trade knowledge network

The Marine Seafood Export Supply Chain in India

Current State and Influence of Import Requirements

Parashar Kulkarni
Consumer Unity and Trust Society (CUTS)

December 2005

iisd International Institute for Sustainable Development / Institut international du développement durable

About the Trade Knowledge Network

http://www.tradeknowledgenetwork.net

The goal of the Trade Knowledge Network (TKN) is to foster long-term capacity to address the complex issues of trade and sustainable development. TKN is an initiative of the International Institute for Sustainable Development. The current phase of TKN research and policy engagement is kindly supported by the Swiss Agency for Development and Cooperation (SDC). In addition, TKN has received past support from the Rockefeller Foundation, the Norwegian Ministry of Foreign Affairs, the International Development Research Centre (IDRC), and the Canadian International Development Agency (CIDA).

The Marine Seafood Export Supply Chain in India: Current State and Influence of Import Requirements

Parashar Kulkarni

Published by the International Institute for Sustainable Development

International Institute for Sustainable Development
161 Portage Avenue East, 6th Floor
Winnipeg, Manitoba
Canada
R3B 0Y4
Tel: (204) 958-7700
Fax: (204) 958-7710
E-mail: info@iisd.ca
Web site: http://www.iisd.org

The International Institute for Sustainable Development (IISD)

http://www.iisd.org

The International Institute for Sustainable Development contributes to sustainable development by advancing policy recommendations on international trade and investment, economic policy, climate change, measurement and assessment, and natural resources management. Through the Internet, we report on international negotiations and share knowledge gained through collaborative projects with global partners, resulting in more rigorous research, capacity building in developing countries and better dialogue between North and South.

IISD's vision is better living for all—sustainably; its mission is to champion innovation, enabling societies to live sustainably. IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Government of Canada, provided through the Canadian International Development Agency (CIDA), the International Development Research Centre (IDRC) and Environment Canada; and from the Province of Manitoba. The Institute receives project funding from numerous governments inside and outside Canada, United Nations agencies, foundations and the private sector.

Consumer Unity & Trust Society (CUTS)

Established in 1984, Consumer Unity & Trust Society (CUTS) started off as a consumer protection organization in Rajasthan, India. Since then, it has been working in several areas of public interest at the grassroots, national, sub-continental and international levels. These activities have now crystallized into five programmatic centres and three resource centres in India, Zambia, Kenya and U.K. under the umbrella of "CUTS International."

CUTS is involved in the area of trade and sustainable development in various ways and at various levels: international, sub-continental, national and state. The activities are focused mainly on WTO and related domestic policies. CUTS also works with several national, regional and international organizations, such as Consumers International, the International Centre for Trade and Sustainable Development, South Asia Watch on Trade, Economics & Environment, the Consumer Coordination Council of India, etc. It also serves on several policy-making bodies of the Government of India.

Contents

The Marine Seafood Export Supply Chain in India: Current State and Influence of Import Requirements

Parashar Kulkarni[1]
Consumer Unity and Trust Society (CUTS)

Abstract

This paper studies the current state of the seafood supply chain in India. The first section discusses seafood sustainability and continues with a brief description of the Indian seafood industry. The second section studies the stakeholders in the supply chain, their roles, income and social conditions. The third section examines the bottom of the supply chain, i.e., the state of the landing centres and the fishermen. Section four investigates whether the adoption of the Marine Stewardship Council label would be viable in the Indian environment. The fifth section explains EU and U.S. seafood product and process regulations and their effect on the Indian supply chain. In the final section, the paper recommends improvements to the fisheries supply chain to make it more sustainable. Recommendations include ensuring hygienic ice and water facilities for fish preservation and cleaning; basic hygiene training to fishermen; promotion of fishermen cooperatives and an integrated approach to food safety. This paper does not venture into the domestic government initiatives to promote sustainability.

1 The author works with CUTS Centre for International Trade, Economics & Environment, Jaipur, India. Comments can be sent to citee@cuts-international.org. The paper is prepared as part of the IISD-led Trade Knowledge Network Program. The author is thankful to Aaron Cosbey of IISD, Canada, Bipul Chatterjee of CUTS International, India, and Moeed Yusuf of SDPI, Pakistan, for useful comments, which have been suitably incorporated. The views expressed are those of the author and do not necessarily reflect the views of the organization.

1. Sustainable seafood supply chains: What do we mean?

Approximately 50 million people worldwide depend on fishing for all or most of their family earnings, while another 150 million depend on fish processing and the fleet servicing industry. More than 10 million work on 2.5 million small-scale fishing vehicles and account for 50 per cent of the world's catch. An increase in the number of artisanal fishermen and industrial vessel activity in coastal waters are the mains causes of fish stock depletion, since coastal over-fishing is a leading problem in developing countries (FAO 2001).

To keep increasing fish supply, aquaculture is becoming an important occupation. However the environmental risks of aquaculture include water pollution, wetland losses and mangrove destruction.

Sustainability of marine fish stocks is a global concern.[2] According to the Food and Agriculture Organization of the United Nations (FAO), "An estimated 25 per cent of major marine fish stocks are under-exploited or moderately exploited. About 47 per cent of the main stocks or species groups are fully exploited and are producing catches that have reached, or are very close to, their maximum sustainable limits. Another 18 per cent of stocks or species groups are reported as over-exploited. The remaining ten per cent of stocks have become significantly depleted, or are recovering from depletion and are far less productive than they used to be… Catches of commercially-valuable fish species may be surpassing permitted levels by over 300 per cent due to illegal and unregulated fishing (FAO 2002)."

Fishing methods such as bottom-trawling uproot the ecosystem at the bottom of the sea. Drift nets covering miles of ocean result in catches of diverse fish varieties. Some of these methods are banned in many countries. Sustainability in the seafood industry depends on the conservation of fish stocks so they are not depleted and continue to be a part of the common man's diet.

Several measures are adopted at national and international levels to promote sustainable fisheries. In 1982, the United Nations Convention established that each country was permitted an exclusive 200 mile economic zone to conserve fish stocks. In 1992, the UN established a treaty banning long drift-nets on open seas. Subsequently in 1995, it strengthened the monitoring and harvesting of migratory fish. In India, in accordance with the 1999 notification of the central government, most coastal states introduced a monsoon ban on fishing (specifically fishing with trawlers). Although the ban was prompted by concerns for fishermen safety, since venturing into the sea is dangerous in the monsoon, another important motive was to arrest depleting fish stocks.

Sustainability of fisheries is distinct from sustainability of the fishery sector. While the former deals mostly with resource management, the latter is also concerned with the sustainability of the supply chain, such as fisherman livelihood issues, employment issues for the industry and income adequacy. The Indian government and other state governments have introduced several plans that target various actors in the supply chain.

The Organisation for Economic Co-operation and Development (OECD) document on Transition to Responsible Fisheries presents a comprehensive model for transition to sustainable fisheries (OECD 2000). It covers the following conditions:

2 Select sustainability issues are outlined in Annex 4.

- biological status of the resource including its spatial-temporal intra-seasonal behaviour;
- economic/industrial status of the fishing industry (size, composition, gear characteristics, malleability of capital and labour, concentration profile of participants, vertical integration, cost components, markets, and value of the harvesting and processing sectors);
- social/community status, including employment levels, communities spatial-temporal, reliance on the fishery, other opportunities; and
- administrative/institutional environment, including licensing arrangements, in-season regulatory program and infrastructure (management measures, monitoring and enforcement, decision-making process, cost responsibility).

