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Status of the shrimp sector in Bangladesh in the context of HACCP and trade issues - A Review

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Abstract

Shrimp culture in Bangladesh has emerged as an important aquaculture industry over the last three decades although its culture in greater parts of the farming area is done in traditional ways. In the meantime, the government of Bangladesh has taken necessary measures along with the private sectors to increase production, upgrade processing industries and to promote export performance. Long supply chain in raw material collection, inadequate infrastructure facilities, poor level of cool chain and lack of adequate HACCP-based training on hygiene and sanitation of different groups of people involved in the field level are the main problems of quality loss of raw materials. Shortage of raw materials results in poor capacity utilization of the processing plants. The growth of bagda (*P. monodon*) hatchery has expanded rapidly over the last few years remaining mostly concentrated in Cox's Bazar region is enough to meet the target production. However, there is a shortage of pelleted shrimp feed in Bangladesh. A large number of export processors are now producing increasing amounts of value-added products such as individually quick-frozen, peeled and divined, butterfly cut shrimp, as well as cooked products. The export earning from value added products is about half of the total export value. About 95% of total fish products are exported to European countries, USA and Japan and the remaining to the Southeast Asia and the Middle East. Most of the EU approved shrimp processing industries have been upgraded with laboratory facilities and provided HACCP training to their workers. As of now, HACCP is applied on the processing plants, but to ensure the quality of raw materials and to reduce risks, shrimp farms are also required to adopt HACCP plan. There is increased pressure time to time from importing countries for fish processors to establish effective quality assurance system in processing plants. Fish Inspection and Quality Control (FIQC) of the Department of Fisheries while having moderately equipped laboratories with chemical, bio-chemical and microbiological testing facilities and qualified technical personnel, the creation of facilities for testing of antibiotics is underway. FIQC mainly supervises quality aspects of the processing plants and has little or no control over raw material supply chains from farm to processing plants. Bangladesh export consignments sometimes face rejection due to reported poor quality of the products.

Three types of barriers are reported for export of shrimp to EU countries. These are:(i) Government Participation in trade and restrictive practices (state aid, countervailing duties, state trading enterprises, government monopoly practices), customs and administrative entry procedures (anti-dumping duties, customs valuation,

classification, formalities, rules of origin); (ii) Technical Barriers to Trade or TBT (technical regulations, standards, testing, certification arrangement), and (iii) Specific Limitations (quantitative restrictions, import licensing, embargoes, exchange control, discriminatory sourcing, export restraints, measures to regulate domestic prices, requirements concerning marking, labeling and packaging).

Key words: Shrimp culture, Marketing, Quality, HACCP

Background

Shrimp culture is of central importance to the fisheries sector in Bangladesh particularly in the context of export earning. It grew from next to nothing in the early 1970s contributing about 11% of the total export earning in the mid-1990s (DOF 1995). No other primary commodity enjoyed such spectacular growth in post-independence Bangladesh. Shrimp culture in Bangladesh made its initial beginning in the coastal district of Satkhira in 1960s. Gradually, its culture expanded to the coastal belts of Khulna, Bagerhat, Cox's Bazar and Chittagong, and the area under shrimp culture has increased from 52,000 ha in 1982-83 to 141,000 ha in 1999-00 (Mazid 2002). About 75% of this land is located in the Khulna, Bagerhat and Satkhira districts in the south-eastern region of the country. *Penaeus monodon* and *Machrobrachium rosenbergii* are the two major species cultured in Bangladesh. Of all the exportable agro-based primary commodities, shrimp is by far the most important. It alone contributes more than 70% of the total export earning from all agro-based products, including tea, raw jute, vegetables, fruit, etc. (Karim 2004). The shrimp industry also provides direct employment to over 600,000 people who in turn support well over 3.5 million dependents. This sector also supports large varieties of local level cottage industries (made out of the home) such as bamboo baskets, mats, traps, nets, rickshaw vans, tempos (tri-wheelers), boats, etc. The export performance in shrimp industries is indeed highly appreciable. In 1973, the export earnings were only US$ 3.17 million, which stands at US$ 420 million in 2004-05 financial year from export of 63,377 MT shrimp and other fishery products, in which shrimp alone contributed 89% of the total export in spite of having a severe price fluctuation in the international market (BFFEA 2006). Although shrimp farming has had a significant impact on the economy of Bangladesh, it is generally agreed, however, that this rapid expansion has had considerable environmental cost as well. The area under shrimp culture tripled in 10 years, from mid-1980s to mid-1990s covering 130,000 hectares by 1999 (UNEP 1999). In the process, mangroves were removed and replaced by coastal shrimp ponds. The ponds have increased the salinity of adjacent lands and jeopardized its future productivity.

The overall research issue of relevance is: Is shrimp farming in Bangladesh sustainable, given the existing marketing and quality aspect? To address such a complex research issue, it is critically important to have detail data on the background of the shrimp sector, highlighting trends in the size of the industry and production statistics, existing farming systems and technologies, quality assurance and marketing access in

the international trade etc. Detail review of information is therefore, desirable on the above aspects to make an assessment of this important sector with a special reference to the compliance of HACCP. An attempt is therefore, made in this paper to review all the relevant information and put them together to understand the present status and to identify further action needed for sustainable development of the shrimp sector.

