

A Gendered Analysis of the Shrimp Sector in Bangladesh

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Executive Summary

[To be added]

1. Introduction

This report has been prepared by the Greater Access to Trade Expansion team for USAID Bangladesh to explore the nature of production and the terms and conditions of employment along the shrimp value chain in Bangladesh. The primary objective of the report is to identify opportunities to improve market outcomes, raise productivity and wages, and to foster pro-poor growth in the sector.

Shrimp export and cultivation in Bangladesh has undergone rapid expansion over the last two decades. Between 1983 and 2003 the volume of shrimp and prawn cultivated in inland aquaculture has increased more than 14 times (DoF, 1985-2004). Over the same period, the area of ponds dedicated to shrimp and prawn production has more than trebled. In 2003, the Department of Fisheries estimates that there are approximately 203,071 hectares of coastal shrimp farms producing an average of 75,167 metric tons of shrimp annually and an average of 370 kg/ha/year.²

Shrimp is a particularly valuable export crop generating substantial revenues and foreign exchange; earning in excess of US\$360 million annually and accounting for 4.9 percent of exports in 2004. After the garment industry, shrimp production ranks second in Bangladesh in terms of the sector's ability to earn foreign exchange. Not only does this crop earn valuable foreign exchange, but the sector also employs significant numbers of rural workers and provides a livelihood for households throughout Bangladesh. The Bangladesh Shrimp and Fish Foundation estimate that there are over 600,000 people employed directly in shrimp aquaculture who support approximately 3.5 million dependents. Our preliminary estimates indicate that there may be as many as 1 million individuals engaged directly in production and exchange throughout the shrimp value chain and a further 4.8 million household members whose wellbeing is linked to the sector.

Despite the rapid growth of Bangladeshi shrimp cultivation, the global frozen fish and seafood market continues to be dominated by Thailand, Indonesia, China and Ecuador. Significant innovations in production and processing in these countries have increased the value added associated with their exports and the market share that they command. Unfortunately, the same is not true for Bangladesh. Innovations in both production and processing have yet to be secured. Furthermore, stricter import requirements and compliance regulations in importing countries have meant that Bangladesh must invest in improving the safety and quality of their fish and seafood exports to avoid products being detained and rejected at point of entry into foreign markets.³ A recent IFPRI (2003) report notes that: "The only way Bangladesh can improve its export position in the shrimp market is to improve the safety and quality of its exports."

It is clear that Bangladesh has the potential to increase production, raise productivity, upgrade processing facilities, and draw further land into shrimp cultivation. Yet, significant

² These data are for 2003-2004.

³ Bangladesh shrimp has been rejected at the port of entry into the European Union and the United States for salmonella, bacterial and antibiotic contamination. Additionally, some shrimp have been contaminated with urea that has been used to accelerate shell-shedding and promote more rapid growth.

challenges remain ensuring that shipments meet standards set by the importing nations. Additionally, if growth in the industry is to benefit the poor and ameliorate inequality attention must be paid to the terms and conditions of employment and production, and the social and environmental impact of activities in this sector.

1.1 Objectives

This report analyzes shrimp and prawn production in Bangladesh with a view to supporting growth in the sector, improving the terms and conditions of employment and production, and raising productivity and earnings.

The goals of the analysis are threefold:

- Provide a detailed summary of the shrimp sector value chain in Bangladesh.
- Identify where women and men are located in the value chain and explore any gender differences in returns, wages, productivity and profits.
- Develop policy and programmatic recommendations to maximize opportunities for vulnerable groups—in particular the resource poor, landless, women and minorities.

1.2 Methodology

This section describes the framework for the report and the data collection and interviews undertaken between September 2005 and November 2005.

1.2.1 Value Chain Analysis

The report undertakes an in-depth analysis of the shrimp value chain. Value chain analyses are similar to supply chain analyses in that both focus on the institutional arrangements that link producers, processors, marketers, distributors, and consumers. Supply chain analyses focus on the way goods move from producers to consumers; the exchange of payment, credit and capital among actors; price signals, pricing behavior and value added; the dissemination of technology; and the flow of information across the chain. A value chain analysis augments this approach, identifying and exploring the spaces where rents are generated, and recognizes that different configurations of actors may influence capabilities, relative bargaining power, and subsequently affect outcomes along the value chain.

To explore opportunities for broader participation in the benefits from trade expansion in Bangladesh, we are using a gendered value chain analysis—focusing on forward and backward linkages and using this analysis to maximize returns for poor men and women working at different points in the value chain. A gendered value chain analysis is designed to highlight the different positions and contributions of men and women across the value chain and uncover the economic, organizational, and coercive relationships among actors located along different points of the industry. The analysis will illuminate the distribution of potential and actual benefits to these actors. Analyzing the national value chain, and the rents

generated provides opportunities to target assistance and provide incentives to reduce the number of intermediaries, increase the bargaining power of gatherers and small farmers, and ensure access appropriate processing technology, storage and transport facilities to enable resource poor gatherers to capture more of the value added in the global value chain.

This approach is particularly suited to a pro-poor and gender analysis, since it recognizes that market imperfections, information bottlenecks, and the scarcity of capital (financial, physical and human) confer unequal power and access to rents upon buyers and sellers in particular industries. Identifying these imperfections and restrictions can increase the ability of poor men and women to gain from liberalization.

A gendered value chain analysis addresses power within the production and exchange relationships. In economic terms, this analysis explores monopoly and monopsony⁴ power to set market prices; the power to bargain with buyers and sellers; as well as indebtedness and coercive contracting relationships. Other aspects of power that relate to gendered outcomes are social mobility and social sanctions that govern men and women's access to markets as well as their entitlements and capabilities.⁵

1.2.2 Pro-Poor Livelihoods Approach

Throughout this document we focus on a pro-poor and livelihoods approach. A pro-poor approach explores how growth in the sector can benefit the poor ensuring that rents and returns are better distributed across the value chain. The analysis highlights how improvements can be made in production and marketing that can assist the poor, upgrade their activities, improve their bargaining position, and reduce the risk associated with shrimp and prawn production. The livelihoods analysis considers the entirety of production and earnings for the poor and makes recommendations to diversify production and earnings and reduce risk. For the livelihoods analysis, we focus primarily on men and women fry catchers and small shrimp and prawn pond farmers who occupy a particularly vulnerable position within the value chain.

In Bangladesh shrimp and prawn cultivation disproportionately occurs in small ponds under traditional or modified traditional practices. More than 70 percent of producers cultivate shrimp and prawn in less than 2 hectares of ponds using traditional farming practices with little or no feeding. Most farmers have learned by doing and few have any training in shrimp and prawn production. Farmers typically do not evaluate seed quality, they stock largely without any understanding of optimal density, and pond preparation, and fertilization or feeding is rare and often inconsistent (ATDP II, 2005; DOF, 2002a). Although production rates and returns are variable, many of these farmers face high risks and losses are

⁴ Monopsony describes a situation where there is only one buyer for a given product. A monopsonist acts like a monopolist determining prices and exerting power over sellers.

⁵ This draws on Sen (1999). According to Sen, entitlements describe the bundle of resources that an individual or group commands for the purpose of consumption, production, or exchange. These entitlements will depend on the resources owned or available for use (including public goods) as well as on the conditions of exchange (such as relative prices, the type of market and mode of exchange). Capabilities summarize an individual's or group's freedoms and abilities to deploy their resources. A capabilities approach focuses less on the nature of the resources available to individuals or groups but emphasizes what they are able to do with these resources.

frequent—particularly for those farmers cultivating shrimp. Additionally, many farmers encounter restrictive contracting relationships and are obliged to sell to specific intermediaries. Furthermore, numerous small farmers face insecure land rights and leases. As a result, there is significant potential to improve production, secure livelihoods and reduce the risks associated with shrimp and prawn cultivation.

Similarly, fry catchers, who sift through the surf and estuaries for shrimp fry occupy a highly insecure position within the value chain. A combination of wild caught and hatchery fry is used by different farmers. Although hatchery production is increasing, the majority of farmers sources fry from the wild. Fry catchers are typically landless or land-poor. Although there are marked regional differences, they may be men, women or children. Fry catchers are frequently indebted and locked into contracting agreements with specific intermediaries. The Government of Bangladesh and the Department of Fisheries are keen to see a shift to hatchery production of fry and fingerlings. If this shift occurs, a significant number of fry catchers will be displaced. This report aims to address the livelihoods concerns of the fry catchers within the context of upgrading and diversifying production along the value chain.

1.2.3 Environmental and Social Impacts

Shrimp and prawn production generate significant revenues. Yet, there are concerns that current practices within the industry lead to environmental and social costs that are not insignificant. An array of environmental concerns have been documented that range from salt water intrusion, alteration of drainage patterns, mangrove deforestation, loss of barrier services, changes in nutrient recycling, and contamination from runoff associated with feeding and fertilization practices.

Similarly, concerns have been raised about labor practices in the industry and human rights abuses of shrimp farmers and communities organizing against shrimp production. The labor rights concerns typically center on the nonpayment of wages and benefits according to labor law, the informalization of production and the subcontracting of workers under conditions where they face personal risk, sickness and injury. Nijera Kori an activist non governmental organization dedicated to improving the lives of the poor in Bangladesh has also documented numerous human rights violations associated with evictions, dispossession and the annexation of communal lands (Ahmad, 1996; Kabir, 2005). The Environmental Justice Foundation estimates that over the last decade 150 lives have been lost in Bangladesh as activists and community members have been targeted for repression (EJF, 2003). These claims are not isolated and many other environmental, labor rights and pro-poor groups document similar abuses (CDP, 2005; SAFE, 2005 a).

In an attempt to address these concerns, this analysis will explore the terms and conditions of employment and exchange throughout the value chain; highlighting how the rents and returns may be better distributed to improve the lives and livelihoods of those working in the sector. We will also explicitly address how and where upgrading and innovation as well as targeted technical assistance can reduce environmental costs, raise productivity, and improve earnings.

1.2.4 Data Collection

The data collection for this report included a series of key informant interviews using a structured questionnaire to elicit information about wages, prices, profits, productivity, cost structure and returns along the value chain.⁶ DATA Inc. was sub-contracted to refine the instruments and collect quantitative and qualitative data along the value chain. Data were collected for production; marketing, transportation and storage; processing; pricing; as well as for the terms and conditions of employment. Interviews and focus groups were conducted at each node in the value chain and the number of individual or collective interviews held were chosen to be representative *a priori* of the density of agents undertaking each type of activity in Khulna, Chittagong and Cox’s Bazaar. A total of 188 individuals were interviewed using the semi-structured questionnaires and an additional 25 key informant interviews were conducted with individuals representing government, the private sector and non-governmental organizations (See Annex 4). Focus group discussions with male and female workers and farmers were also held along the shrimp value chain in the Khulna, Chittagong, Cox’s Bazaar and Greater Noakhali (Feni, Noakhali and Laksmipur) regions between September 2005 and November 2005.

Table 1. Number of Individuals Interviewed in Focus Group and Key Informant Interviews

Type	Number
Fry catcher	13
Fry faria	10
Fry aratdar	19
Shrimp farmer	30
Shrimp faria	16
Shrimp aratdar	21
Commission agent	15
Shrimp nursery	2
Shrimp hatchery	15
Transporter	6
Retailer and wholesaler	7
Shrimp processor	20
Exporter	10
Shrimp trawler	1
Cargo biman	1
Input dealer	1
Commission agent (MS)	1
Total	

Source: DATA Inc. “Shrimp Survey Methodology,” Dhaka, November 2005.

The data collected do not constitute a statistically representative sample of all shrimp and prawn producers and processors in Bangladesh. They are, however, illustrative of the types of the production and marketing that takes place in the shrimp value chain in the areas sampled in Bangladesh. In addition to primary data, collected through focus groups and key informant interviews, we also rely on secondary sources for information about environmental and social costs of shrimp production and data verification.

⁶ These questionnaires are included in Annex 1.

Where possible, we attempted to triangulate to verify our findings by comparing data and information from these different sources.

The primary data were used to map the market channels from production through processing and distribution (see Section 3 and Annex 3). The market channels provide an overview of the value added along the value chain and indicate where the greatest returns are concentrated.

2. Overview of the Sector

Export oriented shrimp culture has undergone rapid expansion in Bangladesh since the mid 1980s. This sector has benefited from a growing global demand for shrimp and a series of measures to increase Bangladesh exports and diversify the export base.⁷ Shrimp culture received critical support from the World Bank in 1985 when a credit of SDR20.6 million was extended to the Government of Bangladesh. The project was intended to intensify existing production, construct embankments and boundaries that would eliminate salt-water seepage, and promote efficient water exchange to flush out salts from soils for paddy cultivation (World Bank, 1985 cited in Bhattacharya, Rahman and Khatun, 2005). Unfortunately, the environmental costs were greater than had been optimistically predicted and a series of projects were subsequently implemented in an attempt to mitigate these costs.

Bangladesh is a nation uniquely positioned to cultivate and harvest fish—situated at the confluence of numerous rivers and tributaries, and occupying the delta of three major transboundary rivers, the Ganges, Jamuna, and Brahmaputra. Currently, Bangladesh is the world's fourth largest producer of inland fish. The fisheries sector generates over US\$ 390 million a year and contributes 5.0 percent of GDP at constant prices⁸ and about 5.6 percent of total exports.

In addition to providing a valuable source of foreign exchange, fish and fish products are clearly critical for food security in Bangladesh, where about three quarters of the animal protein consumed comes from fish that are caught in the rivers and flood waters (CGIAR, 1998). According to Asaduzzaman and Toufique (1998) about 8 percent of the total population in Bangladesh depends on the fisheries sector for their livelihoods and almost three quarters of all households engage in subsistence fishing in the flood plains, or cultivate fish in ponds during the rainy season. Many households engage in both rice paddy cultivation and aquaculture in the same ponds over the course of the year. INFOFISH (2004) estimates that there are approximately 1.3 million rural household ponds where fish aquaculture is practiced. Although subsistence shrimp culture has been practiced for hundreds of years, increasingly, small farmers are adding shrimp and prawn cultivation for export to their crop rotations.

⁷ Japan, the US and Europe are the primary markets for shrimp worldwide and important new markets are also opening in Southeast Asia and the Far East. Over 90 percent of all shrimp traded on the international market is consumed in Japan, the United States and countries in the European Union. The demand for shrimp in the US and Europe expanded significantly in the 1990s and continues to grow, fueling the expansion of shrimp cultivation in Latin America and Asia.

⁸ These data are provisional for 2004-2005. Source: National Accounts, Sectoral Shares of GDP at Constant Prices, Table 8.5, Monthly Statistical Bulletin, Bangladesh Bureau of Statistics, April 2005.

The shrimp sector began to expand rapidly in the mid 1980s (Alauddin and Hamid, 1996). In the early 70s, the industry accounted for less than one percent of total exports. Initially, the majority of shrimp was caught at sea. By 1986, the sector accounted for a little over 10 percent of all exports and the proportion of marine caught shrimp had declined significantly. Currently, shrimp contribute about 4.7 percent of all exports, more than 80 percent of which is cultivated or caught in inland waterways. With the expansion of the sector, the number of fish and shrimp processing plants grew concomitantly. In the early 1970s there were 13 processing plants. By the mid 1980s there were 54 plants and currently there are 129 in operation (INFOFISH, 2004).

Although shrimp production and cultivation in Bangladesh has proven to be dynamic and growth rates have been positive and sustained, fish and fisheries products are typically a high-risk food export, subject to careful inspection for pathogens, natural toxins, bacteria and other possible contaminants (INFOFISH, 2004). Additionally, shrimp are virus-prone and the exposure of Bangladeshi shrimp to the White Spot WSSV virus in 1995 introduced further risk that continues to compromise output and reduce yields.⁹ To address these concerns, the Government of Bangladesh established a Fish Inspection and Quality Control program in the early 1980s through the Department of Fisheries of the Ministry of Fisheries and Livestock. In 1996, the Food and Agricultural Organization developed a program to provide targeted support and technical assistance to the sector based on the Hazard Analysis Critical Control Point (HACCP) endorsed by the US Food and Drug Administration.¹⁰

Despite these measures, the European Union imposed a ban on shrimp imports from Bangladesh in 1997 in response to inspection failures in a number of processing plants. Between 1997 and the end of 1998, the volume of shrimp exported dropped by 20 percent (BSFF, 2005). By December 1998, shrimp exports had fallen by almost a quarter. The ban deprived Bangladesh of their largest shrimp export market and set in motion a series of changes throughout the sector, spurring investment in technology, hygiene practices, and new processing techniques. Cato and Subasinge (2003) report that by 2003 the shrimp industry had invested US\$17.6 million in processing plant upgrades. By 2002, of the 65 plants licensed for export, 45 had secured EU approval (*ibid*). Despite these investments, there is evidence that a number of processing plants and farms have failed to implement adequate changes and that the risk of contamination is significant.

