



**Feasibility study on augmenting homestead  
*Pangasius* aquaculture productivity in three  
Upazillas of Patuakhali through community  
participation**

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## Disclaimer

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## Executive Summary

In Bangladesh, aquaculture production accounts for 57% of the total fish production, in which *Pangasius* (*Pangasianodon hypophthalmus*) culture has contributed >20% of total culture contribution. This species was first introduced from Thailand in 1989 through the research initiative of Bangladesh Fisheries Research Institute. Through a successful artificial breeding technique leading to availability of seed, *Pangasius* aquaculture spread in wider geographical area across the country. *Pangasius* hatcheries have been developed mainly in Bogra and Mymensingh districts from where fingerlings are supplied via a private sector based seed supply network. Both commercial and farm made pellet feeds are used in *Pangasius* farming. *Pangasius* is marketed domestically mostly as live fish which provides year round supply of animal protein to low and medium income people in both rural and urban areas. Over the years, *Pangasius* aquaculture evolved to a shape of commercial enterprise having long backward and forward linkages providing livelihoods for a wide range of stakeholders.

Feasibility study on *Pangasius* aquaculture in three Upazills of Patuakhali region viz. Galachipa, Amtoli and Kalapara showed that farmers are quite interested to do culture of *Pangasius*, although right production technology is not available to their doorstep. A field survey among the Upazillas identified suitable homestead ponds with an average area of 22-26 decimal. It was also found that, in average daily 6 tons live *Pangasius* marketed in Patuakhali district from Khulna region revealed consumers demand with a higher price of Tk. 94/kg in comparison to major *Pangasius* culture zone of Mymensingh, where price ranged between Tk. 68-72/kg. Hatchery for *Pangasius* seed production in the area and available quality fish feed ingredients like fish meal, rice bran (auto), sunflower meal will contribute in low-cost farm made fish feeding to develop a farmers friendly *Pangasius* aquaculture practices in the targeted areas. Moreover, current massive development works in the Patuakhali coast requires a culture-based fisheries to fulfil the future demand of low to medium class consumers, which may not be enough from the present riverine fish species i.e. *Hilsa*. A moderate stocking density with advanced fingerlings of *Pangasius* with good formulation of farm made feed (28% protein) are suggested to demonstrate in the current culture season.

## 1 Background

The fishery sector in Bangladesh contributes around 3.61 per cent to GDP (DoF 2017). In addition to being a major source of animal nutrients, fish is also a major part of Bangladeshi culture. Some 18 million people of a total population of 155 million are estimated to be either directly or indirectly employed in the fishery sector, and 73 per cent of rural households are involved in aquaculture (World Bank 2017). Bangladesh is the fourth largest inland captures producer and the fifth largest aquaculture producer in the globe. During 1985–2013, annual average growth in fish production was 5.36 per cent, largely driven by the expansion in inland aquaculture fisheries, which grew at a rate of 10.16 per cent (FAO 2017).

The growth of aquaculture in Bangladesh has been fuelled by important research findings from the Bangladesh Fisheries Research Institute (BFRI), which has developed and disseminated 57 fish culture technologies and management techniques. The breakthrough in aquaculture technology development has opened a new horizon for self employment, income generation and poverty reduction for resource poor rural population in the country.

Homestead aquaculture occurs as a small component of the larger household farming system. In rural Bangladesh possess a small pond close to their homestead. Baseline survey data from five coastal districts of southern Bangladesh by the Cyclone Affected Aquaculture Rehabilitation Project (CAARP), showed average pond size to be just 0.039 ha (WorldFish 2008). Aquaculture play a important role as a form of insurance which reduces vulnerability and enhances resilience to circumstances likely to precipitate poverty, rather than as a transformative livelihood activity. Numerous development projects have promoted simple ‘improved’ management strategies, such as regular application of fertilizers and feeds, and the stocking of fish species in combinations and densities designed to move the production system from extensive to semi-intensive. When followed consistently, these relatively simple steps have been shown to reliably boost levels of production from less than 1 ton/ha to more than 3 ton/ha, thereby raising pond yields, household incomes and the availability of fish for family nutrition (Belton 2011).

Fish production from inland capture and culture fishery of Patuakhali is far behind from Barisal and Bhola districts under Barisal Division (DoF 2017). Although *Hilsa* is dominated in capture fishery and export to capital markets, cultured species like *Pangasius* is imported from other districts. Most of the ponds in Patuakhali district are under traditional culture system (Debnath *et al.* 2012). Lack of knowledge on fish culture is the main cause of the less production from pond aquaculture practices. This not only hampers the overall fish production but also hampers the fish demand fulfilment as well as the rural economy of the region. The aquaculture productivity of Patuakhali is far below from the average national fish productivity, which needs more attention in aquaculture farming practices.

*Pangasius* aquaculture in Bangladesh has improved the economic and social status of a variety of stakeholders in communities where the fish is farmed. Farming of the striped catfish, *Pangasianodon hypophthalmus* is a major aquaculture activity in aquaculture production hub like Mymensingh. The mean productivity of *Pangasius* is 37 ton/ha, where 87.9% of the farms produced between 15 and 65 ton/ha of *Pangasius* (Ali *et al.* 2012). *Pangasius* are typically

reared for 7-8 months, and harvested at 0.6-1.0 kg, with better capitalized farms generally opting to culture longer as larger fish obtain a better market price. Introduction of improved *Pangasius* aquaculture technology could increased the production rate to at least 15 ton/ha.

Feed costs generally constitute the highest single operational cost in aquaculture production and it accounts for 82% of total production costs, with an average food conversion ratio (FCR) of 2.04 (Munir 2009). In small scale homestead aquaculture system, women are participating in fish feed preparation from locally available ingredients and feed application in their households. Moreover, homestead aquaculture offers opportunities for women, because ponds are often constructed adjacent to the homestead in which women routinely engage. Pond aquaculture is an appropriate entry point for empowerment of women (IFAD 2006). 'Raw' unformulated feeds- most importantly rice bran and, to a lesser degree, mustard oil cake-are widely used throughout Bangladesh in homestead aquaculture.

Ensuring food and nutrition security, augmenting cash income for household expenses and utilization of family labor are the major issues of the rural poor. The role of small-scale aquaculture in household food and nutrition security, income generation and empowerment of women and marginalized communities has been increasingly appreciated in recent years. Fish has been considered as "Living Cash" and a pond is treated as "Savings Bank", because fish can be caught and sold whenever cash is needed. On the other hand, water sources and water retention capacity of soil of Barisal Division is good enough to support aquaculture in the region. Hence, the feasibility study was conducted to know the prospect and potentialities of *Pangasius* culture in homestead pond of Patuakhali region through application of improved culture technology.



*A typical homestead pond, suitable for Pangasius culture in the Galachipa, Patuakhali*



## 2 Objectives of the Study

The study was undertaken to observe the feasibility of use of homestead ponds of Patuakhali region for increasing aquaculture productivity and income generation through practicing of *Pangasius* aquaculture. The specific objectives are:

- To assess the prospect of adoption of *Pangasius* culture technique in the homestead farming system, and
- To assess the market potentialities and business promotion of *Pangasius* aquaculture practices in Patuakhali region.

## 3. Methodology

### 3.1 Study Area

The study was conducted in three Upazillas viz. Galachipa, Amtoli and Kalapara of Patuakhali-Barguna districts (Fig. 1). These Upazillas have been identified for promising in aquaculture because of availability of ponds and low-lying agricultural land, water resources in the form of canal and low-intervened aquaculture zone.

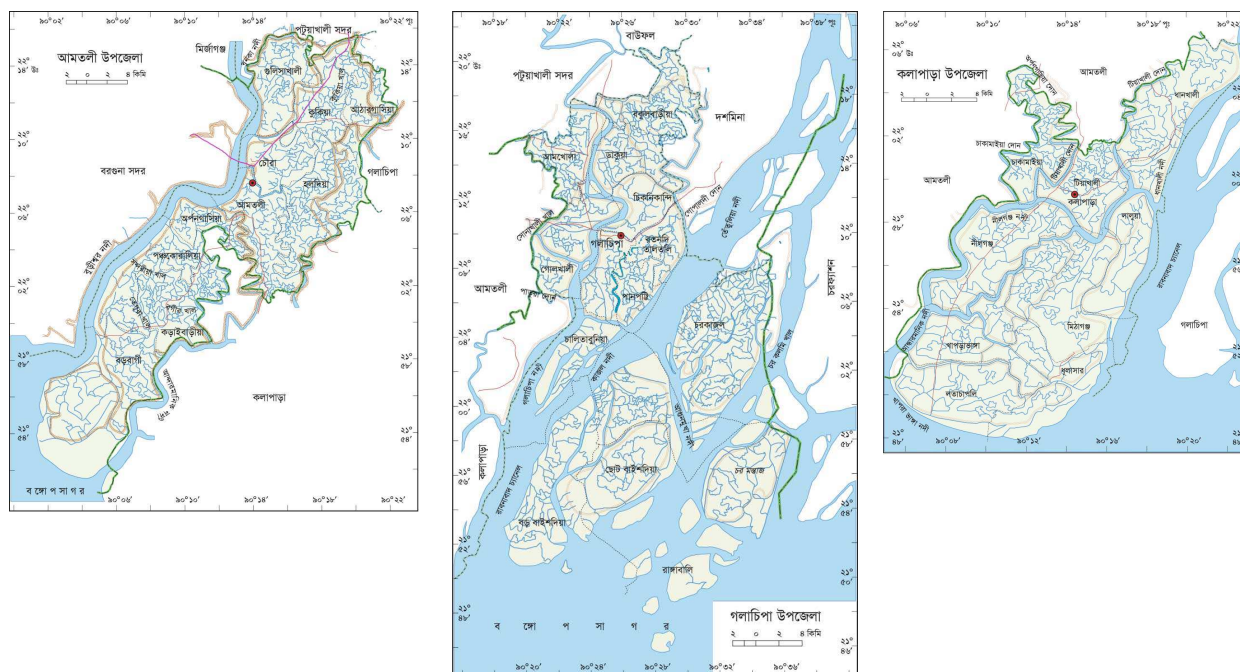


Fig. 1. Map showing the study areas of three Upazillas.