Hazard Analysis Critical Control Point (HACCP)

Shrimp importers particularly the USA and the European countries are highly concerned about the quality and safety of the shrimp produced and processed in the exporting countries. Previously, quality was maintained with respect to decomposition, filth content and pathogenic bacteria. These are not enough now-a-days. International organizations and buyers have already introduced Bioterrorism Act, Antidumping Act, Traceability and HACCP to ensure quality and safety of the shrimp products (Hussein and Islam 2005). HACCP is a process, the application of which can prevent shrimp from all sorts of possible contaminations from any possible sources beginning from culture up to the market. Hussein and Islam (2005) reported that application of HACCP can detect contamination at any stage involved in the production and marketing chains and enable to take required remedial measures. They further reported that implementation of HACCP requires to identify the sources of risk or contamination. Traceability Regulation introduced in 2002 requires creation of capability of the concerned establishment to exactly know how, when, where the culture, post-harvest, handling, processing, marketing have been done. This need to collect and keep records of all information involved in the whole production chain which can subsequently be used for detection of the sources and types of contamination.

So, HACCP and Traceability are the mechanisms through which one will be able to know the total production history i.e. whether any antibiotics, pesticides, hormones have been used, or if contaminated by pathogens; when, where, at what stage it has been occurred which upon analysis would detect the reasons and the real source of contamination thus enabling to correct the results to ensure supply of safe fish food.

Demand for shrimp in the international market has encouraged rapid expansion and intensification of shrimp culture in all potential producer countries. Shrimp farms already cover an extensive coastal area which includes conversion of rice, salt pans, coconut and sugar plantations, abandoned lands and mangrove forests (Chong 1990, Aitken 1990). Removal of mangrove for pond culture can significantly affect shoreline configuration and coastal erosion patterns, generation and cycling of nutrients in coastal areas as well as habitats of many commercially important species which use the intertidal ecosystem as breeding, nursery and feeding grounds (Honculada Primavera 1991, Saclauso 1989, Matthes and Kapetsky 1988).

Important biological implication of shrimp culture refers to the required seed and feed inputs. Even though stocking of hatchery-reared post-larvae is increasing, wild caught post-larvae are often preferred (Hirono and Van Eyes 1990) which leads to over fishing of post-larvae, and to the discarding of an estimated 10 kg of larvae and fry of other species for 1 kg of shrimp larvae harvested (Silas 1987). In 1988, shrimp farming in

Asia absorbed 180,000 tons of fish meal which was used for compounded feeds, and about 1.1 million tons of shrimp feed might have been used by the year 2000. The increasing demand may eventually encroach on species caught for human food as well as on juveniles of these species (New and Wijkstrom 1990).

A variety of chemicals, antibiotics such as chloramphenicol, oxytetracycline, furazolidone, streptomycin, nitrofurazone are applied in shrimp hatcheries and farms to treat and to prevent outbreaks of diseases (Sunaaryento 1988, Liu 1989). Over use of antibiotics (Brown 1989) could be very dangerous due to the potential generation of drug resistant shrimp pathogens (e.g. Vibrio) and the risk of transfer of drug resistance to human pathogens. The above concerns were the basis for introduction of HACCP and traceability regulations by the USA and EU, respectively.

Existing shrimp farming system and technology

Shrimp culture in greater part of the farming area is done in traditional methods which based on the production system can be classified as the following types: (i) salt production vis-a-vis shrimp and fish culture; (ii) shrimp and finfish culture, and (iii) bhericulture and monoculture of shrimp (*P. monodon*). Again on the basis of stocking rate, feed supply and level of management, shrimp culture practice can be divided into three categories: (i) traditional extensive; (ii) traditional improved, and (iii) semi-intensive system. Semi-intensive shrimp culture initiated in 1992 in the Cox's Bazaar region was drastically reduced due to serious outbreak of shrimp disease in 1994 in semi-intensive farms. However, traditional bheri/gher aquaculture had been practiced in the coastal areas of Bangladesh to grow shrimp and fish long before the introduction of current improved shrimp culture practices (DDP 1985). In the early 1960s, the government constructed a large number of coastal embankments to protect agricultural land in the coastal areas from tidal waves and saline water intrusion. This process brought an end to traditional shrimp aquaculture in these areas. However, since the 1970s, strong international market demand and high price of shrimp have encouraged farmers to resume shrimp farming in Polders within the embanked areas. Besides, the Polders were no longer financially viable to cultivate rice because of water logging due to poor drainage. These two factors together acted as a catalyst to the process of accelerated shrimp farming (Karim 1986).