2.1 Regional Variations in Shrimp and Prawn Production

2.1.1 Shrimp Production

Currently, 36 shrimp species are harvested and cultivated in Bangladesh (ICAPMS, 2004). Two regions dominate shrimp production, accounting for approximately 95 percent of the total area dedicated to shrimp culture: Chittagong-Cox's Bazaar and Khulna-Shatkira-

⁹ Viral contamination in shrimp farming areas affects both cultivated shrimp and biodiversity in areas under cultivation (Bhattacharya et al, 2005). Some analysts claim that the source of the virus was inflected brood stock (mother shrimp) purchased by shrimp hatcheries and harvested from the Bay of Bengal (Kalam Azad, 2004).

¹⁰ HACCP is a regulatory system required for food imports to the major importing nations. For more information consult: <http://www.cfsan.fda.gov/~lrd/haccp.html>

Bagerat. Brackish water aquaculture is widespread throughout Satkhira, Khulna, Cox's Bazaar, and Bagerhat. *P. monodon* and *M. rosenbergii*, the two major species of Bagda and Golda are cultivated in these areas. *M. rosenbergii*, the most popular freshwater prawn, is largely produced in southwest region of the country.

The Bangladesh Frozen Food Exporters Association estimate that there are about 37,397 shrimp farms in Bangladesh many of which are small. ATDP II (2005) estimate that the overwhelming majority of these farms is less than 2 hectares in size. Although production volumes vary enormously, average productivity is low. Table 2 provides a summary for representative methods of farming in Bangladesh. Most farms in Bangladesh follow traditional methods of cultivation in open ponds serviced by tidal waters. A few farmers, most notably those receiving technical assistance through donor-led projects,¹¹ are practicing modified traditional methods of cultivation scaling-up inputs and technology. Less than five percent of farmers apply semi-intensive methods which require aeration, pumping, water exchange, and intensive feeding. Most of the farmers who apply semi-intensive production techniques are located in Khulna, although a few may be found in Chittagong and Cox's Bazaar.

Traditional shrimp farming in Bangladesh is carried out in paddy fields during the dry season, when the salinity of the soil and water in the coastal region makes rice culture difficult. In the region surrounding Khulna, rice is grown during the rainy season for a period of up to 3-4 months. In Chittagong and Cox's Bazaar the typical crop rotation is shrimp and salt production.

Few traditional farmers fertilize the ponds and as a result productivity is low, ranging from 250 to 350 kilograms per hectare. Despite the low levels of inputs, costs per hectare are not insignificant and include rent or imputed rent as well as labor costs. Traditional methods incur estimated costs of almost 60,500 BDT per hectare per year.¹² Average returns range from between 14,500 and 44,500 BDT per hectare. Modified traditional practices incur higher costs for pond preparation, dike construction, feeding, and limited aeration. Survival rates and productivity are higher, as are returns. A farmer cultivating one hectare of land using modified traditional practices could expect average returns of 87,460 BDT per year. Finally, semi-intensive production has higher stocking densities, higher costs and significantly higher yields. A farmer practicing semi-intensive methods of shrimp cultivation could expect an average profit per hectare of 282,000 BDT.

¹¹ Two projects that are providing technical assistance to shrimp and prawn farmers are the ATDP II Shrimp Seal of Quality project supported by USAID and the Greater Noakhali Aquaculture Extension Project supported by DANIDA.

¹² US\$1=65 BDT

Table 2. Typology of Shrimp Production in Bangladesh⁴

	Traditional	Modified Traditional	Semi-Intensive
Average Pond Size	1.3 hectares		
Stocking Density Post Larvae/m ²	3.5	0.6	5.0
Water Management	Mostly tidal	Mostly tidal with some pumping and aeration	Pumping and aeration
Fry Sources	Wild and hatchery	Wild and hatchery	Wild and hatchery
Feeding ¹	Natural feeding with occasional fertilization	Fertilization with supplementary feed	Fertilization with supplementary feed
Survival rates			
Production kg/ha/yr	250-350	600	2000
Cost (BDT/Ha)	60,500	92,540	318,000
Cost (BDT/Kg) ²	242-173	154	159
Returns (BDT/Ha) ³	14,500-44,500	87,460	282,000

Notes: ¹ Most of the shrimp feed is locally produced and much of it is homemade.

² These costs take into account lease costs and imputed land rents, labor and security payments.

³ These returns assume a price of 300 BDT per kilogram.

⁴ US\$1=65 BDT

Source: Based on data from ATDP II Cost Benefit Analysis, BFFEA, and the GATE Value Chain Analysis; prices and yields are estimated for 2004-05

2.1.3 Prawn Production

Fresh water prawn production occurs primarily in southwestern and central Bangladesh. Two programs stand out among those that have been implemented in Bangladesh which focus on developing prawn production: the CARE GOLDA (Greater Options for Local Development through Aquaculture) Project under the Agriculture and Natural Resources (ANR) division of CARE-Bangladesh and the Greater Noakhali Aquaculture Extension Project supported by DANIDA. The CARE GOLD project operated in southwestern Bangladesh (in the districts of Bagerhat, Khulna, Jessore, Gopalganj and Satkhira) between 1996 and 2001. The project provided technical assistance and undertook action-oriented research to improve outcomes for small-scale freshwater *gher* farmers to increase their incomes. The project was funded by the DFID (Department For International Development) and provided technical assistance to approximately 15,000 small farmers (Abedin et al, 2001). The Greater Noakhali Aquaculture Extension Project (GNAEP) is currently being implemented by the Department of Fisheries with support from DANIDA and is focused on promoting small scale aquaculture in the greater Noakhali Region.¹³ Both projects targeted small and resource-poor farmers.

Fresh water prawn cultivation is similar to marine shrimp cultivation. The ponds are typically prepared from February-April and stocked with post larvae and juveniles from April-

¹³ This project is part of the DANIDA Private Sector Development Program, see <http://www.psdbangladesh.com/>. For more information on the project consult <http://www.gnaec.org/>.

August. The stocking density for the ponds is usually 100-150 PLs or 40-60 Juveniles per decimal¹⁴ (Abedin et al, 2001). Prawn can be cultivated with other fish such as carp and whitefish and a variety of homemade and commercially processed feeds can be used throughout the production cycle. Most prawn are harvested between November and December, while the remainder is harvested the following year from August to September. Some farmers harvest continually throughout the year.

Women are more visible in prawn production, in part because these projects were family-focused and livelihoods based. As a result of the CARE and DANIDA projects, women have entered a variety of economic activities such as dike cropping, prawn feed preparation and distribution, paddy husking, poultry rearing, tree nursery production and vegetable production in homesteads, snail harvesting and breaking, prawn harvesting, gher cleaning and weeding (Abedin et al, 2001; Demaine, 2005). In the GNAEP project, preliminary data would suggest that 52 percent of ponds are operated by women householders (Demaine, 2005).¹⁵

GNAEP has a distinctly pro-poor livelihoods approach that focuses on poly-culture to meet food security needs and generate income. Carp and prawn are cultivated in mixed systems that frequently include rice production. GNAEP also builds both forward and backward linkages engaging communities in feed production¹⁶, milling, sorting as well as providing support to hatcheries and nurseries. The project is also implementing appropriate technology traceability based on the highly decentralized tracking of inputs such as larvae and feed.

2.2 Processing and Export

Shrimp and prawn are sorted and washed at the farms where they are produced and then sold on to a number of intermediaries who collect and aggregate the crop. A vast number of intermediaries *Faria* and *Aratdar* convey the shrimp and prawn to depots and then on to processing plants. The larger semi-intensive producers contract directly with processing plants and arrange the transportation of their product directly—thereby increasing the returns they receive. At the processing factories the shrimp are cleaned, de-headed, de-veined, peeled, frozen and packed for export. There are currently 130 processing plants in operation, the majority of which are located in Khulna.

3. The Shrimp Value Chain

The shrimp sector is dynamic and growing, providing business opportunities to middle and upper level participants in the value chain. The sector also offers livelihood opportunities to the rural poor who are overwhelmingly the participants in the lower segments of the value chain.

¹⁴ A decimal is 1/100 of an acre or 0.004 hectares.

¹⁵ PROSHIKA estimate that a similar percentage of women are engaged in prawn cultivation in their projects (Rahman, 1998).

¹⁶ Feeds are produced locally from rice bran, wheat flour, mustard oil seed cake, molasses and dried fish.

The recent growth notwithstanding, shrimp production in Bangladesh is typified by low levels of productivity. Average yields indicate that farms produce less than 550 pounds or 250 kg per hectare. In contrast, countries with a larger export market than Bangladesh, that use modified traditional, semi-intensive and intensive shrimp production process have significantly higher yields. The yield rate of shrimp of Bangladesh is 17 times less than that of Thailand, seven times less than that of China and five times less than that of India (Angell, 1995). The comparatively lower productivity in Bangladesh indicates that substantial room exists to upgrade production, improve management and harvesting techniques and increase returns.

3.1. Description of the Production Process

3.1.1. Traditional Extensive Production Process

Since early 1950s, traditional methods of shrimp farming have been practiced in the coastal districts of Bangladesh, encompassing Cox's Bazar, Chittagong, Khulna, Shatkhira, and Bagerhat. Traditional practices require few inputs and have low yields. The traditional form of production developed in these areas because they had adequate water salinity year-round and largely stable temperatures, an abundance of shrimp fry (post-larvae), and readily available and cheap labor.

As market demand increased, so too did the land assigned to traditional shrimp cultivation (Alauddin and Hamid, 1996). In 1982 - 1983, brackish water shrimp farming covered about 52 thousand hectares. By 2000-2001, the area under cultivation had increased to 141 thousand. Total annual production was less than 21 thousand metric tones of shrimp in 1991-1992, a figure that rose to 65 thousand metric tones in 2000-2001, representing a more than three-fold increase in total shrimp production (DOF, 2002b). This output growth was mainly the result of the expansion of the area under cultivation rather than any application of modern technology and improvement management practices.

The traditional shrimp production system was referred to as the "bheri" or pond method which has subsequently been modified to take place in the large empoldered areas known as "ghers" (farms). Usually the ghers are connected to estuaries and canals through channels and sluice-gates allowing farmers to manage the flow of brackish or tidal water. In the months of February to April tidal waters, carrying the shrimp post-larvae (PL) or fry, flow into the gher at high tides which are then allowed to drain out during low tide. Shrimp fry are trapped inside the gher by bamboo barriers that are placed at the exits. The trapped shrimp fry are allowed to grow in the growing period from March to June. During the growing period, farmers change the water as required using the tidal cycles. Very few farmers have pumps or mechanical devices to exchange water.

Golda shrimp fry generally take eight months to grow and reach the marketable size. Bagda can be harvested more frequently. Both crops are harvested in the months of September to November. Simple efforts are taken to prepare the shrimp ghers and usually no food or extra nourishment is provided to the fry. Consequently, traditional farming requires low investment, and as a result yields are also low. Loss rates may also be high.

3.1.2. Modified Traditional Production Process

Traditional methods of shrimp farming have been modified in a variety of ways and have incorporated specific enhancements to increase yields and improve water management techniques. Increasingly farms are switching to augmented techniques and bridging the gap between traditional and modified traditional practices. Some of these modifications are described below:

- Use of nursery-nourished and adapted fry to increase survival rates.
- Use of electric pumps to control saline water flow—this is particularly important for Bagda production where tidal seawater is not naturally available.
- Preparation of land before starting production and enriching the soil with lime.
- Mixed production of both Bagda and Golda in the same gher. To meet the salinity requirement for the PL Bagda, a canal is dug alongside the bank of the gher to create a controlled environment with saline water and the Bagda PL are nursed here for some time. When the Bagda PL reaches its next mature stage, the gher is filled with fresh water and the Bagda and Golda are mingled and cultivated together.
- To maximize the opportunities for continuous production, fry is seeded or served gradually instead of at one time in each gher. The fry are typically added at one month intervals and as a result when the first “serve” matures, shrimp at other stages are added be harvested later on. Bagda is harvested every three months and Golda takes approximately eight months to grow mature.
- Polyculture has been introduced in some farms allowing for mixed production of shrimp and other fish. Some carp can be cultivated to enhance the total production. Some farmers claim that poly-culture reduces viral contamination. Extra feed is provided to ensure that all varieties thrive under mixed production.
- In the coastal region of Cox’s-Bazaar, another type of mixed-production is practiced with shrimp and salt; using the gher during the period when shrimp is not produced. Under this form of mixed production, salt is produced during the winter or off-season. The residual salt, which increases the salinity of the gher does not affect the Bagda production. This practice is very common and many salt processing exist in the region providing employment in the off-season.
- Another form of mixed crop production is undertaken where shrimp along with paddy is produced in the same gher. Usually “BORO” and “IRRI” are produced in this process. According to the farmers interviewed for this report, any reduction in rice production attributed to shrimp cultivation is insignificant. Extra feed is provided to maintain mixed production.
- Partial processing and post-harvest management can also be adopted. Some farmers sell shrimp heads in the local market for domestic consumption or for use for fish or poultry feed. The head of large Golda is traded in the market at BDT 18 to 36 per pound (8-16 BDT per kg).
- Modified traditional farming systems have introduced modern farming techniques by intensification production processes. Some action-oriented projects been launched by the FAO, UNDP, IDA, etc., with the objective of increasing yields and improving production techniques.

3.1.3. Semi-intensive Production Process

Semi-intensive shrimp production requires regulated water temperatures and water management. This farm requires adequate supplies of saline water and electricity. In semi-intensive production processes the stocking density of shrimp is usually more than the normal carrying capacity under traditional shrimp production system, i.e., 25 fry per square meter, or 2.3 fry per square foot. Semi-intensive production also requires a greater supply of wild and hatchery produced fry, high quality supplementary feed, improved infrastructure, improved water and post-harvesting management, and requires that farmers understand the complexities of these processes. Semi-intensive shrimp production produces significantly higher yields, but the process requires an investment of funds, time, and technical assistance for it to be more generalized.

Semi-intensive production is dependent on an uninterrupted supply of electricity, technology (pumps, temperature gauges, etc), technicians, training, and expertise. The supply of electricity is mainly required for water management in the gher. In 1994, the Bangladesh Power Development Board (BPDB) transferred 2000 kilometers (1240 miles) of electric line to the Rural Electrification Board (REB) to supply power to shrimp producing areas. Although further expansion of the rural electrical grid is required, the country is currently not in a position to allocate additional funds to this.

Under semi-intensive shrimp production methods, variation in the salinity of water, levels of dissolved oxygen, pH, and the quantity and quality of feed can influence productivity. This system requires skilled and unskilled labor, marine biologists, engineers, hydrologists, and other technical experts. Effective management through continuous supervision, monitoring and control of shrimp production is essential to guarantee the higher yields from semi-intensive shrimp production. Semi-intensive production is a more capital-intensive process and as a result has been associated with larger adverse environmental effects as a result of water management techniques that divert natural flows, heavy organic loading and increased waste discharge. Researchers report that approximately 20,000 hectares of coastal land is suitable for semi-intensive shrimp production in Bangladesh. Currently, less than one-tenth of this area is under such a system (BIDS, 1995).

3.2. Marine Shrimp

Shrimp grows naturally in at sea and fishermen catch shrimp along with other fish using motor-driven as well as non-mechanized boats, nets and employing cold storage systems on land or on boats. Most of the farmers and hatcheries obtain the brood-mother shrimp (Bagda) from this system. The shrimp harvested in open systems are sold both to the domestic and foreign market.

Bangladesh enjoys the scope for extensive marine shrimp capture throughout its long coastal areas. In the Bay of Bengal the coast line continues for 440 miles. About 87 trawlers, 44 thousand mechanized and non-mechanized boats are currently engaged in marine fishing (ICAPMS, 2004). Marine fishing is controlled and guided by the Marine Fisheries Ordinance 1983 and Rules 1983. Unfortunately, due to inadequate enforcement and insufficient marine

patrols a large number of fishing boats violate regulations and the marine catch is evidently over-fished.

3.3. Description of the Marketing Channels

3.3.1 Fry Catching

Fry catching takes place widely throughout Bangladesh. There are 12 districts and about 40 thanas where shrimp fry catching takes place. We estimate that there are currently around 518,130 fry catchers involved in shrimp fry catching during the peak season. Most of the fry catchers reside along the beaches or river and many have migrated from other parts of the country. Generally, both men and women work in fry catching with women comprising approximately 40 percent of the workforce. Children frequently accompany fry catchers and participate in catching and sorting activities. During the peak season women and girls participate more visible in fry catching. However, throughout the year women and girls sort the fry.

Shrimp fry collectors sift the surf for fingerling. They transfer their catches to earthenware or metal bowls which are often carried back to the villages where the fry are sorted and counted by women and children using white enameled plates. The transporting and sorting process undoubtedly results in a very large wastage of fry of both penaeid shrimps and other commercially important species including fish. The shrimp fry then pass through a chain of middlemen before reaching the shrimp farmers.

