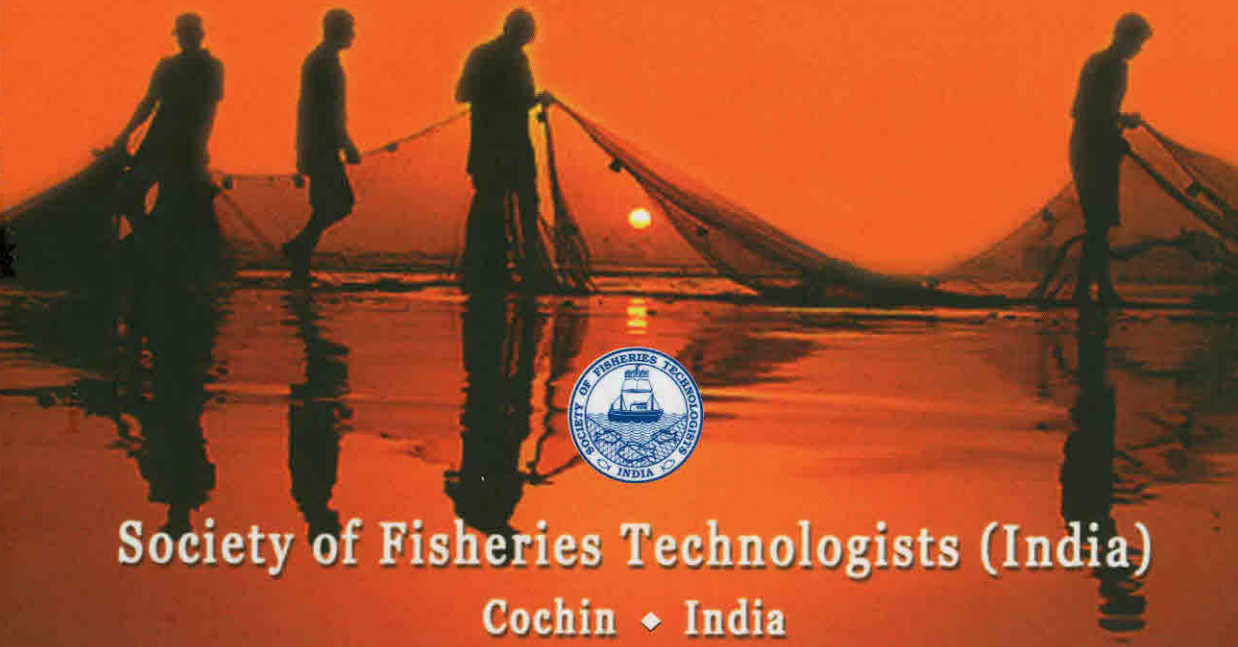
Coastal Fishery Resources of India

Conservation and Sustainable Utilisation



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Quality Standards in Seafood Industry

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Introduction

Food safety has been recognized as an important element in international food based trading emphasizing the importance of quality maintenance and checks at different stages of production cycle. WTO negotiations ensuing free trade across the globe have also introduced requirements of stringent quality norms and certification. Seafood units across the country oriented towards exports have conformed towards the product quality specifications set by importers from time to time. This includes compliance with Sanitary and Phytosanitary measures including Hazard Analysis and Critical Control Points (HACCP). International compliances are capital intensive that only units of big size could afford to adhere. This has been progressively reviewed and subsidized by Government agencies to augment compliance level and trigger development of export related infrastructure.

However, the domestic marketing front presents an extremely distorted scenario of quality compliance owing to limitations of insufficient marketing infrastructure. In India, the bulk of the domestic consumption of fish is confined to a limited circumference around the landing centres due to insufficient storage and transport facilities. Quality of fish sold at retail points is substandard due to lack of preservation and storage mechanism. In this paper, quality specifications applicable to seafood trade in India with special reference to HACCP, cost of compliance, the benefits and challenges arising out of such compliance are discussed.

International standards for seafood trade

The Codex Alimentarius developed in 1963 acts as a global reference standard for international food trade. The Sanitary and Phytosanitary (SPS) measures adopted by WTO member countries in 1995 ensure protection to importing countries to get quality products in lieu of reduction in tariff barriers that restrict trade. SPS agreement applies to food safety measures

concerning animal and plant life and human health. The conformity of food products to such specifications can be achieved by appropriate analysis verifying the prescribed standards (Table 1). Other technical measures outside this area come under the purview of TBT (Technical Barriers to Trade); some of the issues being packaging, labeling etc that would ensure conformity with technical regulations and standards.