Sustainability is, therefore, not only restricted to resources, but also to people and governance processes. Understanding the sustainability of the fishing industry must also include the study of each component of the supply chain, of problems at the bottom levels in the supply chain, of the viability of supply chain certifications in promoting sustainability—such as Marine Stewardship Council (MSC) label—and the influence of importer country regulations in the fisheries sector.

In order to properly examine these issues, it is necessary to understand exactly what is the enabling environment required for implementing sustainability. An ideal enabling environment in the supply chain will cover the following variables:

- well organized supply chain;
- minimum fish wastage due to mishandling and poor hygiene;
- availability of adequate facilities at landing centres namely clean water, clean ice and clean, elevated auction platforms;
- appropriate revenue structures which ensure adequate compensation to fishermen and protect their livelihoods; and
- favourable importing country regulations.

The following sections study the existence of an enabling environment in the Indian context.

2. Overview of the Indian seafood industry

With an annual fish production of approximately six million tons in 2003, India ranks fourth in global fish production and second in aquaculture. (Annex 1 lists the state-wise fishermen population in India, while Annex 2 lists the built up capacity of the seafood industry in select states.)

Table 2.1 reveals the growing importance of inland fish production (primarily aquaculture) in the total production.

In this research we exclusively study the marine fisheries sector.

Table 2.1: Fish Production in India (thousand tons)

Year	Marine	Inland
1989–1990	2,275	1,402
1990–1991	2,300	1,536
1991–1992	2,447	1,710
1992–1993	2,576	1,789
1993–1994	2,649	1,995
1994–1995	2,692	2,097
1995–1996	2,707	2,242
1996–1997	2,967	2,381
1997–1998	2,950	2,438
1998–1999	2,696	2,566
1999–2000	2,834	2,823
Year	**Marine (%)**	**Inland (%)**
1950–1951	71	29
1960–1961	76	24
1970–1971	62	38
1980–1981	64	36
1990–1991	60	40
2000–2001	50	50

Source: Indian Council of Agricultural Research, Ministry of Agriculture

The seafood world market has doubled within the last decade reaching US$49.32 billion. India's share in the world seafood market is 2.4 per cent. The growth of fish production in India has been labelled the "Blue Revolution" by the Indian Council of Agricultural Research since fish production increased from 0.75 million metric tons in 1951 to 6.1 million metric tons in 2003. In 2002–03, marine product exports increased to all time highs in volume and value, with actual export of 467,297 metric tons valued at Rs. 68,810 million or US$1.43 billion, representing a unit value increase of 3.4 per cent over the previous year. Frozen shrimp continued to be the major item, contributing 66.97 per cent of India's total marine product export. The share of frozen fish (comprising of ribbonfish, pomfret, tuna, fish loins and steaks) in 2002–03 was 42.01 per cent in volume and 12.23 per cent in value. In 2001–02, it was 41.22 per cent in volume and 11.97 per cent in value. In 2002–03, export of cephalopods, especially cuttlefish, grew to 35.37 per cent in volume and 48.92 per cent in value. The export of frozen squid also registered a growth of 16.59 per cent in value over the previous year. However, there was a shortfall of 4.91 per cent in volume.

Table 2.2: Trends in Export of Seafood, 1951–2001 (compounded growth rates in per cent)

Period	Quantity Exported	Value of Exports
1950–1960	0.29	5.72
1961–1970	9.88	31.62
1971–1980	10.65	22.91
1981–1990	5.81	11.67
1991–2001	7.58	14.11
1950–2001	6.57	18.17

Source: Indian Council of Agricultural Research (2004)

The U.S. emerged as the largest market for Indian marine products during 2002–03 relegating Japan to second place. The U.S. share was 13.21 per cent in volume and, 29.81 per cent in value, representing an export growth of 25.82 per cent and 44.30 per cent in volume and value respectively. Japan's share was 11.75 per cent in volume and 22.30 per cent in value, representing a shortfall in exports to Japan of 15.39 per cent and 15.70 per cent in volume and value respectively. Export to EU countries in 2002–03 registered a growth of 14.50 per cent in volume and 21.21 per cent in value compared to the year 2001–02. The EU accounted for 20.23 per cent and 20.18 per cent in volume and value respectively. China was first in volume contributing 36.55 per cent of total exports from India, however, China's value share was only 11.08 per cent. This was mainly due to the export of low-valued items.

Table 2.3: Contribution of Seafood to India's Exports

Year	Value of Seafood Exports (Rs. Million)	Share of Exports (%)	
		Total Exports	Agricultural Exports
1993–1994	25,519	3.66	18.11
1994–1995	35,366	4.28	16.05
1995–1996	33,811	3.18	19.22
1996–1997	40,076	3.37	20.50
1997–1998	44,868	3.45	18.93
1998–1999	43,686	3.13	18.17
1999–2000	50,000+	3.14	14.62

Source: Indian Council of Agricultural Research (2004)

Chennai, Mumbai, Kerala and Vishakapatnam are the four biggest seafood-exporting ports in India with 30, 13, 10 and eight per cent share by value and 11, 23, 12, and 21 per cent by volume respectively. In 2002–03, Kerala led all states in the number of exporting companies at 287, followed closely by Tamil Nadu at 286 and Maharashtra at 268.

The Marine Products Export Development Authority (MPEDA) is the government agency for export promotion as well as a primary source of information for social, economics, legal and regulatory environments in the global marine product market.

Barely five per cent of India's seafood exports are in processed form. Most exports are in the form of frozen fish. Also, the Indian brand does not exist in northern markets. In fact, more than 60 per cent of India's exports to south-east Asia are re-exported after processing. The final consumers of Indian fish in the north are not aware of the origin of their fish. The fish market is characterized by uncertainty, though more pronounced in supply than demand. Fish as a depleting commodity and the increased severity of domestic regulations on excess fishing have made supply conditions more irregular.

However, the unorganized state of the suppliers, their inability to form a cartel similar to the oil cartel and the dependency of several poor southern countries on fish as a valuable foreign exchange earner have relegated southern seafood exporters to price takers. They are unable to charge higher prices in spite of rising costs of fuel, labour, maintenance and basic necessities.

The global seafood market is a complex system of trade and sustainability issues. Exporters must deal with over-fishing; environmentally-harmful fishing practices; capacity management; international fishery resources management; trade in endangered species; non-tariff barriers; interlinking of the domains of the World Trade Organization; domestic regulations; and the UN and other international treaties. Indian seafood exporters face several hurdles due to the changing regulations in different countries.

In India, jurisdiction is shared between the central government and state government. Fisheries are a state subject, hence state governments are responsible for the development and sustainability of the fisheries sector. "In recent years in India, the major thrust in fisheries development has been on optimizing production and productivity, augmenting export of marine products, generating employment and improving the welfare of fishermen and their socio-economic status."[3]

Fishing efforts are largely confined to the inshore waters through artisanal and mechanized sectors. About 90 per cent of the present production from the marine sector is within a depth range of up to 50 to 70 metres and the remaining 10 per cent from depths extending up to 200 metres. While 93 per cent of the production is contributed by artisanal and motorized sectors, the remaining seven per cent is contributed by deep sea fishing fleets confining their operation mainly to the shrimp grounds in the upper east coast.

