Draft

FINAL DRAFT

ASSESSMENT of the CARP SEEDS VALUE CHAIN in SOUTHERN BANGLADESH

January 2012

ABBREVIATIONS

AIN	-	Aquaculture for Income and Nutrition
BFRI	-	Bangladesh Fisheries Research Institute
BRAC	-	Bangladesh Rural Advancement Committe
CSISA	-	Cereal Systems Initiative for South Asia
DG	-	Director General
DoF	-	Department of Fisheries
HCG	-	Human chorionic gonadotropin
JMHMS	-	Jessore Matsya Hatchery Malik Samity
JCF	-	Jagoronoy Chakra Foundation
KII	-	Key Informants' Interview
PG	-	Pituitary Gland
RNBHHR	-	Restoration of Natural Breeding Habitat of Halda River
SWOT	-	Strength, Weakness, Opportunities, Threats
USAID	-	United States Agency for International Development

EXECUTIVE SUMMARY

The Aquaculture for Income and Nutrition (AIN) project implemented by World Fish and funded by USAID, aims at increasing aquaculture production in 20 districts of Southern Bangladesh (Greater Khulna, Greater Barisal, Greater Jessore and Greater Faridpur) to reduce poverty and enhance nutritional status. As part of its initial scoping activities World Fish commissioned this value chain assessment on the market chains of carp fish seed (spawn, fry and fingerlings) in the southern region of Bangladesh. The purpose of this study is to obtain a clearer understanding of the volumes of fish produced and consumed in Southern Bangladesh and their origin (by system and location), their destination (by type of market, type of consumer and location), and to gain a clearer understanding of potential market based solutions to farmer's problems, which the project could implement.

The study was conducted on 91 respondents that covered hatcheries, nurseries, grow-out farmers, trade intermediaries and key informants. The information was collected on five steps-(i) secondary literature review to construct problems on the carp fish seeds value chain and the primary value chain map, (ii) preliminary assessment to collect information on the actors in the carp fish seeds value chain, production and marketing practices based on which questionnaire for in-depth qualitative and quantitative survey was designed, (iii) in-depth qualitative survey, (iv) quantitative survey and (v) data analysis.

The end market (type of consumers) for carp seeds vary depending on the type and the size of seeds (spawn, fry, fingerlings, juveniles). The national production of spawn, fry and fingerlings has been estimated to be respectively 19200 crores, 4200 crores and 1200 crores. The total national demand for fingerlings has been estimated to be around 928 crores (500 crores for closed waterbodies and 428 crores for open waterbodies). Given this, there is surplus of 272 crores fingerlings in the national markets. There are as many as 99 operational hatcheries in the southern region, which produced 135 tons spawn or 1353 crores fry, which is about 28% of the total national production. Currently 89% of the spawn produced in the region is sold within the region while the rest 11% is sold outside the southern region. According to the respondent hatcheries, of the total volume of spawn produced in the southern region, 77% is sold to nurseries and 23% is sold to the table fish farmers. The competition for market share has been found to be intense amongst the hatcheries. The hatcheries compete with price as most have failed to deliver quality. The decline in price during peak season together with increasing cost of operations because of increase in cost of imported inputs and inefficient hatchery management practices has resulted low profitability. As a result the financial capacity of the hatcheries to improve quality further declined.

Cost of feed accounts for 32% of the total cost of production of spawn. The inputs are mostly imported and the cost of import has shot up in recent years because of devaluation of Taka against dollars. New low cost input technologies are available but are not yet widely adopted because of lack of awareness. For example use of Ovaprim and Flush (which have to be used once while PG has to be used twice) instead of PG can reduce cost on hormones by more than 50-70%. Besides, Ovaprim and Flush can also potentially reduce the use of immature brood since the hatcheries using it will have to refrain from using immature brood as Ovaprim and Flush damage the ovary of the immature brood. The project can potentially partner with the importers of these hormones to promote appropriate use of these hormones and the benefits. Besides, by improving the quality of the home made feed the hatcheries could increase gonadal development, which would result increase fertility and fecundity and, therefore, increase production of mature eggs and reduce mortality of spawn.

Analysis of the average age of the brood stock, weight, stocking density suggests that the hatcheries are not maintaining standards. From the findings, it can be ascertained that the degree of breeding from immature breeders and negative selection is high for most of the carp species. Further analysis reveals that the problem with brood stock management might be more intense for Catla than for other species. Average age of the Ruhu brood stock (2.2 year) reared by the respondent hatcheries is within the standard (2 year) and so is the average weight of the brood stock (1.8 kg). But the average age (2.3 year) and weight (3.1 kg) of Catla falls below the standard (respectively 3+ and 4+). 56% of the respondent hatcheries maintain a higher than standard stocking density, which hints at improper hatchery management practices.

According to the hatcheries, they are unable to adopt good hatchery management practices mostly because of unavailability of quality brood stock. Fifteen Percent (15%) of the current brood stock maintained by the 21 hatcheries that were interviewed in the Jessore and Satkhira districts is sourced from public hatcheries, 3% is sourced directly from rivers, 60% from nursery and grow-out farmers and 22% are replenished from their own stock. The official price of the Rohu and Catla brood stock sold by DoF is Tk. 140/kg. However, majority (65% for Rohu and 78% for Catla) of the respondents have bought brood for a price higher than Tk. 200/Kg. Ironically, the hatcheries were paying much higher price to collect the brood stock from the informal sources (the grow-out fish farmers and the nurseries), which has led to high degree of inbreeding depression, hybridization, negative selection and use of immature brood stock. The price for Rohu and Catla brood stock in the informal sources was found to be as high as Tk. 350/ kg. This clearly suggests that the hatcheries are willing to pay a higher price for quality brood stock.

We estimate that 798.67 ton brood fish is currently stocked by the hatcheries in the region. Volume of male and female brood stock can be estimated to be respectively 266.22 ton and 532.45 ton. Accounting for replenishment demand of 15% per annum, the annual demand for brood stock in the region can be estimated to be around 119 tons. DoF hatcheries across the country can produce only 25-30 tons brood per annum. A significant percentage of the catch from river sources, for example Halda, is not used to produce desired brood stock. In 2011, only 6 hatcheries from Jessore, Mymensingh, Comilla and Chittagong collected spawn from Halda while about 188 nursery and grow-out fish farmers, mostly from Chittagong, Cox's Bazar and Comilla collected the spawn from Halda river.

Price of spawn has stagnated in recent years because of intense competition among the hatcheries. Early season price of spawn ranges from Tk. 2800/kg- Tk.5000/Kg while the peak season price drops to the range of Tk. 1000/kg-Tk.200/kg depending on the quality of the spawn. But despite increasing competition, stagnated market price and increase in cost of operations, hatcheries that are able to maintain quality have managed to sustain a higher price (higher by Tk. 500/ kg on an average from the market price). The price needs to be increased and sustained at a higher range to make the industry profitable.

Based on the analysis, we identified three core areas of market dysfunctions- (i) unavailability of quality brood stock, (ii) high cost of operations and (iii) low market price. Several underlying constraints have been identified, which include: lack of supply of improved quality brood stock, depleting catch from the river sources, lack of capacity of the public hatcheries, lack of public and private capacity to adapt improved technologies like cryopreservation, increasing cost of imported and locally produced feed and feed ingredients, lack of awareness about cost saving inputs (like Ovaprim and Flush), lack of knowledge about feed formulation, lack of trust among the nurseries and the grow-out fish farmers about the quality of seeds, price competition among the hatcheries because of market saturation, marketing of poor or deteriorated quality seeds because of lack of quality control, inspection and certification, lack of

awareness about cost-benefit of quality spawns that results purchase of low priced inferior quality spawn and seeds.

To tackle these constraints, we have recommended several value chain upgrading strategies that could leverage on the strengths- presence of number of advanced or lead hatcheries renowned for quality, presence of a strong and functioning association, imposing quality certification scheme, availability of improved low cost inputs etc. and market opportunities- the new hatchery policy for management and supply of quality fish breeds/seeds through establishing a number of public or privately owned “Breeding Nucleous”, potential for collaboration with NGOs like BRAC, potential to collaborate with DoF and BFRI, and increasing awareness and interest amongst the hatcheries and nurseries to produce and market quality seeds.

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CHAPTER 1: INTRODUCTION

1.1 Background

The Aquaculture for Income and Nutrition (AIN) project implemented by World Fish and funded by USAID, aims at increasing aquaculture production in 20 districts of Southern Bangladesh (Greater Khulna, Greater Barisal, Greater Jessore and Greater Faridpur) to reduce poverty and enhance nutritional status. As part of its initial scoping activities World Fish commissioned this value chain assessment on the market chains of carp fish seed (spawn, fry and fingerlings) in the southern region of Bangladesh. The purpose of this study is to obtain a clearer understanding of the volumes of fish produced and consumed in Southern Bangladesh and their origin (by system and location), their destination (by type of market, type of consumer and location), and to gain a clearer understanding of potential market based solutions to farmer's problems which the project could implement. This work will assist World Fish in selecting locations for the implementation of its production focused interventions in Southern Bangladesh and in focusing the design of these in relation to market demand and supply characteristics.

1.2 Objectives

The objectives of this study are to assess:

i. *The market potential for fish seeds:* Size of the regional and national market; unmet demand in the regional and the national market

ii. *Production and distribution systems:* Fish seeds producers and their skills; cost of production and distribution; value added; intermediaries in the distribution systems and their roles; price at different level of the distribution systems; technology and technical knowhow; support services rules and regulations etc.

iii. *The competitiveness:* Strengths, weaknesses, opportunities and threats in carps seeds production and distributions systems

iv. *Determine market based solutions:* Based on the analysis identify constraints in the fish seeds market systems in the study region and recommend market based solutions

1.3 Methodology

1.3.1 STUDY PROCESS: The study was conducted in 5 phases:

Phase-1 Secondary research to identify industry problems and construct the primary value chain: Secondary research was culled from Quarterly reports of "Carp Seed Quality" by DANIDA and WorldFish along with government information on carp fish seeds supply. KII (Key Informant Interviews) were conducted with WorldFish HO personnel, then regional contacts in Satkhira and Jessore. Using both secondary research and KII, a comprehensive checklist was developed about the probable bottlenecks working in the industry towards quality degradation.

Phase-2 Preliminary Assessment: Using the checklist, an open-ended in-depth questionnaire was developed to identify core issues regarding current quality of fish in southern region. The questionnaire was used to collect information from Satkhira and Barisal on market-end insights as well as production and business practices of respondents chosen via convenient sampling. From the survey we narrowed down the key issues and stakeholders of the market.

Phase-3 In-depth qualitative survey: Based on the findings from the preliminary assessment, questionnaire for in-depth quantitative and qualitative survey was designed individually for Hatcheries, Nurseries and Farmers to capture the core issues and objectives of the report in more detailed and

quantifiable terms for analysis. This questionnaire was used to initially carry out the survey by the consultants.

Phase-4 Quantitative survey: Following initial survey at Jessore on Day-1, the Enumerators were trained in survey and questioning techniques and then sent to geographically distant locations to acquire more respondents and spread of data. They also re-surveyed the former contacts from Satkhira and Barisal to integrate their responses along the new questionnaire.