Table 1: Required analysis and corresponding standards by US and EU as per Sanitary and Phytosanitary Agreement

Analysis	Standards and parameters
Bacteriological analysis	Faecal coliform US : < 230 MPN.100g^{-1} EU : < 300 MPN.100g^{-1} *Eschericia coli* EU: < 230 MPN.100g^{-1} *Salmonella* (nil in 25 g sample) *Vibrio cholera* and *V. parahaemolyticus* Nil in 25 g sample
Histamine	US (< 50 mg.100g^{-1}
Heavy metals	Cadmium (<1.0 ppm) Copper (< 30 ppm) Lead (2.0 ppm) Zinc (< 100 ppm)
Plankton identification	*Phrodium* sp. *Gymnodinium* sp. *Alexandrium* sp. *Dinophysis* sp. Microalgae
Pesticide analysis	Organochlorine pesticide in marine products tissues
Fish Freshness Index	Eye, body surface, gill, texture

Source: FAO (2005)

The Indian scenario of quality assurance in seafood industry dates back to 1963 when a voluntary pre-shipment inspection was initiated for frozen and canned shrimps under the auspices of CIFT. A comprehensive legislation, The Export (Quality Control and Inspection) Act was initiated in 1963, and the Export Inspection Agency (EIA) was established in 1964. Concentration on the quality compliance of end product was the major drawback associated with these arrangements. In 1997, European Union (EU) banned Indian consignments on account of detection of pathogens. From this point onwards, the EU regulations were made more stringent

and its scope was extended to all aspects of the supply chain following principles of HACCP which were enforced at country level. In 2001, EU has initiated a 'zero tolerance' towards residual antibiotics detected in shrimp exports. USA and Japan has been enforcing their import specifications at company level, insisting compliance to HACCP, standard sanitary operating procedures and good manufacturing practices. The US regulations are implemented through MoU with The Food and Drugs Administration (FDA) and the trading partners where agreement is reached to have HACCP verification and quality assurance on stakeholders in the exporting country (Bostock, 2004).

Though application of International Regulations is voluntary in nature, buyer countries' stipulations demand conformation with standards. The benefits and costs arising out of implementation of the systems have been debated in the country with its introduction in 1997. Regulatory Impact Analysis (RIA) has been used widely in literature to assess the costs and benefits of compliance to food safety regulations (Romano *et al.,* 2004). The typologies of costs and benefits as applicable to different stakeholders in the seafood industry are summarised as in Table 2.

Table 2: Benefits and costs of food safety regulations

Stakeholders	Benefits	Costs
Firms	▪ Reduced costs in terms of reduced occurrence of faulty products ▪ Escalated revenues ▪ Goodwill and increase in trade	▪ Implementation costs ▪ Monitoring and Appraisal Costs
Consumers	▪ Access to safe food without the fear of food borne diseases	▪ Monitoring of compliance (buyer audit in international trade)
Public Bodies	▪ Savings on social security ▪ Improved forex earnings from increased international trade	▪ Enforcement cost

Source: Romano *et al.* (2004)

HACCP in Seafood processing plants

HACCP is a widely used as an internationally recognised science-based control system for assuring food safety. This is achieved by

systematically identifying hazards, evaluating them following the process testing procedure and developing effective control systems, focusing on preventive measures rather than end product testing. The Codex Committee on Food Hygiene has been actively promoting the use of HACCP for food safety. HACCP is compatible with quality systems such as ISO 9000 series particularly useful for the process control section of any quality system taken up by the industry.

The HACCP system consists of seven principles (Report of the 9th session of the Codex Committee on Food Hygiene, 1996). The Report also recommends prerequisites for implementation of HACCP in seafood plants to be effective (FIICC, 1997). These mandatory requirements require capital investment in terms of setting up of pre processing units, establishment of safety standards in the existing units and conforming to each and every requirement listed out in HACCP plan. However there are positive reasons for all sectors of the industry to implement HACCP voluntarily. These include benefits of producing a safer product with better quality, gaining a better understanding and control of operations, actively encouraging raw material suppliers (e.g. those in the catching and harvesting sector) to adopt a similar approach, providing a firm base for application of quality management systems, improving production efficiency and decreasing wastage, becoming a more competitive supplier by participating in changes conforming with current regulatory requirements.