The government of Bangladesh recognized shrimp farming as an industry under the Second Five-Year Plan (1980-85) and adopted measures necessary for increasing shrimp production (Haque 1994). In 1979-80, slightly more than 20,000 ha were under shrimp cultivation (Ahmed 1988). Later, farming area was increased to 130,000–138,000 ha (DOF 1994, Rosenberry 1995). There are now approximately 37,397 bagda farms (*P. monodon*) with an average farm size of 4.5 ha. Bagda shrimp production has increased by 20% per annum in the last fifteen years. There is also 30,000 ha of land under galda (*M. rosenbergii*) shrimp culture with an average farm size of 0.28 to 4 ha comprising 105,000 galda farms, located mostly in the districts under Khulna division. The galda farm is expanding at a rate of 10-20% per annum in other parts of the country (Hasan 2004). An estimate showed that total shrimp production in 2003-04 was 114,660 MT

(DOF 2005) as against the production of 30,000 MT in 1995 (Rosenberry 1995). Experts and fisheries resource planners predict that all potential shrimp areas are unlikely to experience similar expansions. Satkhira District has the greatest potential for expansion of shrimp farming in the south-western region while potential for expansion in Cox's Bazaar District of the south-east region seems also very high (MPO 1987). Among several species available in the coastal regions, *P. monodon* is the preferred species for brackish-water shrimp farming and attracts a very high price in the international market. In Bangladesh, *P. monodon* comprises 60% of the farmed shrimp production, followed by the giant freshwater prawn, *M. rosenbergii* which accounts for 25% of the production (Rosenberry 1995, Ahmed 1996).

In the south-western coastal areas (i.e. greater Khulna region), the cropping pattern for brackish-water shrimp culture is dry months (December–July), followed by transplanted aman rice during July through to December. In some areas, shrimp farming is characterized by monoculture. In the south-eastern coastal areas (i.e. Cox's Bazaar region) shrimps are grown from May to November and for the rest of the year, the land is used for salt production. In some parts of the south-eastern tidal area, rice alternates with shrimp and fish production (ESCAP 1988).

The majority of shrimp farms in the coastal region of Bangladesh follow the extensive culture practices completely relying on natural productivity where there is little or no management in respect of drying the pond bottom, ploughing, liming, fertilization and feeding with stocking density of 2,000 to 15,000 PLs/ha and annual yield is 160- 230 kg/ha. On the other hand, an improved extensive method is a slight modification of the traditional extensive method, whereby farmers apply a few aspects of shrimp farming technologies with stocking density of 10,000 to 25,000 PLs/ha. An annual yield of 350-500 kg/ha of shrimp is obtained (Mazid 1994, Mazid *et al.* 2001). The semi-intensive method requires good management practices which include heavy feeding, removal of farm waste, water exchange, installation of aeration system and high stocking density (5-10PLs/m^2). The annual yield is 500–5,000 kg/ha (head on) with an average of 2,000 kg/ha (Rosenberry 1995). In 1995, only 1% of the shrimp farms in the country used this method (Begum and Banik 1995, Rosenberry 1995). The outbreak of white spot virus in Bagda shrimp in 1994 has reduced the intensive and semi-intensive shrimp culture practice in the country. However, the average production of bagda in Khulna, Satkhira and Bagherhat area is 70-250 kg/ha/yr from a single crop while that in the Cox's Bazar area is 250-500 kg/ha/yr (Karim 2003) as shown in Table1.

Table 1. Present status of shrimp farming in different areas of Bangladesh

District	Number of farm	Area (ha)	Range of production (kg/ha/ year)
Khulna	4,500	40,000	80-250
Bagherhat	5,000	39,000	70-250
Satkhira	4,900	36,000	100-300
Cox's Bazar & other	2,600	35,000	200-500
Total	17,000	1,50,000	200-400

Domestic marketing chain of shrimp

Most shrimp produced in the farm is marketed through three supply chains: (i) farm to the processing plants directly; (ii) farm to supplier, then depot/landing center, commission agent and final delivery to the industry; and (iii) passes through a number of channels that is from farm to supplier, agent, depot, commission agent and finally to the industry. Some farms where communication is developed transport shrimp in iced condition either by boat or by refrigerated van to the industry (Mazid *et al.* 2001). Boat, truck, pickup and van are used to transport the shrimp to distant places of depot or collection centers and processing plants. The quality problem is serious where raw material passes through a number of channels. The overall infrastructure development of most of the depots in the coastal region is very poor and there is a general lack of hygiene and most of the depots are not registered or under any form of control of the Fish Inspection and Quality Control (FIQC) of the DOF (Mazid *et al.* 2001). Organoleptically the shelflife of marine tiger shrimp (*P. monodon*) was found acceptable for processing for 8-9 days in ice storage and freshwater prawn (*M. rosenbergii*) for 5-6 days under similar storage conditions (Rahman *et al.* 2000, Kamal *et al.* 2000). The delayed icing of shrimp and prawn significantly reduces the shelf life (Rahman *et al.* 2001a, Rahman *et al.* 2001b).