Survey data collected by the DoF in 2001, estimate that fry collectors are mostly located in the Barisal region (about 48 percent) followed by a further 31 percent in the Khulna region and 21 percent in Cox's Bazaar. Notwithstanding, the majority of the PL catch comes from the Cox's Bazaar region (accounting for about 63 percent of the total catch). Despite much higher levels of fishing effort, yields of bagda PL in Khulna zone accounted for only 9% of all fry collected. The total catch was estimated to be 3,000 M PL of Bagda (*Penaeus monodon*) fries. No estimates were available for Golda (*Macrobrachium rosenbergii*) fries.

According to this field survey, about 90 percent of the wild shrimp fry caught in south-east zone (Chittagong Division) are transported to south-west zone (mainly in Khulna Division) since approximately 80 percent of the total Bagda farms are in Khulna. Similarly, about 80 percent of the hatchery produced fries are transported to Khulna Division.

It is important to note, although we have no estimates of the volumes, that farmers and fry collectors report that fry also enters the Bangladeshi value chain from India and to a lesser degree Myanmar.

3.3.2. Hatcheries

Hatcheries produce fry from mother shrimp under controlled conditions. The hatchery obtains the mother shrimp from farmers and marine fishermen. Bagda hatcheries need pipes and infrastructure to bring seawater inside the hatchery and to return it for disposal. For breeding purposes, the mother shrimp is kept in a dark quarantined room at a controlled

temperature. Cleanliness and quiet are emphasized as critical factors for successful breeding. Consequently, access to the main breeding room is limited and only the key care-taker is allowed to get in this room to perform essential work.

In 2000, there were about 44 Bagda and 28 Golda hatcheries (BFFEA, 2004); but number of shrimp hatcheries increased rapidly. Currently, in Bangladesh, there are approximately 55 hatcheries for Bagda and 70 for Golda. Most of the Bagda hatcheries are located in the Cox's Bazaar region and the fry are transported by air or road to the southeast regions. In Cox's Bazaar, in close proximity to the hatcheries, shrimp-supply businesses have grown up, dealing fish feed and other inputs for the hatcheries. These sales outlets import and sell all the products necessary to establish and run hatcheries including shrimp feed.

Hatchery bred fry has the potential to augment wild-fry and eventually displace wild fry in the value chain. Since there is an excess demand for fry for farming and capacity remains under-utilized in processing, there exists an opportunity to add value by enhancing and modernizing hatchery operations to supply more fry for farming.

3.3.3. Fry Faria

Fry faria buy fry either from fry catchers or from hatcheries. Fry faria buy fry throughout the year. The peak season for buying fry is five months long from "Baishakh" (April) to "Bhadra" (August). During this period the faria conduct business every day and buying and selling twice a day. During off season in the months of "Poush" (December) and "Magh" (January) they can face significant financial distress and frequently resort to loans from the fry Aratdar which locks them into a contract to sell all fry to the lender. If they try to sell to other Aratdar they frequently face verbal or physical abuse.

Most of the fry faria report that they prefer to buy wild fry as these fry are perceived to be stronger and more resilient than fry from the hatcheries. This preference is reflected in prices where wild fry are valued at comparatively higher prices.

3.3.4. Fry Aratdar

Fry aratdar also purchase fry that comes from hatcheries or from natural sources. Many fry aratdar buy directly from fry faria, aggregating the volumes of fry. Fry are transported by the fry aratdar to the commission agents in other regions by air or road. Some fry aratdar are also farmers who own or manage ghers.

Generally, fry is delivered in two types of containers the "Pateel" and "Drum". There are on average 10,000 to 12,000 fry per "Pateel" and 20,000 fry per "Drum". According to Mr. Mujibur Rahman Howlader, a prominent fry aratdar at "Foylahat" in Bagerhat, each day an aratdar sells approximately 120 "drums".

Usually, the aratdar do not feed the fry which means that they sell them quickly, often within three days. A fry aratdar trades fry twice a day. The market price varies, reflecting clients' demand and the overall market conditions. Golda consistently fetch higher prices than Bagda in both seasons. Hatchery fry typically earn lower prices (see Table 3).

Table 3. The Range of Prices for Fry Secured by Aratdar in Bagerhat, 2005

Fry Type	Seasonality	Source	Average Price in BDT/1000 fry
Golda	Off Season	Wild	950
Bagda	Off Season	Wild	400
Golda	Season	Wild	2000-2200 (MAX3400)
Bagda	Season	Wild	900
Golda	None	Hatchery	Usually not traded
Bagda	None	Hatchery	200-250

Notes: Data reflect averages for the year.

Source: Mr. Mujibur Rahman Howlader, a prominent fry aratdar at “Foylahat ” in Bagerhat.

3.3.5. Fry Commission Agent

Shrimp fry is collected from Cox’s Bazar, Chittagong, and Khulna and transported to Khulna where most of the gher (farms) are located. Typically, Commission Agents receive the fry and sell them to the farmers.¹⁷ The Commission Agents hold the fry for short periods of time. Large containers, usually plastic drums and aluminum pots, are used to carry and serve the fry. Shrimp fry are transported by air and road and no food is provided during either transportation, storage and trading. The Commission Agents are generally medium- to large-scale entrepreneurs.

Commission rates vary between 10 and 60 BDT per 1000 fry with wild golda fry receiving the highest price (see Table 4).

Table 4. Commission Agent Rates in Khulna

Source	Shrimp type	Price (BDT/1000 fry)
Wild	Golda	50-60
Wild	Bagda	30-50
Hatchery	Golda / Bagda	10-15

Source: Mr. Mujibur Rahman Howlader, a prominent fry aratdar at “Foylahat ” in Bagerhat

The commission agents filter the water in which the fry is kept to remove the shell residuals of the fry. The fry are sorted by male workers before trading. Usually the sorters are hired at a rate of 10 BDT per 1000 fry count. The buyers who purchase fry from the commission agents pay for sorting.

Fry commission agents sell wild fry at higher price than hatchery fry. Buyers willingly pay this premium since they believe that the wild fry have higher survival rates. They claim that they lose 10 to 12 thousands of fry on an average per one lakh (100,000) fry. The mortality rate depends on both the quality of net used in catching the fry and the type of management during transportation.

¹⁷ Some commission agents have their own gher and produce shrimp themselves.

3.3.6. Nursery

Nurseries are where the fry are adapted to the production environment. Technical expertise and infrastructure are required for the operation of a nursery.

In the nursery, the fry is kept under controlled conditions and is nourished through regular feeding at three hour intervals. The fry gradually adapts to the temperature and pH level of the water where it will be grown. The fry arrives at the nursery at a temperature of 12 ° centigrade. The water temperature is gradually increased to the temperature of the water available in the locality. The pH level is adjusted with lime to a level that matches the local environment. If necessary, the salinity of the water is gradually changed to ensure proper adaptation for the fry. In addition, an uninterrupted supply of oxygen is provided at every stage of nursing. Because of the reliance on electricity a generator is used to compensate for power outages. Typically there are only men working in the nursery. Fry stay in a nursery for about 3 days and are then sold at a higher price than fry that have not been acclimatized in this manner. Nurseries typically operate only during the shrimp production season. Workers at nurseries claim that their nourished fry have significantly higher survival rates (up to 100% in some cases) and a few nurseries offer a pay-back guarantee if fry die.

Nursery culture is a new value addition option in the shrimp value chain that may help to improve survival rates of hatchery produced fry. Introducing nurseries has the potential to increase the total availability of shrimp fry and provide employment opportunities— although some technical expertise and limited capital investment are required.

3.3.7 Farming

Most bagda shrimp are farmed in Khulna, Bagerhat, and Satkhira; golda is produced in the central districts of Bangladesh since they require fresh and not brackish water for production. Farmers produce golda and different varieties of bagda: Black Tiger, Fresh water, White & Brown Horina, etc. It is unclear how farmers decide what type of shrimp to produce. It is most likely that the types cultivated are influenced by the “dadon” system where shrimp faria and aratdar impose their preferences about shrimp varieties responding to price signals and market demand.

In a large gher (1000 Bigha or 135 hectares) approximately 2,000 fry are seeded per acre (approximately 5,000 per hectare) and no further feed is usually provided. In a small gher feed is provided as the stocking density is typically higher (10000 to 5000 fry per acre). On average farmers spend 267 BDT for food per acre of gher. Increasingly, farmers are cultivating “pocket ghers” using less land, higher stocking densities and adding feed. These “pocket ghers” are smaller ghers without any direct link to the sea.

Although traditional shrimp production is monoculture, increasingly both bagda and golda are produced at the same time in the same gher and frequently other fish are cultivated such as carp and milkfish. Mixed production is very popular since farmers can earn more and diversify reducing the risk of disease for any specific species. Other fish, such as Pangash, Belle, Ruhi, are the most attractive for mixed production as they command higher value and

mix well with shrimp. Some farmers engage in limited post-harvest activities selling de-headed and de-veined shrimp to the Aratdar at a higher cost. Along the banks of the gher the farmers also produce vegetables for home consumption and occasional sale.

3.3.8 Shrimp Faria

Shrimp faria conduct business throughout the year but the peak season for their business continues for five months. They offer conditional loan or “dadon” to the farmers and buy the shrimp from the farmers at a price that they determine. This price-fixing is ensured through the conditions imposed through the loan. Faria usually sell all the purchased shrimp to aratdar within the same day. Consequently, faria do not need to store or provide any food. If they are required to store the shrimp they use primitive refrigeration methods.

The price is fixed based on the grades of shrimp produced and their number per unit of weight. Few accurate measuring devices are used to assess size and weight for grading. It is typically a “subjective grading process,” where the party who exerts greater power over the other reaps the benefits of monopsony. The shrimp faria seek to depress buying prices to maximize the rents earned when selling the product on to the shrimp aratdar.

3.3.9 Shrimp Aratdar

Shrimp aratdar buy shrimp from both faria and farmers. The faria or farmer brings the shrimp in ice in a tub or basket or plastic container for trading. Shrimp are traded in Khulna through a process referred to as “Chatal” where shrimp are sold through auction. All the shrimp sellers, the aratdar and those farmers who are free to sell in spot markets, sell through auction. Spot markets such as auctions ensure that sellers get better prices in comparison to those they receive by selling directly to Aratdar under contracts secured by loans. However, since mixed grade shrimp is sold in this process, the seller loses some of the potential price benefit for selling individual grades of shrimp that could be priced separately. When shrimp of mixed grade are pooled average prices prevail and the full producer surplus is not extracted.

Shrimp aratdars who trade from depots are increasingly facing new challenges. These depots now have to meet compliance standards set by the industry in accordance with mandates from the EU and US. Aratdars claim that their depots must be maintained according to HACCP recommendations. Yet, they have not received funding or training to meet these standards and will incur significant costs renovating and upgrading the depots.

3.3.10 Shrimp Commission Agent

Shrimp commission agents trade shrimp with exporters. They are typically, medium to large sized entrepreneurs, who have access to, and provide, financing. The commission agents buy shrimp from the aratdar and sell to the exporter. The commission agents maximize their returns concealing the price at which they sell and depressing the price at which they buy.

Sometimes they take bribes from the aratdar to sell their shrimp to a specific exporter. As a result, commission agents enjoy significant rents and side-payments.

3.3.11 Transportation

Transportation plays a critical role in the shrimp value chain. Although most of the segments are interlinked through transportation, there are some specific activities that require substantial transportation expenditures. The segments of the chain which incur the greatest transportation costs are fry aratdar, shrimp aratdar, processors and exporters.

The major routes over which fry or shrimp are transported are:

- Fry is transported by air or road from Cox's Bazaar and Chittagong to Khulna, Bagerhat, Satkhira, Barisal, Potuakhali and Noakhali.
- The unprocessed or semi-processed shrimp is transported from shrimp aratdar to the commission agent by road using light vehicles.
- Shrimp is transported from commission agents to processors or processors/exporters by road using light vehicles.
- The processed shrimp is transported from processors or processors/exporters to foreign buyers. This involves the greatest transportation expenditure using a air freight.

The quality of transportation and management during transportation plays an important role throughout the value chain. For example, the transportation of fry from fry aratdar to fry commission agents can affect the physical state of the fry and influence the survival and growth rates of the shrimp. Survival rates decline and the integrity of the fry are more compromised by longer transportation and storage. Adding value by introducing nursery management either in farms or by aratdar could greatly increase survival rates.

3.3.12 Feed Mills

Alauddin and Hamid (1996) report that there was a significant shortage of artificial feed for shrimp in Bangladesh. In the early 1990s an average of 6,000 mt of feed was produced nationally out of a total requirement of 100,000 mt. The majority of feed was imported from Thailand and Taiwan. Most farmers use locally made and produced feeds that may not contain all the nutrients required to promote growth (*ibid*). INFOFISH and the BFFEA emphasize that expansion of aquaculture or intensification of production requires more locally produce feeds of higher nutritional value.

3.3.13 Processors and Processors/Exporter

There are 130 shrimp processing plants currently in operation in Bangladesh. Of these, 65 are in operation, and only 57 have been approved by the EU. Of those plants that are

operational, most operate at between 20-30% of their capacity partly reflecting the insufficient and discontinuous shrimp supply.¹⁸

Most of the processors sell shrimp using their own brand name and they also pack and use the brand name of importers and buyers. Many processors prefer to maintain more than one brand name as these brands enjoy different level of popularity and image in different countries and/or markets. For example, Meenhar Sea Foods Limited sell processed shrimp using “Jasmine” and “Marigold” brands; they also remain ready to pack under any of their buyer’s chosen brand names. In all cases, the package label includes the required information to meet the ‘traceability criteria’.

Processing Plant: The processing plant is an establishment with several facilities or processing rooms, two-layer shrimp warehousing, laboratory, bathrooms, first-aid room, and administrative offices. Usually the entrance to the plant consists of a pool with chlorinated water for disinfecting and the whole plant is kept wet with disinfectants to ensure a hygienic environment. All the individuals inside the plant are required to use plastic boots to reduce contamination. The two-layer warehouses are kept sealed and the whole plant is built with smooth floors and walls to facilitate cleaning. Generators are used to compensate for any loss of power supply.

Warehousing: Processors frequently adopt two-layer warehousing facilities in the factory. The first layer preserves semi or un-processed shrimp in 5-10 kg packs, to be processed at -5 ° centigrade. The second layer keeps fully processed shrimp that will be shipped to buyers after verification. The second layer is kept at a temperature of between -12 ° to -20 ° centigrade.

Cooked shrimp that are boiled or semi-boiled and salted are increasingly in demand in the global market. To supply cooked shrimp, processors need to make a substantial capital investment and seek skilled staff to maintain the equipment and processes required. The processors frequently hire foreign experts and technicians at high cost to ensure the integrity and function of the spiral freezing and cooking plants. Currently in Bangladesh, it is estimated that between four and six processors have added a fully functioning cooking plant, other processors are now interested in installing the cooking plant machinery to meet the growing global demand for processed and cooked shrimp.

Packaging: Processors and processors/exporters use locally manufactured carton and plastic packets and trays with customized labels. The packaging style varies according to requirements of the buyer and according to the price negotiated by the buyer. Higher prices usually command exclusive packaging; shrimp earning lower prices are frequently packed in single plastic packs or blocks and repackaged later by the importer or retailer. Usually buyers of block and unbranded products prefer simple packaging since disposal is expensive in developed countries. This preference for lower quality packaging for unbranded products, however, can conflict compliance standards.

¹⁸ Concerns have also been raised that the rate of under-utilization also reflects the injection of highly fungible loans into the sector which precipitated a rapid expansion of capacity and in some cases the creation of “shell” processing factories that are not functioning.

Ice is used in several stages of packaging and storing. Some processors are badly affected by the market for ice. Prices vary but usually hover at around 70 BDT per 100 kg; at times of scarcity the price can rise to as much as 700 BDT. As a result, some processors began producing ice in their own factories to meet their needs; in some cases they sell any excess ice produced.

Box 1 Fish Preservers Limited: Diversifying Products and Ensuring Integrity

Fish Preservers Limited (FPL) processes and sells “GOLDEN FISH” and “FPL” brands according to HACCP rules, EU and other regulations. FPL was established in 1978 and is an entirely export-oriented fish processing company. FPL also promotes itself as an organic shrimp processor and furnishes high quality shrimp and shrimp products. To diversify its product varieties and to expand its export market, FPL established a modern spiral freezing and cooking plant, which required an investment of a little over three crore taka or US\$462,000.

FPL employs a range of skilled and unskilled workers included Processing Technologists, Marine Scientists, Engineers and Quality control personnel. They comply with foreign regulations in all their export markets and have a U.S. FDA code number (BC-06) and EU approval number (CTG - 38).

FPL is responsive to buyer demands and has a longstanding relationship with their buyers. The GMP and HACCP food-safety programs are well-understood and fully adopted to guarantee product quality. Moreover, FPL has the required facilities, including a well-equipped and staffed microbiological laboratory, to meet customer requirements for product quality and prevailing market standards. FPL also has an efficient pest control system and filtered water reserve and ice production system on site.

FPL offers a wide range of shrimp and fish products including Black Tiger, Fresh Water Shrimp, White and Brown Horina Shrimp, and Lobster, etc., in IQF, Semi IQF, Cooked, Blanched and Block Frozen form. Their product specifications include Head on shell on, Headless shell on, Easy peeled headless, Peeled de-veined tail on (PDTO, PTO), Peeled un-de-veined (PUD), Peeled de-veined (P & D), and Butterfly cut.