### 3.2 Data Collection Method

The study was conducted in the three different Upazillas (Galachipa, Amtoli and Kalapara) of Patuakhali region from 28 February to March 19, 2018. A combination of the participatory, qualitative and quantitative methods was used for gathering information through rapid appraisal. Fifteen ponds from each Upazilla were selected for the study. Series of individual interview, semi-structured interview and observation of activities were the primary sources of required data and information for this study. A structured questionnaire (Annex-1) was used for formal interviews with different farmer who owned pond suitable for *Pangasius* culture. Farmers were interviewed at their houses and/or pond sites. The interviews focused on history of fish farming, culture systems, pond preparation, stocking, feeding, marketing and constraints in fish culture.

Direct field observation was also accomplished in order to get the additional information on the culture practices and to justify cost-benefit aspects. The information collected from direct observation was useful for validation of data collected through structured questionnaire interviews. Three Focus Group Discussion (FGD) from 3 Upazillas and one FGD with fish traders were conducted during study period. Photographs were taken to record different activities.



*Focus Group Discussion with the stakeholder*

Crosscheck interviews were conducted with Key Informants (KI) such as Department of Fisheries personnel, fish traders, NGO workers and consumers to validate collected primary data.



In addition, more secondary data was collected from the related journal articles, books, reports and related web page.



*Discussion with the Assistant Upazilla Fisheries Officer at Amtoli, Patuakhali*

Numerical data which were collected in local units due to familiarity for respondents, converted into international units. Preliminary data sheets were compared with the original coding sheets to ensure the accuracy of the data entered. At each stage of survey, data were checked, edited and coded at the field-level.

### ***Secondary Information***

Secondary data were collected from several relevant organisations, including Department of Fisheries (DoF), Bangladesh Fisheries Research Institute (BFRI) and Bangladesh Water Development Board (BWDB). Literature reviews were also performed with several reports published by DoF, BFRI, WorldFish, BlueGold etc. Literature reviews were also performed with published articles and unpublished documents. Where information was found contradictory to that of secondary data, further assessment was carried out through field investigations and cross-check interviews with key informants.

### ***Data Analysis***

Data from secondary sources and questionnaire interviews were analysed using Microsoft Excel software. Results from the data analyses, in combination with qualitative information collected through various methods such as field visits, focus group discussion and cross-check interviews with key informants, were used to describe feasibility of *Pangasius* farming with production, consumption, production costs and returns, market price and profitability. The analysis was based on the farm-gate prices of fish and current local market prices of all other items.

## 4. Situation Analysis

In Bangladesh, inland aquaculture production is contributed mainly by the Indian major carps (Ruhu, Catla), Chinese carps (Silver carp, Grass carp), tilapia and *Pangasius*. However, *Pangasius* contribution was 29%, next to Indian major carps (32%) during 2015-16 FY (DoF 2017). This large volume of production shaped *Pangasius* aquaculture as an enterprise which in turn contributed to the development of other associated enterprisers in its value-chain. *Pangasius* has become an important fish for national food security in Bangladesh due to both the volumes produced and to its accessibility to lower income and nutrition bracket consumers.

### 4.1 Primary Study

#### *Field visit*

In the study area almost every pond owners were found engaged in aquaculture practice. From the study it was found that the average pond sizes of three Upazillas were  $21.5 \pm 1.29$  decimal,  $25.21 \pm 1.49$  decimal and  $26.2 \pm 1.32$  decimal, respectively in Galachipa, Amtoli and Kalapara (Table 1). The pond sizes ranged from 13 decimal to 50 decimal. The pond owners having 5 to 9 years experiences in aquaculture, although most of Blue Gold Polder Group members do not have any formal training on aquaculture practices. Fish farmers in Galachipa got lowest aquaculture support (37%) in the form of technical and input support and the figure in Amtoli was 47%. About 85% fish farmers got those type of support in Kalapara. Farmers got assistance also from local Dept. of Fisheries (DoF). Some farmers know the presence of a Research Sub-station at Kalapara.



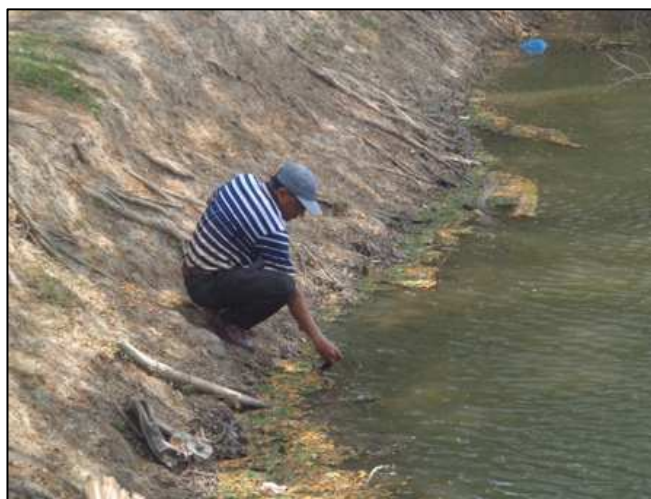
*Pond side interview with Mr. Osman Howlader at Badurabazar, Galachipa, Patuakhali*

**Table 1.** Key fish culture information from 3 Upazillas of Patuakhali region

Upazillas (responded nos.)	Fish farming practices				
	Fish culture experiences (Years)	Institutional support (%)	Pond area (Decimal)	Water depth (Feet)	Culture system (Polyculture, Monoculture)
Galachipa (15)	7.5	37.5	21.5	7.9	Polyculture
Amtoli (15)	4.7	47.4	25.2	6.8	Poly (73.7%), Mono (26.3%)
Kalapara (18)	9	85	26.2	6.7	Poly (90%), Mono (10%)

Most of the farmers stocked mixed species i.e. Indian major carps, Chinese carps, *Pangasius*, tilapia, and the stocking density was highly variable from farmer to farmer. Few farmers stocked shing, koi and golda chingri in their pond. At present most of the farmers interviewed (BlueGold Polder Group Members) in Galachipa and Kalapara Upazillas are not involved in *Pangasius* farming as a target species. In Amtoli Upazilla 26% farmers were responded as *Pangasius* farmer. It was reported that few farmers in Kalapara Upazilla are engaged in *Pangasius* farming. It was notable observed that most of the farmers use fertilizers, feeds in fish farming and use of commercial floating feeds is a common practice in the region. Farmers are well aware about disease problem in aquaculture.

Growth and production of fish mainly depends on the stocking of fingerlings at fixed number in different layers of pond which make less competition for food. Stocking density and stocking rate of a pond actually depend on its physico-chemical parameters and management practices. From the field visit, it was found that most of the ponds having natural water sources for feeding ponds or rain fed. Average depth of reported ponds were 5 to 10 feet. Notable there was no provision of underwater sources for fish culture practices. The observed water quality parameters are good enough for aquaculture (Table 2). On the other hand, pond bottom soil in the study region was lack of nutrients (Table 3).



Observing water pH in a pond at Baliatoli, Kalapara, Patuakhali.

**Table 2.** Water quality parameters from 3 Upazillas of Patuakhali region

Upazillas	Water quality			
	DO (mg/L)	pH	Alkalinity (mg/L)	Salinity
Galachipa	4.55-5.57	8.3	28	0
Amtoli	5.56	8	26	0
Kalapara	5.55	8.2	22	0

**Table 3.** Soil qualities of pond bottom from 3 Upazillas of Patuakhali region

Upazillas	Soil parameters			
	pH	Total Nitrogen	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub>
Galachipa	5.0	Low	Low	High
Amtoli	5.0	Low	Low	High
Kalapara	5.5	Low	Trace	High

On the other hand, according to local DoF personal a good numbers of fish farmers in the targeted region (personal communication). About 6,000 tons of *Pangasius* are produced in the Upazillas under study. Besides *Pangasius*, carps, tilapia and freshwater prawn (golda) are also cultured in the region by the fish farmers. Table 4 highlighted the *Pangasius* farmers and production in the Upazillas under study. These farmers could also play a good role in future expansion of *Pangasius* culture through improved technology.

**Table 4.** DoF recorded *Pangasius* farmers and production in 3 Upazills under study

Upazillas	<i>Pangasius</i> culture practices			
	Farmers	<i>Pangasius</i> farmers	<i>Pangasius</i> production	Other fish production
Galachipa	1,200	102	150	-
Amtoli	3,025	1,210	950	1,470
Kalapara	3,000	2,000	4,500	1,400

### ***Fish hatchery and Pangasius seed availability***

At least two fish hatcheries (one in Galachipa and one in Kalapara) are ready to produce *Pangasius* seed in the current fish breeding season. The hatcheries are medium sized hatchery and each having 100 pairs of *Pangasius* broods. The hatcheries collected broods from BFRI *Pangasius* stock and they are well trained in hatchery operation and nursery management of fishes including *Pangasius*. During the recent past *Pangasius* seed supply was mainly from Jessore region.



*Chanchal Matsha Hatchery, Boufal and Bay of Bengal Fish Hatchery, Kalapara in Patuakhali*

### ***Feeds and feeding practices***

Use of commercial pelleted feed was very common scenario among the farmers in study region. Farmers used floating feeds, however some farmers used farm-made feeds using local feed ingredients. Few farmers used cooked rice and kitchen wastage as feed irregularly. Feed conversion ratios (FCRs) for floating pelleted feed are comparatively lower than for sinking pellet feed: approximately 1.6 vs 1.8-2.0 for *Pangasius* (Hossain 2017). Commercial fish feeds are available to farmer doorstep through feed dealers. Farmers also received feed on credit from dealers. When dealers extend credit to their customers they typically add an extra 1–3% to the retail price, depending on the duration over which the credit is extended and the characteristics of the customer.