In this backdrop an investigation was done following the case study method in five selected seafood units in Kerala to probe the status of compliance of implementing HACCP and associated costs and benefits. Seafood export units located in Aroor (Alappuzha District) and Neendakara (Kollam District) in Kerala operates very well in compliance with the requirements following the Good manufacturing Practices (GMP) specified in the pre requisites of HACCP. The units undertake export of block frozen shrimp and cephalopods. The units maintain HACCP manual duly certified by EIC (Export Inspection Council) and the destination countries' authorities which is taken as the base document for requirement of compliance. Being large units, the exports are being destined to USA, Japan, Gulf countries and major market is the EU. EU and USA have been instrumental in implementing HACCP system (for EU it is known as the on check system) for ensuring food safety. These standards refer to physical, biological and chemical hazards that are possibly present in the specified fish product/ species of fish. On this basis the firm has to

adopt strategies to check the presence of the specified hazards in the process/ product and set Critical Control Points (CCPs) to monitor and control the same. HACCP plan may be designed and implemented towards achieving this objective. The HACCP plan provides a guide to design a comprehensive plan which focuses on control of significant hazards at identified CCP in the process in order to prevent or minimize food safety risk to the consumer. The HACCP plan requires in depth evaluation of product and process to determine the location where specific control is required. Generally we can enumerate as much as twelve steps in designing and implementation of an HACCP plan; that a product/ process difference might cause reduction of or addition to the same.

Though HACCP compliance is voluntary; direction of trade serves as a bench mark to determine whether to comply or not. Exports to developing countries do not follow any stringent quality regulations and small firms which lack capital investment capacity to maintain compliance to quality resort to such destinations. Stakeholders in the seafood export supply chain consist of fishermen, aquaculturists and exporters. It is necessary that the producers must adhere to HACCP implementation from the point of catching fish to processing and packaging seafood products. In this connection, sanitation certificate is issued on the basis of (i) culturing and farming process, (ii) after harvest/landing, and (iii) handling/ packaging process. SPS measures should be taken care of, right from the point of capture and landing, wherein the fishermen or aquaculturist is expected to handle fish appropriately to avoid contamination and maintain freshness.

The economics of compliance

Business units tend to evaluate each unit of investment in terms of revenue generation potential. Implementation of HACCP standards involves certain amount of initial capital investment and operational expenses which may be compared to overall growth of the firm in terms of turnover and price realization of products. Importers specifications for seafood items like that of USA and EU, has forced seafood plants to equip themselves to be branded as "HACCP certified" or "ISO 22000 certified" to maintain market competitiveness.

The inability to respond to changing safety and quality standards is a major concern in developing countries. The high cost of compliance is a major blockade for achieving this objective. It is necessary for each factory to invest in requirements for facilitating potable water system, continuous power supply, effluent treatment plants, flake ice machines,

chill rooms and laboratories. The recurring expenses also tends to be high on account of increase in number of records, operations performed, additional expenses incurred, water and electricity expenses and staff expenditure on training, uniforms and miscellaneous items. It is observed that, compliance to quality specifications in India costs around USD 0.3 million with a yearly operating cost of around USD 41200 which ultimately costs USD 0.21 to 0.28 per kg of processed fish (Table 3).

Table 3: Cost of food safety compliance in selected Asian countries

Country	Total Investment for a plant ($x10^3$ USD)	Yearly operating cost of a plant ($x10^3$ USD)	Cost per kg of fish (USD)
Bangladesh	277.2	34.9	0.03-0.09
India	309.3	41.2	0.21-0.28
Malaysia	795.8	113.7	-
Thailand	380.9-404.8	47.6-71.4	0.01-0.014

Source: Dey *et al.* (2005)

The cost of implementing HACCP in seafood companies tend to vary. Nganje *et al.* (1995) observed that HACCP implementation issues depended on size and nature of food sub-sector. Implementation costs per unit size of turnover is the frequently used methodology to compare firms and across industries without consideration to product and species variations. A study which assessed the cost of establishment HACCP compliance standards in food industry found that seafood sector recorded the highest operational expenditure of HACCP compliance (Rs. 0.64 million), followed by dairy (Rs. 0.24 million), spices (Rs. 0.13 million) and fruits and vegetable processing sector (Rs. 0.09 million) (Deodhar, 2003).

The cost of operating HACCP complied units in the selected units were worked out and the average cost of operation per kg of seafood products worked out to Rs. 10.19, while operational expenditure alone costs Rs. 3.93 per kg (Table 4)(estimate by authors). The additional cost per unit of output can be very well realized from the comparative advantage of export price of HACCP complied seafood products.