FPL has achieved an excellent national and international reputation and received the 7th International Award for Export in Barcelona in 1984. FPL also won the National Export Trophy of Bangladesh in 1991-92.

Source: Personal interview with representatives of FPL.

3.3.14 Financing Processing and Hatcheries

Two processing factories, “Meghna Shrimp” and “Bionic Seafood Exports Ltd.,” have raised investment funds selling shares in the Bangladeshi stock market, but their share position remains poor considering the price to earnings ratio implied by current market values in the DSE (Dhaka Stock Exchange). Similarly, “Beach Hatchery Ltd” is also trading in the stock market. Unfortunately, the market values of shares of all three enterprises have declined, which does not appear to reflect their export position in the market (see Annex 2, Table 1).

The remainder of enterprises uses formal credit markets and have obtained government-backed loans to build their establishments. The GoB has developed an Entrepreneurs Equity Fund (EEF) targeting agri-based and other commodities companies. A number of hatcheries

and processors have obtained financing through this facility. Additionally, all processors have access to a subsidy from the GoB at 10% of the F.O.B. value averaged over three years.

Unfortunately, most of the financing offers from the GoB are not well-distributed and there is evidence that they are being misused to fund shell investments and diverted for other activities. This may contribute to the under-utilization of capacity reported in the shrimp processing sector.¹⁹ Furthermore, almost all the financing available through the GoB targets the processors or processors/exporters, no funds or lines of credit are available for farmers or other lower level participants in the value chain.

3.3.15 Shrimp Retailer

Shrimp retailers are engaged in domestic sales for local consumption. Local hotels, restaurants, supermarkets, and consumers buy shrimp from retailers. The retail markets remain open throughout the year except with the exception Eid and Puja, etc. Retailers buy and sell different types of prawn and shrimp like such as Lobster shrimp, Tiger, Chaka, Chali, Horina, and Laila. They also buy mother shrimp from the hatcheries and sell these at their stores throughout year. Retailers buy from gher owners as well as aratdar. Sometimes they buy from sea fishermen where the most common marine variety is Chaka.

Retailers do not process shrimp but sell “as they purchase.” They sell both head on and headless shrimp as well as fresh and frozen shrimp. Some retailers only sell shrimp and prawn while others sell a variety of fish as well.

All retail transactions are cash transactions. Retailers usually do not make any sales by advancing credit. They sell shrimp on a cost-plus basis with the price ceiling set by the spot market unit price according to the size of shrimp.

3.3.16 Foreign buyer

M. rosenbegii (Bagda) is the most popular Bangladeshi shrimp in all markets around the world. Increasingly, foreign buyers are interested in buying both cooked and uncooked shrimp. Single-frozen shrimp in smaller packs face comparatively higher market demand and are sold easily in developed countries where single or two member households are very common. This form of IQF freezing requires a separate system. Processors and exporters are gradually expanding their facilities to meet the demand for single-frozen shrimp.

3.4. International Markets and Pricing

The total volume of shrimp traded continues to rise in the three principal markets, Europe, the United States and Japan (see Annex 2, Figure 1). The greatest volume of shrimp from Bangladesh is exported to EU countries, with the United States being the second major consumer (see Table 5). The resumption of foreign buyers' interest in Bangladeshi shrimp

¹⁹ There are also claims that because the sector is tax exempt, laundering is occurring with greater frequency artificially inflating profits and distorting information about costs and returns in the sector.

creates an opportunity for further expansion in this sector. Growth in the US market appears to have the greatest potential for absorbing Bangladeshi shrimp. Between 1990 and 2004, imports of Bangladeshi shrimp almost trebled rising from 14,733 thousand pounds to 38,314 thousand pounds product weight (6,685 thousand to 17,384 thousand kg). According to the National Fisheries Institute, Americans spend around US\$50 billion each year on seafood. The bulk of this spending approximately 68% is spent on fresh or frozen seafood—with shrimp being the primary commodity.²⁰

Table 5. Exports of Bangladeshi Shrimp (Percentage)

Country	Percentage of Earning in terms of Value	
		Sub-Totals
USA	34.78	34.78
Japan	11.26	11.26
EU Countries		48.74
Belgium	16.22	
U. K.	11.26	
Netherlands	8.59	
Germany	6.86	
Denmark	2.07	
France	1.15	
Norway	0.92	
Switzerland	0.76	
Italy	0.91	
South East Asia		2.21
Thailand	0.12	
Singapore	0.29	
Malaysia	0.08	
Taiwan	0.05	
Hong Kong	1.67	
Australia	0.03	0.03
Middle East	0.05	0.05
Saudi Arabia	0.03	
UAE	0.02	
Other Countries including India	2.93	2.93
Total	100	100

Source: Bangladesh Export Promotion Bureau, 2004

Shrimp exported from Bangladesh is inspected in Singapore to ascertain whether it meets importer standards before it is sent to the buyer. SGS, Switzerland²¹ and LLOYDS, UK are the international agencies that perform the pre-shipment inspection before shipment to the buyer. Additionally, some in-country inspections in Bangladesh are also performed by appointed quality inspectors for processors and exporters, buyer-designated quality assurer and EU delegated Government bodies.

Despite rising world demand, the prices by weight for shrimp have been declining in recent years as supply has increased. The trend in shrimp prices was consistently upwards between

²⁰ See <http://www.foodmarketexchange.com/>.

²¹ See <http://www.ch.sgs.com/>

1970 and 1990, thereafter world prices of shrimp in the major markets largely stagnated and since the late 1990s have begun to decline in some markets. Currently, shrimp in Bangladesh are fetching a price of US\$5.10 per pound for 16-20 per pound and US\$3.90 for 21-25 per pound. Unfortunately, the real value of prices secured by exporters and processors has declined since the late 1990s (see Annex 2, Figure 2).

Notwithstanding stagnating or declining prices, the rising volume of shrimp exports, with the exception of 2002-2003, has contributed greatly to total export earnings in Bangladesh. Total export earnings have risen significantly, with aquaculture products garnering 384.24 million BDT in 2003-04.

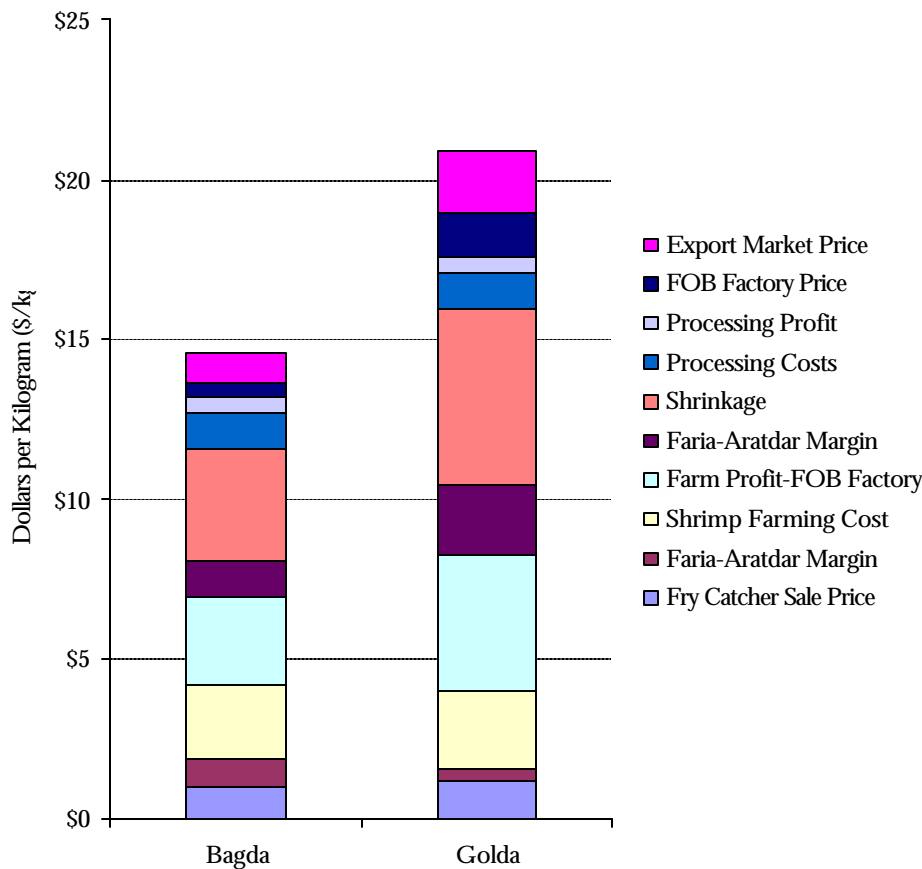
Table 6. Growth of Aquaculture Products and Export Earnings

Year	Volume	Average Price	Total Income
1992-93	42.32	3.57	151.08
1993-94	48.62	4.07	197.88
2000-01	65.37	5.30	346.46
2001-02	66.61	3.79	252.45
2002-03	56.48	4.16	234.96
2003-04	73.05	5.26	384.24

Source: Export Promotion Bureau & Bangladesh Frozen Food Exporters Association

3.5. Costs and Returns

The data collected was analyzed in terms of the total costs and returns across the value chain. This total was then apportioned between actors at each point of the value chain to see how these costs and returns were distributed. Figure 1 provides a graphic of the distribution of the costs and returns along the value chain. These figures are averaged for each actor at each point in the value chain and are differentiated for the bagda and golda value chains. Golda fetches a significantly higher price and offers higher returns along the value chain when compared with bagda.



4. Power and Inequality Along the Value Chain

This report focuses on some key features of power and inequality along the value chain that can restrict opportunities for poor men and women. The analysis of power within the value chain is sometimes addressed through governance. Governance is defined in the value chain literature as the mechanism for coordinating economic activity between and among firms. It is clear when analyzing the global production of garments or cars, or even retailers such as Wal-Mart and The Gap, that some firms either directly or indirectly coordinate or influence the organization of global production. Following Gereffi *et al* (2001) we can identify three forms of governance in value chains:

- inter-firm networks that collaborate or engage strategically—these networks often emerge from a mutual dependence regulated through repeat interactions, reputation effects, social and spatial proximity, or even family and ethnic ties;
- quasi-hierarchical relationships between powerful lead firms and independent but subordinate firms; and
- vertical integration within enterprises.

In the shrimp sector, we clearly observe buyer-driven chains where producers, particularly small producers, have little ability to influence the price at which they sell their product and

are frequently locked into contracts that limit the price they receive when compared with prices that they could freely obtain in spot markets²² or with other buyers elsewhere. Additionally, barriers to entry, poor infrastructure, inadequate communications, and significant transactions and transport costs limit the markets where producers sell. The types of exchange we observe along the shrimp value chain are indicative of unequal bargaining power at a number of key points: fry catching and sale; small-farmer shrimp production and sale; and even consolidation in the depots.

To address these inequalities, we consider power more generally throughout the chain exploring two key elements of power: the economic and social dimensions. In economic terms we consider market power, monopoly and monopsony, the power to bargain with buyers and sellers; as well as indebtedness and coercive contracting relationships. Many of the agents throughout the value chain are locked into contracts on the basis of their receiving advance payments or loans. Fry catchers may be locked into relationships with faria receiving credit or loans in the lean season and being obliged to sell to the contractor who advanced them these funds. Similar contracting relationships exist with small farmers. Additionally, lessees who rent land often do so under arrangements based on the expected yield of the crops harvested. In some cases, particularly if crops fail or do poorly, renters become indebted and payments are passed forward and debts are accumulated. In other cases, the land-owners command a portion of the crops and determine the price at which they are sold—similar to sharecropping arrangements. Such arrangements lock producers into sub-optimal contracts where the price they obtain for their product is lower than it would be in a freely functioning market where credit were forthcoming through the formal financial system.

Another dimension of power is socially determined.²³ Social norms, sanctions and proscriptions frequently affect an individual's ability to enter labor markets, acquire productive assets, invest in their own or other's human capital, and lend and borrow money. Frequently, such norms and sanctions are gender-based. For example, women may face social proscriptions that restrict their mobility. Consequently their access to employment and markets is frequently limited. In southeastern Bangladesh in the Cox's Bazaar region, few women are found in fry catching, largely because of social sanctions that prohibit their entering bodies of water. Since the shrimp fry are caught in the surf, this activity is dominated by men and male children. These same social sanctions determine where women work and the type of work that they undertake. Single women working in shrimp processing factories typically work in a narrow range of activities in an environment that is largely sex-segregated. Where social norms and expectations result in highly sex-segregated activities and occupations, wages frequently differ for male and female activities. Heavily feminized activities usually command lower wages. This is certainly the case in the shrimp production and processing sector where women earn consistently lower wages than men (Tutu, 2004; SAFE, 2005b).

²² Spot markets typically report higher prices than prices received in the factory or in the depots.

²³ Clearly, the economic and social dimensions of power are not mutually exclusive. Markets are socially determined and social manifestations of power frequently emerge from economic hierarchies.

4.1 Segmentation Analysis

Gender analysis provides another means of exploring power and inequality along the value chain (Barrientos, 2001; Joeke, 1999; Ramamurthy, 2000). Men and women clearly have very gender-defined tasks, roles and responsibilities in the fisheries sector. A recent ADB (2004) report attempted to explore the nature of sex- segmentation in aquaculture in Chandpur, Bangladesh. Women largely defined their roles as homemakers and when they contributed to productive activities, these were typically confined to the homestead and the family fish ponds. A number of ADB financed initiatives have created opportunities for group-based fish farming which have enabled women to expand their activities, generate incomes and play a “significant shared role in activities normally dominated by men” (ABD, 2004:13).²⁴

Table 7 illustrates the gender division of labor in fish farming activities in Chandpur. It is clear that two activities are almost exclusively male: harvesting and marketing fish. While many of the activities are shared, there are no activities that are reported as being exclusively female. The extent to which activities are shared may also be attributed to the extension services provided through the project and the focus on drawing household labor into production to improve livelihoods.

Table 7. Gender Roles in Fish farming Activities in Chandpur, Bangladesh

Activity	Only Male (%)	Only Female (%)	Shared (%)
Pond preparation	28	2	70
Fish seed procurement	10	3	87
Feed procurement	6	4	90
Fertilizer procurement	6	4	90
Fertilization	1	10	89
Feeding fish	1	13	86
Harvesting fish	87	3	10
Grading fish	44	10	46
Marketing fish	92	1	7

Source: ADB (2004), special evaluation study based on interviews with 100 respondents.

The labor market in Bangladesh is sex segregated in almost all dimensions—men and women are not distributed evenly across all sectors and occupations in proportion to their participation in the total labor force. One way of measuring this segmentation is using the Duncan Index. The Duncan Index is calculated using the following formula:

$$D = 100 * \frac{1}{2} \sum_{i=1}^N |f_i - m_i|$$

Where $i = (1,2,...N)$ is the total number of sectors, industries or occupations and f_i and m_i are the sectoral employment ratios of men and women to their respective labor force. The Duncan Index of dissimilarity, ranging from 0 to 100, can be used to measure labor market segmentation by sex. An index of 0 indicates that the sectors or occupations are not sex

²⁴ Services and technical assistance for these projects were delivered to households and targeted at both men and women producers inclusively.

segregated and women and men are distributed across these sectors and occupations in proportion to their participation in the total labor force. An index of 100 indicates that men and women are in entirely different sectors or occupations. The Duncan Index calculated for 10 sectors for the entire Bangladesh economy was 31 in 1990.²⁵ By 2000, this index had fallen to 27, registering a decline of over 10 percent in sex-segmentation over the decade of the 90s

We can also calculate the degree of sex-segmentation in terms of person days per year along the shrimp value chain using the number of segments in the value chain. We use person days per year, since hours and shifts vary across the value chain and in different activities. The Duncan Index for hours worked is 62 indicating that the shrimp value chain is highly sex-segmented.²⁶ It is clear that women and men cluster in different segments of the value chain and that their time is used unequally (See Table 8).

Table 8. Segmentation by Sex Along the Value Chain

	Person Days Per Year			Female Intensity		
	Men	Women	Total	F/M	F%	Duncan Index
Fry Catcher	3721	2384	6105	0.6	39.0	
Fry Faria						
Fry Aratdar						
Shrimp Farmer	35028	786	35814	0.0	2.2	
Shrimp Faria						
Shrimp Aratdar	11650	183	11833	0.0	1.5	
Commission Agent	37	0	37	0.0	0.0	
Shrimp Nursery	600	0	600	0.0	0.0	
Shrimp Hatchery	6288	120	6408	0.0	1.9	
Transporter	127	0	127	0.0	0.0	
Retailer & Wholesaler	4	0	4	0.0	0.0	
Processor and Exporter	25790	42483	68273	1.6	62.2	
Shrimp Trawler	10	0	10	0.0	0.0	
Cargo Biman	50	0	50	0.0	0.0	
Input dealer						
Commission Agent(MS)	4	0	4	0.0	0.0	
Total	83,309	45,956	129,265	64.4	35.6	62.2

Notes: Data are estimates for survey area only.