3. The seafood supply chain in India: A ground view

The supply chain, in general, comprises of:

Fisherman ➔ Commission Agent ➔ Supplier (Pre-processor) ➔ Exporter

The general price-sharing pattern is as follows:

Table 3.1: Distribution of Income in the Supply Chain (in per cent)

	Fisherman	Commission Agent	Supplier	Exporter
Selling price to next person (rupees)	10	10.5	14–15	25–30
Average share of final export price	25–35	1.5–4	20	40–50

Source: Field Survey

Table 3.2: Role of Supply Chain Actors

	Fishermen	Commission Agent	Supplier	Exporter
1	Input procurement: diesel, ice, food, nets, boat, 6–12 helpers	Receive fish from boat	Receive fish from agent	Receive fish as raw material
2	Undertake 4–8 days fishing trip	Weigh fish	Stock fish in crates filled with ice	Wash with potable water
3	Classify caught fish as per fish category	Grade fish as per defective and non defective	Sort fish in four grades as per quality standards of exporter	Process using Hazard Analysis and Critical Control Point (HACCP)[4] procedures
4	Store fish in ice	Negotiate price with fishermen and supplier	Transfer fish to pre-processing unit	Pack processed fish
5	Unload fish on docks after preliminary wash		Clean fish	Perform export procedures and dispatch
6	Negotiate with agent and receive money		Negotiate price with exporter and agent	Negotiate price with importer and with supplier

Source: Field Survey

Transaction costs between the fisherman and the commission agent, such as labour expenses on lifting, cleaning, etc., are borne by the agent. Those between the agent and the supplier are borne by the supplier, while those between the supplier and exporter are borne by the supplier. The level of

3 Ministry of Agriculture, Government of India.

4 Hazard Analysis and Critical Control Point (HACCP) is a quality management system which identifies and evaluates points during production in order to set up measures and control hazards to ensure product safety.

sophistication increases up the value chain, implying that at each stage, a better and more sophisticated grading system is used, as shown in point three of Table 3.2.

1. Fisherman

An average fishing trip is approximately four to five days and involves spending approximately Rs. 60,000–70,000. The risk of inadequate catch is completely borne by the fisherman. The inputs required on the boat include diesel (approximately 2,000–2,500 litres), ice (8–10 tons), helpers (10–12 on average), assistant fishermen aboard the boat and food.

Table 3.3: Expenditure Breakdown of an Average Fisherman

Product	Quantity* Price in Rupees	Total Expenditure
Diesel	2,000 litres * 21	42,000
Ice	12 tons * 750	9,000
Food		2,000
Spares		5,000
Net repairs		5,000
Total		63,000/- per 4-day fishing trip
Helpers[5]		Receive share of profit

Source: Field Survey

The fisherman sells his catch as per different types of fish to the commission agent. The fish at this stage are not graded because the fisherman lacks adequate knowledge of fish handling. The ice on which fish is stocked is made from unclean water and handled in unsanitary conditions. Salt used in ice is unprocessed, rendering it inappropriate for consumption. Ice handlers use dirty feet and hands to handle ice and transfer it to the storage facilities of the boat.

"Lack of access to education, drinking water and health facilities still beleaguer India's coastal fishing communities. Mobility of fishers from fishing to alternative forms of employment also seems to be very limited due to lack of education and income poverty (UNDP 2003)."

However, socio-economic conditions in fishing villages are better than in farming villages.[6] The logical argument is that the value of a fisherman's catch is comparatively higher than a farmer's yield. Further, the seafood supply chain in the domestic market is quite short and reasonably transparent, resulting in better margins for each actor, including the fishermen. Also, fishing is not a seasonal exercise like farming.

2. Commission agent

The commission agent is the link between the fisherman and the supplier. The commission agent is particularly useful because he deals with less literate, local-language speaking fishermen as well as organized and professional suppliers. The commission agent procures goods from the fisherman and grades each type of fish as clean or defective, based on the condition of the fish (i.e., wear and tear, size, broken parts, etc.).

5 Each helper receives a percentage share of the catch, and generally no daily wages are given. Percentages range from 1% to 25%.

6 Refer to Annex 3.

3. Supplier

The supplier is the link between the commission agent and the exporter. The supplier has trucks to transport products to his facility where they are cleaned and graded in three to four grades based on size, quality and defects. Suppliers often deal with single types of fish, unlike commission agents who deal with the complete catch of the fishermen.

Suppliers have small depots alongside docks or harbours where products are sorted and cleaned. Severe infringement of labour and human rights are observed at the supplier's facilities, especially child labour and extremely poor working facilities. Sanitation is very poor; drains are open and effluent is discharged without treatment. Solid wastes such as small fins and insoluble effluents are discharged into open drains. Bigger solid waste such as spoiled fish and broken organs are dumped in open garbage cans in the vicinity, creating a foul smell in the surroundings. This situation exists even though garbage is cleaned twice-a-day by municipal authorities.

Working conditions are very poor. Small children, women and some men clean fish in groups of four while squatted on the floor. The ground is wet, cold, without cushions and there is little space between workers. There is no provision of organized labour. A contractor is appointed for daily labour requirements and nearly all workers get daily wages without any social security. Fishermen, suppliers and preprocessors do not receive adequate attention from MPEDA,[7] compared to the attention received by exporters. Hence their performance goes unchecked.

4. Exporter

The exporter is the most sophisticated end of the supply chain. Issues such as the Hazard Analysis and Critical Control Point (HACCP) first emerge at the exporters end. The rest of the chain is completely unaware of export-import regulations and safety issues.

The exporter is the price setter—the prices move downwards from the exporter to the supplier, to the agent and then to the fisherman on a daily basis. The level of transparency is very low between each of these groups. Even suppliers are unaware of the selling price of exporters. Nevertheless, exporters receive prices from their buyers in importing countries.

Due to lower margins and a drop in global prices in 2004, small Indian exporters are facing immense competition from huge global counterparts, often over 100 times their size. Iceland with over 150 small units faced a similar situation nearly two decades ago against the backdrop of globalization and survived the crisis through consolidation. Ten small units merged to become one unit, large enough in size and capacity to match the big ones in the U.S. and EU. Learning from the Iceland approach, eight of the 68 seafood-processing units in Kerala have decided to merge into a single, large public-limited company.

The minimum cost of a EU certified plant is Rs. 80 million. The net worth of companies who are certified to export to the EU ranges between Rs. 800 and Rs. 3,000 million. MPEDA is very active in ensuring that exporter facilities are able to comply with international standards.[8]

---

7 The Marine Products Export Development Authority (MPEDA) is a nodal agency set up by the Government of India in 1972 for the promotion of seafood exports from India.

8 For approximate cost of the EU certification refer to Annex 5.

Employees in export units are well trained and wear gloves and face masks. The hygiene facilities are very good. Staff have access to clean toilets, wear clean uniforms and have a comfortable work environment. Most importers and buyer representatives visit export facilities on a regular basis, especially when the importer is planning a long-term purchasing contract.

Exporters are particularly concerned about the handling methods at the bottom of the chain, i.e., at the fishermen's level. Hygiene and food safety infrastructure at the docks is inadequate. Wastage and the cost of compliance will be substantially reduced with adequate training of fishermen and a minimum infrastructure at the beginning of the chain.

5. Importer

This research involved a short field survey in Europe to determine if importers are concerned about fishery sustainability issues. Similar to several other sectors, there is significant divergence in the performance of big and small importers. Particularly interesting is that several importers are also concerned about importing regulations in their own countries, allegedly driven by consumer organizations. This is causing uncertainty in business transactions.

Small importers have restricted their requirements to mandatory import regulations which are very high, while big importers inquire about traceability and sustainability. Due to the low possibility of implementation and scarcity of resources, no importer has imposed any labelling requirement on exporters beyond mandatory obligations. Several large international groups such as the British Seafood have their own sourcing codes which cover ethical trading and sustainability, and conduct independent verifications and annual supplier audits. These codes are based on international norms such as the Ethical Sourcing Initiative.