Phase-5 Data Entry, collation and analysis: Finally, data collected from 91 respondents were collated and analysed to conclude on the findings and recommended strategies.

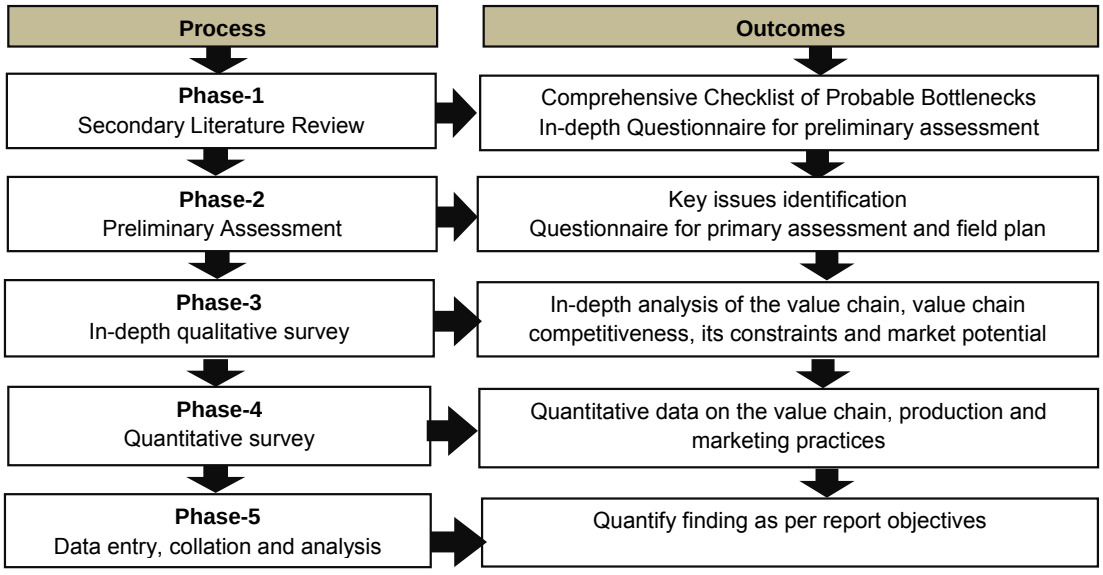
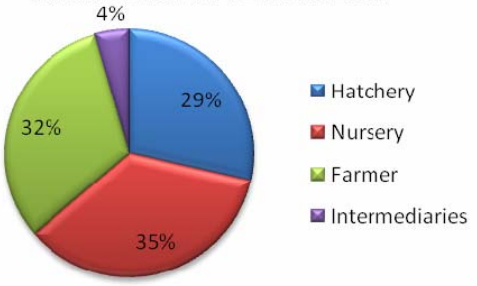


FIGURE 1: THE STUDY PROCESS

1.3.2 SAMPLING: Initial list of hatcheries within Khulna, Satkhira and Jessore was collected from DoF. Using the geographic spread of hatcheries within each district, the hatcheries were chosen based on cluster sampling. Then, within each location, hatcheries were contacted as per availability and convenience. As contacts for nurseries were mostly unavailable, the hatchery respondents were used to discover nursery clusters in Ovoynagor and Sharsha via snowballing technique. Consequently, contacted nurseries were used to find farmer cluster in Fultola and Barandi. In addition, fingerling market in Jessore and Fultola were identified where contacts were made on-the-spot as per availability. The advantage gained is that information of one party could be validated by another, e.g.: Check of hatchery's selling prices of spawn with the spawn buying prices of nurseries to identify any discrepancies and enhance accuracy of information.

FIGURE 2 : PERCENTAGE DISTRIBUTION OF RESPONDENTS



The sample size was determined based on the structure of the value chain and the expected number of population at each level (input supply,

production, processing, intermediaries and end-market) of the value chain. The core respondents of the study belong to four group of actors (i) hatcheries (ii) nurseries (iii) intermediaries (fry and fingerling traders) and (vi) farmers. Besides, officials from DoF, BFRI, Fish Feed and Aquachemical companies, Hormone importers and traders were interviewed as key informants. The list of respondents is provided in Annex 1.

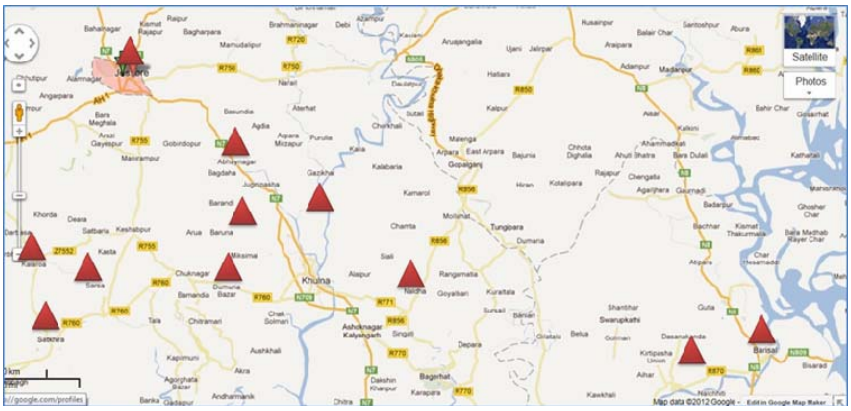
TABLE 1: DISTRIBUTION OF RESPONDENTS OF THE STUDY

Respondent Group	Actors	Respondent no.	Jessore	Satkhira	Barisal
Seed Supplier	Hatchery	26	17	5	4
	Nursery	32	17	12	3
Intermediaries	Agent	1	1		
	Patilwala	2		1	1
	Wholeseller	1	1		
End-User	Farmer	29	17	5	7

1.3.3 LOCATION: Three major districts were covered in the study- Jessore, Satkhira and Khulna (Barisal zilla). Particular emphasis was put on Jessore, considered as the fish seed capital Bangladesh and one of the major sources of fish seed supply. Satkhira and Barisal are the locations for grow-outfish farmers and end-market insights were gathered from there.

Jessore mainly, Chasra and Kolaroa were chosen as hatchery clusters. Obhoynagor, Sharsha, Pantapara were the nursery clusters, while Barandi, Fultola and Satkhira were among the locations surveyed for farmers. In addition, Babla Tolar market and Fultola market – meeting points for Agents and wholesellers respectively – were surveyed for Intermediaries' impact on Market chain.

FIGURE 3: GEOGRAPHIC DISTRIBUTION OF THE SAMPLES



CHAPTER 2: THE NATIONAL and THE REGIONAL MARKET for CARP SEEDS

2.1 MARKET SEGMENTS

The end market (type of consumers) for carp seeds vary depending on the type and the size of seeds (spawn, fry, fingerlings, juveniles). Carp seeds production can be broken down into several stages- (i) egg to spawn production (about 6 days), (ii) spawn to fry nursing (about 20 days), (iii) fry to fingerling rearing (about 20 days) and (iv) fingerling to juvenile rearing (about 50 days). Thus, the carp seed may be categorized at its final size into spawn (below 1 cm), fry (2-3 cm), fingerlings (7-8 cm) and advanced fingerlings/ juvenies (12-14 cm). Besides, overwintered fingerlings/juveniles (upto 100 gm) is produced by advanced nurseries and grow-out fish farmers. The primary buyer for spawn is the nurserers who nurse and sell fry or fingerlings to the grow-out fish farmers. However, some large scale grow-out fish farmers who maintain nursery ponds also procure spawns directly from the hatcheries. Figure 1 illustrates the the end market for the various types of carp fish seeds.

FIGURE 4: END MARKET FOR CARP SEEDS

	Primary Buyer	Secondary Buyer
Spawn (<1 cm)	Nurseries (>100 decimal)	Large scale nursery cum grow out fish farmer (>100 decimal)
Fry (2-3 cm)	Medium (50-100 decimal) and small scale grow out fish farmer (5-50	Large scale grow out fish farmer (>100 decimal)
Fingerling (7-8 cm)	Large scale grow out fish farmer (>100 decimal)	Small scale grow out fish farmer (5-50 decimals)
Advanced fingerlings (12-14 cm)	Advanced farmer (medium or large but adopts improved practice/ innovative technology even for higher expenses	

We can divide the farmers into several groups based on the size of the pond that they own or lease- nurseries (above 100 decimal), large scale nursery cum table fish farmer (>100 decimal), medium scale farmers (50-100 decimal) and small scale farmers (5-50 decimals). The primary buyer for spawn is the nurserer who rears the spawn to produce fry or fingerling and then sell it to the grow-out fish farmers. Since they own several ponds the large scale farmers are able to play the dual role of a nurserer and a grow-out fish farmer. Thus they tend to produce table fish primarily from spawn purchased directly from the hatcheries. They are also the primary buyer for fingerlings produced by the nurseries. However, much of the fish seed is sold to the grow-out fish farmers as fry since the small and medium scale farmers tend to produce primarily from fry because of lack of working capital.

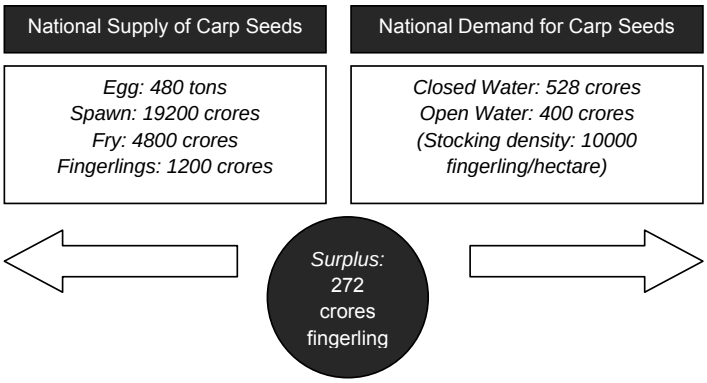
The small and medium scale fish farmers could benefit the most if they produced table fish from fingerling instead of fry as this would shorten the grow out period and reduce cost of operations. The current national trend is to produce table fish up to the size of 500-600g which takes about 5-6 months because of poor quality of the fry. This could be shortened to 4 months if the grow-out farmers produced from fingerling. *But this would require intervention to support the farmers avail credit for working capital.*

The nurseries benefit the most if they sell fry as it allows them to accommodate multiple production cycles (7-8 production cycles per annum for fry against 3-4 production cycles per annum for fingerling) and keeps mortality low (60-70% for spawn to fry while around 70-80% for spawn to fingerling). This means, *the nurseries have a conflicting interest with the small and medium scale grow out fish farmers. This could be reduced if the project facilitates the nurseries to improve their management practice so that they could achieve better survival rate (at least 25% for fingerling).*

2.2 THE NATIONAL MARKET FOR CARP SEEDS

Secondary data suggests a surplus of 272 crores fingerlings in the national market. It has been estimated that in 2009-2010, 77 government hatcheries and 931 private hatcheries produced over 480,000 kg or 480 tons spawn (source: FRSS 2009-2010). Accounting for 4 lacs pieces per 1 kg spawn, total national production of spawn can be estimated to be 19,200 crores. From this, an estimated 4800 crores fry (at 25% survival rate) and 1200 crores fingerling (at 25% survival rate) were produced in the country. Accounting for stocking density of 10000 fingerlings per hectare, total national demand for fingerlings for closed water bodies has been estimated to be 528 crores. Additionally, 400 crores fingerlings are needed for the open water fish cultivation. This means the current national supply (1200 crores fingerlings) is higher than the current national demand (928 crores fingerlings).