Source: Authors' calculations using primary data.

If the labor market is sex-segmented and men and women cluster disproportionately in certain activities and their time is used unequally, this can be a feature of norms and

²⁵ This calculates the index for all sectors using two digit standard international classifications.

²⁶ The Duncan Indices for the shrimp value chain and the economy as a whole are not directly comparable because the number of segments differs.

expectations that limit the choices men and women can make as workers. If, as a result of segmentation along the value chain, women workers are more insecure and contingent, or more likely to be contracted under informal arrangements for lower wages, then it is also likely that these norms and expectations constrain both the choices made by men and women workers and as well as their productivity.

Where women are seen as secondary earners whose income supplements male earnings, they are more easily viewed as flexible and contingent labor. Flexible and contingent workers are often recruited by firms in global value chains to keep labor costs low and meet buyer demands. Women are often seen as flexible workers who can be hired to meet immediate production or processing demands and then let go, or required to work overtime to meet production schedules dictated by buyers or input availability. At the other end of the global value chain, the commodification of products may depend upon trends in consumption that are linked to changing gender patterns of employment and higher female labor force participation (Barrientos, 2001). As Barrientos (2001:83) observes: “Marketing companies adopt gender-based strategies in their campaigns to sell high value goods.” This is particularly the case with prepared foods such as salads, pre-washed, cut and packaged vegetables, as well as peeled and shelled shrimp and prawn. Even in the developed world, the responsibility for provisioning households still lies largely with women householders—many of whom are also working. A key element in marketing and sales strategies in higher income counties is to provide women householders with foods that can be easily prepared with the minimum expenditure of time and effort. Dolan and Humphrey (2004) observe that such strategies can maximize product placement and increase sales. Dolan and Humphrey (2004) document the case of horticulture producers in Kenya who tailor their output to meet the needs of dynamic markets and successfully earn high incomes by producing washed, packaged and chopped vegetables and salads that are ready-packed and labeled for individual stores on short demand. Orders can vary up to the day of dispatch and production is virtually continuous.

Certainly, INFOFISH and the BFFEA consider this a key strategy for increasing the value added captured by exporters and processors: “In all developed countries food habits are changing. The consumers are no longer willing to spend an excessive time preparing food.” The production and packaging of prepared, “heat and eat” and semi-cooked fishery products are increasingly the focus of upgrading and expansion in the sector (see Table 9).

Table 9. Range of Shrimp Products Exported

Product	Process	Value BDT/Kg
Head on shell with claws	IQF, Semi-IQF and Block frozen	
Headless shell on	Head removed, neck meat trimmed, IQF raw consumer pack and raw tray packs	
Headless shell on easy peel	Head removed, neck meat trimmed, IQF raw consumer pack and raw tray packs with garlic and herb bases, butter-fried, blanched and cooked in BF or IQF process	
Peeled	Peeled, headless, raw and cooked, BF or IQF	
Pull de-veined (PD), P&D tail on	Peeled, headless, de-veined, raw and cooked, BF or IQF	

P&D butter-flied	Peeled, headless, de-veined, butter-flied, raw and cooked, BF or IQF	
PD skewer, P&D Butter-flied tail on skewer	Peeled, pull de-veined, headless, IQF shutter pack raw	
Battered	Peeled, de-veined, headless, cooked and battered (tail on or off)	

Notes: US\$1=64.9 BDT

Source: Adapted from INFOFISH (2004)

4.2 Terms and Conditions of Employment

The terms and conditions of employment along the value chain reflect the inequalities in power and contracting at each node of the chain.

In 1990, the FAO estimated that there were approximately 40,000 fry catchers in Cox's Bazaar and another 120,000 working in the Khulna Satkira region (FAO, 1990). The reliance on wild caught larvae in Bangladesh has diminished, even as the number of farms and the area under aquaculture has risen. The Department of Fisheries estimated in 2002 that there were approximately 432,254 wild fry catchers operating throughout Bangladesh. Our data place this number at approximately 518,130 in 2005.²⁷

Both men, women and children work as fry catchers, although social norms dictate how and where this work occurs. As the FAO (1990) observes of fry catching:

“Two patterns of employment emerged. In one, the menfolk and the male children caught fry, and brought them back to the shore or to the house, where women and female children sorted the catch. In the other, both husband and wife went out to sea together to catch fry with separate nets, while the children did the sorting.” FAO (1990:10).

Typically, fry catchers are poor, landless and indebted. Although the potential earnings are high in the peak season, they are also particularly variable and debt repayments must be made using these earnings.

²⁷ This assumes that an average of 6.2 fry catchers are required to produce the fry for one metric ton of harvested shrimp registering a decline from 8.2 in 1990.

Box 2. Fry Catching and Farming in Cox's Bazaar

Mohammed Mostafa is a fry catcher working in Cox's Bazaar. Mohammed used to live in Noakhali, but was forced to migrate with his family after he lost his land to erosion. Mohammed works with his children in the morning sifting for fry in the surf during high tide. During the peak season, from January to June, Mohammed and his three young sons catch between 5,000 and 6,000 fingerlings per day. In the peak season, they earn approximately 350 BDT for 1000 fingerlings and make an average of \$30 a day during the 10 days when they can secure this quantity of fingerlings. In the lean season, from July to November, they catch approximately 1000 fingerlings per day and sell them for 200 BDT per 1000, making a little more than \$3 per day. Mohammed and his sons can sift the surf for about 16 days of each month, during the new moon and the full moon period, when fry are most abundant. Mohammed's wife and their two daughters help sort the fry at home. The older boys go to school at night when they have finished their chores.

When Mohammed is not catching fry he rents 0.4 acres of land where he cultivates tomatoes, cucumber and eggplant for three months of the year between December and February. The vegetables earn about 30,000 BDT at sale, and he invests between 15,000 and 16,000 BDT in inputs and pays 1,500 BDT in rent to the landowner. His farming nets him about \$65 in income a month as compared with the \$360 he and his family earn in the height of the peak fry season and \$49 in the low season. Despite these apparently high earnings in fry catching, Mohammed's family are poor and live on less than \$1 per person per day. Fry catching is a critical component of Mohammed's livelihood. Yet he recognizes that the fry have been declining in abundance in the 5 years since he has been working as a fry catcher and is worried about this.

Notes: This assumes a conversion rate of 65 BDT per US\$1.

The height of the peak season is from February through May.

These are gross receipts and do not take account of loan repayments or the purchase of equipment such as nets and storage receptacles.

Source: Survey data 2005.

Women work as fry catchers in the Khulna region where social sanctions about women entering the water appear to be less restrictive for women than in the Cox's Bazaar region. We interviewed women in Joymoni, in Mongla Upazilla in Bagherat who earned approximately 20 BDT per 1000 fingerling. They caught and cleaned the fry and sold the fingerlings on to intermediaries making between 500 and 1000 BDT a day. In the lean season these women also collected wood and brush for sale for fuelwood and occasionally worked as casual labor for the forest service. They would also be hired by local land-owners to work in the paddy fields where they earned between 30 and 40 BDT per day for between 5 and 6 hours work. This represents about 70-80 percent of the earnings that men receive for a similar number of hours worked. Similar pay differentials for men and women are also observed in the shrimp processing factories. SAFE documents the case of women workers who receive between 300 and 400 BDT per month less than their male counterparts for the same number of hours worked (SAFE, 2005b). These findings are consonant with the analysis of the data collected for this report.

Table 10 reports average wages and earnings by task at different stages of shrimp production for men and women. This table underscores that women receive consistently lower wages at all points along the value chain.

Table 10. Average Wages and Earnings by Task and Sex in Different Stages of Shrimp Production (BDT per day)

	Men	Women	Women's wages as a % of Men's
Fry catching			
Catching			
Cleaning			
Shrimp farming			
Pond repair	94.7	78.0	82.4
Seeding fingerlings	67.1		
Casual day labor	60.9	50.0	82.2
Maintenance	73.4	60.0	81.7
Security	77.2		
Harvesting labor	80.0		
Processing Labor	97.0		
Administration			
Shrimp Processing			
Building Repairs and Maintenance	79	65	82.3
De-heading	100	83	83.0
De-shelling			
De-veining			
Refrigeration	83	65	78.3
Cooking/breeding	100	60	60.0
Packing	112.5	80	71.1
Administration	290	290	100.0

Notes: The length of a day or a shift is between 6 and 8 hours in farming.

Hours may vary in the shrimp processing sector and can be as much as 12 hours.

US\$1=64.9 BDT

Source: Data from survey of wage rates and daily earnings at different points in the production process.

Inequality in women's participation is not only visible in the wages that they earn or the segmented nature of the labor market that they work in. Women typically occupy more insecure status in most of the employment and work relationships that they engage in throughout the value chain. Table 11 reveals that more male time is allocated to permanent work than female time and that a greater proportion of male labor is concentrated in permanent employment when compared with female labor. For example, in most segments of the value chain where women are employed or engaged as workers, a greater proportion of female time is in temporary or casual employment. In farming, although there are more men reported to be working, 73 percent of women's labor time is concentrated in temporary or casual employment as compared with 31 percent of men's time. Similarly, in processing, where estimates reveal that women out-number men, 92 percent of the women's labor time used is considered temporary or casual.

Table 11. Seasonal Workers in Fry Catching, Person Days per Year

	Men	Row %	Women	Row %
Seasonal	3,721 (100)	61.0	2,384 (100)	39.0

Source: Authors' calculations using primary data.

Table 11. continued: Permanent and Temporary Workers in Hatcheries, Person Days per Year

	Men	Row %	Women	Row %
Permanent	3,912 (62.2)	99.4	24	0.6
Temporary/Casual	2,376 (37.8)	96.1	96	3.9

Notes: Permanent in this case means continual employment, it does not imply that workers and the self-employed have contracts or receive mandatory benefits.

Source: Authors' calculations using primary data.

Table 11. continued: Permanent and Temporary Workers in Nurseries, Person Days per Year

	Men	Row %	Women	Row %
Permanent	264 (44.0)	100	--	--
Temporary/Casual	336 (56.0)	100	--	--

Notes: Permanent in this case means continual employment, it does not imply that workers and the self-employed have contracts or receive mandatory benefits.

Source: Authors' calculations using primary data.

Table 11. continued: Permanent and Temporary Workers in Farming, Person Days per Year

	Men	Row %	Women	Row %
Permanent	24,207 (69.1)	99.1	210 (26.7)	0.9
Temporary/Casual	10,821 (30.9)	94.9	576 (73.3)	5.1

Notes: Permanent in this case means continual employment, it does not imply that workers and the self-employed have contracts or receive mandatory benefits.

Source: Authors' calculations using primary data.

Table 11. continued: Permanent and Temporary Workers in Aratdar, , Person Days per Year

	Men	Row %	Women	Row %
Permanent	11,650 (100.0)	98.5	183 (100)	1.5

Notes: Permanent in this case means continual employment, it does not imply that workers and the self-employed have contracts or receive mandatory benefits.

Source: Authors' calculations using primary data

Table 11. continued: Permanent and Temporary Workers in Shrimp Processing , Person Days per Year

	Men	Row %	Women	Row %
Permanent	9,772 (36.0)	72.8	3,468 (8.2)	27.2
Temporary/Casual	16,518 (64.0)	29.7	39,015 (91.8)	70.3

Notes: Permanent in this case means continual employment, it does not imply that workers have contracts or receive mandatory benefits.

Source: Authors' calculations using primary data.

These figures may disguise the extent of flexibility in women's and men's employment in certain segments of the value chain. Flexibility is not only achieved through employing a greater number of temporary and contingent workers but also by requiring permanent staff to work piece rates for varying numbers of hours and shifts. Flexible wage rates with variable piece rates associated with different activities also allow firms to reduce labor costs. As Barrientos (2001:88) notes about horticultural value chains: "These types of flexible wage systems play an important role in raising the productivity of workers and enhancing the economic rents that growers are able to extract from their more flexible workers." This is just as true for the workers in shrimp processing plants.

SAFE (2005b) documents similar practices in shrimp processing plants:

"We work 12 to 14 hours per day at peak season. Sometimes we had to work 72 hours continuously. But our salary is 1200 to 1600 BDT, at best. We do not get any overtime allowance for our extra hours duty." Women worker as a grader in a shrimp processing plant.

4.3 Monopsony and Bargaining

It is clear that the shrimp value chain is a captive value chain or what Willems et al (2004) describe as an importer-driven chain. Captive networks are characterized by highly asymmetric power relationships that force suppliers to conform to the modes of interaction specified by the dominant customer. In Bangladesh, small suppliers such as fry catchers and small farmers tend to be dependent on larger, dominant buyers, or are locked into contracts where they must sell to particular buyers. Intermediaries such as fry faria and aratdar and shrimp faria and aratdar engage with suppliers and farmers and set the terms of exchange. These buyers are monopsonists, who in turn sell their product on to other monopsonists. Monopsony describes a situation where there is only one buyer for a given product. A monopsonist acts like a monopolist determining prices and exerting power over sellers.

At lower ends of the chain among fry collectors and faria bargaining is limited and few agents are more than price-takers. At higher ends of the chain, among the larger farmers and processors there is more opportunity for negotiation. For example, buyers for major supermarkets negotiate with processing plants establishing relationships and committing to future contracts in a repeated bargain that confers some leverage upon the seller.

Phyto-sanitary regulations set by foreign import markets that require the standardization of production and processing methods using Hazard Analysis and Critical Control Point

(HACCP) methods and Codex Alimentarius also lock buyers and sellers into repeated contractual relationships.²⁸ Although the costs of conforming to regulations has been largely transferred to the producers, buyers and importers have to commit to sourcing in advance. Failure to meet compliance results in fewer shrimp on supermarket shelves in Europe, Japan and North America.

Shrimp importers rely extensively on random food-safety quality checks of the products at the point of entry or import. Most importers have highly computerized systems that accumulate information and monitor purchases from every supplier. Information about food-safety findings and phyto-sanitary properties, price, packing volume, water content, as well as quantity is sent back to the local intermediary in the developing country. Reputation is critical in maintaining contracts. If noncompliance is documented, the local intermediary or processing plant that is responsible to the importer runs the risk of losing future contracts. The importers sell the product on to supermarkets or import for specific supermarket chains such as they in turn have contracts and reputations that they must maintain. As a result both importers and processing plants wish to engage in repeated contracts where both parties are known, quality is upheld and buyers demands can be satisfied.

The expansion of standards and quality regulations also provide opportunities for upgrading. As a result of the addition of these standards and regulations, shrimp processors in Bangladesh have assumed greater costs upgrading infrastructure and added a wider range of prepared shrimp to their products including consumer packed, ready-to-eat, cooked, peeled, de-veined, head-on, head-off, and split shell shrimp. Processors are also adding “Individually Quick Frozen” (IQF) shrimp to their array of products as supermarket demand for headless IQF black tiger shrimp on tray packs has risen substantially in Europe and North America. The preferred sizes are - 13/15, 16/20 and 21/25. Even for block products, exporters and processors can add value by freezing the shrimp in pans (which are called pan-frozen products) that fetch 20–30 cents more per block than the carton-frozen products. Offering a broader range of higher value products increases leverage with buyers and importers and increases the returns captured in country.

Interestingly, this same processing technology can be used for a variety of fish products and may be able to be adapted for vegetables (see Section 3.6.1). Diversifying the products processed can enable processors to overcome product shortfalls and continue to produce for export year-round.

4.3.1 Indebtedness and Contracting

The lack of an efficient and open credit market locks many small farmers and fry catchers into sub-optimal contracting arrangements where they borrow money in advance of production and commit to selling their product to a specific intermediary at a price determined by that intermediary.

²⁸ These regulations set limits and designate acceptable ranges for bacteriological quality, contaminants, residues and additives.

The fry catchers may be considered to be the most vulnerable workers/producers that have the least power in the shrimp value chain. Fry catchers are dependent upon largely open-access resources for their living sifting the surf for fry. Most are landless and have few assets (see Box 2. Frequently they are harassed by the authorities and pay bribes to enable them to continue to catch fry (DOF, 2002a). Many are indebted and spend years in cycles of debt. Repayment is enforced by strong social codes and extracted occasionally through violence as this quote from a fry faria focus group reveals:

“A contract is made so that those who are given loan must give fries to the loan giver. They are bound to follow the agreement and price is set at 50 BDT less per thousand [fry]. If anybody violates the conditions [of the loan] then he is judged by the *samity*²⁹ and if necessary physical torture is done.” Fry faria, Cox’s Bazaar, November 2005.

Additionally, fry collectors may receive fishing capital in the form of nets and buckets from the fry faria increasing their dependence upon a particular buyer.

Some fry faria specialize in shrimp and others specialize in prawn. The degree of specialization depends both upon the availability of fry and the region. In Khulna fry faria were also engaged in buying and selling prawn fry, while in Chittagong, the fry faria were almost exclusively trading in shrimp fry.