There is immense pressure on retailers in Europe to keep fish prices low, even at the cost of excessive resource use since fish is becoming a staple food in the diet of Europeans. Its popularity is increasing because of better health benefits in comparison to meat and chicken. In research conducted by Consumers International in Europe, 45 different claims were found on 12 products, ranging from "friend of the sea," "better for the environment," "sourced from population conserving fishery," "committed to conservation fishing methods" to "dolphin safe" (Consumers International 2004). This has confused the consumer and has made him/her less label conscious. The price premium for sustainably managed Indian seafood is untested, since India does not have a single seafood ecolabel. Internationally, the MSC label has certified a handful of fisheries amounting to less than 0.5 per cent of global fish trade. Although MSC certified fish are able to gain certain price premiums, the market for such fish is too small for making any observation.

Most importers think the importance of sustainability will grow exponentially in the future, especially due to the rate that fish stocks are depleting. Although aquaculture is currently filling the gap, expected growth rates in seafood demand may outpace supply. Further, intensive aquaculture has far-reaching impacts, not only on future supply, but also on the environment (mangrove destruction, salinization, groundwater pollution, etc.).

4. Identifying the critical concern: The bottom of the chain

The landing centres

There are generally two types of fish landing centres: natural ports, which are normally beach landings; and constructed ports. Each have distinct infrastructures and problems. By studying the four landing sites in Mumbai and Cochin in India, we can generalize the state of affairs for beach and concrete landing sites.

Table 4.1: Characteristics of Natural and Constructed Ports

Natural Beach Ports	Constructed Ports
Sand surface	Tiled concrete surfaces
Manual labour has to be used to haul ice and oil on the boats	Ice and oil delivery is available right up to the dock
Hygiene levels are difficult to maintain	Hygiene levels are easier to maintain
Generally involve more middlemen since local fishermen sell produce to agents and cooperative fishermen societies are not involved in trade	Generally involve fewer middlemen since local fishermen cooperative societies sell fish directly to suppliers at location
Generally local fishermen communities control access, since government provision on beach ports is minimal	Access to facilities is open for all fishermen, since government provides facilities
Lesser degree of professionalism since subsistence fishing and community-based fishing practices are common	Higher degree of professionalism since the government has invested in promotion of industrial clusters
Local communities of fishermen exist	Generally industrial facilities are common in the local environment
Fishing trips of local fishermen averaged 3–4 days	Fishing trips of fishermen averaged 5–7 days

Source: Field Survey

MPEDA, along with local stakeholders, have developed a modal fishery harbour at Cochin, Kerala. The Cochin harbour adopts a cluster approach to fishery development, where the ice factory, nets and spares depots, auction centres, supplier storage and pre-processing facilities, and transportation facilities are available in the harbour vicinity. Further, the harbour is a fully concrete-tiled. Oil pumps and ice machines directly transfer raw materials into the boat. Elevated, steel-plated and drainage-equipped platforms provide hygienic transfer of fish from the boat to the auction facility on the harbour and subsequently into suppliers' containers.

The state of the other harbours is quite poor. There are more beach landing centres in the country than port landing centres. Beach landing centres, require extensive investment in infrastructure. Most port landing centres, even in big ports in Mumbai, are unhygienic and lack basic amenities such as clean water and drainage systems.

The state of the fisherman

The fisherman is the price taker since the price moves from the international market via the exporter to the lowest actor in the chain—the fisherman. He is also the risk bearer; he bears all fishing expenditures and assumes the risk of a poor catch.

Fishermen are the primary affected stakeholders of government regulations such as annual fishing bans or environmental measures like turtle conservation. In India, fishing is a full-time profession, and fishermen do not have any alternate source of income generation. Export promotion agencies concentrate their activities on assisting exporters, leaving little development for fishermen.

Table 4.2: Central Budget Allocation (Government of India) in Rs. Million

	Allocation Head	2005–2006	2004–2005	2003–2004	2002–2003
1	Export promotion of seafood under MPEDA	540	520	520	400
2	Harbour and landing facilities	230	110	55	95
3	Marine fisheries	580	545	200	699
4	Inland fisheries	273	335	102	185
5	Education, training and other	712	600	450	73

Source: Respective Annual Union Budget Documents, Government of India

With a population of approximately 1.5 million fishermen in India compared to barely 1,200 exporting units with .05 million workers in India, central government outlays in India clearly favour exporters over fishermen.

A study of the subsidy and promotion schemes of MPEDA reveals that among 40 schemes listed, only one is targeted at fishermen. It provides for a maximum of 30 per cent investment assistance, subject to a Rs. 50,000 cap for equipment installation in mechanized fishing vessels. On the other hand, exporters receive assistance for promoting exports, hygiene and sanitation, research and development, and acquisition of machinery. Thus in the complete supply chain, exporters receive most subsidies and government assistance, while fishermen appear to receive the least. Although export promotion expenditure may be justified by trickle down effects, the expenditure on downstream actors, namely the fishermen, has to be increased.

Fishermen are the least organized group, are spread across the country, practise different fishing methods and operate on different scales. Hence their representation is inadequate in lobbying activities.

The poor state of the Indian fishermen is the primary reason for low support of sustainable initiatives. For instance, in 2003, several exporters in Mumbai, India, stopped procurement of shrimps smaller than 18 centimetres to protect juvenile fish. Instead of throwing back small-sized shrimps into the ocean, fishermen opted for the other two options; selling the shrimps at lower domestic value to restaurants and upper class consumers demanding good quality luxury food; and self-consumption. Thus fish catch is never wasted, adding to the difficulties in sustainable fish resource management. Even if a fisherman does intend to throw fish back in the ocean, most of the fish are no longer alive after they are hauled and sorted. Since fishermen compete with each other for catch, non-cooperation of a single fisherman is bound to disrupt any self-regulation mechanism.

Compared to fishermen in south-east Asian countries such as Malaysia, Indonesia and Singapore, Indian fishermen are backwards. In Malaysian fishery liners, most processing occurs inside the boat once the fish is caught. Indian regulators are aware of just two Indian boats with on-board processing facilities. Of the 650 boats registered with the Nakhva Sangh, a society formed by the fishermen community in Mumbai (India's biggest fishing centre by volume of exports), none are equipped with processing facilities and their small size prevents them from ensuring a HACCP-compliant, on-deck processing facility in the future.

Subsistence and artisanal fishing is usually practised in coastal areas. Excess fishing is leading to fish depletion in coastal areas. For example, annual catch levels of pomfret in Maharashtra have come down from 16,000 kilograms in 1990 to just 3,000 kilograms in 2004. Similarly, catch levels of Bombay duck has reduced from 65,000 kilograms to 16,000 kilograms during the same period (Central Marine Fisheries Research Institute 2004). This has forced fishermen to go deeper for better catch, increasing both the number of fishing days required per trip and the cost.

Fishing as a career is becoming increasingly expensive yet this is not reflected in fisherman incomes, which in several cases has decreased. Aquaculture is adding to declining prices so much that more than 50 per cent of India's seafood exports now originate from aquaculture.

5. Marine Stewardship Council label: Is it viable?

The MSC program is a voluntary independent, third party certification that developed out of initial efforts of Unilever and World Wildlife Fund (WWF). Fisheries are assessed for being well managed and sustainable, based on the principles given below:

- a fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery;
- fishing operations should allow for maintenance of the structure, productivity, function and diversity of the ecosystem on which the fishery depends, including the habitat and any associated dependent and ecologically-related species; and
- the fishery is subject to an effective management system that respects local, national and international laws and standards, and incorporates institutional and operational frameworks requiring responsible and sustainable resource use.