FIGURE 5: NATIONAL DEMAND AND SUPPLY OF CARP SEEDS



2.3 THE REGIONAL (SOUTHERN) MARKET for CARP SEEDS

The hatcheries in Jessore were the early movers in Bangladesh in carp seed production and enjoyed first mover advantage in the market in terms of market share. The spawn produced from the hatcheries in

FIGURE 6: THE MARKET (LOCATION) FOR SPAWN PRODUCED IN THE SOUTHERN REGION IN BANGLADESH

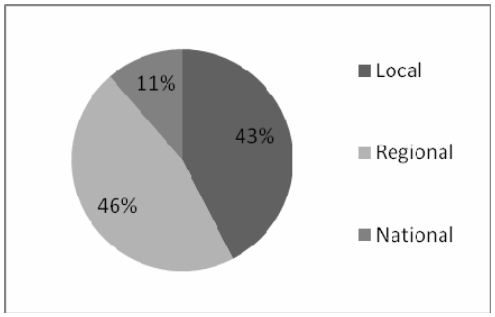
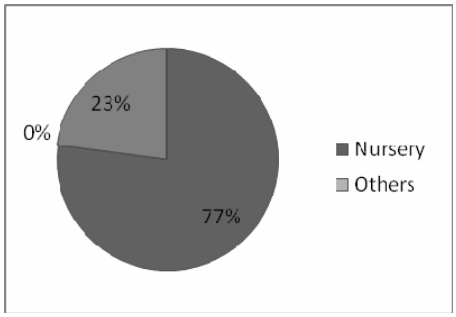
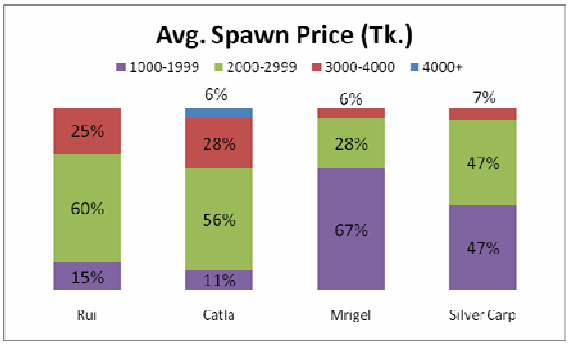


FIGURE 7: CUSTOMER TYPE FOR SPAWNS



Jessore were supplied not only to the southern regions (Barisal, Satkhira and Khulna) but also across Bangladesh. However, the supply to markets other than south has reduced over the last decade because of growth in hatcheries primarily in Mymensingh, Comilla, Bogra, Noakhali and Lakhshmipur. Currently 89% of the spawn produced in the region is sold within the region while the rest 11% is sold outside the southern region (source: primary survey). According to the respondent hatcheries, of the total volume of spawn produced in the southern region, 77% is sold to nurseries and 23% is sold to the table fish farmers. There are as many as 99 operational hatcheries in the southern region which produced 135 tons spawn or 1353 crores fry which is about 28% of the total national production.

FIGURE 8: AVERAGE PRICE OF SPAWNS IN THE SOUTHERN REGION IN BANGLADESH



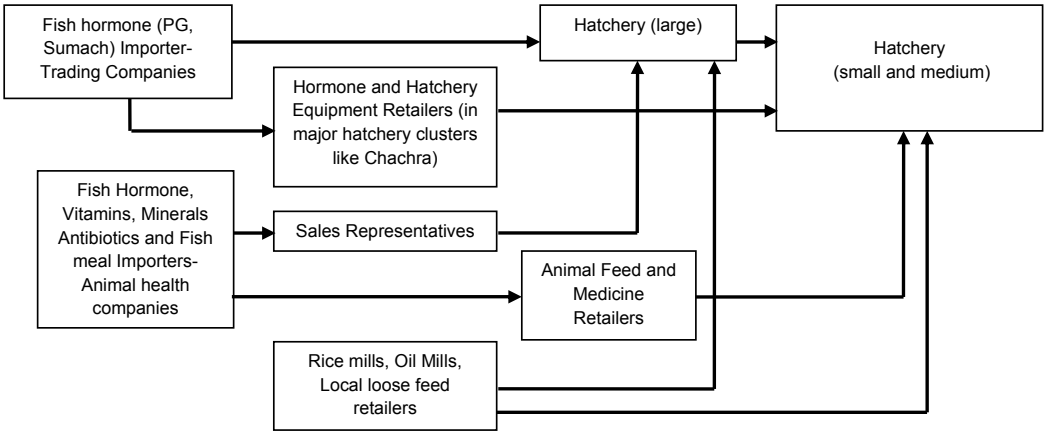
The hatcheries, nurseries and the intermediaries in the region compete mostly with price which hints at a saturated market demand. *However, hatcheries that are able to produce quality seeds and are renowned for consistent quality have reported higher than average market price which hints at untapped opportunities for quality seeds.* The trading intermediaries also reported that they are able to sell better quality fry or fingerling at a higher market price. As can be seen in figure 8, in the peak season, the price of spawn for all the species (except for Mrigel) tends to be in the range of TK. 2000-2999. We cannot conclude that the spawn that is sold at a higher price range is of quality. However, the fact that more than one third of the Ruhi and Catla spawn produced in the region is sold within the range of TK. 3000-4000 is an indication of an existing market for better quality seeds.

CHAPTER 3: THE VALUE CHAIN CATERING to THE REGIONAL and THE NATIONAL MARKET FOR CARP SEEDS

3.1 Inputs Supply

Inputs needed for spawning include- hormones (PG, HCG, Sumach, Ovaprim), antibiotics and other medicines (vitamins, minerals) and feed (homemade and ready feed). PG and Sumach are mainly imported from India. Of the feed ingredients maize and soyabean are imported from India and USA while fish meal, meat and bone meal etc. are imported from India, Malaysia and the EU. Vitamins and minerals are imported from India, Thailand and the EU. HCG, Ovaprim are mainly imported from China. The imported inputs are marketed directly to the large hatcheries. Some of these hatcheries sell the inputs to other medium and small scale hatcheries in their region. *Specialized input retailers exist but the number of specialized input retailers and their reach is low. It can be observed that it is not feasible for specialized input retailers to operate since the hatcheries are spread out and there are not many hatchery clusters in the country like that in Chachra in Jessore district and Shombhugonj, Phulpur, Trishal, Gouripur in Mymensingh district.* However, some local animal health companies like EON, which are marketing imported vitamains and hormones (like flush) have nationwide distribution reaching the hatcheries through sales representatives and retailers.

FIGURE 9: INPUT SUPPLY SYSTEM IN THE CARP FISH SEEDS VALUE CHAIN IN THE SOUTHERN REGION IN BANGLADESH



Currently, there are two hormone importers in Jessore- Sona Howlader Enterprise and Abdur Rashid Enterprise. Another hormone trader, Abdul Kuddus Enterprise is engaged in collecting wet PG from the local market and marketing it in wet or dried form. Sona Howlader Enterprise markets the imported hormone through two agents directly to the hatcheries across Bangladesh through courier service. Besides, several private and public technicians are also engaged in marketing the hormones to the hatcheries.

The feed is primarily mixed and produced by the hatcheries from local ingredients (rice bran, mustard oil cake, maize, wheat bran, wheat flour, de-oiled rice bran, molasses, dry fish) and imported fish meal, soyabean, vitamin premix and minerals. The loose feed is sold by rice mills, oil mills and local loose feed retailers. The fish and poultry feed companies have their dealers and retailers from whom the hatcheries buy soyabean, fish meal, maize, wheat bran, vitamin premix etc. Major fish feed and aqua chemical

marketing companies in the study region include- EON, Paragon, Fishtech and Aftab. The fish feed and aqua chemical marketing companies on an average have 15-20 dealers in the southern region. Number of dealers in the region should be around 200-250 given that there are around 10-15 fish feed and aqua chemical marketing companies active in the region.

3.2 Brood Stock Supply

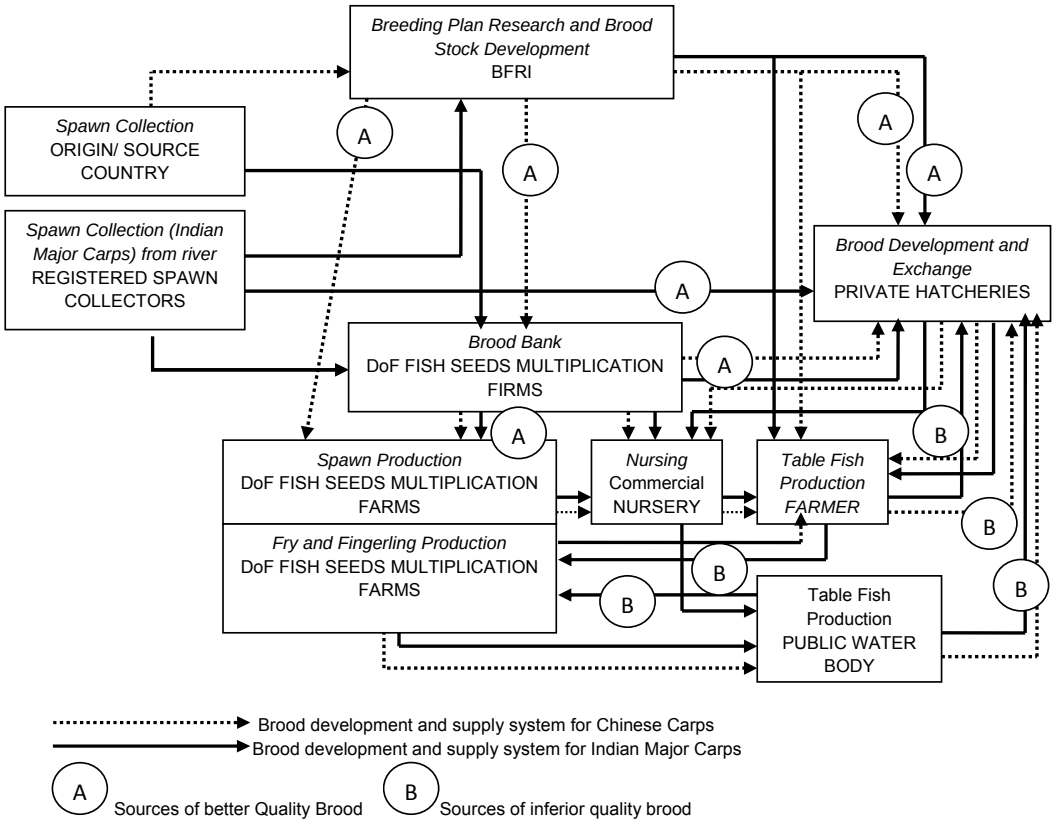
3.2 1: BROOD STOCK SUPPLY SYSTEM: Brood stock is the major and the core input for fish seed production. Brood stock supply thus needs to be categorized as a separate value chain function because of its importance and the complexity in its production and distribution. *Fifteen Percent (15%) of the current brood stock maintained by the 21 hatcheries that were interviewed in the Jessore and Satkhira districts is sourced from public hatcheries, 3% is sourced directly from rivers, 60% from nursery and table fish farmers and 22% are replenished from their own stock.* The system of brood fish production and supply thus engages several public and private channels.