The fry aratdar are further up the value chain and typically buy the fry from fry faria and sell the fry on to commission agents. The fry are transported by boat and truck. A fry aratdar has a broader market and may sell to different buyers in different regions. The focus group interviews revealed that the aratdars sell approximately 60 percent of shrimp fries to the shrimp farmers of Satkhira and Khulna and the remaining 40 percent are sold in different parts of Cox’s Bazaar including Moheskhal, Chakoria and Mothertek.

Fry aratdar loan money to fry faria and similar coercive practices are used to ensure loan repayments are made. Interestingly, since the loan amounts are larger, contracting with written contracts is more prevalent.

“No written contract is needed if the loan money is below 20,000 BDT. But for loans above 20,000 a written contract is needed that is stamped. As part of the loan requirements the farias are bound to sell their fries to these aratdars. If anybody breaches the contract he is fined and sometimes he is tortured physically.” Fry aratdar, Cox’s Bazaar, November 2005.

Shrimp faria also make loans to the farmers and similar contracting arrangements exist. The shrimp faria also supply equipment and materials to the shrimp farmers including: lime, fertilizer, fries, oil cake, and wood for making sluice gates and bamboo for fencing and partitions. The farmer borrows from the shrimp faria and sells directly to him. In turn the shrimp faria will have borrowed money from a commission agent and will be obliged to sell to that commission agent.

“I have taken advance money [payment] from a commission agent. I sell 100 percent of my shrimp to him.” Shrimp faria, Cox’s Bazaar, November 2005.

²⁹ A *samity* is an association of fry faria.

In some cases, even the hatchery producers feel locked into sub-optimal contracting arrangements with commission agents and intermediaries. Furthermore, even if the hatchery owners borrow directly from banks, the additional non-bank charges and bribes they are required to pay to release funds, obtain cash, and change money raises the effective rate of interest to well above 12 percent.

5. Environmental and Social Concerns Along the Value Chain

Shrimp farming has been the subject of heated debate and scrutiny as a result of the negative environmental and social impacts that have been documented around the world. As Bhattacharya et al (2005:50) observe: “One of the reasons why this particular type of farming has come under close scrutiny on a global scale is that whilst open (capture) fisheries are generally deemed to be self-producing and self-sustaining, closed (culture) fisheries need direct use of inputs and human care, involves property rights and, whilst being renewable, generates a wide range of externalities³⁰ that makes sustainable development a critically important issue.”

A number of significant external costs have been documented in Bangladesh that are associated with significant changes in land-use patterns and access rights which affect traditional agricultural activities and practices (Adnan, 1993; Ahmad, 1996). Since shrimp cultivation occurs in a closed or semi-closed system, there is a potential for waterlogging and increased salinity levels to alter drainage patterns and the quality of the soil. Declining soil quality and the obstruction of natural drainage has been blamed for the spread of standing water-borne disease and a marked decline in the diversity of agriculture. Furthermore, the use of fine seine nets to sieve for shrimp larvae for cultivation has been associated with the decline in other fish species that were naturally occurring in the river deltas of Khulna and Chittagong. Finally, the loss of vegetative cover has also been attributed to increased salinization and salt water intrusion.

Manju (1996) documents the impact of shrimp farming in the village of Chalburnia. According to his analysis, the percentage of the population cultivating rice decreased from 33 to 13 percent as the proportion of farmers cultivating shrimp rose from 20 to 32 percent. Manju also documented the net impact on incomes as a result of external costs attributed to shrimp farming. Significant declines in income were documented that were attributed to declining rice productivity, the loss of poultry and livestock, the loss of homestead vegetation and changes in social forestry brought about by changes in soil fertility and access rights. As a result of these changes Manju estimated that income levels for local peasant households were only 62 percent of their incomes prior to the shift to shrimp farming.

Similarly, social and human rights concerns have also been documented where land has been annexed for shrimp farming and communities and activists organizing against shrimp production have been targeted for repression. There are also concerns about the terms and conditions of employment in processing factories, depots and on boats. This section briefly

³⁰ An externality describes a situation where the benefits or costs of an economic activity affect a third party. Pollution is clearly a negative externality.

summarizes these concerns with the goal of highlighting the importance of solutions that increase earnings, improve the terms and conditions of employment and minimize or eliminate external costs.

5.1 External Environmental Costs

This section explores some of the estimated environmental costs of shrimp farming using secondary sources and key informant interviews.

5.1.1 By-Catch

(i) Fry Catching

Among the many concerns about fry catching is the potential loss of other biodiversity in the form of by-catch as the fry are sifted from the surf. The FAO (1990) estimate that the rate of “wastage” is significant when compared with the total amount of Bagda fry collected. Although the FAO report that there are a diversity of estimates for wastage, the consensus is that approximately 5,000 other fry are wasted for every 100 Bagda fry. These other fry includes olda chingri fry, *Macrobrachium rosenbergii* (or white chingri) fry and Chaga or red chingri fry and a number of fish fry. The fish fry include paisha, chauma, tengra (*Mystus* spp), and bekti. The fry catchers interviewed for this report estimated that approximately 40 percent of what they sifted was shrimp fry and 60 percent was by-catch. While many fry catchers claim that they return the by-catch to the sea, a non-trivial proportion is clearly lost. Additionally, the fry catchers recognize that shrimp fry are lost during the sorting process. The respondents interviewed estimated that between 5 and 10 percent of shrimp fry were lost during the sorting process.

(ii) Trawling and Open Sea Fisheries

Trawlers operating in the Bay of Bengal trawl for shrimp and other valuable pelagic fish. Although the share of trawling in the total marine catch is small, comprising only 6.4 percent in total marine fisheries, and 1.3 percent in total fish production (Khatun, 2004), the impact that such activities can have is significant (DOF, 2002a). Many of these trawlers use drag-nets that deplete a wide range of fisheries and result in significant by-catch. Although significant quantities of the fish and shrimp caught are sold for consumption a non-trivial quantity is sold for fish-meal.³¹ The use of drag nets contributes to over-fishing in the Bay of Bengal and increases pressure on fisheries, which in turn threatens the food security of thousands of coastal people who rely on fish as the main source of protein and other vital nutrients in their diets. In addition to the loss of biodiversity as by-catch, some trawlers also harvest brood mothers for sale to hatcheries. Where marine fisheries are harvested unsustainably or in an unregulated fashion, the numbers of shrimp fry are likely to be depleted.

³¹ This type of fishing is referred to as biomass fishing. After the higher valued commercial component of the catch is removed for sale, the remaining catch is converted to fishmeal to feed farmed shrimp and other farmed fish species (Hagler, 1997).

Certainly, a recent Department of Fisheries workshop underscored this concern highlighting that:

“Shrimp PL fishery (to catch post larvae of tiger shrimp), the estuarine setbag net (ESBN) fishery (to catch juveniles of miscellaneous marine fauna) and the shrimp trawl fishery (to catch brood shrimps) are the three major destructive fishing gears, the combined effect of which has made the coastal fisheries resource base too sensitive to depletion. Fishing in the artisanal sector is no longer remunerative. The impact of the trawl fishery on the shrimp PL fishery and the vice-versa was not visible, because the two fisheries came into operation almost at the same time. But the negative impact of both of these fisheries was visible on the catches and the overall income of the ESNB fishers (Khan et al, 1994).”

Unfortunately, regulation and enforcement of laws governing trawlers is particularly difficult in the Bay of Bengal. The marine fishery sector lacks proper management policy for conservation of the marine fishery resources and a number of trawlers operate that do not seek permits from, or bypass the permits required by the Bangladeshi government. Khatun (2004) observes that the Marine Fisheries Ordinance 1983 (GOB, 1983) has made provisions for the management, conservation and development of marine fisheries, but that these apply only to water deeper than 50 meters. All trawlers operating in the Bay of Bengal are required to obtain a fishing license which entitles them to fish for a year on payment of requisite fees. Each trawler has to obtain permission for each and every voyage from the Directorate of Fisheries prior to sailing. Trawlers operate at sea and it is assumed that they operate in depths exceeding 50 meters; any depth up to 50 is reserved for small scale fishing. Currently, there is no specific regulation for small scale fishing in the Bay of Bengal.

5.1.2 Loss of Brood Fisheries

The collection of brood stock (mother shrimp) from the Bay of Bengal for stocking in brood ponds for hatching is an integral part of the hatchery production. Unfortunately, there are concerns about the sustainability of fishing for brood stock. Indeed, the Department of Fisheries reports in a recent workshop held in Cox's Bazaar reports that brood fisheries are declining and marine harvesting techniques are contributing to their loss (DOF, 2002a).

5.1.3 Salt-water Intrusion

There have been few rigorous studies of the environmental impacts of salt water intrusion. Nijera Kori contracted the Soil Science Department of Dhaka University in 1996 to carry out a systematic analysis of the impact of salt-water intrusion and waterlogging. The findings were condemnatory and pointed to significant and unmitigated environmental costs. The report identifies the following costs:

- Increasing salinity and soil degradation
- Deforestation and the destruction on homestead vegetation
- Loss of coastal vegetation
- Water-logging leading to irreversible changes in wetland ecology and the loss of micro-flora and fauna.

Other researchers and NGOs report similar findings. The Coastal Partnership for Development maintains that the production of rice has declined in many shrimp producing areas, leaving these communities dependent on rice imports from other parts of Bangladesh imperiling food security and undermining nutrition (Tutu, 2005). Additionally, the Environmental Justice Foundation report that in some shrimp producing areas farmers do not follow drainage management protocols and discharge pond water appropriately contributing to seepage and salt-water intrusion and reducing crop yields by up to one third (EJF,2003).

Salt water intrusion affects both economic and household activities but can place a disproportionate burden on women who are largely responsible for provisioning fuelwood and water. As salinity increases in wells, fresh water is made more scarce. The Environmental Justice Foundation documents the case of women and girls who have to walk further and carry water for greater distances to ensure that their household has sufficient access to drinking water (EJF, 2003). The EJF attributes this to increased salinity as a result of shrimp farming.

5.1.4 Eutrophication

Natural eutrophication is the process by which lakes and semi-closed and closed water bodies age and become more nutrient-laden. This process normally takes place over thousands of years. Humans, through their various activities, have accelerated this process in thousands of lakes and water bodies around the globe. Anthropogenic eutrophication is water pollution caused by runoff from the application of excessive plant nutrients to crops, sewage and other organic pollutants. Semi-intensive shrimp aquaculture can contribute to eutrophication with the discharge or seepage of nutrients and feeds added to the ponds.

To prevent additional eutrophication, any semi-intensive aquaculture must ensure a complete conversion of food into animal protein following a 1:1 ratio. The Shrimp Seal of Quality Program has been working to ensure that when feeds are given to shrimp food conversion is complete. Where there is no wastage of feed there can be no additional exchange of nutrients into the water system.

5.1.5 Loss of Livestock

Another concern raised by groups such as Nijera Kori and the Coastal Development Partnership is the loss of livestock and access to grazing lands. The construction of ponds and dikes and the annexation of lands prevent villagers from accessing communal grazing lands. Additionally, community members may be discouraged from keeping patio ducks because the ducks eat the shrimp larvae and feed. Livestock produce milk, meat and dung for fuel. As a result, the landless or land poor lose additional income and a critical source of domestic fuel.³²

³² The loss of domestic fuel has been linked to greater incidence of diarrhea and higher parasite burdens as fuel is prioritized for cooking and not for boiling water (EJF, 2003).

5.1.6 Deforestation

While much of the loss of mangrove forest in Bangladesh occurred over 50 years previously, some forest areas have been deforested as a result of shrimp aquaculture. Among those forests that have been identified as experiencing significant deforestation as a result of shrimp aquaculture are the Chokoria mangrove forest in the Khulna region. Approximately 8,750 hectares of mangroves have been lost to salt-water intrusion, dike and pond construction and human intervention (Bhattacharya et al, 2005). In addition, with the gradual deposition of silt encouraged by water management practices under shrimp cultivation, the land elevation increases so that land is flooded only during monsoon. As a result the drainage system gradually changes increasing the retention of fresh water and altering the saline balance required for sustaining the mangrove forest (FAO, 1985).

Mangroves are highly valuable ecosystems that perform multiple functions which secure direct and indirect benefits for the coastal inhabitants. Their loss implies foregone sustainably harvested fuelwood and timber, the loss of fisheries, barrier and filtration services, as well as habitat and potential pharmaceutical benefits.³³

5.2 Social Costs

5.2.1 Land and Human Rights

Property rights are central to the analysis of the consequences of external costs. Well defined property rights potentially enable compensation to be effected. The absence of well-defined property rights ensures that few external costs are addressed or compensated and, in many cases, shifts these costs onto the landless and the poor. Frequently, shrimp cultivation in Bangladesh has occurred under leasing arrangements that privilege producers from outside the communities who lease land from absentee landlords. Shrimp farming can be highly profitable and generate significant rents. Land lease prices are bid up as a result of a shift to shrimp cultivation, and landless share-croppers whose livelihoods depend on the leasing of cultivable land are deprived of access to paddy fields and fish ponds as well as common property grazing lands (Manju, 1996; Ahmad, 1998; Toufique, 2000; Tutu, 2004). The customary approach to shrimp farming requires consensus or coordination. If at least 85 percent of the landowners agree to lease out their lands for shrimp farming, the owners of the remaining 15 percent are obliged to lease out their lands for the same purpose or allow the current lessee to inundate the entire area with saline water for farming (Bhattacharya et al, 2005; Tutu, 2004).³⁴ This practice has led to documented expropriations, evictions,

³³ The Environmental Justice Foundation reports that fishermen in Chokoria believe that yields have declined by over 80 percent since shrimp farming has expanded in the region. They attribute this loss to the loss of mangroves and the construction of dikes and polders (EJF, 2003).

³⁴ Additionally, permission should also be sought from the Bangladesh Water Development Board for the construction of water management infrastructure and a license is required from the Upazila Shrimp Control Committee. However, neither bodies are representative and the interests of the landless or land-poor are seldom reflected in their decision-making (Kabir, 2005; Bhattacharya et al, 2005).

coercion and human rights abuses as small farmers have been displaced and community activists threatened and killed (Ahmad, 1996; Tutu, 2004).

Similar concerns arise where the land in question is *khas* land or common property land reserved for the landless or land poor.³⁵ Land is scarce in Bangladesh and highly unequally distributed. SAMATA estimates that less than ten percent of the total population occupies 80 percent of the land (SAMATA, 2005). *Khas* land is public land that has been set aside for the landless under low cost leasing arrangements. Many landless families eke a precarious living from fish and shrimp ponds located on *khas* land and leased from the government. Yet despite the allocation of *khas* land to the poor and landless, land-grabbing and eviction is widely documented (Tutu, 2004; Kabir, 2005; Nijera Kori, 2005). In a situation where the victim has property rights compensation can be devised. But when, lessees have no property rights or common property rights are not upheld, restitution and compensation is rarely forthcoming.

5.2.2 Labor Rights

Social Activities for Environment (SAFE) an NGO that has been in operation since 1998 is currently working with shrimp workers and collaborating with the Solidarity Center to improve the terms and conditions of work in the shrimp sector. SAFE estimates that there are about 25,000 workers in shrimp processing factories in Bangladesh. SAFE and the Solidarity Center have documented a number of concerns about working conditions in the sector including:

- Violations of the 8 hour workday
- Forced overtime
- Unpaid overtime
- Failure to provide adequate health-care
- Failure to provide child-care and maternal leave
- Failure to observe the right to organize and collectively bargain
- Inadequate hygiene and health and safety measures
- Insufficient bathrooms and toilet facilities

Unfortunately, labor laws and regulations are spotty and confusing. Different acts, ordinances and rules apply to different types of enterprises and workers. Some of the general categories to which rules and regulations apply are factories, shops and establishments, tea estates and the public sector. For all of these categories of establishment, the labor laws cover basic worker rights in the following areas: minimum wages, payment of wages, leave and holidays, working hours, workplace safety, workplace facilities (washrooms, first aid, canteens for larger enterprises, and rooms for female workers' children in factories with over 50 female workers), worker compensation, maternity benefits, child labor, and industrial relations (including rights to organize and bargain collectively). Social security is

³⁵ There are approximately 4.2 million acres or 1.7 million hectares of land defined as *khas* land.

offered to a number of workers through different types of ‘welfare funds,’ ‘provident funds’ and/or ‘participation funds’ that certain employers are required to establish and maintain.

The rights that workers have in the shrimp sector depend on the size of the company, the number of contracted employees, the location of the firm and the local ordinances that apply. Much of the labor that is contracted on shrimp farms and in processing factories is informal.³⁶ Few workers have contracts or receive the statutory benefits. Many complain that they lack ID cards. Furthermore, the minimum wages that apply in the shrimp sector are those set for agriculture and not those that apply to manufacturing. Yet, despite the existence of these minimum wages, they are frequently are not observed.

Box 3. Labor Rights in the Shrimp Processing Sector

“We know our rights, but we have no alternatives, we have no way to get another job. What we need is more organization,” Woman worker, shrimp processing factory, Khulna.