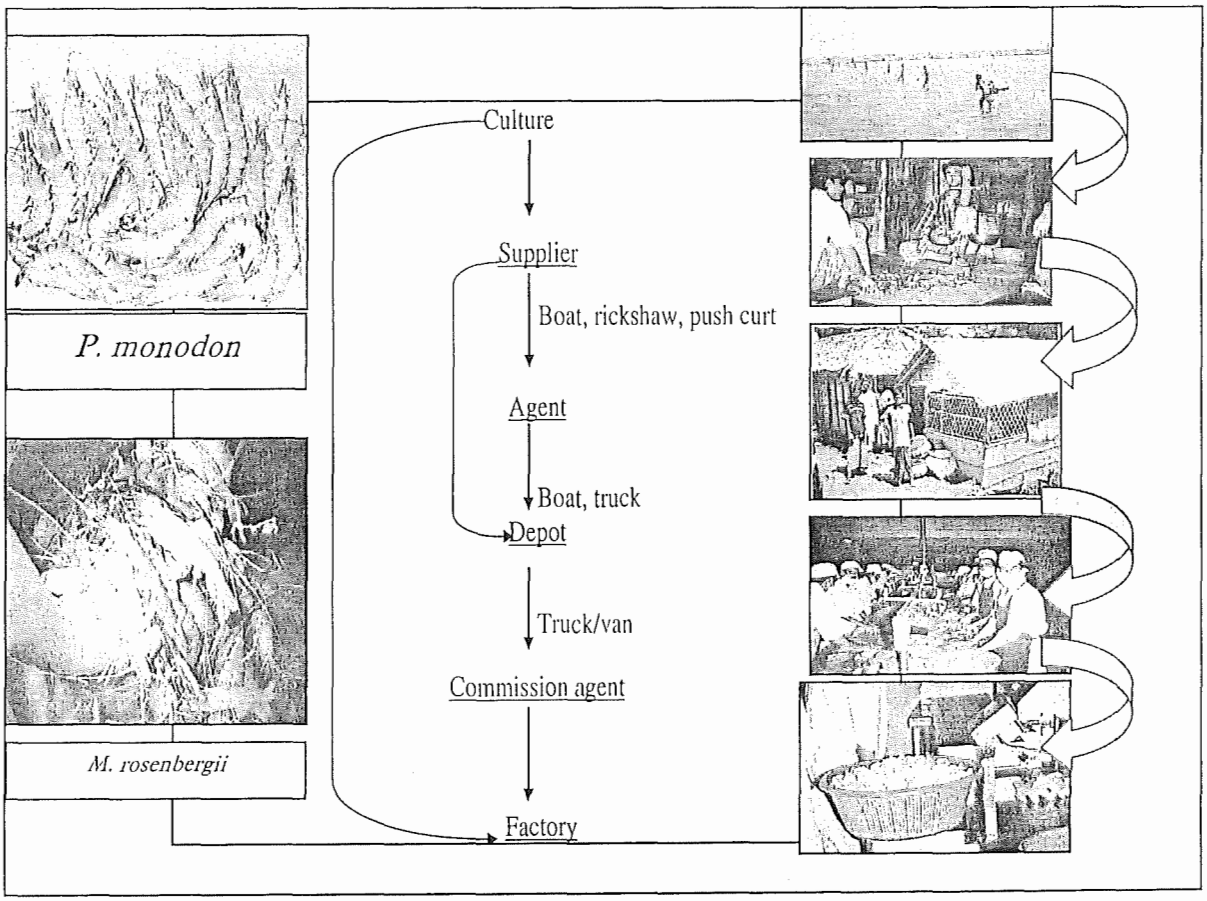

Fig. 1. Supply chain of shrimp/prawn.

Shrimp hatcheries

About 95% of shrimp farms were largely depended on wild fry collection for stocking of PLs until recent years (Ahmed 1996) having serious implications for biodiversity. Since black tiger shrimp (*P. monodon*) is the most targeted species, wild shrimp seed collectors discard other shrimp and fish species larvae onshore where for every single *bagda* fry collected from the natural habitat, up to 99 other species of shrimp and finfish could be destroyed (Islam *et al.* 2001). Realizing this, DOF provided plans for construction of about 30 private-sector hatcheries (Selim 1994), 12 of which were under construction in 1995 (Haque 1995). Until 1995, there was only one *bagda* hatchery (DOF 1995) in Bangladesh producing between 20–30 million post-larvae. The estimated requirement for the 130,000 ha of shrimp farms is 2.6–3.0 billion postlarvae and the difference is made up from wild fry (Karim 1995, Rahman and Pal 1995). Khan (1994) estimated a standing stock of only 7,000-8,000 MT of shrimp in Bangladesh water of the Bay of Bengal. In recent years, shrimp hatchery establishment expanded very rapidly. In 2005 there were about 44 *P. monodon* hatcheries and 28 *M. rosenbergii* hatcheries. In Bagda hatcheries about 3,050 million of post-larvae are produced. Almost all bagda hatcheries are located in the Cox's Bazar region, but major culture grounds are situated in the south-west region of Bangladesh where most of the hatchery produced post- larvae are transported from the south-east region by air cargos (BFFEA 2004). The recent expansion of bagda hatchery has significantly excess capacity which needs rationalization to ensure a stable and viable industry with a high quality output responsive to grower demand (Huntington 2002). The country's 50 hatcheries produce about 5.0 billion shrimp larvae, which is regarded enough to meet the production target by 2008 (Khan 1994).