However, beneath these three principles lie management practices which propose fundamental changes in fishing practice in India.

The number of boats in a given geographic fishing area requires to be regulated and limited.

In India, most ports and beaches do not restrict fishermen since the seas have open access. Fishing is the livelihood for a large number of artisanal fishermen and any regulation will lead to a livelihood crises unless alternatives are provided. Unlike the U.S. and EU, India does not have fishing quotas and private fishing rights.

The number of fishing traps, net sizes, net types and catch volume has to be regulated.

In India, there are over 70 methods for fishing. Fishing time, duration and scale can vary among fishermen within the same fishing zone. Hence regulation is a huge task in the Indian environment.

The fishery has to be certified based on specific species, not a variety of species.

In India, nearly all fishermen catch different varieties of fish—whatever is caught is sold. Thus all fisheries are multi-species fisheries, rendering themselves ineligible for MSC labelling, since catch diversity is not respected in the MSC labelling framework.

The fishery must undertake measures to minimize or close fisheries when designated catch limits are used.

Currently several states have imposed a 45-day monsoon ban, causing concern to many fishermen, since they are unemployed for these days. A conditional ban will be completely unacceptable to the fishermen community.

The fishermen must use fishing gear that is able to exclude non-targeted species.

Since all Indian fishermen do not fish for a particular fish variety, use of restrictive fishing gear is not possible.

Fishery stakeholders must adopt a scientific approach to fishery management.

The awareness of MSC labelling in India is negligible. Out of 10 top EU certified exporters, none were aware of the MSC label. The government export promotion agency, state fishery departments and research institutes were unaware of the MSC label. Even if awareness is created, the scientific depth needed is difficult, given that most fishermen are illiterate and operate non-mechanized or motor-powered boats with no technical instruments on board.

Price premium may not be guaranteed.

A certified fishery is expected to gain a price premium. However, the fishermen in India are price takers. The price transmission mechanism moves from the exporters to the fishermen. Thus there is no guarantee that fishermen will receive a better price for their catch.

6. The EU and U.S. seafood import regulations: Boon or bane?

U.S. process regulations

The December 1995 U.S. seafood regulation on HACCP has mandated every processor and importer to comply with HACCP from December 1997. To ensure compliance with its food-safety regulations, the U.S. Food and Drug Administration (FDA) requires importers to meet one of two conditions. First, importers may obtain seafood from countries with voluntary agreements with the FDA. These agreements may document that the countries' seafood safety systems are equivalent to or in compliance with those of the U.S. Second, if these agreements do not exist, importers must have records demonstrating that foreign firms' products entering the U.S. have been processed in accordance with U.S. HACCP requirements. Such records may include a copy of the foreign firms' HACCP plan.

The FDA inspects some U.S. importers and some foreign firms to determine their compliance with HACCP regulations. It also examines and tests samples of imported seafood products at U.S. ports of entry to verify their safety. The FDA has the authority to hold imported seafood products while determining if the product is adulterated. The FDA also has the authority to detain imported seafood products and requires importers to demonstrate the products are not adulterated, a process called detention without physical examination (DWPE).

The HACCP system is based on the following seven principles that each seafood firm must address:

- conduct a hazard analysis to identify hazards likely to occur;
- identify the Critical Control Point (CCP) to determine a point, step or procedure in the production process where controls can be applied to prevent, eliminate or reduce food safety hazards likely to occur;

- establish critical limits for each CCP by setting maximum or minimum parameters of factors, such as cooking time and temperature, that must be controlled at each CCP to prevent, eliminate or reduce the hazard to an acceptable level;
- monitor each CCP to ensure the process is under control at each CCP;
- establish corrective actions taken when monitoring shows deviations from established critical limits;
- establish verification procedures to ensure HACCP plans accomplish intended goal of safe product production; and
- establish record-keeping and documentation procedures such as the HACCP plan, CCP monitoring, corrective actions and verification activities.

Unlike the EU system, where exporters are required to seek prior approval from the European Commission (EC), the U.S. system requires the importer to adopt certain measures to import seafood.[9]

Importers must maintain a written product specification for each product and must document at least one of following six affirmative steps for each product:

- HACCP and sanitation records from processor;
- continuing or lot-by-lot certification from foreign inspection authorities or third-party;
- regular inspection of foreign processor;
- copy of HACCP plan from processor and written guarantee that the imported seafood product is processed in accordance with HACCP requirements;
- periodic testing of the imported product and a written guarantee that the imported seafood product is processed in accordance with HACCP requirements; and
- other appropriate verification measures.

HACCP defines requirements for critical control points in production, sets practices for plant staff to prevent hazards from occurring and provides procedures for monitoring and auditing. The standards also delegate responsibility to the operating staff. In this way, the standards are a tool to ensure food safety by focusing on prevention rather than relying on end-product testing.

In 2003, the FDA Interim Final Regulation announced the *Public Health Security and Bio-terrorism Preparedness and Response Act*. The Act requires all domestic and foreign facilities processing, packing or holding food for human or animal consumption in the U.S. to register with the FDA. These facilities must also submit electronic notice before the shipment arrives in the U.S. In 2003, the FDA issued a circular to all countries exporting processed packaged food to register with it. The regulation is part of the regime's move to guard its citizens from possible bio-terrorism attacks by protecting the food supply and is a component of the new Bio-Terrorism Act enforced in the U.S.

9 GAO-04-246, United States General Accounting Office.

EU process regulations

EU is India's largest trading partner. In 2004, 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 Export Inspection Council of India (EIC).

Facilities are required to undergo inspection every two months. The EU Council Directive 91/493/EEC lists the health conditions for the production and export of fishery products to the EU. Several subsequent directives provide detailed rules for application of 91/493/EEC, such as 94/356/EC regarding health checks on fishery products and 92/48/EEC for rules on fish caught on board certain vessels.

In 1999, the EU undertook a detailed mission to India, as per EU directive 91/493/EEC. The mission suggested several measures to improve India's fisheries sector to ensure India remains in List 1, Annex 1 of the EC Decision 97/276/EC, which allows approved units in a country to export to the EU. These recommendations included improving the hygienic environment in pre-processing plants and improving the hygienic environment for block-ice factories.

The EU process regulations are similar in architecture to the HACCP compliance but are more detailed and require extensive upgrades of the domestic certification system and the exporter. Exporters must submit an application form and relevant documents, including the HACCP manual, to the EIC who conducts a short assessment to discover deficiencies.

Once the documentation is in order, multi-organizational teams comprising of MPEDA, the Central Institute of Fisheries Technology (CIFT) and EIC conduct a deeper assessment, after which formal requirements are suggested. After completing these requirements, the exporter is cleared by the Supervisory Audit team and issued an approval number that is valid for two years. Regular monitoring is conducted with monitoring visits and corporate audits. A health certificate is also issued by EIC on request after verifying the requirements.

EU requirements are more comprehensive than U.S. requirements. The EU requires exporters to have their own ice-making units and preprocessing facilities. The EIC acknowledges that EU process requirements impose more-than-necessary conditions often not listed in formal documents. For example, after visiting facilities, the EIC has also listed conditions which do not form a part of the written text of the EC decision, such as the number of change rooms per facility and separate chill rooms for every section of the processing unit.

EU and U.S. product regulations

Apart from process regulations, both the EU and the U.S. have product regulations, which impose standards on specific substances present in the final product and environmental aspects for instance packaging.