Fifteen Percent (15%) of the current brood stock maintained by the 21 hatcheries that were interviewed in the Jessore and Satkhira districts is sourced from public hatcheries, 3% is sourced directly from rivers, 60% from nursery and table fish farmers and 22% are replenished from their own stock. (Source: Primary Survey)

Indian major carps (Rohu, Catla, Mrigea) and other carps (Kalibsu, Gonia, Reba, Bata etc.) are primarily collected from river sources (Halda, Jamuna, Padma, Brahmaputra rivers) through spawn collectors registered with DoF. Field representatives of DoF usually monitor the collection by being physically present over there. Spawn of Chinese carps (Silver carp, Bighead, Grass Carp, Common Carp, Black Carp etc.) and Minor Carps (Thai Shorpunti or silver barb) were primarily imported from source countries and were then researched and bred in research hatcheries managed by BFRI.

Spawn of Indian major carps collected from river sources are nursed in the brood banks managed by DoF Fish Seeds Multiplication Farms to produce small size fish (300gm - 1 kg) which is developed as brood stock by the private hatcheries. The DoF Fish Seeds Multiplication Farms across the country maintains brood stock produced from spawns collected directly from river sources (for Indian Major Carps) or from origins (for Chinese Carps) and through BFRI (for Indian Major Carps, Common Carps, Silver Barb Carps). They replenish their brood stock primarily from their own brood stock and then from BFRI but also collect mature brood fish directly from commercial grow-out fish farmers before spawning schedule in November and December to meet revenue targets. The spawn, fry and fingerlings that are marketed by DoF brood banks and the fish seeds multiplication farms are taken up in the commercial table fish production value chain by nurseries and table fish farmers.

FIGURE 9: BROOD SUPPLY SYSTEM FOR INDIAN MAJOR CARPS AND CHINESE CARPS IN BANGLADESH



Apart from DoF and BFRI, BRAC operates a brood bank in Srimangal. This brood bank is primarily managed to exchange brood fish among the 3 BRAC hatcheries across the country. The brood bank produced 7 tons spawn and 40-50 lacs fry and fingerlings. The spawns, fry and fingerlings are sold to private nurseries and grow-out fish farmers (BRAC beneficiaries as well as other commercial nurserers and grow-out fish farmers). The Indian Major Carp brood stock managed by BRAC is said collected to be collected from Halda, Jamuna and Padma rivers. The Indian Major Carp; Common Carp and Silver Barb brood fish are collected locally from BFRI. The brood stock is replenished primarily through exchange between the hatcheries.

The private hatcheries maintain brood stock developed from small sized fry/fingerlings supplied by BFRI and DoF brood banks. But the majority of their brood stock is collected from the commercial grow-out fish producers rearing table fish produced from fry and fingerlings that can be traced back to the spawn supplied by DoF brood banks or the fish seeds multiplication farms. Besides, the private hatcheries also maintain a small percentage of the brood stock that are developed from spawn collected directly from river sources. Finally, some hatcheries also exchange brood stock between them to improve quality of their brood stock.

From this analysis we can deduce two types of brood fish that are currently stocked and managed by the hatcheries: *(i) Brood collected as mature table fish from grow-out fish farmers and (ii) brood developed from spawn collected directly from river sources or from small sized fry/fingerlings collected from BFRI or DoF brood banks. The brood stock collected as mature table fish from table fish farmers represent the highest volume of brood supply in the southern region (explained further in subsequent sections) as well as in the country. Development and supply of brood stock from river sources or from small sized fish researched, managed and marketed by BFRI or DoF represents a small share of the total brood stock in the country, which is attributed to depleting catch from river and limited capacity of BFRI, DoF brood banks and the fish seeds multiplication farms.*

TABLE 2: SOURCE OF BROOD STOCK OF THE HATCHERIES INTERVIEWED IN THE SOUTHERN REGION IN BANGLADESH

Source	Percentage of the Total Brood Stock
Public Hatcheries	15%
River	3%
Nursery and Table Fish Farmers	60%
Replenished from Self Stock	22%

Source: Primary Survey

Thus, as much as 82% of the current available brood stock in the hatcheries in the southern region has been sourced through a system that is highly vulnerable to inbreeding depression, hybridization, negative selection and breeding from inferior quality and smaller sized brood fish.

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3.2.2 BROOD FISH AVAILABILITY:

As per the data collected from the CSISA Jessore Hub Region, there are around 99 operational carp hatcheries in Greater Jessore, Greater Barisal, Greater Khulna and Greater Faridpur region. The hatcheries produced 135.3 tons spawn in 2009-2010. From this account *we estimate that 798.67 ton brood is currently stocked by the hatcheries in the region.* Volume of male and female brood stock can be estimated to be respectively 266.22 ton and 532.45 ton. *Accounting for replenishment demand of 15% per annum, the annual demand for brood stock in the region can be estimated to be around 119 tons.*

TABLE 3: CURRENT VOLUME OF BROOD STOCK IN THE SOUTHERN REGION AND THE DEMAND FOR REPLENISHMENT[1]

Region	Volume of Female Brood Stock (ton)	Volume of Male Brood Stock (ton)	Total (Region) (ton)	Replenishment Demand (ton) (15% of the Brood Stock)
Jessore	357	178	535	80
Khulna	11	5.5	16.4	2.46
Barisal	106	53	159	23.85
Faridpur	59	29.5	88.4	13.26
Total	**532**	**266**	**798.8**	**119.82**

Source: Extrapolation from Primary Data on Annual Production of Spawns by the Operational Hatcheries in the Study Region (CSISA)

[1] 1kg spawn can be produced from 4 kg female brood. Given that the total volume of spawn production in Jessore region in 2009-2010 was 96 tons the total female brood stock can be estimated to be approximately 357 tons. The same formula was used to derive the brood population for other region. Male to female stocking ratio was calculated to be 1:2

DoF's brood bank project supplied 74 tons brood fish in last four years from 20 hatcheries. The DoF maintains that it would continue its production and supply of brood stock through the revenue hatcheries once the brood bank project is completed but it will not be able to scale up the production from the current level because of lack of resources (ponds, technical expertise and funds).

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Supply of the pure line brood stock from the river sources has depleted over the years. Annual catch of fertilized carp eggs (once it was collected about 4000 kg) from Halda river has been drastically gone down and recently estimated was approximately 0.234 ton in 2011.[2] Ninety percent (90%) of the production from Halda (0.21 ton) is reported to be Catla. Account of collection from Jamuna and Padma is not available. Moreover, the catch from Jamuna and Padma is reported to be the residual coming from India. Since, catch from Halda is the only formal and the major source for pure line stock, we estimate that the national catch from river sources is around 40% higher than the catch from Halda or about 0.32 tons. According to the Project Director of Halda Project (Restoration of Natural Breeding Habitat of Halda River), large volume of the catch from Halda is consumed directly by the nurseries and fish farmers to produce table fish. Some of this is recycled as brood fish. But few advanced hatcheries from Jessore and Khulna and from other districts also purchase spawn from Halda which is reared as brood.fish In 2011, only 6 hatcheries from Jessore, Mymensingh, Comilla and Chittagong collected spawn from Halda while about 188 nursery and grow-out fish farmers, mostly from Chittagong, Cox's Bazar and Comilla collected the spawn from Halda.

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The price of spawn caught from Halda river is usually on the range of Tk. 50000-Tk. 60000/ kg. Given the huge cost of the spawn it is ironic that a larger share of the catch from Halda is used to produce table fish. The value addition would have been higher if the catch from Halda was managed primarily to produce brood fish. Clearly, there is a huge deficit in supply of quality brood stock through formal resources, which need to be addressed at the national level for sustained improvement of the quality of carp seeds. *The capacity of BFRI and DoF needs to be expanded to facilitate breeding plan and genetic management research to maintain public "Breeding Nucleus" and development of improved quality brood fish over there. On the other hand, "Breeding Nucleus" in a number of privately owned commercial fish hatcheries in different places can also be established and operated. Furthermore, the existing channel of mature brood supply through the grow-out fish growers needs to be improved to ensure sustainable supply of quality brood stock in the country.*

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3.3 Seeds Production

District	# Carp Hatcheries	% of Total
Jessore	29	29.29%
Khulna	16	16.16%
Barisal	37	37.37%
Faridpur	17	17.17%
Total	**99**	**100%**

[2] http://www.thedailystar.net/newDesign/news-details.php?nid=218540

3.3.1 SPAWN PRODUCTION: There are 99 operational hatcheries in the region. According to a survey conducted by CSISA Jessore Hub Region, the hatcheries in the southern region produced over 135.3 ton spawn in 2009-2010. An important point to note is that even though number of hatcheries operational in Jessore is about 29% of the total number of hatcheries in the region, the hatcheries in Jessore produced over 71% of the total volume of production of spawn in the region (table 5). On the contrary the Barisal Region constitutes 37% of the total number of hatcheries in the region but the total volume of production of spawn in the region is roughly about 13%. *This indicates that the hatcheries in Jessore are much larger in terms of capacity.*

TABLE 4: DISTRIBUTION OF CARP HATCHERIES IN THE SOUTHERN REGION

Source: CSISA Jessore Hub Region

3.3.2 FRY AND FINGERLING PRODUCTION: Accounting for 400000 pieces of fry from 1 kg spawn *we estimate that the total production of fry in the region was about 1353 crores which is about 28% of the total national production (4800 crores).* However, according to industry experts, average production per kilo spawn should not be more than 300000-350000. On this account a conservative estimate of the total production of fry in the region would be 1015 crores.

TABLE 5: DISTRIBUTION OF CARP SPAWN PRODUCTION IN THE SOUTHERN REGION

District	Approx. Production of carp spawn (ton)	% of Total
Jessore All	96	71%
Khulna All	7	5%
Barisal All	17.6	13%
Faridpur All	14.7	10.88%
Total	135	100%

Source: CSISA Jessore Hub Region

3.4Seeds Distribution: The spawn is sold directly to the nursery or grow-out fish farmers from the hatchery premises. The hatcheries sell major percentage of the spawn directly to the nurseries who then rear the spawn to produce fry or fingerling. Usually the nursery or grow-out fish farmer places pre-order to the hatchery based on which the hatchery produces the spawn. Ready spawn are also available in limited volume from residual, leftover or unsold produce. *According to the respondent hatcheries, 93% of the spawn are sold on pre-order while the rest are sold as ready to order.*

The nursery markets fry or fingerlings mostly through hawkers or patilwalas who then sell the fry or fingerlings to the grow-out fish farmers. The nurserers also sell through sub-agents who purchase the fry or fingerlings on credit and then sell to commission agents in larger fingerling market(s) like that in Chachra. According to the respondent nurserers 45% of the fry and fingerlings are marketed through commissioning agents, 27% are marketed directly to grow-out fish farmers while the rest 18% is sold through patilwalas or hawkers. It should be noted in this context, that the volume of sales through patilwalas appears to be low given that the study focused mostly on locations that are proximate to the hatchery clusters. For areas that are far from the hatcheries and the nurseries the patilwalas are the primary trader of fry and fingerlings.

