impacts, register them, can order the demolition of polluting farms, etc. It will be the agency to fix standards in the sector with regard to inputs liks seeds, feed, additives, chemicals and drugs, etc. used in the farm in addition to ensuring protection of both ecologically and socially sensitive areas from being converted to aquafarms. According to the Act, all coastal aquaculture farms should be registered with the authority, usually for a period of 5 years. Construction of new farms within the 200m from the highest high tide limit is prohibited in the coastal regulation zone, however, farms constructed before the enactment of CAA and non-commercial research farms by the agencies of government are permitted to operate. The authority has a District Level Committee and State Level committee to verify applications for registration of the farms which are disposed in a time bound manner. Further, the authority can collect samples from the farms, analyze them, close down facilities for unsustainable practices and recommend for punishment of individuals involved.

The authority issues guidelines for sustainable aquaculture practices. It has prohibited the use of 20 pharmacologically active substances and set residual levels for permitted substances. Management of waste water is another major concern and it is mandatory for farms with more than 5 ha area to install effluent treatment system and the authority has stipulations for different water quality parameters at discharge points in estuarine areas and coastal marine waters. Farms with more than 40 ha area need to conduct Environmental Impact Assessment at the planning stage and should have an Environment Monitoring and Management Plan.

Conclusion

A quantum jump in the production (220,000 mt in 2011-12) of farmed shrimp in the country was achieved by the introduction of L. vannamei. With more farmers falling line for biosecure shrimp farming, the production trend is likely to continue in the near future. The high stocking densities and production has increased the yield in shrimp farming by several times. The fluctuation of price in the international market is likely to fluctuate due to the increase in production. The vast potential for developing a strong domestic market would be the ideal to sustain the industry. The present achievements in quantity has come without much increase in the water spread area for culture, and given the potential for systematic development of shrimp farming in states like Gujarat and West Bengal, the future of aquaculture industry looks bright. However, adherence to principles of biosecurity will remain critical in averting disasters of pathogenic origin.

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41

Trade-offs in Environment and Trade : Need for sustainable development

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Introduction

In economics the term 'trade-off' is expressed as opportunity cost, referring to the most preferred alternative given up. A trade-off, then, involves a sacrifice that must be made to obtain a certain product, rather than other products that can be made using the same required resources. For a person going to a basketball game, its opportunity cost is the money and time expended, say that would have been spent watching a particular television program (Wikipedia). Another key word is 'sustainable development'. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development). Sustainable development was added as one of the general objectives of the World Trade Organization when it was established in 1994.

In this write-up, an introduction is given about the ecosystem and the significance of the services it provides followed by an introduction to the factors which affect sustainability. Also a few instances where the marine resources have been affected and disputes in international level which the World Trade Organization had to solve.

How the WTO facilitates protection of the environment

There are several provisions in the WTO agreements dealing with environment. There is a reference to sustainable development as one of the general objectives to be served by the WTO in the Marrakech Agreement which established the WTO. There are provisions in the Agreement on Agriculture and the General Agreement on Trade in Services (GATS). However by far and away the most important provisions as far as environmental issues are concerned are Article XX of the GATT and the Agreements on Sanitary and Phytosanitary Measures and the Agreement on Technical Barriers to Trade (Oxlay; *www.apec.org.au/docs/oxley2001.pdf* www.apec.org.au/docs/**oxley**2001.pdf)

Why environment is important: the ecosystem services

Ecosystem services, ecological footprints and and other information have been sourced from the report of WWF entitled 'Focusing on the future' (WWF-2012; The Living Planet Report 2010)[1] . The Living Planet Report relates the Living Planet Index – a measure of the

health of the world's biodiversity – to the Ecological Footprint and the Water Footprint – measures of humanity's demands on the Earth's natural resources. Ecosystem services are the benefits that people obtain from ecosystems (Millennium Ecosystem Assessment, 2005).They can be mainly be categorized as given under

1. **Provisioning services: goods obtained directly from** ecosystems (e.g. fish, food, medicine, timber, fibre, biofuel)

2. **Regulating services: benefits obtained from the** regulation of natural processes (e.g. water filtration, waste decomposition, climate regulation, crop pollination)

3. **Supporting services: regulation of basic ecological** functions and processes that are necessary for the provision of all other ecosystem services (e.g. nutrient cycling, photosynthesis, soil formation)

4. **Cultural services: psychological and emotional benefits** gained from human relations with ecosystems (e.g. enriching recreational, aesthetic and spiritual experiences