In 2002, the EU implemented the so-called "zero tolerance" policy regarding antibiotics residue. The detection of some antibiotic residues (chloramphenicol and nitrofurans) at the level lower than one part per billion (ppb) have often led to rejection of seafood, and specifically shrimp products imports, from Asian countries.

Recently, import regulations have increased on heavy-metal residues in fish. These include arsenic, tin, cadmium, lead, chromium, mercury and nickel. In select carnivorous fish, mercury is retained albeit at below-hazardous levels. But EU regulations for mercury are close to being non-detectable—less than one ppb.

U.S. and EU import regulations also have strict standards for micro-organisms and the presence of infections such as salmonella, sulphite-reducing anaerobes and faecal coliform. Fish imports must be certified as "product meets all microbiological standard for frozen seafood" before they are dispatched. Anywhere between five and 100 per cent of product is tested and subject to an alert system.

In 1979, a high violation rate caused the FDA to issue an Import Alert on Indian shrimp, placing all shrimp-shippers from India and a few other countries on automatic detention. In January 1980, a certification program was agreed upon by the FDA and the Indian government as an assurance that better testing and export controls for filth and decomposition would be implemented by the Indian government.

A list of certified shippers exempt from automatic detention for filth and decomposition was developed (U.S. FDA 2005). Attachment A (last revised in February 2005) and Attachment B (last revised in July 2004) of the FDA Imports Program Branch list approximately 100 units which are exempt from automatic detention. Companies not on the list often face delays, higher warehousing costs and closer inspection. Nevertheless, in recent years, automatic detention is not a major concern for Indian exporters since most exporters with a strong U.S. focus have found a place in the exempt list.

In 2004, the U.S. Department of Commerce imposed anti-dumping duties on certain frozen and canned warm-water shrimp from India and select developing countries. The U.S. alleged that producers/exporters have sold them in the U.S. market at less-than-fair value, with margins ranging from 3.56 per cent to 27.49 per cent for India. Anti-dumping duties have become a routine matter of concern for shrimp exports of several developing countries to the U.S.

According to the FAO, several developed countries continue with tariff escalation even though average duty on fishery products in developed countries is only 4.5 per cent, resulting in most fish-processing to occur in developed countries.

In September 2004, the U.S. government introduced a new labelling requirement for seafood to ensure food traceability. It requires information such as country of origin labelling and whether the fish were from marine environments or aquaculture. The reasoning is that consumers should know where their seafood comes from and have a sense of security. Although this regulation was mentioned in the U.S. Farm Bill 2002, it was not finalized until September 30, 2004, and is expected to increase costs along the supply chain.

Views from the ground

Views from exporters in Chennai, Delhi and Mumbai, and from regulatory agencies revealed that HACCP is a management system necessary for any company. MPEDA validates exporters complying with HACCP, and HACCP compliance is a mandatory requirement for all exporting units.

MPEDA and the Export Inspection Council certify the exporter as HACCP compliant. HACCP has helped the Indian seafood industry in becoming more organized and process-oriented. It is not very difficult for an organization to introduce HACCP in their unit. Also the costs in many studies are

inflated. One study calculates that complying with EU and U.S. regulations increases processing costs from Rs. 2 per kilogram to Rs. 7 per kilogram. However, the breakup seems less realistic and researchers have often calculated cost difference by comparing zero level of compliance and 100 per cent compliance. Of the 15 exporters selected for intensive interviews, none have complained about the difficulty or cost of HACCP compliance.

Government authorities and exporters are not very concerned about the U.S. bio-terrorism regulation since implementation is not very complex. Registration is online and there are no additional costs of registration, although several exporters in Kerala faced delays in schedules from delayed registration (Sareen 2004).

Select exporters have expressed concern about EU process requirements, which often do not result in any risk reduction but impose additional costs such as providing separate chill rooms. The strictness and rigidity of EU requirements concerns some exporters. One exporter in Cochin, Kerala, mentioned that one of his processing facilities was not approved for export to EU because it did not have a laboratory and conducted tests outside its premises. The EU regulation also does not give scope for establishing common laboratories, which help to reduce costs in clustered setups.

Nevertheless, the EU process regulations have made government agencies more active in assisting exporters. Where U.S. HACCP regulations require the exporter and importer to bear the onus of food safety and supply chain hygiene, the EU regulations transfer some degree of onus to the government.

Product regulations are not very positively viewed. There is wide consensus that EU and U.S. product regulations have a negative effect on seafood exports compared to process regulations, since the severity of import regulations are based more on precautionary principles rather than actual food safety concerns. Several studies substantiate how the U.S. and EU seafood regulations are higher than international standards set by Codex.[10] "In the United States, HACCP allows the establishing of Memorandums of Understanding (MOU) with countries importing seafood into the U.S. However, to date no MOUs have been agreed to by the U.S. FDA. Also the U.S. program adopts a different hygiene code than that of Codex."

"The EU version of equivalence is different from that of Codex. To achieve equivalent status with the EU, the exporting country must demonstrate that its "National Competent Authority" has the capability to enforce EC legislative regulations that safe and wholesome products are being produced and sold. EC regulations do not contain a process to develop a MOU-type arrangement, thus equivalence occurs by the EC approving individual countries and companies within them to export to the EU. This sets up a convenient opportunity for the use of equivalency as a non-tariff trade barrier (Sophonphong and Lima dos Santos 1998)."[11] Codex on the other hands calls for transparency in equivalence criteria and suggests harmonizing criteria wherever possible.

Since 2004, heavy-metal residue has replaced antibiotic and microbiological contamination as the biggest concern of the future. In the first half of 2004, more than one-third of total Chinese seafood rejections in the U.S. were on account of high levels of cadmium, mercury and other heavy-metals. Heavy-metal concentrations are often determined by variables such as water contamination, mining activity and effluent treatment activities in the fishing region.

---

10 Refer to FAO "Economics of Hazard Analysis and Critical Control Point (HACCP) programs," Fisheries Technical Paper. No. 381 for additional information.

11 *Ibid.*

For example, an October 2003 study by the European Environment Agency revealed that of 153 fishing regions in the EU, ten regions exceeded the EU statutory limit for lead content in mussels (European Environment Agency 2003). With inadequate environment legislation, monitoring systems and poor environmental compliance by Indian businesses, seawater contamination may increase the rejection of Indian seafood exports. In addition, bio-accumulation increases the concentration of heavy metals in fish.[12] For instance, mercury concentrations in fish can be over 100,000 times the mercury concentration in the water due to bioaccumulation.[13] This creates a need to strengthen India's heavy-metal monitoring system.

Non-harmonious importing conditions within Europe are also a cause of concern. The U.K. sets statutory limits for lead at 2.0 milligrams per kilogram in fish compared to an EU limit of 0.5 milligrams per kilogram. Spain sets strict allowance limits of copper for cephalopods at 20 milligrams per kilogram while the EC does not have legislation for copper. The number of non-harmonized Microbiological Criteria (MC) in EU member states varies considerably. France has more that 80 MC for foods while no MC exists in German federal legislation, except those laid down by EC Directives. Countries with non-harmonized, national MC for fish and fish products are France, Norway, Spain, Denmark and Belgium (EC 1998).

Policy recommendations

As outlined earlier, a number of variables are necessary to create an enabling environment for sustainability in the seafood industry.