Source: Primary Survey

FIGURE 10: MODE OF SALES

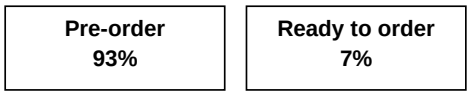

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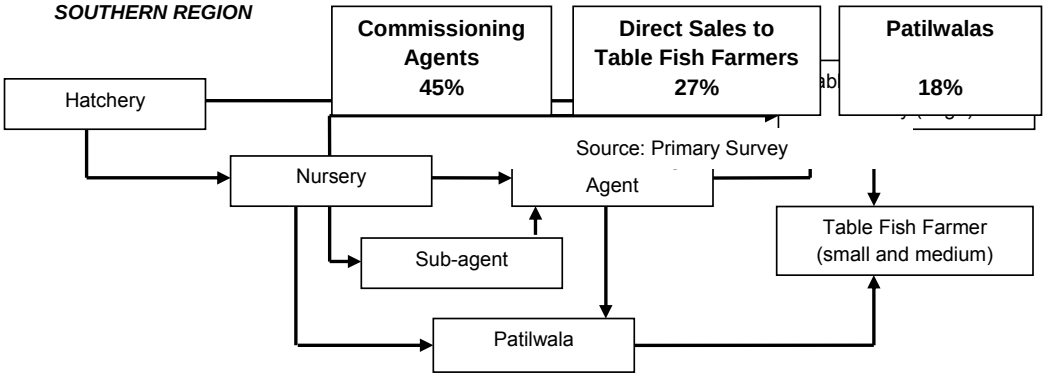
FIGURE 12: CARPS SEEDS DISTRIBUTION SYSTEMS IN SOUTHERN REGION

FIGURE 11: TRADE CHANNELS FOR FRY AND FINGERLING



3.5 Relationships amongst the Value Chain Actors

3.5.1 VERTICAL LINKAGES

Between the hatcheries and the nurseries: Trust and loyalty was found to be a key factor for retaining business for the hatcheries as well as the nurseries. *Eighty percent (80%) of the customers (nurserers) of the respondent hatchery operators have regular transaction with the hatcheries.* According to the nurserers they prefer to have a regular relationship with one or multiple hatcheries as it guarantees them certain quality and weight. For example, if mortality is found to be higher than usual the hatchery will supply certain percentage of the total sales as replacement stock. Besides, some nurserers reported that they get credit support from the hatcheries because of which they tend to continue their business.

However, even though the hatcheries have managed to retain their customers, in recent years the price of spawn has stagnated while cost of production has increased (further detailed in chapter 4). Even though hatcheries that are known for quality are selling their products at a higher price (on an average higher by Tk. 500/kg from the regular market price), the rest of the hatcheries are struggling to keep their profit margin. *It can be ascertained from these facts that the market is primarily dictated by the nurserers. In other words it's a buyer's market when it comes to trade between hatcheries and the nurseries.* The bargaining power of the nurserers has increased as the hatchery operators generally are not able to control their quality and are forced to provide flexible terms (replacement, credit, lower price etc.). *By improving quality of their produce the hatchery operators will be able to dictate better price in the market, which will help to generate higher income to sustain quality carp seed production.*

The nurserers and grow-out fish farmers that purchase directly from the hatcheries also serve as the brood suppliers to the hatcheries.

Between the nurserers and the trading intermediaries: As noted before, the nurserers primarily sell through the trading intermediaries (commissioning agents or patilwalas). Forty Nine Percent (49%) of the of the customers of the nurseries are regular buyers while 31.5% are irregular buyers. The rest of the customers (13%) are one time customers. *The relationship between the nurserers and the trading*

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intermediaries are thus much more evenly distributed. The nurserers usually sell through the trading intermediaries on a daily or weekly credit terms. The intermediaries source from several suppliers and mix the fry and fingerlings, which makes it impossible to trace the source of the fry and fingerlings sold by the intermediary.

Between the trading intermediaries and the farmers: The farmers usually get their spawn from the patilwalas, the commissioning agents or directly from the nurseries. The purchase is usually made on cash. *The bargaining power of the trading intermediaries is higher, particularly in the case of small scale farmers as these farmers cannot buy directly from the nurseries on bulk volume.* Price is dictated by the trading intermediaries.

Between the input suppliers and the farm enterprises (hatchery operators, nurserers and farmers): Bulk inputs, for example, feeds are sold on cash or on credit. Other inputs (hormone, vitamin etc.) are sold primarily on cash.

Between the public hatchery and the private hatchery operators, nurseries and grow-out fish farmers: The relationship between the public and the private hatchery operators has a huge significance on quality since the private hatcheries depend on the public hatcheries for the supply of brood stock. Besides, the nurserers as well as large scale grow-out fish farmers source fry and fingerlings from the public hatcheries. According to the public hatcheries for example, the Kotchandpur Brood Bank or the Raipur Hatchery, buyers are served on a first come first serve basis. However, *according to our respondents, only those hatchery operators, nurserers or grow-out fish farmers with strong lobby have access to the public hatcheries. Therefore, much of the quality brood stock and the fry and fingerlings are bought by large scale hatchery operators, nurserers and grwout fish farmers.*

3.5.2 HORIZONTAL LINKAGES

Between the hatcheries: The hatchery owners exchange brood fish between them. They also have very clear knowledge about each other's capacity and competency. Exchange of knowledge and information on hatchery management also takes place through formal and informal meetings, seminars and workshops. *The close relationship between the hatcheries ensures that knowledge on improved breeding technology, hatchery management practices etc. are quickly disseminated to all the hatcheries in the region. It has also been reported that some hatcheries purchase spawn at lower price from other hatcheries if they have a short supply and sell to the nurseries at a higher price that was agreed upon at the time the order was placed.*

Between the nurseries: Like the hatcheries, the nurseries too exchange knowledge and information on sources of quality seeds, price etc. to other nurseries in their locality or region. They also collaborate with other nurseries to visit hatcheries outside their region together and rented vehicle for transportation of the spawn.

3.6 Provision of Business Services

3.6.1 EMBEDDED SERVICES

The provision for embedded services for the seeds value chain has been found to be absent. The input companies and their dealers are not engaged in providing embedded knowledge and information on use of inputs, technologies etc. The public hatcheries that supply brood stock to the private hatcheries do not

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provide information on brood stock management and brood stock propagation and multiplication. The seeds supply system disconnects the fish grow-out farmers from receiving information on quality of the seeds that they are purchasing. Embedded information services across the value chain needs to be strengthened to increase awareness about the benefit of quality seeds and its sources.

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3.6.2 PUBLIC BENEFIT SERVICES

Presence of an active hatchery association (Jessore Zilla Matsya Hatchery Malik Samity) in Jessore is an advantage for the southern region, which can be leveraged to improve the market systems for quality seeds. The hatchery has recently merged with another association (Jessore Zilla Matsya Malik Samity) to represent a wider group which includes the hatcheries, nurseries and grow-outfish farmers in the Jessore region. The association has been working actively for advocacy and lobbying and coordinated efforts to safeguard the carp fish industry in Jessore from decline due to unavailability of quality brood stock. The association is facilitated by the WorldFish Center to collaborate with BFRI for training on brood stock and hatchery management, nursery management, improved brood stock development or new introduction of improved strains from abroad (import of Joyonto Rohi from India and Chinese Carps from China).

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Besides, the association is also working to ensure access to spawn collected from Halda river. The association is also doing an advocacy with the government for dredging of the Jamuna and Padma rivers to develop natural fish breeding habitat and spawning grounds. The hatchery is also coordinating with the nurseries to provide the nurseries information on quality seeds and sources of quality seeds so that there is increased incentive and market for quality seeds in the region.

BFRI's regional research sub-station in Jessore is actively engaged in providing technical support to the hatcheries. DoF extension service is also available, especially in Jessore, given the importance of the region in production of carp seeds in the country. The relationship among the hatcheries, BFRI and DoF can be further strengthened to facilitate fish breeding and related research and promote/adopt improved technologies, for example cryopreservation, to improve brood stock production and supply of quality seeds in the region.

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The "Restoration of Natural Breeding Habitat of Halda River Project" provides an opportunity to the hatcheries in the southern region to collaborate for increased access to natural spawn/seeds from the Halda River.

3.6.3 TRANSACTED SERVICES

Formal transacted service for extension is not available. Unofficially the hatchery operators and to some extent the nurserers take service from the DoF officials in their respective region to manage their production systems. Transportation service has developed in response to the strong hatchery and nursery clusters. But the poor conditions of the roads have led to disruption in service and increased service cost in recent years.

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3.7 Enabling Environment

The new hatchery policy makes it mandatory for the hatcheries to maintain brood ponds to have license. According to the new hatchery policy all the hatcheries in the country have to get license from DoF to operate. The hatchery policy has also made provision of quality check and inspection. If implemented the hatchery policy will ensure better hatchery management practices and improved quality of fish breeds/seeds. The Director General of DoF in his interview with the consultants showed determination to

strictly implement the hatchery policy. However, the respondent hatcheries were not found to be much aware about the hatchery policy. *The project needs to collaborate with the hatchery association and DoF to create awareness amongst the hatcheries about the hatchery policy and support the hatcheries to qualify for license.*

CHAPTER 4: COMPETITIVENESS ANALYSIS

4.1 PRODUCTION COMPETENCY

4.1.1 USE OF INPUTS:

New low cost input technologies are available but are not yet widely adopted because of lack of awareness. For example use of Ovprim and Flush (which have to be used once while PG has to be used twice) instead of PG can reduce cost on hormones by more than 50-70%. Besides, Ovprim and Flush can also potentially reduce the use of inferior quality brood fish since the hatcheries using it will have to stop using such brood stock as Ovaprim and Flush damage the ovary of the brood fish. The project can potentially partner with the importers of these hormones to promote appropriate use of these hormones and the benefits. Currently EON Animal Health is marketing Flush while Ovaprim is being marketed by Allwell Marketing Company.