*Sunflower meal could be a good fish feed ingredients in the region*



*Small-scale fish feed mill in fish farm*



A good numbers of fish feed ingredients are available in the region. The prime feed ingredient- fish meal is produced in the Patuakhali region (Mohipur, Taltoli, Pathargatha etc.) and other potential feed ingredients like rice bran (auto rice mill), sun flower meal and maize are also available in the region. Locally collected some fish feed ingredients are analyzed for their nutritional composition (Table 5). Simple pellet mills (50–100 kg feed/hour @ the cost of Tk. 0.7 to 1 lac) could be manufactured in local workshops and operated by the fish farmers in a group.

**Table 5.** Proximate composition (%) of locally available fish feed ingredients

<b>Ingredients</b>	<b>Moisture</b>	<b>Crude protein</b>	<b>Crude lipid</b>	<b>Crude fibre</b>	<b>Ash</b>
Fish meal	15.21	43.01	16.00	1.60	14.40
Mustard oil cake	13.98	32.75	14.00	7.00	8.66
Soybean meal	11.00	41.00	1.00	8.50	9.50
Sunflower meal	8.22	31.16	13.11	8.00	5.23
Rice bran (auto)	14.43	10.88	22.00	8.00	7.43
Maize	13.33	6.43	4.93	8.00	1.16



*Pangasius in the local market*

## 4.2 SWOT Analysis

### 4.2.1 Strengths

- The farmers are very enthusiastic to know the improved aquaculture practices.
- Available ponds and nearby natural water source.
- Good number of consumers with market demand.
- Hatchery backup for quality seed production.
- Available fish feed ingredients, especially fish meal from nearby sources.

### 4.2.2 Weakness

- Insufficient knowledge and skill on improved fish culture technologies.
- Inadequate fisheries extension service.
- Farmers did not keep records on management practice, expenditure and income.
- Long and complicated value chain and weak transportation system.
- Less access to formal credit system

### 4.2.3 Opportunities

- Comparatively more profit due to higher productivity.
- High local market demand.
- More employment opportunity for the rural community.
- Homestead farming can

### 4.2.4 Threats

- Upland surface water supply and changing water quality.
- Natural disaster and climate change in the past.
- Availability of good quality seed, feeds in affordable price.
- Maintaining GAP (Good Aquaculture Practice) to ensure food safety compliance.
- Absence of insurance coverage.

## 5. Value Chain Analysis

### 5.1 Value Chain Actors of *Pangasius*

The *Pangasius* value chain analysis refers to the full range of activities that are required to bring the *Pangasius* from conception through the different phases of production to delivery to final consumers. In marketing and distribution of inputs, marketing costs and margins, number of middlemen in the marketing channel, distance between primary and retail markets, and consumers' behaviour on price are considered. In *Pangasius* production, distribution and marketing, a number of actors are involved in the value chain who play key roles in different aspects of value addition.

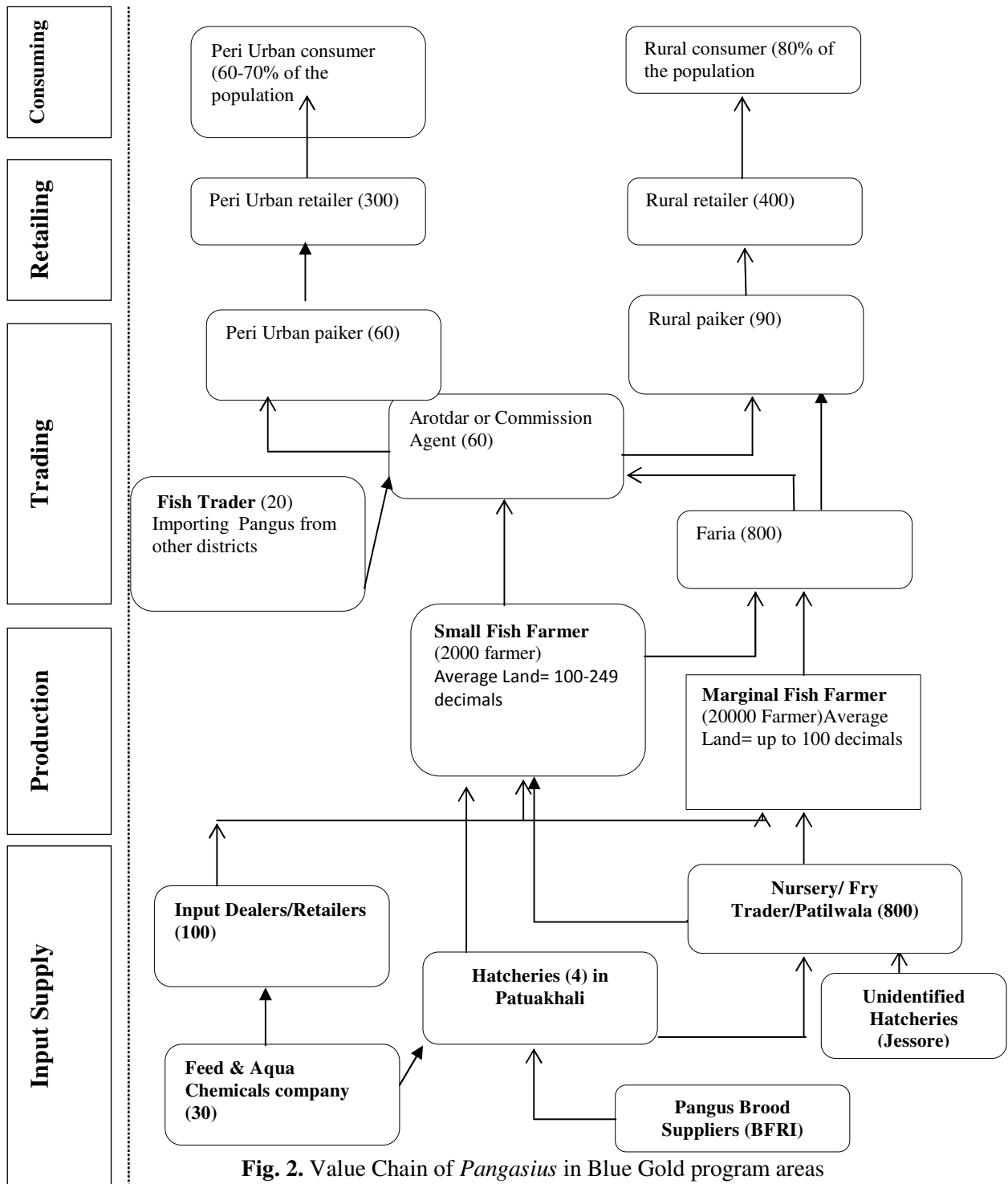
**Table 6.** Key actors and their roles in *Pangasius* production, distribution and marketing

Actors	Functions	Roles
Brood supplier	Brood production and supply	Production of quality <i>Pangasius</i> fry for brood development and sell to the hatcheries. Total number is undefined. Private sector <i>Pangasius</i> hatcheries could not produce quality brood throughout the year. Only BFRI could maintain the quality and supply to the hatchery owners.
Hatchery operators	Hatchery operators collected quality brood from BFRI and cultured fish up to 3 years for brood development	Hatchery owners produce <i>Pangasius</i> spawn/hatchling and sell to the nursery operators for fry production as well as hatchery owners produce fry/fingerlings for the fry traders or pond operators directly. Total number of hatchery is 2 in targeted areas.
Input supplier	Selling of feed and aqua-chemical	Selling of commercial or loose feed (floating and sinking), also selling aqua-chemicals eg. Zeolite, Lime etc. Total number of input supplier is around 100 in the targeted areas.
Nursery operators /Fry traders	Fry rearing and selling	Nursery operators purchase <i>Pangasius</i> spawn/hatchling from the hatcheries for the production of fry/fingerling and selling out to the fry traders/patilwala or direct to the pond operators. Hatchery owners also produce fry/fingerlings and sell to fry traders and medium to large pond operators directly. Total number fry traders are around 800 in the targeted areas and about 90% of the produced fries marketed by the traders.
Farmers	Grow-out	Farmers stocked <i>Pangasius</i> fingerlings from fish fry traders/patilwala or from hatchery owners and culture up to marketable size (around 1 kg) and sell to faria/paikars or arotdars (commission agent).
Foria	Trading	Marketable size <i>Pangasius</i> purchase from farmer's pond (mostly extensive) and sells to arots or paikers. Total number are 800 and doesn't play any significant role in value addition. The channel through forias is

		quite informal.
Arotdars	Trading	Arranges or negotiates sales for the sellers on a commission basis. Mainly collecting <i>Pangasius</i> from farmers and forias, and They often act as wholesalers; takes around 4% commission from the selling price. Total number is around 60 in the targeted area.
Rural paikers	Trading	Buy fish from arots and trade mostly to the rural retail markets; sometime faria also act as paiker. Total number is around 90.
Peri-Urban paikers	Trading	Buy fish from both arots and rural paikers; trade directly to the urban retailers. Total number is around 60.
Rural retailers	Retailing	Collect <i>Pangasius</i> from different rural paikers and sell to the rural consumers. Also they collect directly from small farmers. Some faria also act as retailer. Total number is around 400.
Peri-Urban retailers	Retailing	Collect <i>Pangasius</i> from different urban paikers or arots and sell to the urban consumers. Total number is around 300.
Rural consumers	Consumption	Consumers located mostly in the rural areas. <i>Pangasius</i> consumers are mostly low income people. A major portion of middle income group also consume <i>Pangasius</i> irregularly
Peri-Urban consumers	Consumption	Consumers located mostly in the district headquarters and Upazila headquarters. Low income to middle income group people prefer <i>Pangasius</i> for its lower price.

*Pangasius* value chain is a structure of physical, economic and social transactions between individuals and enterprises engaged in raw material transformation into end products. Flow of *Pangasius* and money are exchanged through value adding transactions driven by profit and allocation. Figure 3 shows overall value chain of *Pangasius* in terms of input supply (backward linkage), production, distribution and marketing with value addition process in different stages.

## Value Chain Analysis



**Fig. 2.** Value Chain of *Pangasius* in Blue Gold program areas



## 5.2 Description of *Pangasius* Value Chain in BlueGold program areas

Conducting a value chain analysis requires a thorough investigation of what is going on between the actors in a chain, what keeps these actors together, what information is shared, and how the relationships between the actors evolve.