It was also observed that the cost burden tends to be higher for smaller firms compared to the larger ones when measured in comparison with the turnover. The small firms which are unable to comply with the requirements, often change export destinations that do not follow such stringent quality checks such as Gulf countries.

Table 4: Cost of HACCP compliance in selected seafood units

Cost component	Value / Quantity
Average operating expenditure, Rs. $x10^6$	28.4
Average annual turnover (seafood products), t	7200
Average operating cost per kg of seafood, Rs.	3.93
Total expenditure per kg of end product, Rs.	10.19

Quality compliance in domestic trade

The total fish imports in the world have exceeded USD 100 billion in 2008 (FAO, 2009). About half of world fish exports originate in developing countries, while 80% of world imports go to developed part of the world. Fishery products are an important source of foreign exchange earnings for developing countries including India. However, the entire output generated in fisheries sector in the country is not routed to exports. In fact, the seafood exports account only for 29.33% of the total value of output generated from marine and inland fishery in 2008-09, which implies that major portion is used for domestic consumption and other non consumptive uses (Table 5). Here arises the importance of the domestic marketing system. In fact, domestic markets can act as a shock absorber to the vagaries in export marketing system.

Table 5: Total value generated from fisheries sector and exports

Year	Value of output from inland and marine fisheries*, Rs. $x10^6$	Export value of seafood items**, Rs. $x10^6$	Percentage of exports to value of output
2003-04	222930	60919	27.33
2004-05	263260	66467	25.25
2005-06	256820	72453	28.21
2006-07	274110	83635	30.51
2007-08	281700	76209	27.05
2008-09	293530	86079	29.33

Source: * Central Statistical Organization, New Delhi; ** MPEDA , Cochin

The domestic fish marketing scenario in India is restrained by infrastructural limitations. The lack of exclusive fish markets except in urban centres limits the movement of this highly perishable commodity. Further, the length of the marketing channels consumes time and decreases the efficiency in marketing of fish. Marketing channels involved in domestic fish marketing in India can be either producer-consumer direct channel or producer-middlemen (trader)-consumer channel or producer-wholesaler- retailer-consumer channel (Sathiadhas, 2005). The consumer at the end of a longer marketing channel gets a more degraded fish that a person directly purchasing it from the landing centre. This happens because of the inadequate storage and transporting mechanism at retail level. A wholesaler of fish may have cold storage wagon to supply fish at retail markets. The retail suppliers are small traders, cycle and rickshaw vendors and headload traders who cannot afford capital intensive technologies other than using broken ice for storage. The water quality used in ice preparation also causes degradation of fish. What restricts the domestic trade in complying with quality standards are the price conscious middle and low income consumers who form a majority. Hence, capital intensive quality compliance technologies cannot be adopted by the retail vendors as they are unable to transfer such costs to the consumer.

The average per capita income of an Indian is Rs. 33,283 per annum (2007-08). The estimated monthly per capita consumption expenditure (MPCE) shows that the spending pattern of an average Indian rural household is Rs. 695 per month while that of urban areas is Rs. 1312 per month. It is also reported that a rural household spends an average of Rs. 24 per month on egg, meat and fish items, while an urban household spends Rs. 34 per month (NSSO, 2008). Given this scenario, it is quite clear that the quality conscious consumer may have to bear a price differential compared to price conscious average consumer who may not have the capacity to bear such margins. However, it is possible to ensure quality compliance where the customers are driven by quality and ease of using the product rather than weighing the price credentials. Another caution to be taken care of at this point is the lack of quality monitoring system in the domestic markets which can lead to use of hazardous chemicals for preserving the quality of fish.

In view of the development in the international markets and through awareness, domestic consumers, particularly at the premium end are motivated by quality consciousness. Modern trade in India operating as supply chain outlets and supermarkets provide infrastructure facilities in

terms of cold storage which would conserve the quality of fish and fish products sold through these outlets. High quality compliance in seafood industry may be out of the reach of the small-scale traders in domestic marketing system. Some simple steps for improving quality of fish in the domestic trade are reiterated below:

- Fishermen, traders and those who handle fish at different stages should be made aware of the following aspects for achieving better quality without added costs.
- Fish and shellfish should be preserved properly immediately after catch.
- Ice should be prepared using good quality water and used in appropriate proportion.
- Handling area and containers should be properly disinfected.
- Proper drainage and storage should be provided in markets and landing centres.
- Fish should be protected from rodents, flies, insects, birds and animals.
- Immediately after catch, fish should be sorted species-wise and shrimps should be graded, beheaded, peeled and de-veined as soon as possible.
- Quality standards such as limits for heavy metals and microbial limits should be imposed.
- Bivalves should be depurated before shucking.
- Sun drying in sandy beach should be stopped and while salting good quality salt should be used.
- Quality of fish sold in domestic market should be assured.
- Proper cost effective preservation facilities should be provided at all retail outlets; cold storage units can be established on cooperative basis or by local bodies extending the facilities on nominal charges.
- Educate the fisherfolk, traders and the public about the need of seafood safety norms through proper extension strategies.

Issues and challenges in assurance of seafood quality

Though the initial problems of lack of awareness regarding implementation of HACCP has been partially solved with concerted efforts of agencies such as CIFT, EIC and MPEDA, several issues continue to confront the industry including issues like continuous advancement in technology and regulations and cost of compliance. Some of these issues are discussed in the following sections:

High cost of compliance

Good Manufacturing Practice (GMP) is a basic requirement in producing food in hygienic manner. However, lack of GMP and sanitation is seen as an impediment for HACCP implementation, especially to small scale seafood processing units that lack sufficient financial and technical resources. The small-scale seafood export units still practice traditional methods of food production and are not willing to conform to HACCP plan unless there is an intention to export to destinations having product quality specifications like that of USA, EU and Japan.

Diverse quality standards

HACCP certification is based on the requirement of EU and USFDA which focuses only on food safety. Other importing countries may have other requirements besides HACCP certification. For example, Canada's Quality Management Practice (QMP) includes food quality while Australian SQF2000 program combines HACCP and ISO 9000. Currently, the Codex Alimentarius is revising the Code of Practices for fish and fishery products to a HACCP based document. Many countries promote quality control systems that are a mixture of ISO and HACCP where selected elements of ISO are combined with HACCP principles. Because of the differing requirements and occasional changes in terms of new technology and standards, exporting countries would have to carefully scrutinize and comply with HACCP systems of the importing country in order to avoid rejection of consignments.

Technological obsolescence

Emergence of new food-borne diseases and ailments warrant more advanced and sensitive methods for testing contamination in food. Purchase of high-tech equipments for upgrading technology for detecting new strain of microbes is a burden to developing countries in terms of capital cost and training of human resources.

Genetically modified organisms and irradiated seafood

HACCP plan is prepared for monitoring food safety based on the microbial, chemical and physical hazards. However, it does not cover issues on genetically modified organisms (GMOs). In 1999, the US Department of Agriculture (USDA) permitted food produced from controversial methods such as genetic modification and nuclear irradiation in order to achieve high productivity. Eventually, the USDA withdrew this proposal due to tremendous public outcry in US (Huffman *et al.*, 2004).

HACCP should also include the issues on GMO and nuclear irradiated food products.

Need for surveillance

Fish, being a highly perishable commodity, need to be conserved for maintaining quality right from the point of capture. In India, supervision from starting point to various stages of the supply chain till it reaches the export processing unit is lacking. Hence, it is required to have concerted efforts under the auspices of the Government to monitor quality at all stages. Surveillance is required with respect to aspects including control of fish harvesting environment, fish handling hygiene practices and monitoring of processing establishments. The fisheries and aquaculture environment should be regularly monitored in terms of parameters such as fecal coliforms, pathogens, pollutants and heavy metals.

Conclusion

Despite the issues and challenges, Indian seafood industry has complied with requirements of HACCP and seafood exports have been improving over the years. An important issue concerning implementation of HACCP is its cost which cannot be borne by small scale units. In order to fully comply with HACCP, the exporting countries must change traditional business into industrial scale. This approach being capital intensive requires Government intervention like that of organizing Special Economic Zones (SEZ) or Export Processing Zones (EPZ) which provide incentives for small industrial units to achieve quality at lesser cost. Above all there should be strong commitment in complying with the HACCP requirements. In addition to its contribution to economic activity, employment and in generating foreign exchange, trade in fish and fishery products play an important role in improving food security and contributes to nutritional security. However, the quality of fish traded in domestic markets is still at stake as the tradeoff between price and quality is always outweighed by the price sensitive attitude of low and middle income consumer. Domestic quality can be ensured by Government intervention in terms of improvement of domestic market infrastructure and awareness campaigns to enhance stakeholder perception on hygiene and food safety.

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