The hatcheries primarily purchase mustard oil cake from the loose feed retailers or the local oil mills. *The mixing is done based on trial and error which leads to high cost of production and causes malnourishment.* Cost of the feed (mustard oil cake, fish meal, dry fish, soyabean meal etc.) has increased in recent years (for example price of mustard oil cake has increased from Tk.14-15/ Kg to Tk. 18-20 Tk./ Kg in last 3 years) because of increase in demand (for locally sourced loose feed) and increase in conversion rate in dollars (for imported maize, wheat bran, fish meal, soyabean meal etc.). *By improving the quality of the homemade feed the hatcheries could increase Gonadal development which would result increase fertility and fecundity and therefore increase production of mature egg and reduce mortality of spawn.*

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4.1.2 PRODUCTION PRACTICES:

Analysis of the average age of the brood fish, weight, stocking density suggests that the hatcheries are not maintaining standards. As can be seen in Figure 13 and Figure 14, average age of the Rohu brood (2.2 year) is within the standard (2 year) and so is the average weight of the brood (1.8 kg). But the average age (2.3 year) and weight (3.1 kg) of Catla falls below the standard (respectively 3+ and 4+). Average weight (1.7 year) and age (1.8 kg) of silver carp is also below standard (2+ for both cases). From the findings, it can be ascertained that the degree of breeding from inferior quality or smaller size breeders and negative selection is high for most of the carp species other than Rohu.

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FIGURE 13: BROOD AGE AGAINST STANDARD
Source: Primary Survey

FIGURE 14: BROOD WEIGHT AGAINST STANDARD
Source: Primary Survey

Further analysis reveals that the problem with brood stock management might be more intense for Catla than for other species. Only 10% of the respondent hatcheries are not able to maintain standard age of the Rohu brood stock. On the contrary for Catla, more than 52% of the respondent hatcheries have brood stock that falls below the standard range for age. For both Mrigal and Silver Carp, 20% of the respondent hatcheries have brood stock that falls below the standard range for age. Furthermore, just about 20% of the respondent hatcheries have Rohu brood that falls below the standard range for weight while in case of Catla, 63% have failed to maintain the standard range for weight. For Mrigal and Silver Carp respectively 15% and 60% of the respondent hatcheries are not being able to maintain the standard range for weight.

FIGURE 15: BROOD AGE BY SPECIES

Source: Primary Survey

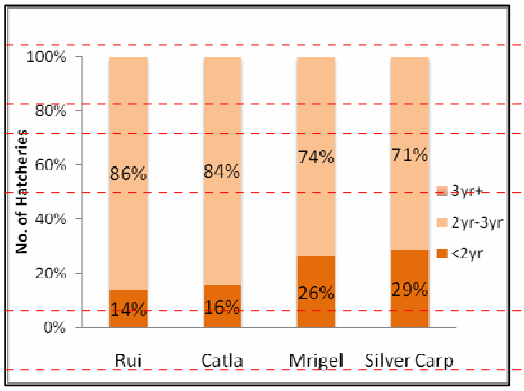
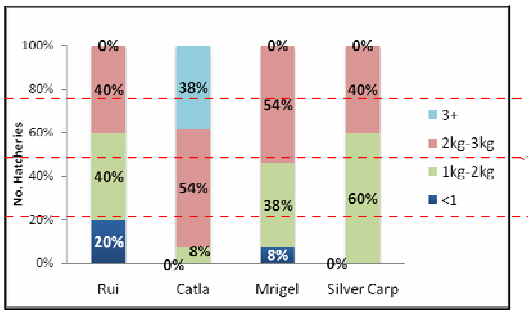


FIGURE 16: BROOD WEIGHT BY SPECIES

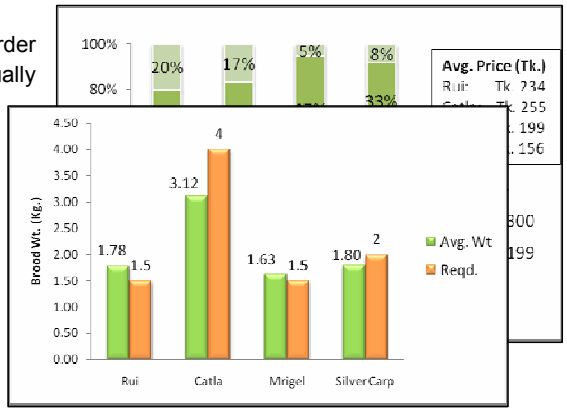
Source: Primary Survey



The official price of the Rohu and Catla brood sold by DoF is Tk. 140/kg. However, majority (65% for Rohu and 78% for Catla) of the respondents have bought brood for a price higher than Tk. 200/Kg. The price of brood is lower for Mrigal and silver carp. Respectively 52% and 41% of the respondent hatcheries have bought the brood for these species for a price higher than Tk. 200/Kg.

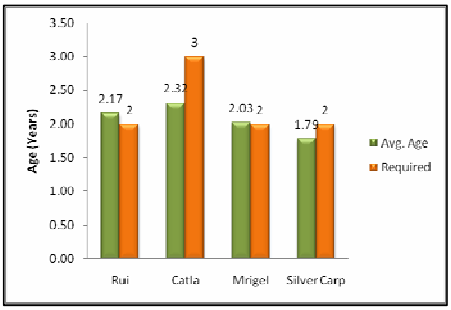
FIGURE 17: BROOD PRICE BY SPECIES

Source: Primary Survey



56% of the respondent hatcheries maintain a higher than standard stocking density which hints at improper hatchery management practice.

The hatcheries mostly produce spawn on pre-order as received from the nurseries but they usually



produce higher than the volume demanded to

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address mortality or unfertilized eggs. This also helps them to cater to higher demand in the market during the peak season. *Hatcheries that fail to produce as per order tend to collect inferior quality spawn from other hatcheries at lower than the price fixed at the time the order was placed. The problem is much more prominent for smaller hatcheries lacking the skill on brood stock maintenance and hatchery management.*

Two processes are followed for breeding- Induced breeding and controlled natural breeding. For major carp both induced and controlled natural breeding methods are adapted while for Chinese carp only induced or artificial breeding method is used. In this method, eggs are mostly collected by stripping, which requires fewer males (1:2) than controlled natural breeding (2:3) and is more popular with the hatcheries. *Sometimes the hatcheries deliberately cross two species (for example Catla with Rohu, Rohi with Mrigal, Mirror Carp with Catla). This happens because of two reasons-(i) failure of the hatchery to catch the male breeders from the brood pond and (ii) cross between certain species, for example Catla with Rohu, results a intra specific hybrid, which grows faster in nursery ponds which is preferred by the nurserers. The first problem (unavailability of the male breeders) could be addressed if melt collected from the males could be preserved in 0.9% sodium chloride NaCl) solution in an ice box or refrigerator. This can also help reduce cost by (i) decreasing the number of male brood stock (ii) increasing the amount of egg fertilization and (ii) fertilization from preserved melt in the next batch. However, the hatcheries are not aware of such technologies.*

FIGURE 18: AVERAGE STOCKING DENSITY

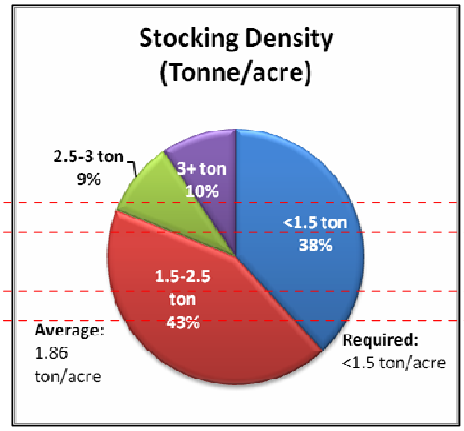
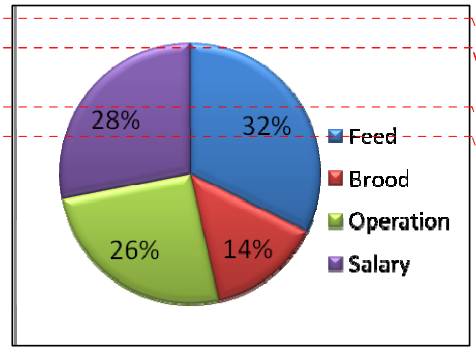


FIGURE 19: DISTRIBUTION OF COST

Source: Primary Survey



Cryopreservation is an advanced technique that has been successfully used in Vietnam for Pungas and in India for major carp species. In Bangladesh, faculty of fisheries of Bangladesh Agricultural Universtiy (BAU) in collaboration with BFRI organized training on cryo preservation technique for the hatcheries. The technique has not been widely adapted yet because of certain challenges, which include- requirement for advanced and expensive equipments like containers to preserve milt or semen on liquid nitrogen which costs around Tk. 6-7 lakhs. Besides, trained technicians or researchers to conduct external fertilization of eggs through preserved semen are not available. *Multiplication from milt preserved through cryopreservation will reduce the need for male brood by 25-30%, which would help reduce the cost of operations and at the same time ensure geneticquality of the brood stock.*

Cost of feed accounts for 32% of the total cost of production of spawn. Because of increase in dollar conversion rate and inflation price of imported feed has increased over the last few years. Besides, price of fuel has also increased which has increased cost for maintaining generators in absence of electricity.

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The increase in cost of production against a stagnating market price (See section 4.2) has reduced the competitiveness of the hatcheries as they have less income and capital to produce quality seeds.

Number of hatcheries in the region has significantly dropped in recent years. Number of operational hatcheries in Jessore declined from 72 to 42 in recent years. Some of the hatcheries that were interviewed suggested that they are planning to switch over to Tilapia production and close the operation of their carp hatcheries. The DG of DoF expressed that the decline in number of hatcheries will prove to be beneficial for improving supply of quality seeds as the national supply of carp seeds far exceeds the national demand for carp seeds. Our findings suggest that the intense competition amongst the hatcheries to sustain market share will induce further decline in number of hatcheries. *Therefore, achieving production competency through increased production of quality seeds, increased productivity and reduced operational costs will be the key issue to sustain seed business for the hatcheries.*

Based on the production practice adopted, we can determine three grades of hatcheries. The Grade A hatcheries are the ones that have comparatively better quality brood stock sourced from DoF, BFRI or from riverine sources thanks to their strong network and leadership position in the industry. The Grade B hatcheries are those that have good knowledge and understanding of quality management system in hatcheries but are struggling because of unavailability of quality brood stock from through which they can improve the quality of their produce. The Grade C hatcheries are those who have poor quality brood stock and lack the knowledge on quality management systems.