Threats to Environment due to development/trade related reasons

All human activities make use of ecosystem services, but can also put pressure on the biodiversity that supports these services. The five greatest direct pressures as indicated in the Living Planet Report 2011 are:

Habitat loss, alteration, and fragmentation: mainly through conversion of land for agricultural, aquaculture, industrial or urban use; damming and other changes to river systems for irrigation, hydropower or flow regulation; and damaging fishing activities (WWF-2012). Several studies have shown the drastic decline in nearshore critical habitats like mangroves and seagrass due to anthropogenic activities. These point to the fact that the breeding and nursery grounds of several important commercial fishes and shellfishes like the penaied and non penaeid resources are lost. This will create repercussions on the fishery due to low recruitment leading to poor catches, low income and trade opportunities', less food. This will also lead to social problems like alternate livelihood opportunities for fisher families and migration of fishers.

Over-exploitation of wild species populations: harvesting of animals and plants for food, materials or medicine at a rate above the reproductive capacity of the population (WWF-2012). One typical example of the overexploitation is the cod fishery. The Newfoundland cod fishery was closed in the early 1990s because stocks had declined drastically and thousands of fishers lost their jobs and the financial cost was estimated as at least US$2 billion .
Rapid declines in Atlantic cod (*Gadus morhua*) fisheries are well documented . As a commodity in world trade, this species has been heavily exploited for several centuries The Living Planet Index (WWF-2012) for Atlantic cod suggests that populations have declined by an average of 74 per cent over the past 50 years. Losses have been greatest in the Northwest Atlantic. The biomass of the Scotian Shelf stock is less than 3 percent of the pre-industrial fishing level.

Pollution: The main pollution is from excessive pesticide use in agriculture and aquaculture; urban and industrial effluents; mining waste; and excessive fertilizer use in agriculture (WWF-2012). In recent years, marine litter is contributing to pollution. This has lead to concept such as "ghost fishing" due to derelict fishing gear. Marine litter has started impacting the habitats where fishes spawn. Apart from the seafood industry it will also have impacts on the tourism industry.

Climate change: due to rising levels of greenhouse gases in the atmosphere, caused mainly by the burning of fossil fuels, forest clearing and industrial processes (WWF-2012).
Invasive species: introduced deliberately or inadvertently to one part of the world from another; they then become competitors, predators or parasites of native species (WWF-2012).

The Living Planet Index (LPI)

The Living Planet Index (LPI) reflects changes in the health of the planet's ecosystems by tracking trends in nearly 8,000 populations of vertebrate species. The global Living Planet Index declined by almost 30 per cent between 1970 and 2008. The global tropical index declined by 60 per cent during the same period.The global temperate index increased by 31 per cent; however this disguises huge historical losses prior to 1970.
The marine Living Planet Index declined by more than 20 per cent between 1970 and 2008 (WWF-2012). The marine index includes 2,395 populations of 675 species of fish, seabirds, marine turtles and marine mammals found in temperate and tropical marine pelagic, coastal and reef ecosystems. Approximately half of the species in this index are commercially used.
Marine ecosystems exhibit the largest discrepancy between tropical and temperate species: the tropical marine index shows a decline of around 60 per cent between 1970 and 2008, while the temperate marine index increased by around 50 per cent. There is evidence that temperate marine and coastal species experienced massive long-term declines over the past few centuries (Lotze et al., 2006; Thurstan et al., 2010); therefore the temperate marine index started from a much lower baseline in 1970 than the tropical marine index. The relative increase in temperate marine populations since then is likely a reflection of slight recovery from historic lows

Measuring the human demand: Ecological Footprint

The 'Ecological Footprint' is an accounting framework that tracks humanity's competing demands on the biosphere by comparing human demand against the regenerative capacity of the planet (WWF-2012).
To determine whether human demand for renewable resources and CO2 uptake can be maintained, the Ecological Footprint is compared to the regenerative capacity (or 'biocapacity') of the planet. 'Bio-capacity' is the total regenerative capacity available to serve the demand represented by the Footprint. Both the Ecological Footprint (which represents demand for resources) and biocapacity (which represents the availability of resources) are expressed in units called global hectares (gha), with 1gha representing the productive capacity of 1ha of land at world average productivity (WWF-2012). When trade progresses the bio-capacity of the marine ecosystem should be considered and the ecological foot print should not be damanging.