“Well, we don’t get what we should get. We don’t get a weekly holiday or day off. We don’t get annual leave, not even sick leave or maternity leave. We don’t even get paid overtime if we do it.” Woman worker, shrimp processing factory, Khulna.

“I work about 12 hours a day standing up without a lunch break. If I come later because of a problem at home, I have to stay later. Production goes on for 24 hours a day at peak time. It is very stressful.” Woman worker, shrimp processing factory, Khulna.

“I work in cold storage. I spend a lot of time in the freezer. What bothers me is the change in temperature. I get sick easily. It is hard work and the floor is slippery. If you fall you will get attention – but only in the moment. If you are bleeding they send you from the floor. But you never get any treatment after that.” Male worker shrimp processing factory, Khulna.

“We are all supposed to be permanent workers at our factory. But this isn’t true. None of us have an ID card.” Woman worker, shrimp processing factory, Khulna.

“Yes, the inspectors come, they have to come at least once a year. But they always inform the management first. The management then arranges everything: they change the shifts and only put people on who agree with them. They even prepare a separate salary sheet. The inspectors know the management, they are all friends.” Woman worker, shrimp processing factory, Khulna.

“One day an inspector came to our factory. I knew him, his family were friends of mine. He came over to talk to me. We didn’t talk about the work, just said hello. He asked about my family. But later, the management called me in. They were very worried. They wanted to know what I said. I felt uncomfortable, I feel like they are always watching me now.” Male worker shrimp processing factory, Khulna.

Source: Focus group with 2 men and 14 women workers in a shrimp processing factor in Khulna. The focus group was held outside the factory in the offices of the Solidarity Center affiliate in Khulna.

³⁶ Many of these informal workers are considered permanent—they are contracted year round, but their hours and pay may vary.

5.2.3 Health Concerns

A number of health concerns have been raised about shrimp production and the consequences of a shift to semi-intensive shrimp aquaculture in rural areas. Fry collectors who sift the surf and estuaries for fingerlings spend significant amounts of time in the water. Women fry collectors may suffer particular types of vaginal and fungal infections as a result of their activities.

Similarly, in areas where the density of shrimp farms has risen sharply, concerns about water-borne disease have also been documented (Kabir, 2005). Standing water increases the likelihood of malaria and other mosquito-borne diseases. While the net impact of shrimp farming on health is difficult to establish, some researchers have estimated that extensive farming may increase the risk of water-borne disease by as much as 50 percent (Bhattacharya et al 2005).

Additionally, concerns about injuries and health-impacts of working in the processing factories remain unresolved. Arthritis, urinary-tract-infections, varicose veins, repetitive strain, muscle strain, cuts, inflammation, fungal infections, and diarrhea, are all ailments widely reported in the industry (Halim, 2004). Some of these ailments are the direct result of working conditions where workers stand for long periods of time and are exposed to significant temperature differences when compared with ambient temperatures. Others are the result of a failure to wear protective clothing, in particular gloves, in combination with exacting production targets. Employers may not provide sufficient protective gear or may subject workers to pressure to meet exacting production targets requiring that they work faster and increase their productivity.

5.3 Cost Benefit Analysis of Shrimp Aquaculture

There are few studies that attempt to estimate the monetary costs and benefits of shrimp aquaculture and their distribution in Bangladesh. The Centre for Policy Dialogue (CPD) research stands out among those studies that have been undertaken. In 1998, the CPD undertook a detailed environmental and social cost benefit analysis of shrimp aquaculture that attempted to explore the nature of the costs and benefits generated (Bhattacharya et al, 2005). Using a variety of valuation techniques Bhattacharya *et al* estimate the costs of lost agricultural production, the costs of mitigation, restoration and land reclamation, livestock loss, the health impacts in terms of increased mortality and morbidity, and the costs of deforestation in terms of lost timber and fuelwood as well as foregone pharmaceutical values. They compare these estimates of costs to the benefits from export earnings in the sector.

Although such calculations are fraught with methodological and data limitations, they can be illustrative of the underlying costs and benefits generated in a particular sector and the potential incidence of these costs and benefits. Such social accounting exercises are more than academic endeavors and can usefully inform both policy and programs. Applying a production function analysis that calculates foregone production the authors conclude that

the annual cost of shrimp aquaculture is approximately 2,464.4 million BDT.³⁷ When the cost of mitigation and restoration is used to derive an estimate of the total cost of aquaculture, this figure rises to 3,558.4 million BDT.³⁸ The benefits are placed at about 11,889 million BDT.³⁹ Although not all of the external costs have been calculated, this analysis is indicative of the potential to devise programs and policies to compensate for some of the environmental and social costs by taxing and redistributing revenues generated within the sector or engaging in cleaner production techniques.

It is important to note, however that some of the environmental costs, such as biodiversity loss, are irreversible and compensation is not necessarily possible. Yet, the analysis holds important implications for minimizing external costs by changing production methods and approaches or by improving the terms and conditions of production for workers and for compensating for other costs that cannot be minimized.

6. Complementary Economic Activities

6.1 Fruit and Horticulture

Polyculture of shrimp and other crops can increase food security, diversify the income portfolio and raise incomes for the rural poor. Bangladeshi farmers have pursued mixed aquaculture, rice paddy and horticulture for several centuries. In June and July they would plant rice and harvest fish cultivated in the same paddy. In November and December they would harvest rice and follow this with oil-seeds, pulses, and vegetables. Integrating these types of cropping patterns with shrimp cultivation has significant potential to improve rural livelihoods and meet local food security requirements.

6.2 Rice

Mixed aman rice and shrimp is also a viable strategy to ensure food security and diversify income-earning for small farmers. The FAO (1985) has documented some of the positive synergies between rice and shrimp:

- After rice harvesting, detritus and the remains of the paddy plant stem become food for the microorganisms through the process of bacterial decomposition. In turn these microorganisms feed the shrimp.
- During shrimp culture, the molted shells of shrimps and the heightened metabolite load enriches the soil through and contributes to organic fertilization of the soil for paddy culture.

³⁷ The reference year for this study is 1994.

³⁸ These costs value only a portion of the direct and indirect environmental and social impacts. No attempt has been made to explore existence values and a full specification of option values (see Pearce and Turner, 1990).

³⁹ These benefits only consider the direct benefits and do not include estimates of any multiplier effects generated through the expenditure of wages and income garnered in the sector.

- Sediments deposited during water exchange for shrimp culture also enrich the soil for paddy culture.

This system works best where farmers are land-owners or tenants for the entire year. The FAO observes that where the tenants for different crops are different, a competition for land can result that reduces earnings for the paddy farmer. If the tenant shrimp farmer can influence the land owner to increase the time allotted to shrimp cultivation this will affect the paddy cultivation, since the water in the pond is not drained in time to plant and harvest optimally.

6.3 Forestry

6.4 Fish Aquaculture

A recent study of polyculture in Thailand underscores that fish and shrimp aquaculture has the potential to raise and diversify income sources (Yi and Fitzsimmons, 2003). Three versions of tilapia-shrimp⁴⁰ polyculture—simultaneous, sequential, and crop rotation systems—are practiced by Thai shrimp farmers. Tilapia is a species that is particularly well-suited to freshwater farming because of its tolerance to varying water quality, the ease of reproduction, and tolerance of both natural and artificial foods. The only constraint for tilapia farming is the temperature: at less than 16°–17°C tilapia does not feed and it dies at temperatures lower than 10°–12°C.

Yi and Fitzsimmons (2003) find that among the farmers who adopt a simultaneous tilapia-shrimp polyculture system in Thailand, 76.9% released tilapia directly into shrimp ponds, and 23.1% stocked tilapia in cages suspended in the shrimp ponds. The survey revealed that shrimp production and economic returns from the two simultaneous polyculture systems and in sequential polyculture systems were higher than those in the shrimp monoculture systems practiced before. Furthermore, shrimp production and economic returns from these polyculture systems were higher than those in the crop rotation polyculture system and in the currently practiced monoculture system. Additionally, there was evidence that the tilapia-shrimp polyculture could improve water quality in shrimp ponds, reduce diseases, and reduce the use of chemicals.

Some species actually perform better in the presence of other fish and crustaceans. Freshwater prawn is one such variety (Lutz, 2003). When certain fish species that do not predate prawns, such as tilapia are stocked with *M. rosenbergii*, their feces serve as a substrate for bacterial growth, which in turn provides additional nourishment for the prawn (*ibid*).

Fish cultivated in small ponds are typically consumed or sold in the domestic market. A mixed shrimp-fish aquaculture system has the advantage that fish can also be processed for consumption during the lean season. Fish processing by salting and drying is usually

⁴⁰ Tilapia-shrimp polyculture can take place in a wide range of salinity levels from 0 to 30‰. Tilapias used in polyculture in Thailand include red tilapia (*Oreochromis spp.*), Nile tilapia (*O. niloticus*), and Mossambique tilapia (*O. mossambicus*).

undertaken by women. PROSHIKA has worked with women's groups to provide technical assistance and loans to promote fish processing. The average loan provided is 100,000 BDT and it is repayable in one year. PROSHIKA have demonstrated that this activity can yield an average income per member of between 1,200 and 1,500 BDT per month (Rahman, 1998).

7. Conclusions and Recommendations

It is clear that to effect significant improvement along the value chain, additional funds need to be invested in upgrading infrastructure, improving marketing channels, expanding markets, and ensuring compliance with existing regulations and quality requirements. This additional investment should increase the returns captured throughout the value chain and has the potential to improve the terms and conditions of employment and production for workers and small producers.

7.1 Improvements within the Existing System

7.1.1 Intensification

- (i) Modified Traditional Practices
- (ii) Semi-Intensive Production

Bagda is unfortunately prone to a number of viruses including the White Spot Syndrome Virus (WSSV) that affected Bangladeshi production in 1995. WSSV was first documented in Asia in 1992-93 (Jory, 1999). Rapid and complete pond mortality can occur in infected animals. Although golda is not prone to WSSV it can act as a carrier. To reduce the risks of contamination, farmers require virus-free larvae and need to adhere to strict hygiene requirements to prevent cross-contamination from other infected shrimp and crustaceans. In Thailand, management protocols endorse cleaning ponds with short-lived insecticides that kill other crustaceans that may also carry the virus (Jory, 1999). Since WSSV does not survive outside of a host for more than 3 to 4 days, treating the ponds in this way for a minimum of 5 days can reduce the risk of contamination.

The introduction of seed certification (see Section 7.8.1) and adequate hygiene and water management techniques can be an integral part of strategies to keep ponds and stock virus free.

7.2 Trade-off Between Bagda and Golda

Bagda and golda are both valuable crops. Golda, however, garners higher prices in the market, faces fewer risks from viral contamination and is associated with lower environmental impacts. Because golda farms are generally smaller than bagda farms (averaging 0.28 hectares compared to 4 hectares) golda cultivation supports a greater proportion of poor and marginal farmers (DoF, 2002). Furthermore, women are more visibly engaged in golda production. Efforts to increase the share of golda produced by small farmers following examples such as the Noakhali Aquaculture Extension Project supported by DANIDA and the CARE/ICLARM projects could prove particularly successful. USAID could provide resources to distill the lessons learned from these projects and promote their replication in other regions of Bangladesh.

7.3 Drawing More Land into Production

7.4 Complementary Production

A variety of types of complementary production and polyculture could be implemented that would increase returns, reduce risk and ensure greater food security for small producers. This can either be done in the shrimp ponds themselves or undertaken sequentially so that the cultivation of different species is part of the water management and treatment process. Not only does such an approach increase yields and diversify risk, but it has the potential to absorb more labor and potentially absorb labor that may be displaced from fry catching.

Among the opportunities for polyculture could be mixed cropping systems with:

- Carp
- Tilapia
- Milkfish
- Mullet
- Clams
- Scallops
- Mussel
- Oysters
- Mud crab

An additional feature of polyculture systems is that they require labor for sorting at harvest time. A labor abundant country such as Bangladesh should have no difficulty contracting additional workers at harvest time. USAID should consider supporting projects that integrate polyculture into their activities and focus on small farmers.

Other types of mixed cropping systems could include aman rice, horticulture and timber. **[To be expanded].**

7.4.1 Feed Production⁴¹

In addition to the diversification of homestead and small-farmer production, there are opportunities to substitute domestically produced feed for imported feed. Currently, the majority of shrimp feed that is applied is imported. Shrimp feeds require higher protein content than fish feeds. These feedstuffs are both expensive and occasionally problematic. There is a danger of viral contamination from the imported feed since the feed is frequently made from animal and vegetable proteins.

A number of sources of protein, carbohydrates, fats, vitamins, and minerals which are derived from raw materials available in Bangladesh can be considered for shrimp feed:

⁴¹ We are grateful to the BFFEA and Alhaj Ali Hassan Chowdury Secretary General of the Shrimp Hatchery Association of Bangladesh for detailed information on this section of the report. We also draw on findings from Suprayitno, and Widagdo (2003).

- Legumes: soybean meal, soybean flakes, green pea meal, etc.
- Miscellaneous fodder plants: sweet potato leaves, cassava leaves, water hyacinth.
- Roots and tubers: sweet potato, cassava, sago, molasses.
- Cereals and cereal by-products: rice bran, broken rice, corn meal, wheat flour, sorghum.
- Oil cakes: copra meals, copra oil, palm oil, corn oil, ground peanut cake, etc.
- Feeds of animal origin: blood meal, meat and bone meal, bone meal, shrimp meal, fish meal, earthworm meal, hydrolized feather, limestone powder, squid meal, clam powder, fish liver meal, white fish meal, etc.
- Other feedstuffs: Vitamin sources in synthetic form are available commercially and premixed or sold individually or in combination of two or more. Vitamins that are usually added to the ration are vitamins A, D, E, K and B12, choline, niacin, riboflavin, pyridoxin, vitamin, calcium, panthothenate, biotin, folacin, ascorbic and inositol. Mineral sources: Calcium, phosphorus, sodium, chlorine, potassium, iron zinc, cobalt magnesium and iodine.

Sourcing nationally will increase the backward linkages in the sector and the employment benefits secured. Additionally, some of these inputs could be produced locally by small producers, cooperatives and women-owned businesses. USAID could provide resources to expand the local production of feeds with a higher nutritional content that target small producers and women-owned businesses.

7.5 Marketing Systems

7.5.1 Spot Markets

Spot markets and auctions offer farmers and intermediaries higher prices. Injecting credit into the sector lower down the value chain and expanding spot markets could release many small farmers and intermediaries from usurious contracts. Expanding depots where auctions are held and providing resources to ensure that they meet compliance requirements and standards could increase the returns lower down the value chain and ensure that these returns are better distributed.

USAID could work with the Department of Fisheries to identify regions lacking depots and provide targeted credit and assistance to increase the use of auctions and spot markets.

7.5.2 Temperature and Salinity

7.5.3 Cold Storage

7.6 Credit and Financial Services

Clearly, a cycle of indebtedness and sub-optimal contracting prevails along the value chain. Fry collectors, farmers, faria and aratdar are indebted and indebt others, and are locked into contracts that perpetuate this cycle of debt. Providing flexible credit to enable small

producers and intermediaries to invest, upgrade and adopt better management practices would alleviate debt burdens and free agents to seek better contracting arrangements.

Historically credit has been available in the sector, but has been targeted at the higher end of the value chain. The Department of Fisheries has identified a pressing need to provide credit to activities lower down the value chain. Specifically, DoF recommends offering credit facilities for the development of improved extension services for farmers, improved post harvest practices and improved water management regimes in the polders (DoF, 2002c). The DoF recognizes that targeting funds to the production sector will require a more decentralized and responsive system. They recommend that financial resources be divested at the Upazila Parishad level and priority given to improving extensive production systems and post harvest practices.

USAID could work with the Government of Bangladesh and development organizations to provide credit. The credit should be offered with technical assistance and tied to specific investments. In the case of fry and shrimp faria and aratdar they can upgrade their fry and shrimp management by adding drums and containers, as well as cooling, water treatment and feeding, where appropriate. Similarly, in the case of shrimp farmers the credit could be provided for specific investments in pond excavation and treatment, water management, feeding and hygiene. Credit could also be provided to diversify out of shrimp production and increase the portfolio of arable crops and horticulture. Credit could be provided for individually and collectively owned enterprises to produce shrimp and fish feed to substitute for imported feed. Since this is likely to be a female intensive activity, these credits could be marketed towards women.

Repayment schedules and horizons should be flexible and reflect the likely yield stream of the activities in question. Credit should be graduated and lending can be extended to groups if individuals do not have sufficient capital or assets to offer as collateral.

7.7 Extension Services

Extension services along the value chain are critical, both to promote and enhance upgrading and to shift producers into complementary economic activities. Extension services and technical assistance can be provided through a variety of mechanisms. Extension could be provided through the Department of Fisheries, NGOs working in particular regions, the Bangladesh Shrimp and Fish Foundation, as well as through shrimp processing plants to ensure the integrity and continual supply of shrimp and prawn.