### 5.2.1 *Pangasius* consumer market

**Purchase Behaviour:** In term of protein rich food supply, *Pangasius* aquaculture impacted positively on both farmers and non-farmers living in and around the producing communities (Haque 2012). To the non-farmers who are poor, *Pangasius* was found cheaper protein source than other fish, meat and *dal* (lentil soup). This indicates the easy access of poor people to protein rich food being produced within their community. *Pangasius* aquaculture tends to make the fish available to the community people for longer period of time in the year due its higher survival, higher yield, regular/partial harvesting and sale.

**Seasonality:** The captured fishes are available for 5-6 months in a year (July-November) in Patukhali region and supply of those determine the consumption of *Pangasius* and other cultured species.

**Customer Group:** The poor people can afford the fish with their low level of income (BDT 300-500/day) that is not possible for carps, capture fishes and meat at regular basis.

**Desired Quality:** *Pangasius* is normally sold and transported to the market in live condition. People can buy this fish in live, thus its freshness was ranked with higher score compared to other perishable ones. According to the interviews (KII and FGD) of fish traders, 95% of the Pangas are sold in live condition whereas only leftover 5% are sold in dead condition.

**Comparison with other fish species:** Producers, traders and consumers have given almost equal scores to the *Pangasius* in terms of its preference to the children and age old members of the family. Children prefer this fish because of its less intramuscular bones and higher taste. The interviewee of value chain actors also ranked *Pangasius* first for its highest eatable (least wastage) portion. Particularly traders also expressed they need not to do initial processing thus they could save time during their business hour. The preference of *Pangasius* is possibly due to its cheaper price and easy way of pre-cooking processing to cook. Again, it can be estimated from the interviews of Arots that *Pangasius* are equally consumed in urban and rural areas.

### 5.2.2 Output Market

Output market comprised of trading and retailing which involve number of actors. Some are also play multiple in output market which has been observed in the targeted areas.

#### *Foria/Paikers*

In case of polder areas, *Pangasius* are sold via foria/paikers to arotdars. The amount of value addition done in this stage is very low; forias generally plays the role of transporting from remote farmers. The paikers also collect *Pangasius* from mostly Jessore and Satkhira region. Few years

back, they usually sourced *Pangasius* from Mymensingh region. Due to transportation hassle and higher mortality rate their first preference is now from Satkhira and Jessore.

#### ***Arotgars***

The arotgar is the main focal point that unites all the supply from various channels of *Pangasius* originated from the farmers. The arotgars in the targeted areas play the traditional roles of commission agent. *Pangasius* is marketed in live condition from farm to market transporting in water filled plastic drums to get the original live weight in the market place for ensuring higher profit margin. This contributes to food safety for the consumers because live fish has very little food hazards in terms of microbial contamination (Haque 2012). On the other hand, the price difference for live and dead *Pangasius* is around 20-30 taka/kg in the output market.

#### ***Paikers/ Retailers***

A significant number of paikers/retailers are involved in the rural and Peri-urban markets in the targeted areas for *Pangasius* as well as other fish trading. This indicates that *Pangasius* is not only contributing to the food security, also providing livelihood opportunities. Some of the paikers/retailers in the rural areas play multiple roles. For example, retailers/paikers in the rural areas also collect *Pangasius* and others directly from the farmer's pond. They have their own transportation system, drums, nets etc. or they arrange by themselves.

### **5.2.3 Production**

The *Pangasius* farmers in the BlueGold polder areas can be divided into two groups according to their production area size. Criteria followed from Bangladesh Bureau of Statistics. They are:

- **Small fish farmers:** The total cultivation area between 100-249 decimals. This area includes both owned and leased in ponds. In the program areas around 10% farmers are medium sized fish farmers. The expected number of small fish farmers in polder areas is around 2,000.
- **Marginal fish farmers:** This group of fish farmers normally own only 1 pond. Their total cultivation area is below 100 decimals. In the target areas majority of the fish farmers (90%) belongs to this category. The expected number of marginal fish farmers in the polder areas is around 20,000.

### **5.2.4 Input Service Actors**

#### ***Hatcheries***

There is only 1 hatchery in Patuakhali district which is currently producing spawn/fry/fingerlings and supplying in Barishal division. This hatchery is producing around 5 million fry instead of production capacity of 10 million. Moreover, the spawn/fry are directly sourced by the nursery operator from Jessore or Barishal. Almost 75% of the nursery operators of this region collected spawns/hatchlings from Jessore or Barishal region while large hatcheries from Jessore dominate the supply.

#### ***Brood Supplier***

In the targeted areas the Chanchal Hatchery do collect brood fish from Bangladesh Fisheries Research Institute (BFRI). It has been observed that most hatcheries (in Jessore) have own

broodstock rearing pond and every year owners recruit new broodstock from their own farms or from different grow-out farms.

### ***Nursery cum Fry Trader/Patilwala***

Nursery is an important value chain actor for *Pangasius* farming like other culture fish farming. Conventional and Over-wintering nurseries are present in BlueGold program areas. However, rate of mortality is high for the *Pangasius* nursery. Primary Study found that mortality of *Pangasius* spawn/fry in hatchery/nursery is as high as 60%. However, nurseries still make a lucrative profit due to the profit margin for the fingerling of *Pangasius*. For Chanchal hatchery production cost is around 0.40 taka/pc, whereas sales price is 1 taka/pc. The traditional nurseries usually do sell the fries directly to patilwala/hawker or medium to large farmer.

### ***Input Supplier***

Feed is one of the most important inputs to increase *Pangasius* production. A major controlling factor of growth for *Pangasius* is feed intake. Feed costs generally constitute the highest single operating cost in *Pangasius* aquaculture. Thus, there is a high degree of variability among farmers in terms of their use of supplemental feeds to minimize the production costs. A variety of feeds is used for *Pangasius* farming including supplementary diets, farm-made feeds and industrially produced feeds. Now-a-days in the targeted areas commercial is the dominant one.

With the advance of time and for vibrant private sector, commercially produced feed have been made available to augment production. In recent years, several small to medium sized feed industries have been established in the production hubs of *Pangasius*. The study did not notice any feed mill operating in the targeted areas. There are about 100 feed mills producing aquaculture feeds and marketed both in nationally or regionally. All aquaculture feed industries produce *Pangasius* feed and others. However, maintaining feed quality remains problematic, and in many instances, poor feed quality results in low production. Furthermore, feed ingredient prices have risen dramatically in recent years.

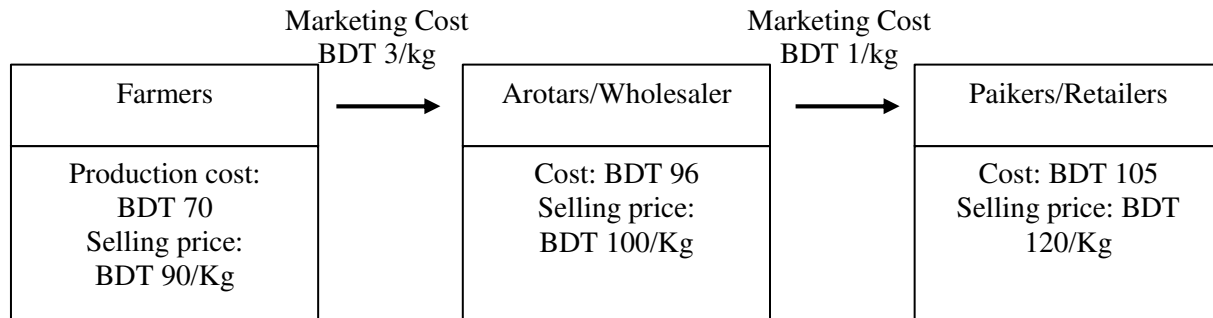
In addition to feed, farmers also depend on natural productivity of ponds for feeding of carp with *Pangasius* through the application of fertilizers, such as cow dung, urea, murate of potash and TSP. It has further been reported that farmers are often induced to use various feed supplements, such as probiotics, hormones, enzymes, growth promoters, antibiotics and other substances which are not certified by the relevant authorities, and that their use does not fall within defined quality standards. There is also a need to build capacity to enable famers to assess the quality of their feeds and feed additives.

### ***5.3 Margin and Value Addition***

A total of BDT 26 value added to *Pangasius* from farm gate to the retailers. The highest value addition (46%) is done by the Paikers/Retailer, while second place is taken by the farmers (38%) and least by Arotdars (15%). Paikers are key actors in delivering the products to a larger perimeter, which gives them the leverage of increasing the price as per their costing. Arots, generally acting as a commissioning agent has the lowest value addition (15%), as the bargaining between the Arotdars and Paikers are mostly dominated by the Paikers.

**Table 7.** Value addition at present

	Farmer	Arot	Paikar/Retailer
Price	90	100	120
Marketing cost	3	1	8
Value Addition	10	4	12
Value Addition %	38	15	46

**Expected Margin and Value Addition**

If the farmers use cost effective locally produced sinking feed, the farmers would enjoy a higher profit margin of 55% compared to existing 38%. The expected value addition figures would be as follows:

**Table 8.** Value addition as expected

	Farmer	Arot	Paikar/Retailer
Price	90	100	120
Marketing cost	3	1	8
Value Addition	20	4	12
Value Addition %	55	11	33

**5.4 Market Analysis*****Demand-Supply Situation***

It is difficult in district levels to estimate demand for any specific fish species. All fish supplied to the markets eventually consumed which makes it difficult to measure the demand for fish. However, in-depth interviews of output market traders confirmed that the demand for *Pangasius* has been increasing steadily in last five years and likely to increase more in future both in rural and peri-urban areas with few exceptions. Particularly, in last year excessive supply of hilsa fish dominated the market over other fishes. During the study, it was also observed that price of *Pangasius* was much higher in the targeted areas (Patukhali and Barguna district) than any other parts of the country. Output market traders reported that the price range of *Pangasius* in the retail market was 100-130 taka in the last year though the market experienced with huge supply of hilsa at that period. According to the field study (In depth interview and FGD with the traders), the targeted areas are deficit of *Pangasius* fish production. According to the traders/wholesalers

around 6 tons of *Pangasius* are coming to the targeted areas from different parts of the particularly from Satkhira and Jessore district.