Human demands on the planet exceed supply
(Abstract from The Living Planet Report 2012)

- Humanity's Ecological Footprint exceeded the Earth's biocapacity by more than 50 % in 2008.
- In recent decades, the carbon footprint is a significant component of this ecological overshoot.
- Biocapacity per person decreased from 3.2 global hectares (gha) in 1961 to 1.8 gha per capita in 2008, even though total global biocapacity increased over this time.
- Rising consumption trends in high-income groups around the world and in BRIICS countries, combined with growing population numbers, provide warning signs of the potential for even larger footprints in the future**.**

Focus on our footprint: Marine fisheries

Currently the most widely used indicator for development is the United Nations Development Programme's (UNDP) Human Development Index (HDI) which, by combining income, life expectancy and educational attainment, compares countries based on both their economic and social development level. The UN defines the threshold for a high level of development as an HDI value of 0.8. Countries meeting or exceeding this threshold show an enormous range in per person Ecological Footprint, from Peru with a Footprint of just over 1.5gha to Luxembourg with a Footprint of over 9gha per person.

Fishes are vital to billions of people around the world Wild fish form a central food source for billions of people — and are increasingly used as feed for poultry, livestock and farmed fish. The habitats that support commercial marine fish populations are also important, providing coastal protection from storms and other large waves, supporting marine-based tourism, and shaping the cultural identity of coastal societies around the world (WWF-2012).

Overfishing is the greatest threat to fish stocks and marine biodiversity

High demand for fish and fish products combined with overcapacity in the global fishing fleet and inefficient fishing techniques have driven massive overfishing. This is often encouraged by subsidies, which support fishing activity even for depleted stocks that would otherwise be unprofitable (WWF-2012).

Seventy per cent of commercial marine fish stocks are now threatened, with some fisheries and stocks, such as Mediterranean bluefin tuna, already on the verge of collapse. As large, long-lived predators like cod and tuna have become depleted; fishing fleets have increasingly turned to small, short-lived species further down the food chain, like sardines, squid, shrimp and even krill — threatening the balance of entire marine ecosystems. This has led to 'Fishing down the food web'. This will lead to changed trading pattern and new value chains. In the long run, sustainability will be affected and this can also lead to conditions like "Starved Marine System". A typical example is the cod fishery which collapsed in 1992 and did not recover even after one decade. In this ecosystem, they have observed the starved condition, where fishes with large head and thin body. Damaging fishing practices and a high level of incidental catch of non-target species (bycatch) further threaten marine habitats and species around the globe (WWF-2012).

Another ecological phenomenon is the cascading effect seen in many ecosystems. When there a sharp decline in big sharks along the Eastern Seaboard this led to a boom in other marine species which affected valuable commercial fisheries. The study by a team of Canadian and U.S. scientists found that intense fishing for sharks in the northwest Atlantic over the past 35 years has produced a cascade of unexpected effects. With fewer large predators in the sea, the number of rays, skates and small shark species has exploded, and these species are decimating such shellfish populations as North Carolina bay scallops and the Chesapeake Bay's American oysters.

Catch rates of some species of large predatory fishes – such as marlin, tuna and billfish – have dramatically declined over the last 50 years, particularly in coastal areas of the North Atlantic and the North Pacific (WWF-2012). This continuing trend also applies to sharks and other marine species. Targeted fishing of top predators has changed whole ecological communities, with increasing abundance of smaller marine animals at lower trophic levels as a consequence of the larger species being removed. This in turn has an

impact on the growth of algae and coral health (WWF-2012). Such changes in the ecosystem will affect on other fish stocks and the trade and livelihood related to fisheries and tourism.

In India, the recent menace of puffer fish along Kerala coast can be a boom related to the absence of predators of this fish. Studies on the food of several fishes have indicated that this fish is mainly predated upon by the Cobia and the recent increased harvests of cobia would have led to decline in predator population which would have supported the population increase of puffers. Since puffers are do not have many predators unlike other fishes of tropical ecosystem, the declining predator pressure would have led to puffer fish menace in Kerala. (Mohamed et al MS under publication)

Bad governance

One major problem behind overfishing is poor fisheries management. Governance issues include systematic failures by many fisheries bodies to heed scientific advice on fish quotas, few international regulations for fishing on the high seas, and the failure of many countries to ratify, implement and/or enforce existing national and international regulations.