TABLE 7: COMPARATIVE ANALYSIS OF THE HATCHERIES

Indicator	Grade A	Grade B	Grade C
Brood Stock	❑ Primarily sourced from DoF, BFRI or from riverine sources ❑ Multiplied in self brood pond through good practices ❑ Comparatively better size, weight and stocking	❑ Primarily sourced from nurseries and table fish farmers ❑ Multiplied in self brood pond through good practices ❑ Moderate management of standard size, weight and stocking	❑ Primarily sourced from nurseries and table fish farmers ❑ Does not multiply brood through good practices ❑ Poor management of size, weight and stocking
Know-how	Have relatively better know-how on proper practices	Does not have the know-how but have willingness to learn and improve	Does not have the know-how and is not keen to learn and improve
Customer base	Mostly permanent	Mix of permanent and irregular	Mostly irregular
Cost of Operations	High cost of operations but in control	High cost of operations and less control on cost	Low cost of operations
Price	Gets higher than average market price	Gets average market price	Offers the lowest market price
Profitability	Good profitability because of control in cost of operations, higher market price and large number of permanent buyers	Low profitability because of higher cost of operations, average market price and shift of customers	Moderate profitability because of low cost of operations and low market price

From the table, it can be observed that while the Grade A hatcheries have managed to sustain profitability the Grade B hatcheries are struggling despite adopting comparatively better production and operations management practices. Ironically, the Grade C hatcheries are ripping the benefit out of the Grade B hatcheries by marketing inferior quality seeds at a lower price which they can sustain because of improper management practices. To sustain the industry the Grade C hatcheries have to be forced to adapt standards through stringent implementation of quality management policies by DoF while all the hatcheries should be provided access to quality brood stock. This will particularly benefit the Grade B hatcheries, which are ready to take off if provided the access to quality brood and the knowledge to manage the brood stock and quality of their produce ie. improved quality fish seeds.

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The nurserers usually prefer to produce and sell fry since mortality rate is low at the spawn to fry stage (on an average 60%) than on the fry to fingerling stage (around 70%). Besides, if they sell fry they can manage to produce more batches in one production year. The patilwalas or hawkers who market the seeds also prefer fry as they can sell higher volume. Even though it is more beneficial for the table fish growers to produce from fingerlings or juvenile majority of the farmers prefer to procure fry as the cost is comparatively lower for fry (Tk 0.10 per piece) than for fingerling (Tk. 0.30-0.40 per piece). But survival rate of fry in the grower pond (40-50%) is lower than the survival rate of fingerlings (around 60-70%) and nola (80-90%). This means *even though the farmer saves by purchasing fry at a lower price he loses in the overall production due to high mortality resulting because of production from fry. Besides, it is difficult to determine quality and purity of species while purchasing fry and thus the farmers are more prone to fraud while purchasing fry.*

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4.3 MARKETING COMPETENCY

The hatcheries and the nurseries in the region have strong distribution network thanks to the presence of one of the largest hatchery clusters in the country as well the largest nursery market. However, the roads and highways connecting the markets are in appalling condition and have affected the inflow of buyers from districts outside the southern region. As was noted earlier, growth of hatcheries across the country as well as within the southern region has dispersed the demand and supply of carp seeds which is one of the major reasons for decline in number of hatcheries that are operating in the Jessore region. Price of spawn has stagnated in recent years because of intense competition among the hatcheries. *Early season price of spawn ranges from Tk. 2800/kg- Tk.5000/Kg while the peak season price drops to the range of Tk. 1000/kg-Tk.2000/kg depending on the quality of the spawn. But despite increasing competition, stagnated market price and increase in cost of operations, hatcheries that are able to maintain quality have managed to sustain a higher price (higher by Tk. 500/ kg on an average from the market price). The price needs to be increased and sustained at a higher range to make the industry profitable.*

4.3 MARKET POTENTIAL

The analysis suggests that there is no gap between demand and supply for carp seeds in the region. At the current situation, only the hatcheries that are able to manage the quality of the spawn and the operations cost through improve hatchery management practices are able to dictate better price and sustain their market. *The wide dispersion in the range of price in the lean period and in the peak season suggests that the market elasticity for price is high.* The hatcheries will be able to dictate better price if they can earn the trust of the nurseries. The nurseries in return will be able to dictate better price for fry and fingerling as it is evident from the study.

Brood Cost/Kg	Spawn per 1 Kg of Brood	Spawn Price/kg	Spawn Revenue /Kg of brood	Value Added
Tk.	**Kg**	**Tk.**	**Tk.**	**Tk.**
(A)	(B)	(C)	(D)=(B) × (C)	(E)=(D) – (A)
150	0.15	2406	362	212

Calculation:

(A) Brood Cost/Kg

Brood Cost/kg = [Total Brood Cost ÷ Total Brood Volume purchased]

Total Brood Cost= *Tk. 147,798(avg.)* Total Brood Volume purchased= *757 Kg (avg.) (For details please refer to Appendix 1a)*

(B) Spawn per 1Kg of Brood

Spawn per 1Kg of brood = [Total Spawn Volume Sold ÷ Total Brood Stock].

Total Spawn Volume Sold = *(918Kg on average)*

Total Brood Stock = Stocking Density of Brood/Acre × Total acre of waterbody available

Stocking Density = *1857 Kg(avg.)* × Total Acre= *~4.08 acres (avg.)* = Total Brood Stock= *7514 Kg*(avg.)

With quality brood, **250gm** of spawn is usually produced from 1Kg of brood. However, the general low quality of brood was indicated by the average of 0.16Kg, i.e, **150gm** of spawn from 1Kg of brood. *(For details please refer to Appendix 1b)*

(C) Spawn Price/Kg

Spawn Price/Kg was calculated from [Total Revenue ÷ Total Spawn Volume Sold]

Total Revenue = ∑[Spawn Volume by-species × Average of highest and lowest price/Kg by-species]

Total Revenue = *Tk. 2, 120, 560 (Avg.) (For details please refer to Appendix 1c)*

Nursery:

Spawn Cost/Kg	Fingerling per 1Kg of Spawn	Fingerling Price/Kg	Fingerling Revenue/ Kg of Spawn	Value Added
Tk.	**Tk.**	**Tk.**	**Tk.**	**Tk.**
(A)	(B)	(C)	(D)= (B) ×(C)	(E) = (D) – (A)
2628	26.75	86	7442	4814

Calculation:

(A) Spawn Cost/kg

Spawn Cost/kg = [Total Spawn Cost ÷ Total Spawn Volume purchased]

Total Spawn Cost= *Tk. 1,694,000(avg.)* Total Spawn Volume= *664 Kg (avg.) (For details please refer to Appendix 1d)*

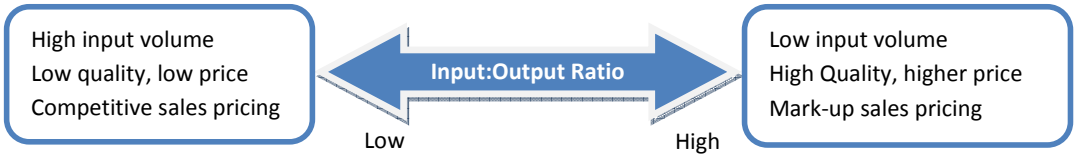
(B) Fingerling per 1Kg of Spawn
Fingerling per 1Kg of Spawn = [Total Fingerling Volume Sold ÷ Total Spawn Volume Purchased]
Total Fingerling Volume sold= *17714Kg (avg.)*
(For details please refer to Appendix 1e)

(C) Fingerling price/kg = [Total Revenue ÷ Total Fingerling Volume Sold]
Total Revenue = ∑[Spawn Volume by-species × Average of highest and lowest price/Kg by-species]
Total Revenue = *Tk. 1,432,570 (Avg.)*
(For details please refer to Appendix 1f)

In the value chain, we notice a sizeable shift in Value addition done by nurseries as opposed to hatcheries. This is due to the fact that input:output ratio of hatcheries lie at 1:0.15 while that of nurseries are 1:26.75. However, a single brood is used for 3-5 years so delivers over time. In addition, production related costs are much higher for nurseries, especially feed costs as the growth from spawn to fingerling requires intense feeding over a short period of time.

Industry **Grading**

As discovered from the survey, the quality of fish has inconclusive relation with size of the business in terms of sales volume. This is due to the spectrum of business practices that lie between:



Thus, while hatcheries and nurseries of all sizes are able to hit their desired volumes, the cost of input makes a strong difference in the ultimate value addition. Consequently, the input:output ratio becomes a better scale of measurement for the quality of their output as explained further below.

Hatchery – Grading impact

Grade	Spawn Volume	Stocking Density/Acre	Spawn/ 1kg of brood	Brood Cost/Kg	Spawn Revenue/ Kg of brood	Value Added
	Kg	Kg	Kg	Tk.	Tk.	Tk.
A	1141	1100	0.27	158	738	580
B	803	1650	0.13	175	357	182
C	863	2242	0.06	178	250	72

As shown above, the difference in quality brood purchase and management creates significant difference in value addition. Various factors impact the result as per business practices of the 3 kinds of hatcheries.

Grade-A *Hatchery*

These hatcheries generally have a much higher quality-conscious attitude and have established their business on the reputation and trust of their products' quality. Due to stronger linkage with government sources, they have a much higher quality of brood, which results in higher spawn production gained and low brood purchase requirements. Also, low stocking density ensures that the brood stock gets proper attention and nutrition. Consequently, they can demand higher prices for their spawn leading to the high value addition. As industrial trend-setters, they can play an important role as examples to demonstrate the business value of quality fish seed among their surrounding hatcheries as well as their customers

Grade-B *Hatchery*

Grade-B hatcheries are also quality-conscious, however, they are also much more sensitive to market-prices. This is because they do not have the government sources for brood and thus have to depend on nurseries and farmers like most of the industry, which makes it difficult for them to acquire the quality-assurance required to get a market for higher prices. Consequently, during peak season, when maximum demand meets maximum supply, they are most impacted by the lower prices offered by Grade-C hatcheries. However, since they maintain near ideal stocking density and production practices (proper pond preparation, use of PG, medicine and quality feed, etc), their production capacity is also limited. As such, these hatcheries maintain a smaller customer base (118 customers vs. 199 *(Grade-A)* and 173 *(Grade-B)*) who are convinced of their higher quality and are willing to pay the price. Thus, even though these hatcheries maintain almost the same standards as Grade-A hatcheries, their input:output ratio is much lower due to the lower quality of brood.

In case an intervention is designed to inject quality brood, these hatcheries are the ideal beneficiaries as they have the willingness and ability to nurture the stock properly and also gain the reputation and quality assurance required for them to improve their business.

Grade-C *Hatchery*

Grade-C hatcheries make up the majority of the industry. They are quality-conscious but prefer to compete on price rather than quality. As quality broods are insufficient in supply and there are no set standard to define quality, their business model runs on providing consistent quality at the best price by sacrificing brood quality and production practices. They acquire greater amounts of lower quality brood and nurture them in a high stocking density environment. Thus, leading to the low input:output ratio (0.06 vs. 0.13 of Grade-B). However, the sheer size of brood stock leads to higher output volume than Grade-B hatcheries. What is of greater concern is the practice of using their own spawn from their best brood fishes to replenish their brood stock, which is much higher among Grade-C hatcheries (40% vs. 5%*(Grade-A)* and 0% *(Grade-B)*). This means inbreeding is a much more common factor among them leading to faster deterioration of brood stock quality.
The high brood purchasing cost also indicates that many hatcheries purchase brood right before breeding season, which lasts for 4 months, and sell off the lower quality broods at the end of it as table-fish/brood fish to others in order to avoid the feeding cost of maintaining a brood for the off-season (8months). This is a strong influential factor as rising feed costs and stagnant spawn prices may encourage more hatcheries to adopt this practice.

Injecting quality brood into Grade-C hatcheries might not give the desired results as their selective in-breeding and high stocking density might result in lower output and fast deterioration of new brood's quality.