Shrimp feed mills

There is a shortage of supplemental shrimp feed in Bangladesh (Hussain 1994, Karim 1995). At present, there are about 55 feed mills in operation and 20 more in pipeline. Most of them are producing both poultry and fish feeds where only 10 feed mills are producing exclusively fish and shrimp feeds. The annual feed production is about 0.8 million tons in which 0.5 million tons are commercially produced and 0.3 million tons are farm made by commercial fish farms/individual farmers. In this quantum of feed, only about 0.1 million ton feeds are used for shrimp and prawn. Among fish feeds, pangas feeds dominate the market since pangas culture spread rapidly (Hossain 2006a). The well known industries that produce fish and shrimp feeds are Saudi-Bangla Fish Feed Ltd., Aftab Feed Products Ltd., Quality Feeds Ltd., AIT Feed Ltd., Usha Fish Feed Ltd., Urbashi Fish Feed Ltd., Paragon Feed Ltd., Suny Feed Ltd., Oriental Feed Ltd. and Rupashi Feed Ltd (Kader *et al.* 2005). All these companies are local. However, CP (Thailand) shrimp feed is also available in the market. Various types of shrimp and prawn feeds are used commercially. Shrimp feed types are nursery, starter-1, starter-2, starter-3, grower and finisher, while galda feed types are nursery, starter, grower and finisher. The major ingredients used for shrimp and prawn feeds are

fish meal, dry fish, dry trash fish, soybean meal, deoiled full fat, wheat flower, yeast meal, squid oil, squid liver meal, oyster shell meal, soybean lecithin and different types of binders (Hossain 2006b).

Bangladesh Fisheries Development Corporation (BFDC) fishmeal production plant was the first to produce fish meal in the country. Later, SABINCO and several other feed mills were established in Mymensingh and other areas (Karim and Aftabuzzaman 1995). Shrimp feeds, usually with a shelf-life of about three months are also imported from Thailand and Taiwan. It has been reported that stale feeds are supplied at the farm level, leading to adverse effects on shrimp farming (Karim and Aftabuzzaman 1995). Consequently, most farmers rely on natural feed and their farms suffer from lower productivity.

Shrimp processing and export

Shrimps are grown primarily for the international market and, although Bangladesh contribution is small in terms of its share in the international market (i.e. 4-5% of world production of farmed shrimp), it is the seventh largest cultured shrimp producer in the world. In 1973, there were only 15 shrimp processing plants in Bangladesh which now stands at 129 having only 65 in operation. Annual production capacity of the 65 plants is about 2,60,000 MT. But due to scarcity of raw materials, these plants run at only about 13% of their installed capacity (Haque 2003). Out of 65 plants, European Commission has approved 57 plants in regards to quality standard. HACCP has already been introduced in most fish processing establishments.

There are sixty two species of shrimp identified in both marine and fresh waters of Bangladesh of which four species are exported in frozen form. These are: *P. monodon* (tiger shrimp), *P. indicus* (Indian or Chaga shrimp), *Metapenaeus monoceros* (Horina shrimp) and *M. rosenbergii* (freshwater giant shrimp). Three species of lobsters are available and exported as well. These are *Panuirus polyphagus*, *P. versicolor* and *Scyllarus nearctus* (Paul 1996). In Bangladesh before 2000, only few processing establishments were involved in production of a very limited quantity of value added products. In 1998-99 only 3,176 MT value added products worth of Tk. 1,954 million (US$ 39.45 million) was exported by 16 plants. At present most of the EU approved fish processing plants, i.e. 50 out of 57 are involved in processing value added products and the export earning stands at about half of the total fish export values (Hossain and Islam 2004). The following are the new value added products marketed in EU and USA.

- Head on shell on shrimp with claws (IQF, Semi IQF and Block frozen)
- Headless shell on (neck meat trimmed) IQF raw consumer packs
- Headless shell on (neck meat trimmed) IQF raw tray packs
- Headless shell on easy peel (raw, raw garlic and herb bases butter flied, blanched and cooked in form of BF or IQF)
- Peeled shrimp raw, cooked in form of BF or IQF
- Pull-divined (PD) and P & D tail on (raw and cooked in the form of BF or IQF)
- P & D butter fly and P & D butter fly tail on (raw and cooked in the form of BF or IQF)

- PD skewer and P & D butter fly tail on skewer (IQF shutter pack raw)
- Buttered Nabashi (IQF raw shutter pack)

A large number of export processors are now producing increasing amounts of value-added products such as individually quick-frozen, peeled and divined, butterfly cut shrimp, as well as cooked products. In 2001, these value-added exports made up almost 25% of the total exports of 32,500 MT, valued at US$ 363 million. Improvements are making a difference because the unit price of exports has risen steadily over recent years, in contrast to the sharp decline in 1997. Some exporters are now recording an average unit price of more than US$15/kg, a price comparable to that received by major exporters from the region (Cato and Subasinge 2003). The average volume of shrimp exports has also increased from about 18,000 metric tons in 1990-91 to about 46,000 MT in 2004-05 (Fig. 2). Improvements in food safety have thus set the stage for Bangladesh to become more competitive in the global market for seafood.