Variable	Current State in India's Marine Seafood Export Sector
Well organized supply chain	Yes, the supply chain is organized, well connected with adequate clusters.
Minimum fish wastage due to mishandling and poor hygiene	No, fishermen and other bottom of the chain workers are not trained in fish hygiene and handling methods. However, the state of good handling and hygiene within exporting firms is adequate.
Availability of adequate facilities at landing centres namely clean water, clean ice, clean elevated display platforms at landing and handling centres	No, most ports lack adequate hygiene facilities. In general all beach landing ports are in a poor state of sanitation and hygiene. Most constructed ports are also inadequately equipped.
Appropriate revenue structures, which ensure adequate compensation to the fishermen, and protects his livelihood	By and large, revenue structures are acceptable. However, in comparison to developed countries, fishermen need better earnings. Nevertheless the state of the fishermen is better than the state of the farmer. (refer to Annex. 3)
Favourable importing country regulations - Process regulations - Product regulations	Yes, the U.S. and EU process regulations for the most part, are helping to bring efficiency and sustainability in the industry. Product regulations, in select cases are causing discomfort, especially the emphasis on zero tolerance and use of excessive precaution without valid concerns.

This paper recommends the following:

Bottom-up approach to hygiene and food safety

Any attempt to improve the Indian seafood industry requires an approach that starts at the lowest actor of the supply chain. Concern over food-safety starts from the salt used in ice factories, which is further used

12 Bioaccumulation denotes the accumulation of a substance in a living organism as a result of its intake both in the food and also from the environment. For example the bioaccumulation of mercury in fish involves the increase in concentration of the metal in its tissues.

13 Texas Department of Health, Seafood Safety Division, (2004),"Fish Consumption Advisories and Bans."

by fishermen for fish preservation. Similarly, the first target for improvement in infrastructure should be the harbours and beach landing centres. The following points deal directly with the bottom-up approach.

Promotion of fishermen cooperatives

Fishermen are the most disorganized group in the supply chain. They are inadequately equipped to handle the future technical, financial and legal developments in their industry, especially as the government focuses more on marine sustainability concerns. Fishermen cooperatives will pave the way for a better-managed fishery by regulating access and managing information better. The Versova landing centre in Mumbai, which is a community enterprise, is a good example of community-based regulation of fishery operations.

The Nakhva Sangh society at Versova is made up of 600 fishermen cooperatively managing the landing centre resources. They have established a market where they deal directly with suppliers, thus eliminating the agent. They have adequate labour to move oil, ice, food and other amenities to the beach harbour from up-to one kilometer away. They allot docking space, boat maintenance and repairs, life and boat insurance, and provide regular representation of problems to the local government. Each fisherman makes a contribution to the cumulative fund, which is used to meet shared expenses such as cleaning, insurance, water provision and medical treatment for workers.

However, the society is ill-equipped to deal with sustainability issues. They lack the understanding, resources and measurement instruments for community development and have little or no financial assistance from the government. The fishermen are unable to strictly control catch volume or regional fishing activities because of their legal inability to exercise their fishing zone rights. A cooperative will help in legalizing community ownership of local resources and ensure smoother sustainability initiatives.

Basic hygiene training to fishermen

The Council Directive 92/48/EEC of the EU sets minimum hygiene rules for fishery products caught on certain vessels. This directive provides measures that are easy for Indian fishermen to implement if the government provides adequate support. Apart from commonly known on-board hygiene concerns like clean water, good quality ice and adequate hygienic environment for storing fish, this directive also requires vessels to have temperature measurement devices for maintaining uniform temperatures when storing fish. This can be implemented by providing a thermometer with a log table on all vessels. Routine monitoring of boats and harbours to maintain hygiene and sanitation is also advised. Local community health centres can play an active role by establishing a control mechanism similar to that at the Cochin Harbour and ensure good sanitary conditions are maintained.

Ensuring hygienic ice and water facilities for fish preservation and cleaning

The first stage of hygiene starts at providing clean ice to fishermen for preserving fish on board. Many port ice-factories are very unhygienic, increasing contamination risks. The workers add to the poor hygiene by spitting, using footwear on ice slabs and neglecting floor cleanliness. The salt used in ice is also of a non-potable nature.

Fish cleaning is in a similar state. At most beach landings and select concrete docks, seawater is used for cleaning. However, seawater in several places, such as Mumbai, contain oil, community garbage and organic effluents rendering them unviable. Minimum provision of municipal taps should be ensured at all landing centres.

The above recommendations hint at an integrated approach to sustainable livelihoods and fisheries, which are often in conflict. For instance although increasing the size of net holes helps smaller fish survive, it may be detrimental to fishermen by decreasing catch size. Although trawler-fishing benefits fishermen through greater haulage, it also uproots important life forms from the ocean floor. A more balanced approach would be to permit a flexible net size and push for a gradual reduction in trawling.

There is a growing support for a universal ban on bottom trawling, and in the next ten years, an international UN Convention banning bottom trawl fishing is possible. Therefore, the Indian government should work towards gradual replacement of bottom trawlers with other fishing methods.

Finally, it is not necessary to adapt international best practices to national priorities. MSC certification may not fully apply in the Indian environment, but its property rights framework may help introduce cooperative rights to the fishing community. Its access control regime may appear excessive, but mandatory and voluntary instruments for reducing excessive fishing may help tackle resource depletion.

Bibliography

Consumers International. "Green food claims." 2004.

European Commission. Directives 91/493/EEC, 92/48/EEC, 94/356/EC and 97/276/EC. 2004.

European Environment Agency. *Hazardous Substances in Marine Organisms and Loads to Coastal Waters: Lead*. Indicator fact sheet. 2003

Food and Agriculture Organization of the UN. *Report of and Papers Presented at the Expert Consultation on Illegal, Unreported and Unregulated Fishing*. Rome: Feb. 22- 23. FAO 2001.

Food and Agriculture Organization of the UN. "The State of World Fisheries and Aquaculture." FAO 2002.

Food and Agriculture Organization of the UN. *Economics of Hazard Analysis and Critical Control Point (HACCP) Programs*. Fisheries Technical Paper. no. 381.

Organization for Economic Co-operation and Development. AGR/FI(2000)11/PART1/FINAL. Lane, Daniel. "A Model Approach for Analysis of Fishery Transition." OECD 2000.

Sareen, Shashi "Export Certification System for Marine Products," *Seafood Export Journal*. 2004.

Texas Department of Health, Seafood Safety Division. "Fish Consumption Advisories and Bans." 2004.

United Nations Development Programme. "Trade in Fisheries and Human Development." UNDP 2003.

U.S. Food and Drug Administration, Dept. of Health. "Automatic Detention of Fresh Raw Fresh Frozen and Cooked Shrimp from India," pp.16–39, revised 02/07/2005. U.S. FDA 2005.

U.S. Food and Drug Administration, Dept. of Health. "Fish and Fishery Products, Hazards and Controls Guidance." 3rd ed. U.S. FDA 2001.