**Table 9.** Supply of *Pangasius* in the targeted areas

	For local source (Patuakhali and Amtoli)	For source from outside (Satkhira and Jessore)
Average daily quantity	5 tons	6 tons
Cost of sourcing by wholesaler	96 taka/kg	94 taka/kg
Mortality rate	Zero	5 pcs/ drum (40 kg)

During the study, the key informants and some wholesalers reported that demand for cultured fish, particularly *Pangasius*, will increase many fold after the completion of ongoing huge development work (bridges, Pyra port, power generation plants etc.) in the adjacent areas. It will also lead to rapid urbanization and development of private sector commercial zones which would boost economic activities in the region. These economic activities will encourage private organizations to acquire lands to set up businesses which in turn will shrink natural water bodies for cultivation of fishes as well horizontal expansion of cultured fish. To meet the near future demand for fish, *Pangasius* may play an important role due to its high productivity, low market price and scope for vertical expansion. The *Pangasius* production in the targeted areas are still lagging behind and it will not be adequate to meet the future demand unless active initiatives are required to boost the production.

## 5.5 Cost Benefit Structure

According to the field survey and interviews with key informants, the average annual variable costs of *Pangasius* farming in the targeted areas vary greatly due to cultural practices. It was difficult to calculate the cost of production and benefit as no one was habituate to keep records of their activities and relevant costs. The team documented the details of the costs based on recall method. There was a considerable difference of variable costs in different farming categories. The major variable costs occurred in case of feed because *Pangasius* production is feed intensive and totally depends on supplied feed without any dependency on natural food production. According to the key informants, the semi-intensive and intensive farms can reduce their feed price to a greater extent installing own feed machine/mill and drying yard which is not possible for the extensive farmers due the requirement of large investment. For this reason, semi-intensive and intensive farmers can reduce about 20% of feed cost compared to commercial feed producing feed in their own farms. This factor positively affects the intensive famers to provide regular feed at an optimum level in their farms for longer period of time which in turn make their fish larger in size that ensures the higher market price.

According to field investigation cost of production has increased significantly in last couple of years mainly due to the increase in price of commercial feed. The table below shows the cost of production per acre of fish pond per year. The cost is estimated based on our primary survey conducted on 48 samples.



**Table 10.** Average production cost and return for return for *Pangasius* farming

Cost and return item	Cost and return in <i>Pangasius</i> farming system (Tk/acre)
Variable Cost (VC)	
Fingerlings	31000
Feed	130000
Fertilizer/Cow dung	1500
Aqua Chemicals	3500
Labor (Family <sup>1</sup> and hired)	13500
Harvesting and Marketing	2000
Miscellaneous	2000
<b>Sub-total</b>	<b>183500</b>
Fixed cost (FC)	
Depreciation <sup>2</sup>	6000
Interest on operating capital/loan	2000
Land use cost or lease	6000
<b>Sub-total</b>	<b>14000</b>
Total Cost (TC=VC+FC)	197500
Average productivity (kg/acre) (P) <sup>3</sup>	2500
Average farm-gate price (Tk/kg) (FP)	90
Gross revenue (GR=P×FP)	225000
Net return (NR=GR-TC)	27500
Benefit-cost ratio (BCR=GR/TC)	1.14

<sup>1</sup>To determine the cost of unpaid family labor the opportunity cost principle was adopted. The opportunity cost of human labor is its value in its best alternative use.

<sup>2</sup> Depreciation cost of water pump, nets etc are calculated as [(purchase price-salvage value)/economic life]

<sup>3</sup> The productivity of *Pangasius* in extensive and semi-intensive farming is associated with carp and tilapia under polyculture, thus the actual productivity is higher than these figures.

As depicted in the table, input cost accounts for more than 80% of the total cost. The key informants expressed that *Pangasius* farming still has scope for growth in productivity as well as economic potential.

## 5.6 Relationships and Linkages Across Actors

To properly support the development of any sector there must be strong, self-sufficient linkages across the actors. Through these relationships and linkages, the necessary information is disseminated to the value chain actors. So we also need to look at the relationships & linkages across the actors for *Pangasius*.

### 5.6.1 Horizontal Linkage

Generally, there is a good relation among the actors.

- **Farmers level:** For *Pangasius* fish farmers, it has been observed that the fish farmer rely on the progressive fish farmers for advice on fish cultivation. They consult the lead farmer about various queries. The lead farmers are also willing to share information.
- **Hatchery/Nursery level:** There are some nurseries in the targeted areas to compensate the linear number of hatchery cum nurseries in the localities. They willingly share the

information about production technologies as per their knowledge. Basically they are backed by the hatcheries of Jessore. Also different development projects (IAPP, DANIDA, WorldFish) supported nurseries for the capacity development and market expansion.

- **Input suppliers level:** The input retailers compete for the feed and other ingredients. Sometimes inferior quality products hamper the usage of quality inputs thus deteriorate the production potentials.

Overall there is co-operation among the actors though relevant technology transfer process needs to be strengthened.

### 5.6.2 Vertical Linkage

In the studied areas vertical linkage is strong but the information quality is not up to the mark.

- **Nursery to Farmers:** The fish farmers rely on the nursery for information beyond the lead farmers. They consult the nurseries when they have a problem. But the nurseries are not always able to help them as they do not know the solution of the problem. On the other hand, capacity of the nurseries did not allow them to promote improved and cost effective technologies. Moreover, Patilwala/hawkers are prominent in the targeted areas and mostly only trade the fingerlings only.
- **Farmers to output traders:** The fish farmers sometimes consult with the traders/paikers about the market price and quality. Also the fish farmers ask the arotdars about the market price of the fish.
- **Hatchery to Farmers:** As there is only one hatchery out of 4 dealing with *Pangasius*, hatchery, the linkage to nursery is almost non-existent. Moreover, medium to large farmers in the targeted areas collected fingerlings from the hatchery cum nursery but information dissemination in terms of quality produces are not prominent.
- **Input companies to Farmers:** The representatives of private input companies usually are well connected with the dealers and retailers. The study team did not notice about the linkage between farmers and companies in the targeted areas.

In many cases the actors live in the same neighborhood. So the actors maintain a good relationship with each other.

### 5.6.3 Access to supporting Markets

#### *Finance*

Finance is an important aspect of fish farming as it requires feed at daily basis. As most of the farmers in the targeted areas are poor, they do not have working capital. So they need to borrow money for fish farming and other activities. The farmers usually borrow money from the NGOs/MFIs whenever required. But they complain that:

- The banks do not lend them money
- The interest rate is too high for NGOs/MFIs
- It is very difficult to get government loans

As a result, they borrow money from the NGOs/MFIs, which lend them money at the with the weekly installment basis. We also learned from the FGDs, that few association of Water Development Board provide loan to its members.

### ***Transportation***

For transporting fish to markets, smooth connectivity and infrastructure is very important since perishable good. Due to the geographical condition the targeted areas are crisscrossed with rivers and canals. Farmers from remote areas cannot market their products to peri-urban or larger market due to higher cost of transporting fish. The farmers are often charged extra (TK 20/KG) for carrying fish. In other areas, farmers carry fish with local van to markets.

### ***Information/ Communication***

In the targeted areas, there are no formal institutions providing information to the farmers or other actors. Mostly people gather information through their personal contact. Though there is a community radio service which disseminates information on improved technologies and market information but it is not adequate. The relevant officials cannot often play an active role as they have limited resources and are understaffed to provide required support for the small fish farmers.

### ***Extension and Business Development Services***

To support the development of the fishery sector, the government has initiated extension services. But in the targeted areas there is no such activity for cultured fish. They remain busy with different administrative tasks and natural fish conservation activities like embargo monitoring. The DFO, UFO often are understaffed and struggle with their duties and cannot focus on the development of the fishery sector in the targeted areas. Moreover, study team observed that UFOs in the areas have arranged a dedicated day to provide consultation services to fish farmers once a month. Also the small and distant fish farmers are reluctant to go to Upazilla Fisheries Officer to get the information. Also, there are no private sector training or support facilities. It would be beneficial for the fish farmers if initiatives are taken to set up extension & business development services.

## **5.7 Potentials and the Constraints**

The objective of the study is to assess the feasibility of use of homestead ponds of Patuakhali areas for increasing aquaculture productivity and income generation through practicing of *Pangasius* aquaculture. Hence, we need to analyze what holds the *Pangasius* aquaculture back on achieving growth as per its potential and what facilitation interventions are required to give required momentum to the farming. This section summarizes the potentials and the constraints from the previous chapters and provides us a road map to design development strategies and interventions/activities.

### ***Potential***

- Increase productivity and profitability of *Pangasius* aquaculture: The productivity of the *Pangasius* fish farmers in Patuakhali areas can be increased from 2.5 MT/acre to at least 5 MT/acre, a target that can be set from experiences of other *Pangasius* fish farming in Mymensingh, which we have taken as benchmark for Patukhali areas.

- Offset the demand-supply gap of *Pangasius* in Patuakhali areas: The demand for *Pangasius* in Patuakhali areas are fulfilled from the supply of other districts. So the increased production will meet the local demand as targeted. The increased productivity will reduce the dependency on outside sources.