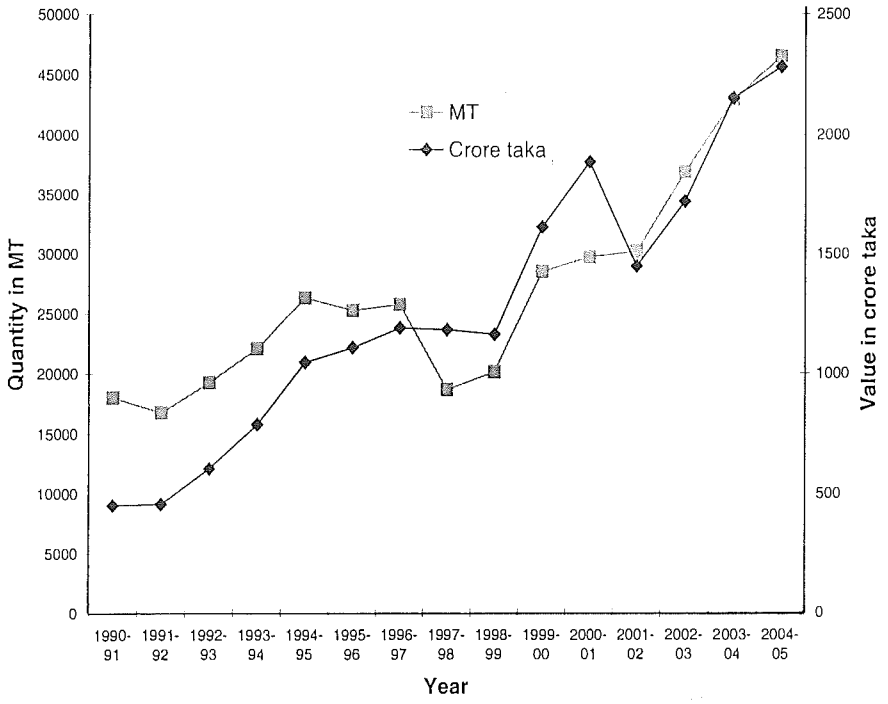

Fig. 2. Export of frozen shrimp from Bangladesh.

About 95% of the total fish/shrimp products are exported to European countries, USA and Japan and remaining to the South-east Asia and the Middle East. About 49% of the fish and fishery products are exported to EU countries followed by USA 40% and Japan 5% and distribution of shrimp export from Bangladesh has shown in Fig. 3. The export performance in shrimp industries is indeed highly appreciable having earned about US$ 395.65 million in FY 2004-05 by exporting 63,377 MT of fish and fishery products in spite of severe price fluctuation in the international market, where shrimp

alone earned about US$ 352 million (BFFEA 2006). Despite its spectacular growth and bright prospect our shrimp industry is saddled with various hurdles. With the progress of hatchery production, Bangladesh has also placed increased emphasis on good aquaculture practices as well as certification of aquaculture facilities. In the meantime, 44 *P. monodon* hatcheries have been established in Cox's Bazar region and 28 *M. rosenbergii* hatcheries in different parts of the country. In Bangladesh, *P. monodon* hatcheries are now able to meet up the country's major seed requirement for cultivation. As a result, the situation of wild seed collection has significantly improved which is a good sign for natural biodiversity conservation.

The EU countries continue to be sensitive to HACCP compliance issues, forcing the country's frozen food exporters to seek increased shipments to the USA. According official figures, frozen food export to the USA rose to US$ 160 million in fiscal 2005-06 from US$ 149 million in 2004-05 and US$ 126 million in 2003-04. The country fetched US$ 390 million in 2003-04, 420 in 2004-05 and 459 million in FY 2005-06 from frozen food exports (Mala 2006). The country has an excellent opportunity to export its frozen food to the US market as other major exporting countries have been facing anti-dumping barriers by the US. The US has imposed anti-dumping duty on import of frozen food from India, Thailand and Vietnam. But Bangladesh's duty free access to the US has helped increase the overall export volume to that country (Islam 2006).

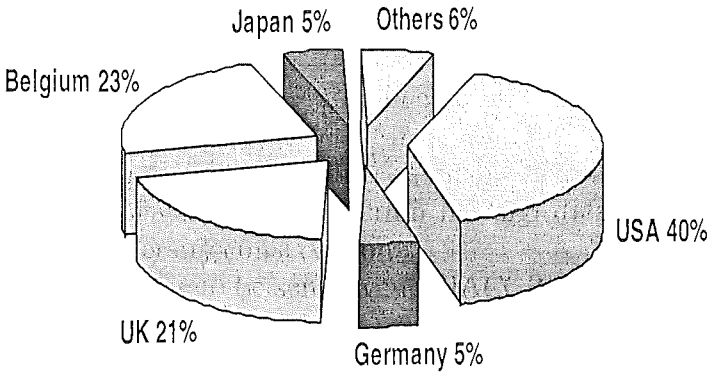

Fig. 3. Showing shrimp exported from Bangladesh during the year 2004-05 (Source: Shrimp and Fish news, BFFEA, January –April 2006).

Quality management assurance

The Ministry of Fisheries and Livestock of the Government of Bangladesh (GOB) has established a Fish Inspection and Quality Control (FIQC) wing in the Department of Fisheries to provide statutory support to processing plants and to fulfill the international requirement and achieve international recognition regarding Fishery products. FIQC has three stations located at Dhaka, Chittagong and Khulna with moderate laboratory facilities. Each station is managed by qualified technical personnel and equipped with chemical, bio-chemical and microbiological testing facilities.

However, they require more scientific qualified technical manpower to effectively conduct the quality assessment. FIQC needs further modern laboratory and equipment facilities to detect the presence of antibiotics and other hazardous chemicals in fish and shrimp according to the EU standard. Bangladesh Fisheries Research Institute (BFRI) having technically qualified manpower and its food quality laboratories with modern equipment may act as the reference laboratory. The government should provide necessary financial assistance to the BFRI in the form of a development project to further upgrade the facilities to achieve this goal.