Certainly, the Department of Fisheries believes that the failure to provide targeted and appropriate extension services has accelerated the spread of disease and increases the risks borne by small farmers and traders:

“One result of the lack of support is the prevalence of diseases, reducing survival, lowering yields and reducing profits.” (DOF, 2002a:3)

“The lack of handling, transporting and pond stocking techniques of traders and pre-nursery operators and the shrimp farmers themselves also contributes to poor survival rates of fry (estimated at 60-70%). (DOF, 2002a:3)

Extension services should provide information that is easily understood and applied. Popular education techniques, pamphlets, cartoons, audio-visual materials, dramatizations as well as workshops and on-site visits can be targeted to a wide audience of both men and women.

7.8 Moving up the Value Chain

This section outlines some of the potential interventions that could move agents up the value chain or enable them to capture more of the rents along the chain. USAID could consider supporting projects and interventions that would provide resources for the following activities:

- Among the options to increase the returns for farmers is through nursery production. Simple nursery production methods can be introduced through the construction of a shallow nursery pond within the confines of each grow-out pond. With a two-phase production cycle, the farmers stock juvenile shrimp from hatcheries in nursery ponds and then, several weeks later, transfer the juveniles to grow-out ponds. The shift to a two phase production process increases survival rates and allows for more continuous production. The Department of Fisheries could provide training to provide the technical expertise required to expand nursery production on farms and for acclimatizing fry sold to farmers by aratdar.
- Greater returns could also be secured for small farmers through organizing and pooling their resources for shrimp culture instead of leasing their land to large farmers. This would require efforts to support farmer collectives.⁴² create collective storage, post-harvest processing and refrigeration facilities; encourage shared transportation; and provide extension services to collectives and associations of small farmers.
- There is an urgent need to develop linkages between shrimp farmers and processing plants. This would reduce the number of intermediaries and also to ensure greater product integrity. There is the potential for the factory to provide capital to the farmers and the farmer supply shrimp to the processing plants.
- For processors, adding new products and diversifying the range of products available provides another opportunity for value addition. Exporting “heat and eat” and semi-cooked products may provide a new retail niche for Bangladeshi shrimp exporters.
- Finally, introducing low-cost and appropriate technology traceability measures could increase the price at which fry and shrimp are sold. Labeled and dated buckets and drums for transportation, feed sacks that are labeled and dated, bar-code labels for

⁴² Farmer collectives should include both male and female householders and workers.

transported fry and shrimp could be easily implemented to maximize traceability and increase compliance.⁴³

7.9 Social and Environmental Concerns

A range of options may be available to the shrimp sector to improve environmental outcomes and address social and human rights concerns. It is important to note here that a number of prominent grass roots organizations and activists, most notably groups such as Nijera Kori, maintain that any attempt to ameliorate the environmental and social costs will be insufficient and only allow current perpetrators to continue evade poorly enforced rules and regulations. For these groups, the environmental and social costs far outweigh the potential gains (Nijera Kori, 1996; Adnan, 1998). Other groups such as the Centre for Policy Dialogue and the Coastal Development Partnership believe that the environmental and social costs are significant, but that there may be measures that can be implemented to reduce these costs and improve the lives and livelihoods of those who are working in the sector (Bhattacharya et al 2005; Tutu, 2004).

The recommendations included in this report focus on how the rents and returns may be better distributed across the value chain to ensure that the sector fosters pro-poor growth that is also pro-environment. In keeping with the recent USAID Country Strategic Statement, these recommendations also focus on Strategic Objective 12: Expanded economic opportunities created through equitable economic growth; and Strategic Objective 14: Improved food security and disaster mitigation, preparedness and relief.

7.9.1 Environmental Regulations and Guidelines

(a) The sector should be encouraged to develop a series of environmental guidelines and protocols that are consonant with existing environmental laws and regulations. These guidelines should be developed consensually and consultatively under the auspices of an independent or semi-autonomous body (see section 7.9.4). Clear definitions need to be developed for extensive and semi-intensive production and zoning regulations should be developed and implemented that are appropriate for each region.⁴⁴ These guidelines and protocols will define extensive and semi-intensive methods of cultivation that are based on stocking densities, input usage, nutrient recycling and discharge.

(b) Fry catching should be actively phased out and incentives developed to absorb displaced fry catchers in other economic activities. The Department of Fisheries has developed a series of guidelines with stakeholders that provide recommendations for phasing out this activity (DOF, 2002a). As an interim measure, fry catchers could be issued with permits and licenses that allow the seasonal capture of fry. The Department of Fisheries recommends an open season from April to September in addition to providing training for catchers and traders in

⁴³ For similar approaches refer to the Noakhali GOLD project supported by DANIDA which has implemented low cost and appropriate technology traceability measures with tremendous success.

⁴⁴ Zoning should be undertaken at the Thana and Upazila level and overseen and approved by the appropriate authorities including the Department of Fisheries, Bangladesh Water Development Board, Ministry of Land, Ministry of Forests and Environment, Thana Nirbahi Officer, and the Upazila Nirbahi Officer.

improved catching methods that reduce by-catch, better handling, storage and transport methods. The same document also advocates further regulating the broodstock fishery to protect stocks in addition to releasing hatchery fry into coastal areas to replenish stocks.⁴⁵

(c) Efforts should also be made to enable fry-catchers to switch into other economic activities such as feed production, operation of shrimp fry nursery, shrimp fry trading, artisanal production of fishing traps and gears, operation of fish feed mills, shrimp de-heading for processing, crab fattening, hogla and mat making, bee-keeping, coir industry, tree plantation, horticulture, tailoring and knitting etc. Credit and training could be provided to facilitate their diversification into other activities.

(d) In the case of hatchery production seed certification is also required to ensure the continued production and supply of quality hatchery bred shrimp seeds. Seed certification requires the screening of shrimp brooders and seed lots for viruses and deformities using quick and reliable diagnostic techniques. Seed certification should generate a demand for certified seed that will facilitate a shift away from over-fished wild-caught fry. A careful evaluation of existing programs that have attempted to introduce seed certification—such as the FAO “Empowerment of Coastal Fishing Communities for Livelihood Security” in Cox’s Bazaar, and the DANIDA Greater Noakhali Aquaculture Extension Project should yield concrete recommendations for how to implement and expand such a program.

(e) Shrimp producers adding feed and fertilizers to their ponds should be encouraged to introduce settlement ponds, canals, and biological filters (biofilters) that treat the effluent. These ponds capture the nutrient-rich sediments so that they are not released into local waters. Suspended solids can take a week to settle out. Similar experiments in Colombia have found that an area equal to 10-25% of the surface area of the ponds is required for adequate settlement and treatment.⁴⁶

(f) Finally, the existing laws and regulations need to be reviewed and revised. As Bhattacharya et al (2005:81) observe: “there is no shortage of policies and regulations that are directly concerned with the environmental consequences of shrimp cultivation⁴⁷Most of these policies are never implemented properly.” These authors are adamant that there is insufficient coherence in these laws and that supporting regulations and ordinances have not been enacted. They maintain that there is a need to review all of the documents and develop a unifying framework and a comprehensive law such as a Sustainable Shrimp Culture Act which could encompass all aspects of sustainable shrimp aquaculture, land management and conservation.

The Department of Fisheries has made significant inroads in identifying policy and legislative reform that could harmonize existing laws and regulations and address some of

⁴⁵ These recommendations were developed in a workshop and were endorsed by hatchery producers.

⁴⁶ See for example work by WWF

http://www.panda.org/about_wwf/what_we_do/policy/agriculture_environment/commodities/shrimp/better_management_practices/nutrient_loading/index.cfm

⁴⁷ These laws and regulations include the Fish Act (1950), Shrimp Mohal Management Policy (1992), the Shrimp Cultivation Tax Act (1992) and the National Fish Policy. Additional documents such as the Bangladesh Environment Conservation Act (1995), the National Environment Management Action Plan (NEMAP), and the National Conservation Strategy also lay out guidelines that are relevant for sustainable shrimp culture.

the environmental and social concerns (DoF, 2002c). Additional donor funds and resources directed towards enacting these recommendations and policies would prove particularly useful.

7.9.2 Labor Rights and Benefits

(a) Clearly, in the interim, as the sector grows and transforms, many workers will remain informal, working without contracts, IDs, and mandated benefits. Informal and sub-contracted workers do not have access to those benefits extended to formal workers, including health-care and pensions. One way that the Government of Bangladesh could formalize the provision of these benefits to informal workers in the sector could be through a Welfare Fund, taxing not the employers but the revenues generated in the sector. India has a similar system for *bidi* workers who produce hand-rolled cigarettes (Jhabvala and Tate, 1996). The *Bidi Workers Welfare Act* (1976) stipulates that revenues generated by the sector be taxed to create a welfare fund administered by the government. The welfare fund operates hospital and dispensaries, awards scholarships and provides school supplies and uniforms to the children of *bidi* workers. Such a system could be particularly useful to ensure that the children of informal workers in the shrimp sector, including fry catchers, have the opportunity to go to school and remain in school.

As the market becomes more sensitive to the terms and conditions under which shrimp are produced—particularly in Europe—the possibility of taxing the shrimp sector revenues to ensure that workers receive coverage for health-care and pensions is likely to be well-received.

(b) Another avenue for distinguishing Bangladeshi shrimp, increasing market share and ensuring improved terms and conditions of employment could be through the supporting ethical and fair trading initiatives. For example, the Ethical Trading Initiative is an alliance of companies, non-governmental organizations (NGOs) and trade union organizations based in the United Kingdom. The ETI exist to promote and improve the implementation of corporate codes of practice which cover working conditions in specific supply chains. The ETI works with local stakeholders in developing countries to develop codes of conduct, monitoring and verification procedures, and to provide certification for traded products. Their goal is to ensure that the working conditions of workers producing for the UK market meet or exceed international labor standards.⁴⁸

An alternative group that is keen to establish ethical trading initiatives is the Fair Trade Foundation (UK), representing the Fair Trade Labelling Organization (FLO).⁴⁹ The Fair Trade Foundation (FTF) is currently exploring the possibility of certifying the DANIDA Noakhali Gold prawn producers. FTF is working with the DANIDA producers to develop appropriate standards and codes.

Similarly, the Shrimp Seal of Quality Program (SSOQ) is attempting to address a wide range of social, environmental and labor rights concerns through the certification of standards.

⁴⁸ See for example, <http://www.ethicaltrade.org/>.

⁴⁹ See <http://www.fairtrade.net/>

The standards developed through the SSOQ program describe the requirements that must be met by shrimp operators (hatcheries, farmers, depots or transporters, processors, etc.) in Bangladesh in order to receive SSOQ certification.⁵⁰ SSOQ is a voluntary process certification and certifies that the operator is deemed to have met the minimum requirements in the areas of food safety and quality assurance, traceability, environmental sustainability, labor practices, and social responsibility.

Finally, a number of private sector initiatives are also emerging in the aquaculture sector. The Aquaculture Certification Council (ACC) which is based in Missouri in the United States, builds on the voluntary standards set by the Global Aquaculture Alliance Responsible Aquaculture Program. The ACC's mission is to "help educate the aquaculture public regarding the benefits of applying best management practices and the advancing scientific technology that directs them. By implementing such standards, program participants can better meet the demands of the growing global market for safe, wholesome seafood produced in an environmentally and socially responsible manner." The ACC has developed a "Certification of Aquaculture Production Processes for Seafood Buyers" that combines site inspections and effluent sampling with sanitary controls, therapeutic controls and traceability measures. This certification is currently targeted toward the seafood buyers and shrimp producers and processors (ACC, 2005).

USAID could consider providing funds and technical assistance to enable farmers to meet these types of standards and quality assurance measures by expanding programs such as the SSOQ to meet the needs of smaller farmers and tenant farmers. Such an initiative could be implemented in tandem with low cost appropriate technology traceability measures (see Section 7.8).

7.9.3 Land Titling and Access Rights

Clearly guaranteeing and upholding property rights is essential for any improvement within the existing system. Property rights include individual and collective title to land. Existing court cases disputing dispossession have yet to be adequately resolved (Kabir, 2005) and concerns about land insecurity for tenant farmers remain unaddressed in many communities. Nijera Kori estimates that 70 percent of all cases currently in local and national courts pertain to land-related disputes (Kabir, 2005). Progress must be made on land rights to reduce individual and collective risk and to ensure the rights of communities—in the absence of this progress, certification under ethical trading vehicles will not be earned.

Among the key concerns raised by NGOs working on environmental and human rights are those that relate to khas land. Khas land should not be used for shrimp cultivation unless the cultivation is extensive and it can be proven (1) that those households cultivating shrimp ponds are landless or land-poor, and (2) that they have elected to cultivate shrimp freely and without being subject to duress. Prosecution of rights to khas land is an imperative that should not be ignored. The Government of Bangladesh should take pains to ensure that collective rights to khas land are protected.

⁵⁰ The SSOQ standards can be downloaded at:
<http://www.enaca.org/modules/mydownloads/viewcat.php?id=101>

Additionally, where the same land is cultivated in sequence by several tenants, efforts to promote greater livelihood security can be significantly undermined. Initiatives that focus on diversifying the portfolio of crops cultivated—including shrimp and fish aquaculture, shrimp and rice—may need to be accompanied by support for more secure tenure and defined access rights.

USAID could support broader initiatives to investigate appropriate individual and collective tenure regimes and secure land title for the landless and land poor. Women’s land rights are largely secured through their relationship to a male family member.⁵¹ Changes in that relationship, such as those brought about by marriage, divorce, death and widowhood, can undermine a woman’s rights to land. Care should be taken to ensure that land title is extended legally to both spouses and that women’s inheritance rights are observed and protected. Initiatives to increase titling to the rural poor should make clear provisions for women and most particularly divorced and widowed women.

USAID could also support participatory analyses of optimal land management practices in areas where shrimp cultivation is being practiced. Where access rights to common property and grazing land have been undermined additional costs are imposed upon households. If these changes result in fewer head of livestock, an essential source of animal protein and fuelwood may be lost. Similarly, if shrimp farming does reduce the portfolio of crops grown locally the nutritional implications can be far-reaching and should be fully evaluated. The costs of the reduced availability of staples and animal proteins may not be distributed equally, calories may be prioritized for income earners—typically men—and women and girls may bear the brunt of any nutritional deficit. Additionally, if dung is not available for fuel, women may have to spend greater time gathering fuelwood to meet domestic cooking needs. The increase in time burdens may have significant impact on caring responsibilities and the welfare and wellbeing of women and children in the household.

In support of SO13 “A better educated, healthier and more productive population,” and SO14 “Improved food security and disaster mitigation, preparedness and relief,” USAID could consider providing resources to evaluate the full costs of shrimp farming in terms of any changes in local measures of food security and nutritional indicators as well as time burdens and intra-household impacts.

7.9.4 Institutionalizing Change

It is clear that to effect these recommendations, support will need to be given to current ministries—including Labor, Health, Agriculture, and the Department of Fisheries. Additionally, we recommend that the Government of Bangladesh consider creating an independent body that is vested with powers to inspect farms, processing plants and export facilities and ensure that compliance is being upheld. This independent oversight body should be quadpartite: composed of representatives from the private sector, government, labor movements, and civil society. The civil society representatives should be chosen to reflect environmental and social concerns and to ensure that the concerns and interests of

⁵¹ Patrilineal inheritance systems, dowry, early marriage and female seclusion contribute to women’s subordinate status (Kabeer, 2002).

the landless and land-poor are included in any directives issued by the independent oversight body.

This body should be responsible for developing guidelines and protocols to govern shrimp aquaculture that include definitions of intensive and extensive farming; zoning and land-use regulations; wetlands conservation and mitigation obligations; upholding common property and access rights in shrimp aquaculture regions; biodiversity protections that include protocols for brood stock and fry harvesting; and measures to monitor and ensure compliance. Where possible these guidelines should be introduced as regulations and ordinances following the appropriate legal and judicial procedures.

7.9.5 Continuous Monitoring

It is clear that an independent body composed of the principal sectors engaged in and affected by shrimp farming should pursue continual monitoring and oversight. Deliberate and persistent evasion of regulations or the failure to adhere to existing laws and ordinances should be sanctioned—either by curtailing access rights to open access resources such as marine and coastal fisheries, or by reducing access to credit, technical assistance, or tax benefits.

7.9.6 Data Collection

Finally, secondary data on shrimp production and marketing are extremely difficult to obtain and may be contradictory. Efforts to invest in data collection and verification could greatly improve policy and inform targeted and responsive interventions. The Department of Fisheries has diligently tried to collect and monitor data from the sector, but could benefit from additional resources and technical assistance to ensure that the data gathered are consistent and verifiable.

Similarly, greater efforts could be made to foster the inter-institutional exchange of data on the sector among a number of agencies including: the Bangladesh Bank, the Bangladesh Bureau of Statistics, the Ministry of Food, the Ministry of Land, the Ministry of Environment and Forests. Triangulating information and cross-verifying estimates of costs and returns in the sector will also improve policymaking. Furthermore, inter-agency collaboration could provide additional means of combating unlawful laundering in the sector and the diversion and misuse of credit. USAID could provide support for an inter-agency task force on data collection that would address improvements in generating and verifying data on the sector.