### **Constraints**

Low feed conversion ratio and low productivity: From our earlier analysis we have seen that the reasons behind the poor performance of *Pangasius* aquaculture are low productivity and low feed conversion ratio. The farmers are complaining that they are not profitable any longer because of rising cost of input, particularly, commercial feed cost. The reasons behind these phenomena are:

1. **Lack of knowledge on appropriate method of pond management:** The study team observed that the fish farmers in the targeted region are farming fish with the objective of subsistence farming and using the pond for different other purposes. The dike of the ponds are used for dense wood tree plantation which keeps the pond shady all the time. Due to complex topographic condition farmers are not allowed to use ground water for filling up the pond or exchange water. Though they have scope to exchange the water with nearby canal water.
2. **Lack of authentic source for quality fingerlings:** Most of the fish farmers in the targeted areas are dependent on pantilwala/hawkers for the fingerlings. The fingerling traders basically sourced the *Pangasius* other fingerlings from local/regional nurseries. Again these nurseries collect spawn from different hatcheries of Jessore. So the qualities of fingerlings are questionable. Still only one hatchery in Patuakhali are producing *Pangasius* fingerlings with sub-optimal production capacity. Another hatchery in Kalapara reported failure of *Pangasius* spawn/fingerling initiative.
3. **Lack of access to information on alternative low cost feed/input:** Increasing cost of commercial feed has increased cost of production and forced the *Pangasius* fish farmers to cultivate in less or inappropriate doses of feed. Information on alternative low cost feed (sinking feed) or feeding methods can support decreasing cost of production. For instance, *Pangasius* farmers in Mymensingh region remained their feed cost below 60 taka by using locally produced sinking feed. On the other hand, some interviewed value chain actors expressed that feed cost in Patuakhali areas is around 80 BDT. This can reduce cost of feed by BDT 20/kg. Again, use of zeolites as an alternative to lime can also reduce cost at the preparation stage. Such alternative methods need to be identified, scrutinized and promoted to support the farmers grow more fish and reduce feed cost. Due to inappropriate feeding practice farmers experienced irregular size of the *Pangasius* within the same pond.

## **5.8 Interventions**

### ***Improve feed conversion ratio while ensuring increased productivity through involving value chain actors***

To improve the feed conversion ratio and to achieve higher production the farmers have to have the proper pond management and *Pangasius* fish cultivation techniques. The hatchery/nurseries

have to be informed about the proper breeding and nursing techniques because properly nursed fingerling is a prerequisite for proper fish cultivation. Also the farmers have to be informed about the proper fish cultivation techniques and their feed conversion ratio has to be improved. If the farmers are to be most productive, than they have to properly feed the fish with feed that has right proportions of desired content. Moreover, output market actors can disseminate relevant technology for better functioning of the value chain.

#### ***Capacity Development of local nurseries to ensure quality fingerlings supply***

Most of the nurseries in Patukhali areas are linked with hatcheries of Jessore for the spawn of *Pangasius*. On the other hand, local hatcheries are struggling to produce spawn/fingerlings as of production capacity. Also few hatcheries could not produce *Pangasius* spawn/fingerlings probably due to appropriate brood and technologies. So capacity development of the local hatcheries will ensure the supply quality fingerlings at lower price and relevant production technologies.

#### ***Strengthening linkage between the farmers with the others value chain actors***

It has been observed that input suppliers/companies and large traders are focusing on large producers. Thus small farmers are not getting relevant information and technologies from them. Mobilize *Pangasius* producers so that these actors can be attracted. Group mobilization will also ensure low cost feed mill establishment in the respective clusters.

#### ***5.9 Gender issue***

Women in the Patuakhai areas involve in fish cultivation to some extent. They are involved particularly in feeding and pond cleaning process. To increase the productivity of *Pangasius* farming they should be equipped with improved knowledge. So far they did not receive any formal training from government, NGOs and projects. Capacity development of female farm families will augment the farm productivity and profitability.



*Pangasius value chain study in the local market*

## 6. The Way Forward

### *Culture potentialities of Pangasius in Patuakhali region*

About 6-7 tons of *Pangasius* @ Tk. 94/kg has been supplied daily to Patuakhali Sadar with adjacent Upzillas from Satkhira and Jessore districts and the fish sold out @ Tk. 100-120/kg in the local markets. The wholesale and retail prices are much higher than the other *Pangasius* culture zone in the country (from Mymensingh to Dhaka the price is between Tk. 68-72/kg). So economic return will be much higher if *Pangasius* culture zone established in the Patuakhali region.

Although the Patuakhali region flourished by capture fisheries, especially *Hilsa* fisheries, the on-going development works in the region (6 coal based power generation, 3<sup>rd</sup> sea port, EPZ and 4-lane highway) will open a new era of aquaculture in the region. The population engaged in these development activities are mostly from outside of this region and they are not well familiar with the brackishwater fishes. Hence *Pangasius* may be a good choice to them like Gazipur-Dhaka-Narsingdi industrial zone.

On the other hand, climate change poses new challenges to the sustainability of fisheries and aquaculture systems in the region. Considering the research findings, *Pangasius* could be a suitable species for aquaculture adaptation to climate change in cyclone, flood and saline-prone coastal ecosystems, as it is considered one of the most stress and saline tolerant species

In general, *Pangasius* culture starts with fingerling stocking in April-May and the fish is harvested during October-November. Most of the farmers purchased hatchling directly from hatchery and then nursed in their own nursery ponds before transfer to grow-out ponds. Overwintered fingerlings of *Pangasius* also available in the region. Moreover, advanced fingerlings of *Pangasius* will also be available in near future through nursing of hatchery produced *Pangasius* seed. So stocking of advanced and overwintered fingerlings possibly by June, than fish crop will be harvested by December. A moderate stocking density will be maintained for the newly adopted *Pangasius* farmers (Table 11). Indian major carps will be included to utilize mid-layer pond productivity and also as per local farmer preferences. Tilapia will be included to utilize the planktonic feed.

**Table 11.** Proposed species combination and stocking nos.

Species	Size (cm)	Stocking nos. (per decimal)		
		BFRI suggested	DoF suggested	Proposed
<i>Pangasius</i>	12-15	100-120	75-90	80
Indian major carps	12-15	10-15	3-5	5-6
Chinese carps	12-15	-	7-10	-
Tilapia	5-7	20-30	40-45	10-15

Almost all over Bangladesh, locally available feed ingredients like rice and wheat brans, oil cakes, duckweed maize etc. are traditionally used to prepare fish feed that is nutritious but cheaper than commercial feeds. In recent past years, with support of donor funded projects in

the southern districts, sunflower has been promoted with the rice farming system. Increased production of maize and sunflower introduced alternative feed ingredients for small-scale aquaculture farming, even these two crop increases new hope in integrated-aquaculture production system by rural households of Southern region. Introduction of sunflower, created diversified source of oil for human consumption and the by-product meal/cake during extract of oil from the seed created opportunity of using in aqua feed as alternative source of relatively cheap plant protein to other oil seed cake especially on mustard oil cake. The great advantages of local fish farmers to use fish meal- the prime fish feed ingredients for aquaculture from local sources will be helpful to introduce/demonstrate a low-cost fish feeding in *Pangasius* farming in the region. A low cost but nutritious fish feed (28% protein) will substitute use of costly commercial floating feed by the local farmers. In small-scale homestead-based aquaculture system, women can participated in fish feed preparation from locally available ingredients and feed application in their ponds.

The targeted fish farmers will be selected from BlueGold Polder Group members having a pond size 25-40 decimal. An exchange visit of the farmers to Mymensingh or other *Pangasius* culture areas will be conducted just after stocking. The selected farmers will be trained for pond management during stocking and post-stocking management regimes. Hands-on training on good aquaculture practices (GAPs) will also be provided to address food safety compliances. Project will also facilitate to develop a business model for sustaining the farming practices. A participatory planning process and joint monitoring system by involving all relevant stakeholders can help-support the development process.

## Conclusion

Considering the above context, there is a very justifiable ground to demonstrate and up-scaling *Pangasius* farming in the proposed Patuakhali region to explore the due potentials. Which eventually ensures the food and nutrition security of the climate vulnerable coastal peoples as well as contribute for achieving the specific SDG targets.

## References

- Alam, M.F. 2012. *Marketing of Major Fish Species in Bangladesh: A Value Chain Analysis*. FAO.
- Ali, Hazrat, M.M. Haque and B. Belton. 2012. Striped catfish (*Pangasianodon hypophthalmus*, Sauvage, 1878) aquaculture in Bangladesh: an overview. *Aquaculture Res.*, 2012. 1-16.
- Belton, B., M. Karim, S. Thilsted, K. Murshed-E-Jahan, W. Collis, M. Phillips. 2011. Review of aquaculture and fish consumption in Bangladesh. *Studies and Reviews* 2011-53. The WorldFish Center.
- Debnath, P.P., M. Karim, Q.A.Z.M. Kudrat-E-Kabir, M.A. Haque and M.S.K. Khan. 2012. Production performance of white fish in two different culture systems in Patuakhali, Bangladesh. *J Adv Sci Res*, 3(4): 55-67.
- DoF. 2017. *Fishery Statistical Yearbook of Bangladesh 2015-2016*. Fisheries Resources Survey System, Department of Fisheries (DoF), Ministry of Fisheries and Livestock (MoFL), Dhaka, Bangladesh.
- FAO. 2017. Fishery Statistical Collections. <http://www.fao.org/fishery/statistics/global-commodities-production/en> (accessed on 16 March 2015).
- Haque, M.M. 2009. Emerging *Pangasius* Aquaculture Dialogue (PAD) Standards: Can Bangladesh Comply with? Paper Presented in *Pangasius* Aquaculture Dialogue (PAD) Meeting, 22 Aug 2009, Bangladesh Agricultural University, Mymensingh.
- IFAD. 2006. People's Republic of Bangladesh Aquaculture Development Project Results at Project Completion. International Fund for Agricultural Development, Asia and the Pacific Division, IFAD.



- Khan, M.H. 2009. Water use in *Pangasius* aquaculture: potential for reuse of discharged farm water, MS Thesis, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh. 42p.
- Munir, S.A.M. 2009. Socio-economic impacts and sustainability of *Pangasius* (*Pangasianodon hypophthalmus*) farming in Trishal Upazila under Mymensingh, Bangladesh. MSc Thesis, University of Stirling, Scotland.
- Phan L.T., M.B. Bui, T.T.T. Nguyen, G.J. Gooley, B.A. Ingram, H.V. Nguyen, P.T. Nguyen and S.S. De Silva. 2009. Current status of farming practices of striped catfish, *Pangasianodon hypophthalmus* in the Mekong Delta, Vietnam. *Aquaculture*, 296: 227–236.
- World Bank. 2017. World development indicators database. Available at <http://databank.worldbank.org/data/home.aspx>.
- WorldFish Center. 2008. Baseline Survey Report for Cyclone Affected Aquaculture Rehabilitation Project (CAARP 1).