The case of shark fishing to meet the demand in international trade for their fins, meat, liver oil, cartilage and hides, and as aquarium specimens is an example of market demand can create ecological imbalances. An estimated 3 million sharks are harvested annually and even when sharks are caught as part of fishing activities for other species such as tuna (as often happens), they are usually retained rather than being discarded. Most shark species are inherently vulnerable to overexploitation since they mature late and have a relatively low reproductive output compared to other fish species.

'Business as usual'

The "business as usual" scenario predicts that humanity will be using resources and land at the rate of 2 planets each year by 2030,and just over 2.8 planets each year by 2050 (WWF-2010). As the "business as usual" scenario shows, our present track is unsustainable.

WTO and disputes on ecosystem related aspects

Turtle x Shrimp Issue : The United States had implemented a ban on shrimp from countries whose fishing fleets did not have special "turtle excluder devices(TED)," to prevent endangered sea turtles from being killed in the shrimp fishing process. India, Malaysia, Thailand, and Pakistan claimed that the law was a disguised restriction on free trade and challenged the measure in the WTO an international body dealing with the rules of trade between participating nation's dispute resolution process. The dispute was settled and trade continued.

Tuna x Dolphin Issue : In eastern tropical areas of the Pacific Ocean, schools of yellowfin tuna often swim beneath schools of dolphins. When tuna is harvested with purse seine nets, dolphins are trapped in the nets. They often die unless they are released. The US imposed a ban on imports of tuna fished from such areas.

This case still attracts a lot of attention because of its implications for environmental disputes. The case was by Mexico and others against the US under GATT. The panel report was circulated in 1991, but not adopted, so it does not have the status of a legal interpretation of GATT law. The US and Mexico settled "out of court".It was handled under the old GATT dispute settlement procedure. Key questions are:

- Can one country tell another what its environmental regulations should be?
- Do trade rules permit action to be taken against the method used to produce goods (rather than the quality of the goods themselves)?

A complaint about the WTO provisions is that trade restrictions on how a product is produced or processed are not permitted. Challenges under GATT and WTO provisions that US restrictions on imports of tuna in cases where fishing methods did not minimize the incidental kill of dolphin were lost. The general point was that the WTO did not permit one member to restrict trade with another on the basis that they did not apply policies which the first party preferred (Oxlay) .

The environmental case is that if one method of processing (such as a method of fishing for tuna) causes environmental damage (high levels of incidental kill of dolphin) then an importer should be able to express preference for the product (tuna) processed in a way that does not cause environmental damage (caught using fishing methods that reduced the incidental kill of dolphin). WTO provisions generally do not allow trade to be restricted on those grounds. The
TBT Agreement recognizes "related processing technology" as a relevant consideration for applying a mandatory technical standard to protect the environment (The green peace report; www. greenpeace.org).

Other farmed seafood trade : The issues related to farmed catfish from Vietnam (anti-dumping), rejection of shrimp from India by Japan in September 2012 are some issues related to trade and production.

Better management practices

Sustainable fisheries management can help to restore and maintain both fisheries' productivity and marine biodiversity. This would also increase the resistance of fisheries and marine ecosystems to other pressures like pollution, increased ocean acidification and climate change, as well as safeguard food supplies for coastal communities. In order to maintain, and even increase fish catches in the long term, fisheries' biocapacity needs to be increased. At the fisheries management level, this means maintaining fish stocks at optimal population and age levels to maximize growth, while at the ecosystem level it means improving and conserving marine habitats by establishing protected areas, limiting coastal pollution and curbing carbon dioxide emissions (WWF 2010).

Ecosystem Based Fisheries Management (EBFM)

The EBFM can help inn sustaining fisheries. A typical example of EBFM is the pollock fishery in the North Pacific under USA jurisdiction. Here Total Allowable Catch (TAC) set in accordance with the precautionary approach and Individual harvesting quotas allocated to each fishing vessel. Apart from this harvests are monitored closely by independent observers and by-catch is extremely low. In India, the clam fishery of Ashtamudi Lake is managed by observing a ban during the spawning period of clams which was identified by scientists of CMFRI. Every year fishermen abstain from fishing from November to February and the fishery is sustained.
In India, the CMFRI has developed detailed trophic models from primary data sources for Arabian Sea off Karnataka, Northwest Coast Ecosystem (NWC) and Gulf of Mannar (GOM).

A green economy ?

The last two years have seen the rise of discussions at an international level on the need to build a global "green economy". In a green economy, economic thinking embraces people and the planet. According to UNEF a green economy is described as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In other words, we can think of a green economy as an economic environment that achieves low carbon emissions, resource efficiency and at the same time is socially inclusive. For promoting sustained trade it is imperative that we reduce over fishing, promote trade of eco-labeled products and comply with environment and resource protection regulations. We cannot afford to sacrifice environment at the cost of trade nor can we deny development of trade.