However, recognizing both the potential for exports and the problems with safety and quality of the product, the Food and Agriculture Organization of the United Nations (FAO) assisted Bangladesh to develop product standards, regulations, and fish inspection schemes in the early 1980s. In 1983, the Government of Bangladesh promulgated Fish & Fish products (Inspection & Quality Control) Ordinance, 1983 and Rules, 1989 and upgraded the inspection laboratories and their personnel in 1985. On July 30, 1997, the EU imposed ban on imports of fishery products from Bangladesh following its inspection to Bangladesh's seafood processing plants. Inspections found serious deficiencies in the infrastructure and hygiene situation in processing establishments and insufficient guarantees of quality control by the Bangladeshi government inspectors. The ban was estimated to cost the Bangladesh shrimp-processing sector nearly US$ 15 million revenue loss from August to December 1997. In order to lift the ban, by 1997, the Bangladesh shrimp processing industries invested US$ 17.6 million in plant upgrades, the government invested US$ 382,000 in laboratory and personnel upgrades, and outside partners invested US$ 72,000 in training programs in Bangladesh (Cato and Subasinge 2003). After successful upgradation by July 1998, a total of 11 plants were approved for export to the EU. Collective efforts by the industry, the Bangladesh Department of Fisheries, and the Bangladesh Frozen Food Exporters Association (BFFEA) have continued to strengthen the export-processing sector. By 2002, out of 65 plants licensed for export by the government, 48 plants had EU approval. EU advised the Bangladesh government to implement HACCP system in shrimp industries for hygienically safe production of frozen food. For implementation of the system by the shrimp industry, the government along with BFFEA obtained experts' services from the USFDA, EU, FAO/ WHO, SGS and other sources. The government promulgated Fish and Fish Products (Inspection and Quality Control) Rules in December 1997 to implement the program. The EU experts subsequently visited Bangladesh to inspect the arrangement made by the government. The experts were satisfied by the government/BFFEA efforts in this respect and the EU ban on import of frozen fish from Bangladesh was lifted in 1998.

There is increased pressure from importing countries for fish processors to establish effective quality assurance systems in their plants (Hussein and Islam 2005). Recently environmental aspects, human rights, child labor, gender development and similar issues have again placed this sector in a critical juncture. These have been further complicated by inclusion of the Bio-terrorism Act, Antidumping Act, COOL system and traceability regulation. There are a number of Council Directives and legislations set for

importing the fishery products from developing countries for access to the European market. Bangladesh government emphasized mainly two issues: (i) quality and safety (bacteriological quality, contaminants, residues, additives and traceability), and (ii) trade issues (labeling, documentation and G.S.P). Two Directives bear special relevance to the trade in fishery products. Directive 91/493/EEC lays down the health conditions for the production and placing on the market of fishery products in general, while Directive 91/492/EEC lays down the health conditions for the production and placing on the market of bivalve mollusks. Directive 91/493/EEC is based on HACCP quality assurance approach which is well implemented in all processing plants (Hossain and Islam 2004).

Bangladesh Govt. has taken some measures to assure the quality and the safety of the fishery product which include: (i) Fish and Fish Product (Inspection & Quality control) Rules 1989 have been amended and up-dated in per view of USFDA HACCP regulations and EU Directives. Now these rules are being enforced in all stages of production, aquaculture, transportation, processing, distribution and shipment and so on ; (ii) Field Level Training on post-harvest handling, transportation, hygiene and sanitation; (iii) Training of Quality Control Officer & Microbiologists of most of the Fish Processing Establishments on Microbiology & HACCP; (iv) Compulsory registration of raw materials suppliers & private shrimp/fish landing centers; (v) Organization of follow-up training program for the personnel of fish processing plants on HACCP and sanitary & phyto-sanitary measures; (vi) Monitoring of field level aquaculture activities; (vii) Establishment of 21 raw material landing centers as a model for further expansion of these facilities; (viii) Implementation of FAO assisted HACCP-based Quality Assurance Project". The project provided training to 30 GOB personnel and 190 staffs from processing plants on HACCP system; (ix) Collaboration with Public Health Institute, BCSIR, BAEC and ICDDRB laboratories as a reference laboratory of FIQC since 1998; (x) Testing of samples in other laboratories to judge the effectiveness and harmonize the activities of FIQC; (xi) Mandatory receiving of "Head on Shrimp" by the processing industries to avoid post-harvest contamination & to ensure the quality and traceability of raw materials; (xii) Operation of annual monitoring plan to monitor the activities starting form the culture of raw materials to the end of processing activities as a routine work; (xiii) Upgrading export licensing system that ensure exported shrimp products fully comply with international food laws, and (xiv) Provided a national license and registration system for all shrimp operators from hatcheries through to farmers, processors and exporters to ensure traceability within the Bangladesh shrimp supply chain.

Meanwhile, all licensed factories have developed their HACCP-based Quality Assurance Plan (QAP) manual and some of those have verified by HACCP system in their establishments following SSOP & SOP.