## Responsibilities of the Feasibility Study Team Members

### Coordinator

**Akhand, Md. Rafiqul Islam**

Executive Director, Innovision Agro Service Ltd.

(Site selection, PRA/FGD conducting expert)

- Coordinate the whole study including site selection, and communication with Blue Gold authority and other stakeholders (DoF, BWDB etc.)
- Conducting PRA and FGD with pond owners and fish consumers in Upazillas under study.
- Assessing present demand and supply of *Pangasius* seed in the region.

### Technical Members

**Kohinoor, Dr. A.H.M.**

Principal Scientific Officer, BFRI

- Assessing present culture practices, fish hatchery infrastructure (regional), and promotion of improved *Pangasius* aquaculture practices case by case in the Upazillas under study.
- Monitoring pond water and soil for basic water quality (DO, pH, Salinity etc.) and soil quality (nitrogen, phosphorus, organic matter).
- Assisting in PRA and FGD with pond owners and fish consumers in Upazillas under study.

**Hoq, Dr. Md. Enamul**

Principal Scientific Officer, BFRI

- Assessing locally available fish feed ingredients for their abundance, seasonality and prices. Also assessing the prospect of establishing home-stead small-scale fish feed mills in Upazillas under study.
- Laboratory analysis of fish feed ingredients and formulation of farm-made fish feed for *Pangasius* culture.
- Assisting in PRA and FGD with pond owners and fish consumers in Upazillas under study.

**Haque, A.F.M. Mominul**

Value Chain/Market Development Specialist

Innovision Agro Service Ltd.

- Assessing local fish market and fish landing centres for fish supply and price estimation. Also find out the market chain in the region.
- Evaluate the regional perspectives of Patuakhali for *Pangasius* farming, explore statistic on fish production, market price and resources in Upazillas under study.
- Identify the value chain for the home-stead *Pangasius* farmers in the region.

## Activities of the Feasibility Study Team Members

Day/Date	Activities	Place
1/31.3.2018	Communication, Planning, Questioner preparation	Mymensingh
2/5.4.2018	Literature review, Field visit, Data collection	Dhaka, Patuakhali
3/6.4.2018	Field visit, Data & feed sample collection, Water & soil testing,	Patuakhali
4/7.4.2018	Field visit, Data & feed sample collection, Water & soil testing, FGD	Patuakhali
5/8.4.2018	Field visit, Data collection, Water & soil testing, FGD	Patuakhali
6/9.4.2018	Field visit, Data collection, FGD	Patuakhali
7/10.4.2018	Field visit, Data collection, FGD	Patuakhali
8/11.4.2018	Field visit, Data compilation, Laboratory test	Patuakhali, Mymensingh
9/12.4.2018	Field visit, Data analysis, Laboratory test, Report preparation	Patuakhali, Dhaka,Mymensingh
10/16.4.2018	Report preparation	Dhaka,Mymensingh

## INNOVISION AGRO SERVICE LTD.

**Feasibility study on augmenting homestead pangasius aquaculture productivity in three Upazillas of Patuakhali through community participation under Blue Gold Program**

মাছ চাষ সম্ভাব্যতা বিষয়ক জরিপ প্রশ্নমালা

তারিখ:.....

নমুনা নং:.....

**১. সাধারণ তথ্য**

১.১ উত্তর প্রদানকারীর নাম ও মোবাইল নং: .....

১.২ যদি আপনি মাছ চাষে সম্পৃক্ত না থাকেন, তাহলে আপনার ভূমিকা কি: .....

১.৩ পিতা/স্বামী/স্বামীর নাম:.....

১.৪ পুকুরের অবস্থান: গ্রাম:..... ইউনিয়ন:.....  
উপজেলা: .....

১.৫ বর্তমানে পুকুরে মাছ চাষের অবস্থা:.....

১.৬ পরিবারের সদস্যদের মাছ চাষে অংশগ্রহণ (সংখ্যা): পূর্ণ বয়স্ক: পুরুষ..... স্ত্রী.....  
শিশু: পুরুষ..... স্ত্রী.....

১.৭ কেন আপনি মাছ চাষে আগ্রহী হলেন ও কিভাবে মাছ চাষের জ্ঞান লাভ করলেন এবং কতদিন যাবত আপনি মাছ চাষ করছেন?  
.....  
.....  
.....

১.৮ মাছ চাষে কোন প্রকার প্রাতিষ্ঠানিক সহযোগিতা (প্রশিক্ষণ/আর্থিক) লাভ করেছেন (মৎস্য অধিদপ্তর/বিএফআরআই/ এনজিও/ সমিতি/প্রকল্প)?

**২. পুকুরের তথ্য**

বিষয়	উত্তর
পুকুরের বয়স	
পুকুর তৈরির উদ্দেশ্য, মালিকানা ও প্রকৃতিঃ মৌসুমী/সারা বছর পানি	
পুকুরের আয়তন (শতাংশ)	
মাটির প্রকৃতি (sand/clay/ loam/ sandy loam/ clay loam/others)	
পুকুরের গভীরতা ও পানির উৎস	
পুকুরের পাড়ে সবজি চাষ বা গরু-ছাগল পালন করেন কিনা?	

### ২.১ মাছ চাষের আনুসাংগিক দ্রব্যাদি কি আছে?

আনুসাংগিক দ্রব্যাদি	সংখ্যা	মূল্য	বয়স
জাল			
পানির পাম্প			
অন্যান্য			

### ২.২ মাছ চাষে সার, রাসায়নিক দ্রব্য এবং খাদ্যের ব্যবহার

সার/রাসায়নিক দ্রব্য/খাদ্য	মাছ চাষ		সবজি চাষ বা গরু-ছাগল পালন	
	পরিমাণ (কেজি)	মূল্য (কেজি/টাকা)	পরিমাণ (কেজি)	মূল্য (কেজি/টাকা)
গোবর				
কম্পোস্ট				
মুরগির বিষ্টা				
ইউরিয়া				
টিএসপি				
এমপি				
অন্যান্য				
চুন				
ব্লিচিং				
রোটেনন				
সম্পূরক খাদ্য				
এজোলা/ডাকউইড				
চাউলের কুঁড়া				
গমের ভূষি				
ভূট্টা				
সরিষা খৈল				
ফিস মিল				
ঘরে তৈরি খাবার				
ফ্লোটিং খাদ্য				
সিংকিং খাদ্য				
অন্যান্য				

### ২.৩ মাছ মজুদের তথ্যাদি

মাছের প্রজাতি	মজুদের মাস	সংখ্যা	আকার	ওজন	মূল্য	উৎস


## ২.৪ মাছ চাষ কার্যক্রমে শ্রমের বিভাজন

কার্যক্রম	পরিবারের লোকের শ্রম সময়		দৈনিক শ্রমিক	
	পুরুষ	স্ত্রী	পুরুষ	স্ত্রী
পুকুর খনন				
পুকুর প্রস্তুতি (আগাছা পরিষ্কার, পানি সেচ ইত্যাদি)				
মাছ চাষের উপকরণ, সার ও খাদ্য ক্রয়				
মাছের পোনা ক্রয় ও পরিবহন				
পোনা মজুদ				
সার ও রাসায়নিক দ্রব্য প্রয়োগ				
খাদ্য তৈরি ও প্রয়োগ				
ঔষধ ব্যবহার				
পুকুর ব্যবস্থাপনা ও পরিচর্যা				
মাছ ধরা				
মাছ বিক্রি				
পাহাড়া				
সবজি চাষ বা গরু-ছাগল পালন				

## ২.৫ মাছ ধরা ও বাজারজাতকরণ

### ২.৫.১ কখন বা কিসের ভিত্তিতে মাছ ধরেন?

.....

.....

### ২.৫.২ মাছ কিভাবে বাজারজাত করেন?

মাছ বিক্রির পদ্ধতি	(✓/✗)	মোট মাছের কত ভাগ
নিজে		
পুকুর পাড়ে ফরিয়ার কাছে		
আড়তে		
মাছ ধরার দলের কাছে		

## ৩. মাছ চাষে ব্যবস্থাপনা বিষয়ক জ্ঞান

### ৩.১ মাছ চাষ, সমস্যা, মাছের মূল্য ও বাজারজাতকরণে অভিজ্ঞতা বিনিময় বা কারও পরামর্শ গ্রহণ করেন কিনা এবং করলে কিভাবে?

.....

.....

.....