The teaching material has been mainly sourced from the 'The Living Planet Report 2012' published by WWF. More detailed information on the work related to CMFRI is available at CMFRI website (eprints)

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42

Capture process and prospects in marine island fishery with emphasis on trade: a typical paradigm of underutilized resources in Bay Islands

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Marine fisheries in India have been managed similar to the wild life as the capture based resources have contributed to the major chunk of the resources. The mari-culture sector has contributed only to the high intensity shrimp farming and low-intensity clam, mussel, oyster and sea weed farming. Timely research interventions helped in the sustained and enhanced marine fish production from capture as well as culture sectors. Typical to the tropical condition the multi-species capture fisheries sector is studied as pelagic, demersal, crustacean and molluscan without involving much into the nitty-gritties of each species except for the major groups. Practiced as an open access management of the resource, the potential and present level of exploitation of marine fishery resources of India (Table 1) is opening up a policy debate on revalidation of the resources.

A cross-analysis of the growth rate/ fluctuations in various marine fishery resources (Table 1) due to the research interventions are analyzed below:

Table 42.1: Major marine resources of India and their estimated potential

Fishery resources	Estimated potential (m t)	Present level exploitation (m t)
Pelagic	1.67	1.49
Demersal (including crustacean and mollusc)	2.02	1.21
Oceanic & others	0.24*	0.51
Total	3.93	3.21

*The potential estimated are so undervalued that the exploitation levels have been far better and yet indicates an underutilized fishery.

Marine fishery resources of **A**ndaman and **N**icobar **I**slands (ANI), located between 6^0 45' N and 13^0 41' N Latitude and 92^0 12' E and 93^0 57' E Longitude in the southern reaches of Bay of Bengal (BOB), are vast and abundantly diversified (Table 2). According to John *et al*., 2005, 139000 t of pelagic, 22500 t of benthic and 82500 t of oceanic resources are estimated to be available for exploitation. The major marine fishery resources of ANI, their estimated potential and present levels of exploitation in tonnes (t) are tabulated below. The exploitation of fishery resources at present is restricted to coastal waters (Pillai and

Abdussamad, 2009). Vessel size and the gears are inadequate for operating in deep waters and there is no organized offshore fishing from Andaman base (Dam Roy and Grinson George, 2010). There are 97 fishermen villages with a population of 15,320. Around 5,617 active, full-time and 718 part-time fishermen are engaged in marine fishing activities. The registered fishing crafts in operation are about 2,808 of which 1524 are non-motorized/traditional crafts, 1279 motorized crafts and 10 mechanized boats. There are 57 beach landing centers. Drift gillnet is the main fishing gear used which contributes to over 40% of the marine fish landings. Other fishing gears commonly used are shore seine, hook and line and cast net (Nithyanandan, 2009).

Table 42.2: Major marine fishery resources of ANI and their estimated potential

Fishery resources	Family	Estimated potential (t)
Pelagic	Scombrids	10,000
	Clupeids	20,000
	Engraulids	1,000
	Neritic Thunnids	100,000
	Carangids	1,000
	Pelagic Carcharhinids	5,000
	Others	2,000
Benthic	Carcharhinids	4200
	Leiognathids	5000
	Perches (serranids, lutjanids and lethrinids)	8000
	Aplolectids and Bramids	1900
	Plotosids	1000
	Nemipterids	1500
	Sciaenids	1200
	Gerrids	1400
	Upenids	900
	Pomadaysids	100
	Nomeids	300
	Synodontids	150
	Bothids	50
	Priacanthids	100
	Other deep-sea fishes	2700
	Others	2130
Oceanic	Oceanic Thunnids	82,500

Table 42.3 Major fish landing cnetres of Andamna and Nicobar Islands and their locations