One of the risks has emerged out of sanitary and phyto-sanitary agreements and subsequent standardization of production and processing methods using HACCP methods. As of now, HACCP is applied on the processing plants, but to ensure the quality of production and to reduce risks, the shrimp farms are also required to adopt HACCP methods. Processing plants, being the large investors and the ultimate risk

takers in the business, have already adopted the procedures mentioned in HACCP rules, but it has been quite difficult for them to impose it on small shrimp farms. Overall, the industry is in crisis due to low production and under-utilization of production capacity at the plant and a very low yield at the shrimp farms. The farming community lacks capital, education and the motivation to accept the changes under the current conditions of the market. Most shrimp farmers are aware of the risks in business but they are not adequately and actively motivated to adopt the standards. Also, most farmers need to be trained on the impact of chemicals used during crop production on shrimp quality (Haque 2003).

Bangladesh Frozen Foods Exporters Association (BFFEA)

Bangladesh Frozen Foods Exporters Association (BFFEA) established in the year 1984 and approved by the Government of Bangladesh under Section 3 of the Trade Organizations Ordinance 1961 (Ordinance No. XLV of 1961 and Registered with the Register of Joint Stock Companies, Dhaka under the Companies Act. 1913 (Act VLL of 1913) as a Company with limited liability which looks after the export of shrimp.

BFFEA is the only trade body for the existing 85 members of the Fish Processing Units in Bangladesh. Since its inception, the association has been working to promote and protect the interest of the Frozen Food Processors, Packers and Exporters in the country. It also acts as a vital link between the trade bodies and the different Government and Private Agencies. The Association is also devoted to promote and establish contacts with foreign buyers, business associations and the Chambers of Commerce and Industries to develop export marketing of frozen foods. BFFEA has also been playing a vital role in advising the Government in relevant policy, quality control, packaging, marketing and developing the frozen fisheries industries of the country.

Barriers towards market access

Consignment rejection of shrimp had found to be a regular phenomenon under applicability of the standards and Sanitary and Phyto-sanitary measures (SPS) and Technical Barriers to Trade (TBT) requirements. In 2005, the number of rejected consignments from the EU was 17 to 18 compared to that of the 25 in the last seven months in 2006 due to detection of the harmful antibiotic 'Nitro Furan' in prawn bodies. The number of the rejected consignments has marked a significant rise in recent years which led to the annoyance of the EU buyers (Khan, 2006). Bangladesh government has made testing of the prawn bodies mandatory before their shipment to the European Union (EU) countries. According to the EU directives, the exporters are required to send their shrimps to Singapore since there is no testing facility for antibiotics in FIQC of the Department of Fisheries and other laboratories in Bangladesh. Three types of barriers were reported for export of shrimp to EU countries (Haque *et al.* 2005). These are as follows:

Type I: Government Participation in trade and restrictive practices which includes state aid, countervailing duties, state trading enterprises, government monopoly practices, customs and administrative entry procedures (anti-dumping duties, customs valuation, classification, formalities, rules of origin). Due to insufficient production capacity of inputs such as raw shrimps at the farm level, shrimp exporters could not take advantage of the rules of origin applied in EU. For exporters, relaxation of the rules of origin might help them to export more shrimps to EU and take the benefits of the EBA initiative. This means that if Bangladesh shrimp processors could import raw materials from neighboring countries (like Myanmar) then with a change in the rules of origin it could have been possible for them to export more shrimps to EU.

Type II: TBT (Technical Barriers to Trade) which includes technical regulations, standards, testing, certification arrangement. Of the Type II_barriers, compliance with the SPS and TBT provisions (barriers related to technical regulations) along with HACCP and criteria set by the Food and Veterinary office (FVO) 25 acts as a major barrier towards EU export market. Complying to these standards required adequate technical assistance. The small shrimp firms are still struggling in adopting the standards with low production capacity and very low yield (Haque 2004). Testing related problems are also found to prevail leading to consignment rejection due to existence of unauthorized antibiotics (e.g. Nitrofural) and exploitation of usage of existing levels of the approved antibiotics in the form of overdose. Consignment rejection had found to be a regular phenomenon under applicability of the standards and SPS and TBT requirements.

Type III: Specific Limitations which includes quantitative restrictions, import licensing, embargoes, exchange control, discriminatory sourcing, export restraints, measures to regulate domestic prices, requirements concerning marking, labeling and packaging. Type III barriers, meeting the packaging and labeling requirements have been identified as a significant problem towards market access. Packaging has to be tailored (based upon the importers' requirements) and perfectly sealed. Labeling and marking over each package and over the container are mostly required to be in English (language requirements) and sometimes required to be done according to the importing countries official languages.

Furthermore, due to lack of appropriate training and skills, exporters many a times made technical errors in coming up with the correct approach in labeling and marking and placing the required information which causes withholding of consignments and sometimes rejection of consignment leading to major financial losses

In this review paper, attempt was made to focus the status of shrimp culture and cultural technology, raw material supply chain, processing and export, HACCP and quality management assurance and trade related issues. It is important for FIQC and processing plants to acquire modern equipment and go for urgent actions to improve the performance of the laboratories and the reliability of their results. Bangladesh shrimp sector both in farming and processing has improved a lot but need to continuously upgrade the quality assurance program time to time as per requirement of the importing countries to retain its position in the international market. As of now, HACCP is applied

on the processing plants, but to ensure the quality of production and to reduce risks, shrimp farms are also required to adopt HACCP methods. In order for this to happen, government should increase its assistance to strengthen capabilities of the research organizations to enable them to deal with the emergent solutions.

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