Annex 1. Indian Fishermen Population by States in 1992[14] (in hundreds)

State/Union Territory	Male	Female	Children	Total	No. of Family Engaged in Fishing		Family Members Engaged in			
					Full-time	Part-time	Marketing of Fish	Repair of Fishing Nets	Processing of Fish	Other Activities
Andhra Pradesh	2,768	2,602	3,348	8,718	1,428	1,321	1,121	504	219	260
Arunachal Pradesh	4	1	-	5	-	-	420	-	-	-
Assam	1,538	807	795	3,140	254	201	132	113	26	-
Bihar	1,800	1,322	1,589	4,711	255	754	331	167	56	167
Goa	53	49	47	149	24	14	20	6	3	7
Gujarat	889	882	1,844	3,615	557	236	147	116	34	637
Hariyana	49	8	13	70	4	-	-	-	-	38
Himachal Pradesh	13	8	15	36	2	3	2	1	-	-
Jammu & Kashmir	120	129	124	373	19	22	39	11	1	-
Karnataka	434	411	615	1,460	134	74	114	47	16	26
Kerala	1,978	1,970	2,381	6,329	1,099	275	254	135	81	426
Madhya Pradesh	890	671	1,050	2,611	112	566	152	103	23	15
Maharashtra	1,277	1,670	1,022	3,969	761	387	650	272	184	45
Manipur	305	186	66	557	318	239	-	-	-	-
Meghalaya	-	-	-	0	-	-	-	-	-	-
Mizoram	1	1	-	2	-	-	1	-	-	-
Nagaland	-	-	-	0	-	-	-	-	-	-
Orissa	1,065	977	1,400	3,422	225	128	132	113	4	9
Punjab	-	0	-	0	-	-	-	-	-	-
Rajastan	26	24	37	87	5	9	-	1	-	-
Sikkim	-	-	-	0	-	-	-	-	-	-
Tamil Nadu	1,460	1,325	2,379	5,164	890	145	221	237	48	69
Tripura	27	17	21	65	8	31	13	4	-	1
Uttar Pradesh	5,951	5,196	5,146	16,293	301	750	246	89	50	376
West Bengal	2,829	1,181	1,343	5,353	884	1,927	613	320	95	394
Andaman & Nicobar islands (p)	80	64	97	241	9	22	5	5	5	1
Chandigarh	3	-	-	3	3	1	3	-	-	-
Dadra & Nagar haveli	-	-	-	0	-	-	-	-	-	-
Daman & Diu (p)	-	-	-	0	-	-	-	-	-	-
Delhi	-	-	-	0	-	-	-	-	-	-
Lakshadweep (p)	174	175	175	524	9	21	-	-	6	2
Pondicherry	127	124	135	386	83	11	31	13	24	89
India	23,861	19,800	23,642	67,303	7,384	7,137	4,647	2,257	875	2,562

Source: Ministry of Agriculture, Government of India

14 Indian Livestock Census-1992, Summary tables Volume-I Directorate of Economics and Statistics, Ministry of Agriculture.

Annex 2. Built up capacity of the Indian seafood industry in select states

State	No. of Exporters	No. of Process Plants	Freezing Capacity Tons per Day	No. of Cold Storages	Storage Capacity	No. of Fishing Vessels
Kerala	287	124	1,585.77	169	23,086.50	2,963
Tamil Nadu	286	48	524.55	67	5,900.00	1,562
Karnataka	43	14	186.40	26	3,540.00	3,226
Andhra Pradesh	95	52	779.50	53	7,200.00	717
Goa	9	7	104.00	9	1,275.00	420
Gujarat	64	55	2,216.03	57	22,925.00	426
Orissa	30	21	220.00	20	2,460.00	414
Maharastra	268	41	1,327.11	39	19,372.00	2,932
West Bengal	99	37	340.00	30	3,500.00	0
Delhi (UT)	92	—	0.00	1	15.00	0

Source: Indian Council of Agricultural Research

Annex 3. Social impact indices (SII) by villages' primary occupation[15]

	Salinity	Access	Salinization	Employment	Health	Fuel Wood
Fishing villages (N=16)	0.149 (11)	0.09 (16)	0.248 (11)	0.272 (13)	0.44 (9)	0.15 (2)
Farming villages (N=9)	0.471 (6)	0.443 (3)	0.281 (8)	1.0 (1)	1.75 (0)	0.235 (8)

Source: Patil and Krishnan (1998b). The number of villages reporting this impact as problematic is in parenthesis.

15 Patil and Krishnan (1998b). The number of villages reporting this impact as problematic, is in parenthesis.

Annex 4. Relevant facts from the United Nations Environment Programme's Fifty Key Facts About Seas and Oceans on World Environment Day

1. The Plan of Implementation adopted at the World Summit on Sustainable Development (WSSD) calls for a global marine assessment by 2004 and the development of a global network of marine protected areas by 2012.

2. Less than one-half of one per cent of marine habitats are protected compared with 11.5 per cent of global land area.

3. The High Seas areas of the ocean beyond national jurisdiction cover almost 50 per cent of the Earth's surface. They are the least protected part of the world.

4. Although there are some treaties and some fisheries agreements that protect ocean-going species such as whales, there are not protected areas in the High Seas.

5. Studies show that protecting critical marine habitats such as warm and coldwater coral reefs, sea-grass beds and mangroves can dramatically increase fish size and quantity, benefiting both artisanal and commercial fisheries.

6. Some 90 per cent of the world's fishermen and women operate at the small-scale local level, accounting for over half the global fish catch.

7. Some 95 per cent of world fish catch (80 million tons) is from near-shore waters.

8. More than 3.5 billion people depend on the ocean for their primary source of food. In 20 years, this number could double to seven billion.

9. Artisanal fishing communities, who harvest half the world's fish catch, are seeing their livelihoods increasingly threatened by illegal, unregulated or subsidized commercial fleets.

10. More than 70 per cent of the world's marine fisheries are now fished up to or beyond their sustainable limit.

11. Populations of commercially attractive large fish, such as tuna, cod, swordfish and marlin, have declined by as much as 90 per cent in the past century.

12. Governments at WSSD agreed, on an urgent basis and where possible by 2015, to maintain or restore depleted fish stocks to levels that can produce the maximum sustainable yield.

13. The WSSD Plan of Implementation calls for the elimination of destructive fishing practices and subsidies that contribute to illegal, unreported and unregulated fishing.

14. Government subsidies estimated at US$15–20 billion per year account for nearly 20 per cent of revenues to the fishing industry worldwide, promoting excess fishing capacity and encouraging over-fishing.

15. Destructive fishing practices are killing hundreds of thousands of marine species each year and helping to destroy important undersea habitats.

16. Each year, illegal long-line fishing, which involves lines up to 80 miles long, with thousands of baited hooks, kills over 300,000 seabirds, including 100,000 albatrosses.

17. As many as 100 million sharks are killed each year for their meat and fins, which are used for shark fin soup. Hunters typically catch the sharks, de-fin them while alive and throw them back into the ocean where they either drown or bleed to death.

18. Global by-catch—unintended destruction caused by non-selective fishing gear such as trawl nets, longlines and gillnets—amounts to 20 million tons a year.

19. The annual global by-catch mortality of small whales, dolphins and porpoises alone is estimated to be more than 300,000 individuals.

20. Fishing for wild shrimp represents two per cent of global seafood but one-third of total by-catch. The ratio of by-catch from shrimp fishing ranges from 5:1 in temperate zones to 10:1 and more in the tropics.

21. Shrimp farming, too, is highly destructive. It causes chemical and fertilizer pollution of water and has been largely responsible for the destruction of nearly a quarter of the world's mangroves.

22. Mangroves provide nurseries for 85 per cent of commercial fish species in the tropics.

Annex 5. Estimated annual cost of approval and monitoring of a single EU-approved fish and fishery product processing establishment, 2003 (US$)

Activity	Elements	Estimated Cost (US$)
Approval	Processing and desk audit	20.6
	Assessment of Establishment	205.7
	Approval certification	41.1
	Total	267.4
	Annual cost	133.7
Monitoring of establishment	bi-weekly inspection by EIA officer	43.2
	Testing of samples taken by EIA officer	169.7
	Annual cost	5,110.1
Testing samples	Quarterly monitoring of environmental contaminants	822.9
	Intra-/inter-laboratory comparison	212.9
	Annual cost	1,035.8
Supervisory checks	Quarterly supervisory visit	41.1
	Annual cost	164.6
	Total	6,444.1

Source: Export Inspection Agency, Cochin