Conclusion:

Overall, we see that maintaining a lower stocking density of better quality brood with proper nurturing can

give a much higher value addition. Also, smaller brood stock would mean less feed required and thus much lower operating costs. So, even though it makes good business sense from a financial perspective, it increases the risk greatly. A large sized brood fish is a prized commodity and the risk of it being stolen is high, which would mean additional security costs. Another factor is that the fewer brood fish you have, the greater is the business impact of spawn produced by individual brood mothers.
The driving reason for trade relationship in this industry is the reputation of a business and the trust gained between a single customer and supplier built over many interactions over the years. At the core of that trust lies the quality of the spawn produced. Since no recognized standard of quality exists in the market, customers depend on the quality acquired previously from each hatchery to judge their current quality. In a fight to capture the market in a highly competitive environment, most hatcheries depend on price to capture and retain their customers; thus quality considerations taking a back-seat.

In such a scenario, improving brood quality must also be co-ordinated with spreading the message of such an activity being done and the individuals who are attempting it, in order to ensure they get the right price for their investments.

FIGURE 20: SWOT ANALYSIS OF THE MARKET POTENTIAL FOR QUALITY SEEDS IN THE SOUTHERN REGION IN BANGLADESH

Strength

- Holds the largest share in the national supply of carp seeds
- Presence of the largest hatchery and nursery clusters in the country as well as fry and fingerling market
- Presence of number of advanced or lead hatcheries renowned as producers of quality carp seeds in the country
- Presence of a strong and functioning association
- Introduction of improved low cost inputs like and input technologies like Oveprem and Flush

Weakness

- Unavailability of quality brood
- Stagnated market price and increased cost of production reduced profit margin and thus the capacity of the hatcheries to improve quality
- High degree of inbreeding, hybridization, negative selection and breeding of premature fish which results inferior quality seeds
- Lack of knowledge on improved and cost effective breeding techniques and technologies
- Lack of knowledge on hatchery management
- Lack of traceability for quality seeds or poor quality seeds because of complex bulking and de-bulking activities in the trade system

Opportunities

- The new hatchery policy, if implemented , can help induce quality management systems in carp seeds production and supply
- Potential to collaborate with other projects like CSISA to leverage interventions
- Some table fish farmers are informally producing brood in leased public water body; this can be taken up to produce brood in captive spaces within the public water body
- Potential for public-private collaboration for brood supply
- Potential to introduce technology like cryo-preservation
- Increased awareness and interest to produce quality seeds
- The hatchery association has an active agenda on improving quality of seeds and creating entry barrier for marketing inferior quality seeds

Threats

- Price competition has led to decline in product quality and reduced trust amongst the nurseries and table fish farmers
- Decline in catch from river sources like Halda, Jamuna and Padma
- Sell of inferior quality hatchery brood as river sourced brood reduced trust on brood and spawn quality
- Devaluation of Taka against Dollar will further increase cost of imported feed ingredients
- Increase in number of hatcheries in other regions outside south
- Lack of security increases risk of maintaining high quality/ bigger sized brood in grow out pond
- Reduction in carp production in some part of Satkhira, Barisal and Khulna regions because of increasing salinity

CHAPTER 5: VALUE CHAIN UPGRADING STRATEGIES

5.1 CONSTRAINTS:

Based on the analysis, we conclude that the symptoms of market imperfections or lack of competitiveness in the carp seeds value chain in the southern region include (i) unavailability of quality brood stock, (ii) improper brood stock management practices (iii) high cost of operations and (iv) low market price. The following table illustrates the underlying constraints that have caused the imperfections:

Table 8: Underlying Constraints for Market Imperfections

Symptoms of Market Imperfections	Underlying Constraints
Unavailability of Quality Brood Stock	• Lack of supply of pure quality strains • Depleting catch from the river sources • Lack of capacity of the public hatcheries • Lack of public and private capacity to adapt improved technologies like cryo preservation
High Cost of Operations	• Increasing cost of imported and locally produced feed and feed ingredients • Lack of awareness about cost saving inputs (like Oveprem and Flush) • Lack of knowledge about feed formulation
Low Market Price	• Lack of trust among the nurseries and the table fish farmers about the quality of seeds • Price competition among the hatcheries because of market saturation • Marketing of poor quality seeds because of lack of quality control and inspection • Lack of awareness about cost-benefit of quality spawns that results purchase of low priced inferior quality spawn

5.2 RECOMMENDED MARKET SOLUTIONS:

The upgrading strategies illustrated below explains how AIN can solve the underlying constraints together with the value chain actors as well as the support service providers and the actors in the enabling environment as was detailed in Chapter 3. The strategies also leverages on the horizontal and vertical linkages that were explained in Chapter 3.

STRATEGIC INTERVENTION AREA Increasing Availability of Quality Brood			
Underlying Constraint	**Intervention**	**Potential Partner**	**Activities**
i. Lack of supply of quality brood strains ii. Lack of capacity of the public sector to supply quality brood iii. Depleting catch from natural resources	Linkage between the Halda Project (RNBHHR) and the Jessore Hatchery Association (JMHMS) for private sector management of multiplication of quality brood stock	RNBHHR JMHMS BFRI DoF	- AIN can facilitate linkage between the Halda Project and Jessore Hatchery Association - Under the arrangement the association will select and mandate number of advanced hatcheries as brood producers - The brood producers under the technical support from DoF and BFRI will produce improved quality brood stock, which can be marketed at a rate fixed by the association - The association can be later facilitated to access quality spawn from other river sources which would further strengthen the capacity of the hatcheries to increase production of brood *Note:* This intervention will primarily help to improve brood of Catla which according to our findings has gone through extensive hybridization and cross breeding in the southern region.
	Facilitate production and marketing of imported quality brood fish/strains (for example Joyonto Rohu from India and Chinese Carps from China)	DoF, BFRI, Private Hatcheries	- The spawn need to be sourced from several hatcheries in India or directly from river sources; this will reduce the chance of inbreeding - Selected public and private hatcheries should be partnered with to import Joyonto Rohu from India and Chinese carps from China; under the arrangement these hatcheries should operate as brood producers and marketers - The hatcheries can be provided technical support by BFRI and DoF to maintain quality brood fish produced from imported founder stock or strain(s) - BFRI/DoF should be supported for cryopreservation of the strain so that genetic quality and purity of the strain can be sustained - BFRI/DoF should also be supported to build their staff and technical capacity for cryo preservation of the imported brood *Note:* AIN needs to discuss with DoF and BFRI to address the issue related to quarantine
	Facilitate genetic stock enhancement research for improved brood stock/strain development	BFRI	- BFRI can be partnered with to produce improved strain by cross breeding imported brood (For example: Joyonto Rohu) with local brood sourced directly from Halda, Padma or Jamuna) - If successful, the improved cross breed can be marketed through public and private hatcheries
	Promote electronic tagging system to ensure origin	Aqua chemical companies, Hormone Importers	- AIN can partner with interested aqua chemical companies and hormone importers to import and market electronic tagging system - The companies can also be supported to market their product and train their customers on electronic tagging and managing register
	Lack of public and private capacity to adapt improved technologies like cryopreservation for brood production	BRAC, DoF, BFRI, BAU	- Organize exposure visit in countries like Vietnam that has successfully adapted the technology - Support large scale hatcheries like that of BRAC Brood Bank in Srimangal, Pabna and Bogra as well as research institutions like BFRI to install the technology and conduct trials - Link the hatcheries in south with BRAC and BFRI to produce quality brood stock from preserved milt - Promote the technology through workshops and exposure visits

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			- Experts from BAU can be engaged to support development and promotion of the technology
STRATEGIC INTERVENTION AREA Controlling cost of operations and improving quality by improving hatchery management practices			
Underlying Constraint	**Intervention**	**Potential Partner**	**Activities**
i. Lack of awareness about cost-benefit of proper brood development and management practices ii. Lack of awareness about cost saving inputs (like Oveprem and Flush) iii. Increasing cost of imported and locally produced feed and feed ingredient iv. Lack of knowledge about feed formulation	Strengthen knowledge and information share between the hatcheries to demonstrate cost-benefit of proper brood development and management practices	JMHMS	- In partnership with the association identify cases of good practices in the region - Organize exposure visit to the hatcheries that have been identified for good management practices and arrange learning sessions - Support the hatchery association to publish a booklet of good management practices along with the cases and distribute through the hatchery
	Promotion of cost saving inputs (for example Ovaprim and Flush) through private sector importers and distributors	EON Animal Health Products, Allwell Marketing, Fishtech BD Ltd.	- Develop module and case study on the application of the inputs to reduce cost and increase efficiency - Facilitate private sector partner to organize training/ workshop for the hatcheries to present the case and train the hatcheries on application of the inputs to reduce cost and increase efficiency - Facilitate the private sector partner to organize demonstration - Organize follow up workshop at the end of the production cycle to share learning and experiences of the hatcheries that have used the inputs
	Create knowledge provision on feed formulation through feed meal, vitamin, minerals importer and distributor	Paragon Agro, EON Animal Health Products, Novartis	- Develop module and case study on the application of the inputs to reduce cost and increase efficiency - Facilitate private sector partner to organize training/ workshop for the hatcheries to present the case and train the hatcheries on application of the inputs to reduce cost and increase efficiency - Facilitate the private sector partner to organize demonstration - Organize follow up workshop at the end of the production cycle to share learning and experiences of the hatcheries that have used the inputs

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STRATEGIC INTERVENTION AREA Support Development of a Market for Quality Seeds			
Underlying Constraint	**Intervention**	**Potential Partner**	**Activities**
i. Lack of trust among the nurseries and the table fish farmers about the quality of seeds ii. Price competition among the hatcheries because of market saturation iii. Marketing of poor quality seeds because of lack of quality control and inspection iv. Lack of awareness about cost-benefit of quality spawns that results purchase of low priced inferior quality spawn	Introduction of a quality certificate to create demand for quality seeds among the nurseries and table fish farmers	JMHMS, DoF	- Develop the certification standard and certification process in collaboration with DoF - Organize workshop in collaboration with the hatchery association to promote the certificate - Support the hatcheries to adopt good practices essential to qualify for the certificate - Support DoF to issue the certificate to qualified hatcheries
	Create awareness about the new hatchery policy	JMHMS, DoF	- Together with DoF and the hatchery association AIN should organize workshop to create awareness about the new hatchery policy - This will induce DoF to start implementing the policy in the region - On the other hands, the hatcheries would become more aware about the need for licensing and start to adopt practices as made mandatory by the hatchery policy
	Organize road shows in nursery and table fish production clusters and markets to increase awareness about the negative impact of poor quality seeds and promote the quality certificate	JMHMS, DoF	- Create awareness about the certificate amongst the nurseries and table fish farmers by organizing road shows in fingerling markets like that in Chachra or nursery clusters like that in Sharsha; this will help induce demand for the certificate as the nurseries and table fish farmers begin to show willingness to pay more for the spawn produced by the certificated hatcheries. It would also use live drama and interactive tools (like video) to create awareness about the negative impact of quality seeds