Sector	FLC	GPS Coordinates
North Andaman	Aerial Bay	13⁰25' N 93⁰06' E
	Durgapur	13⁰16' N 93⁰03' E
	Kalighat	13⁰21'N 93⁰04' E
	Kalipur	13⁰13' N 93⁰02' E
	Machidera	12⁰55' N 92⁰54' E
Middle Andaman	Rangat Bay	12⁰30' N 92⁰57' E
South Andaman	Baratang	12⁰18' N 92⁰47' E
	Chatham	11⁰41' N 92⁰43' E
	Dignabad	11⁰41' N 92⁰45' E
	Guptapara	11⁰33' N 92⁰39' E
	Havelock	12⁰03' N 92⁰59' E
	Junglighat	11⁰39' N 92⁰44' E
	Kadamtala	12⁰19' N 92⁰47' E
	Neil Island	11⁰50' N 93⁰02' E
	Panighat	11⁰42' N 92⁰44' E
	Wandoor	11⁰36' N 92⁰36' E
Little Andaman	Hut Bay	10⁰34' N 92⁰33' E
	V.K. Pur	10⁰44' N. 92⁰34' E
Nancowrie	Kamorta	08⁰02' N 92⁰33' E
Great Nicobar	Campbell Bay	06⁰60' N 93⁰56' E

Table 42.4 Technical specifications of the gears and crafts used in Andaman

Category	OAL* (feet)	Engine (Hp)	Gear	Validations	Duration	Depth (m)
Gillnetters	10-24	8-25	21-27 mm mesh (sardine) 57 mm (mackerel)	50	7-9 h	>100
Trawlers	47-51	108-151	40 mm stretched mesh	22	3-4 days with 4-5 trawls/day	200-700
Longliners†	55-60	320- 402	35-60 km line, 900-1400 hooks, baskets (4-36), branchline rigged with galvanized circle hooks (14/0-16/0)	15	5-6 days	< 1000

*OAL= Overall length of the fishing vessel.

†Whole frozen finfishes (*Sardinella* spp, *Rastrelliger* spp and *Chanos chanos*) were given as bait in longliners.

Resources vis-à-vis pricing and trade in the islands in a globalized regime

Presently fish is traded as a commodity without considering the ecosystem price. The operational cost prevails the price determining mechanism. But in case of a tropical Islands fishery like Andaman there is a need to improve the pricing by including the ecosystem price to the total value as a resource price. In the purview of climate change regime where islands are vulnerable heavily due to increasing MSL and extreme events, the ecosystem supporting the fishery is at doldrums. Mass coral bleaching events of 1998, 2002, 2005 and 2010 as well as Tsunami of 2004 are some recent examples which resulted in massive destruction of coastal bio-resources. Trade needs to be conceptualized in this context. There is a need for thorough evaluation of the resource economics. A pattern followed by Barbier (1993) is illustrated below:

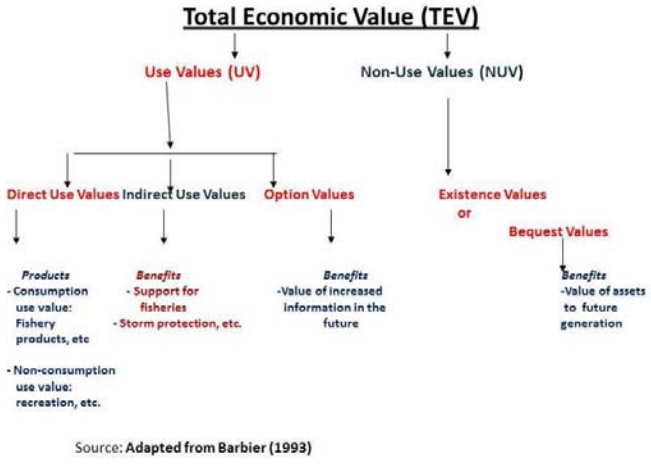

Fig 42.1 Total Economic Value (TEV)

Few ideal interventions for improving the fishing and profitability of the sector without disturbing the ecosystem can be achieved through adoption of Potential Fishing Zone Technologies (PFZ). The advantages are as follows:

- Enhancing CPUE - Ideal intervention to harness the underutilized resources.
- This strategy to harvest more fish with the existing efforts by spending less non-renewable resources can be termed **'green fishing'.**
- Fishing activity in the islands extends from 6 h to 25 days depending upon the fishing vessel employed.
- **Potential Fishing Zones** - Minimize the time of operation
  Improve the CPUE
- With the advent of remote sensing techniques, fishing grounds could be predicted for 2-3 days in advance.

Despite being a potential area for resource exploitation, the islands are disadvantageous in terms of accessibility, infrastructure, human resource and other factors which may hamper a smooth trade. But there are immense possibilities and this can be harnessed with will. There is an in-depth study required in all fronts before addressing the island resources in a trade front. This paper may ignite some positive vibes in readily introducing the resources to potential venture's and policy planners.

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