ক্রমিক নং	মাছ চাষ বিষয়াদি	(✓/✗)	যদি না করেন, কেন
১	পুকুর প্রস্তুতি		
২	পুকুরে চুন ও সার প্রয়োগ		
৩	পুকুরের উৎপাদনশীলতা		
৪	মাছ চাষে উপযোগী প্রজাতি নির্বাচন		
৫	পুকুরে মাছের মজুদ ঘনত্ব		
৬	মাছ চাষে খাদ্য প্রয়োগ		
৭	মাছ চাষে রোগ সংক্রমণ ও প্রতিকার		
৮	অন্যান্য		

বিশেষ কোন মন্তব্য, যদি থাকে

তারিখ

ইন্টারভিউ গ্রহিতার স্বাক্ষর  
নাম ও মোবাইল নং



## Officials/Person/Focus Group Meet/Communicated

### Department of Fisheries

1. Mr. Md. Wahiduzzaman, Deputy Director, Barisal Division
2. Mr. Md. Mosiur Rahmam, Senior Upzilla Fisheries Officer, Patuakhali Sadar
3. Mr. Md. Mahbubul Alam, Assistant Upzilla Fisheries Officer, Amtoli Sadar
4. Mr. Md. Kamrul Hasan, Senior Upzilla Fisheries Officer, Kalapara

### Bangladesh Fisheries Research Institute, Riverine Sub-Station, Khepupara

1. Mr. Ahmed Fazla Rabbi, Scientific Officer & Sub-Station Chief

### BlueGold Programme

1. Judith de Bruijne
2. Mr. Robul Islam
3. Mr. Shahidul Islam
4. Mr. Asraf

### Focus Group Discussion Participants

কলাপাড়া, পটুয়াখালী  
(কলাপাড়া গ্রুপ, ব্রগোল্ড ৪৭/৪)

নাম	ঠিকানা	পেশা	মোবাইল
ঝুমুর বেগম	কানকিনি পাড়া	গৃহিণী	০১৭৩৯৮৭৬২৭৪
হোসনেয়ারা বেগম	কানকিনি পাড়া	"	০১৭৪৩৯৩৬৭৬
লিপি বেগম	কানকিনি পাড়া	"	০১৭৯৯৩৫১৬৭৪
লাইলি বেগম	মুসুল্লিবাদ	"	০১৭৭৯৪৯৫০১০
আব্দুস সালাম	বালিয়াতলি	হ্যাচারি মালিক	০১৭১৮২৭৬৯৮৩
মোঃ রাসেল	মুসুল্লিবাদ	কৃষি	০১৭৪৮৩৯৩৬৭৬
আব্দুর রহিম	কানকিনি পাড়া	কৃষি	০১৭৮০২৫৩৭৮৮
দেলোয়ার খান	তুলাতলী	কৃষি ও মাছ চাছ	০১৭৪৯৭৬৯৩৪৩
নাসির কাজী	মুসুল্লিবাদ	নার্সারি মালিক	০১৭১২১৭৬৫৫৩
মোঃ ফোরকান খলীফা	মুসুল্লিবাদ	ব্যবসা	০১৭৬৪১৪২৪৮১
মোঃ সিরাজ সিকদার	মুসুল্লিবাদ	নার্সারি	০১৭৩৩১৬৫১৮৬
মোঃ আনোয়ার	তুলাতলী	মাছ চাছ	০১৭৪৭৪২৮৮১১
আব্দুল আজিজ	মুসুল্লিবাদ	কৃষি ও মাছ চাছ	-
সহিদুল ইসলাম	মুসুল্লিবাদ	চাকুরি	০১৭১০৩৭৩৫০৮
মোঃ হারুনুর রশীদ	মুসুল্লিবাদ	কৃষি	-
মোঃ সান্তার শরীফ	কানকিনি পাড়া	কৃষি	-
মস্তফা জামান	পূর্ব মধুখালী	ব্যবসা	০১৭২১৩৬৬৭৫৭
মোঃ সলিমুল্লাহ	মুসুল্লিবাদ	কৃষি	-
মোঃ শহীদ কাজী	কানকিনি পাড়া	মাছ বিক্রেতা	০১৭৬৩৪২১৩৮৯
মোঃ জাকির কাজী	মুসুল্লিবাদ	কৃষি	০১৭৮২৯৯০৯৫৩
মোঃ আখতারুজ্জামান	মুসুল্লিবাদ	কৃষি	০১৭১৬১৭৪৮০২

**শাখারিয়া বাজার, আমতলী, বরগুনা**  
(শাখারিয়া গ্রুপ)

নাম	ঠিকানা	পেশা	মোবাইল
মোঃ বাদল মিয়া	শাখারিয়া	মাছ চাছ ও ব্যবসা	০১৭২৯৬৪৭৪৯৯
মোঃ জাকারিয়া খান	"	পড়াশুনা ও মাছ চাছ	০১৭৩৫৬০২৮৭৯
মোঃ সোহেল রানা	"	মাছ চাছ	০১৯৯৪১৮৭৬৪৬
মোঃ রতন	"	"	০১৯৮৭৭৩৬২১৭
মোঃ রাহাত	"	পড়াশুনা ও মাছ চাছ	০১৭৬০৭৭৮৫৪৪
মোঃ সিদ্দিকুর রহমান	"	মাছ চাছ ও ব্যবসা	০১৭১৬৯৯৩৮৫৫
সালাম ব্যাপারী	"	মাছ চাছ	০১৭৩৪৬৬৬১২৭
জাহাঙ্গীর বিশ্বাস	পটুয়াখালী	মাছ চাছ ও ব্যবসা	০১৭২৪৭৫৯৩৮০
রতন সিকদার	শাখারিয়া	কৃষি ও মাছ চাছ	০১৭১২২৮২৪৯৫
সোবাহান ফকির	"	মাছ চাছ	০১৭৫৯৫৩৫৯৮২
মোঃ হাবিবুর রহমান	"	মাছ চাছ ও ব্যবসা	০১৭৫৯৯৬৪৪৮১
মোঃ জামাল হোসেন	"	মাছ চাছ ও চালক	১৭১৩৩৬১২৫২
মোঃ মিজানুর রহমান	"	মাছ চাছ	১৭৫৪৫১৫০৭৯
মোঃ সাইফুল ইসলাম	"	মাছ চাছ ও চালক	১৭৭৬০৫০৬৪০
মোঃ মোতালেব	"	মাছ চাছ ও ব্যবসা	০১৭৭৬০৫০৬৪০
মোঃ খলিল শিকদার	"	মাছ চাছ	১৭৫৩৪৭৪৩১০

**মহিষকাটা, আমতলী, বরগুনা**  
(মহিষকাটা গ্রুপ)

নাম	ঠিকানা	পেশা	মোবাইল
নুরুল হক আকন	কালিবাড়ী, গুইসাখালী	মাছ চাষী	০১৭৩১১৭০১৪৫
শহীদুল	"	মাছ চাছ ও ব্যবসা	০১৭৪৫৮৪৮২০০
লুৎফা বেগম	"	মাছ চাছ	০১৭০৭৯৯২২৭৮
কুদ্দুস হাওলাদার	"	মাছ চাছ ও ব্যবসা	০১৭৩৩১৫৩৫৮০
সাহিনুর বেগম	"	মাছ চাছ	০১৭১৯৯৩১৮৬৫
মোঃ আবুবকর	"	মাছ চাছ ও কৃষি	০১৭৪৭৭১৯২৭৪
গোলাম মোস্তফা	"	শিক্ষক ও মাছ চাছ	০১৭৪৬৩০৬৩০৬
খবির হাওলাদার	"	মাছ চাছ	০১৭৬৬১৩৫০০৮
মোঃ নাসির উদ্দিন	"	মাছ চাছ	০১৭৩৪৬১৭১০২
মোঃ রুবেল	"	মাছ চাছ ও শ্রমিক	০১৭৬০০৫৫১২১
দেলোয়ার হোসেন	"	কৃষি ও মাছ চাছ	০১৭১৯৯৩১৮৬৫
মোঃ মিরাজ	"	মাছ চাছ ও চালক	০১৭৯৭১৫৭৪৪৯
মানছুরা বেগম	"	মাছ চাছ	-

**গলাচিপা, পটুয়াখালী**  
(গলাচিপা গ্রুপ)

নাম	ঠিকানা	পেশা	মোবাইল
মোঃ সরোয়ার হোসেন	কল্যানকলস	মৎস্যজীবী	০১৭৩৯২৮৩৭৯১
মোঃ সুলতান রাড়ী	"	কৃষক	০১৭২৫৮৯৮৪৩০
মোঃ আইয়ুব রাড়ী	"	ঠিকাদার	০১৭৩২৩১১৮২৮
মোঃ মোতালেব তালুকদার	"	মৎস্যজীবী	০১৭১৮৮০০৪৫১
সম্পা রানী	"	গৃহিনী	-
মোছাঃ রহিমা বেগম	"	"	০১৭২৩৪২৪৮৩৭
মোছাঃ লাকী বেগম	"	"	০১৭৪১৭৭৬৩৪৬
শ্রীমতি রিতারানী	পটুয়াখালী	"	০১৮৩৩৮৮৪০৩০
মোসাঃ নাজমা	শাখারিয়া	"	০১৭২৫৮৯৮৪৩০
মোতালেব রাড়ী	"	"	-
মোসাঃ শাহিনুর	"	"	-

**হেতালিয়া বাঁধঘাট বাজার, সদর, পটুয়াখালী**  
**আউটপুট মার্কেট ট্রেডার্স**

নাম	ঠিকানা	পেশা	মোবাইল
মোঃ খোকন মিয়া	আমতলী	ব্যবসা	০১৭১০৮৮১৮৫৫
আবুল বশার	হেতালিয়া বাধঘাট	মাছ ব্যবসা	০১৭২২১৪২০৩৯
মোঃ শাহজালাল	"	"	০১৭১৭৪০৭৬৬০
মোঃ মিজানুর রহমান	"	"	০১৭৪২৪১৬২৮৬
যোগেন দাশ	"	"	০১৭৩০৬৪২৬১৫
মোঃ রাজ্জাক গাজী	"	"	০১৭৮৫৫৬৯৬৯৬
মোঃ আমির হোসেন	"	"	০১৮৩১৮১১৫৮৯
সিদ্দিক শিকদার	"	"	০১৭২৯৫৮৭৯৭২
মোঃ খলিলুর রহমান	"	"	০১৭৮৮৬৩৯৫১২
মোঃ খালেক রাড়ী	"	"	
মোহতাব হোসেন	"	"	০১৭৬৬৮২৭১৫৫
আলহাজ্জ মোঃ সুলতান খন্দকার	"	"	০১৭১৮২০৫৯৬২
মোঃ কাওছার	"	"	০১৮৩২৩৮৯৫৬২
মোঃ রুবেল	"	"	০১৭৪৫৫২১০১৫
মোঃ হারুন	"	"	০১৭১২০০২৩০৮
মোঃ হাবিবুর রহমান	"	"	০১৭৮৪৩৯২১০৯
রেজাউল চোকিতার	"	"	০১৭৪৫৭৩৪৫৬৮
মোঃ জুয়েল চোকিদার	"	"	০১৭৮৮৮০৪০৭৪
মোঃ হারুন হাউলাদার	"	"	০১৭৯১৪৭৬৭৯৪
মোঃ আলমীর	"	"	০১৭৩৪৮৫৮০৮৪