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Bangladesh J. Agric. Econs XXVIII, 18c2 (2005) 49-60

FISH SEED MARKETING SYSTEM IN BANGLADESH

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ABSTRACT

The study attempted to examine the marketing system of fish seed aiming to determine the channel and marketing profit of market participants. For this study 20 hatchery operators, 80 nurserers, 20 fry traders and 90 pond fish farmers were selected from four districts of Bangladesh. Primary data were collected by survey method wherein various market participants were interviewed from the selected areas for eliciting information at various stages of fish seed marketing. Hatchery operator sells fish seed at their farm gate to nurserers and fry traders. In general, fish farmers receive fish seed from fry traders at their farms. For that reason, both hatchery operators and fish farmers had no marketing cost. The fry traders and r}urserers - the main intermediaries or market participants incurred marketing cost as they performed different marketing functions.

Purchase and sale price were main determinants in making profit for market participants. The study revealed that government fish seed farms (GFSFs) produced good quality fish seed and accordingly their cost of production and sales price both were higher compared to private fish seed farms (PFSFs). As a result. marketing margin and profit for market participants who purchased seeds from GFSFs were also higher compared to those who purchased seeds from PFSFs. The seasonal price variation was observed in different months of a year due to changes in demand and supply of fish seed.

I. INTRODUCTION

A good marketing system is very important to ensure supply of fish seed to fish farmers in time. Earlier, till 1970, the country was almost fully dependent on fish seed collected from rivers. Afterwards production of fish seed in hatcheries through induced breeding was initiated. But for the last three decades collection of fish seed from rivers decreased continuously and at present supply of fish seed from this source *is* very minimum. Now the fish farmers do not depend on wild seed collected from natural breeding ground (rivers) and usually they can receive fish seed from hatchery according to their demand. By this time, hatching facilities have been developed, both in government and private level, to supply quality fish seed needed for fresh water aquacultural development. It may be noted that fish seeds are largely and commercially produced by government and private Fish Seed Farms (FSFs). But along with other areas, there are many Private Fish Seed Farms (PFSFs) established in Mymensingh and Jessore district and they supply fish seeds in different areas of Bangladesh.'

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It may be noted that culture fishery under scientific management is relatively a new gesture in Bangladesh as it expanded rapidly in the last two decades. In this period quality fish seed also was needed for scientific culture and management but due to some man-made and natural problems, fish seed collection from rivers declined for the last few years. To bridge this gap in supplying of quality fish seeds government has established 113 FSFs covering almost all districts of the country (DoF, 2002). Private entrepreneurs also came forward to produce fish seeds and they established 779 fish seed farms by 2001. As a result, production of hatchling in private hatcheries increased from 6500 kg in 1987 to 297781 kg in 2003 (DoF, 2004). Production of hatchling in government farms also increased from 1068 kg in 1987 to 3902 Kg in 2003 (DoF, 2004). This recorded a significant increase in overall supply of hatchling during 1987 to 2003. The scenario indicates high demand for fish seeds in the country. The demand for fish seeds would increase further if it would possible to bring all suitable ponds and culturable waterbodies under intensive cultivation.

It is argued that successful culture fishery depends mainly on the availability of quality fish seeds, the research work, however, on the economics of fish seed production and marketing was lacking in the past. The shortage of fish seed (major carps) has been identified by various agencies as one of the main constraints for aquacultural development of Bangladesh. A few empirical studies (Malek 1997, Gill and Motahar 1982) observed that pond fish production was suffering due to shortage of fish seeds. Islam and Dewan (1988), and Kabir *et.al (2001)* studied the economic status of fish seed multiplication farms, however, with a limited coverage in terms of both farm categories and sample size. But no study of this nature has been conducted with a reasonably large size of sample and various types of farming.

The present study is an attempt to examine the marketing system of fish seed aiming to determine the profit of market participants. The study also focuses the cause and effect of variation of prices of fish seed in different months of a year and during the period of 1992 - 1993 to 2004 - 2005.

II. METHODOLOGY AND SOURCES OF DATA

Production practices in producing fish seed and management of fish seed farms (FSFs) is very important to have higher production and economic return. It is argued that private fish seed farms (PFSFs) are more efficient and productive compared to government fish seed farms (GFSFs). Accordingly, both government and private FSFs were selected to make a comparative economic analysis between government and private FSFs. For the present study, in total 20 FSFs were selected and most of which are available in Mymensingh district particularly in Trishal, Ishwargonj and Mymensingh Sadar Upazila. Only one GFSF was selected from Gazipur district. Of these 20 FSFs, only 8 were GFSFs and those of other 12 were from PFSFs. However, related market participants such as operators of FSFs, nurserers (nursery management in the pond), fry traders and pond fish farmers who are the beneficiaries and directly involved with the supply chain and marketing system of fish seed were selected for this study. In the case of nursering and rearing fingerlings only those stakeholders (farmers/nurserers) attached with NGOs and working under Development of Sustainable Aquaculture Project (DSAP), WorldFish Centre were selected. Selected NGOs were Social Association for Rural Advancement (SARA), Organization for Rural Development (ORD)

and Grwneen Manobic *Unnayan Sangstha (GRAMUS)* from Mymensingh district and Social Advancement Through Unity *(SATU)* from Tangail district. Finally 80 nurserers and 90 pond fish farmers were selected from Mymensingh, Netrokona and Tangail districts who cultured fish under the supervisions of these NGOs. In addition, *20* fry traders as intermediaries involved in fish seed marketing channel were selected from Mymensingh district. In total, *210* sample respondents of different categories (20 operators of FSFs + 80 nurserers + 90 pond fish farmers and 20 fry traders) were selected for this study. However, data and information regarding fish seed production and marketing were collected for the period *2004 - 2005*.

FSFs were considered as the unit of analysis to determine the production practices and quality of fish seed produced in government and private FSFs. Secondly, nurserers and fry trader, as well as fish farmers were selected to examine the marketing system and supply chain of fish seed. The present study collected data and information mainly on fish seed production and marketing. For fish seed production and marketing, operators of FSFs, and nurserers and fry traders involved in marketing channel were identified, and economic returns of fish seed production, and marketing participants were determined by using tables and flow diagram.

III. FISH SEED MARKETING SYSTEM AND PROFITABILITY OF MARKET PARTICIPANTS

Marketing Channels and Supply Chains

For distribution of fish seed, direct marketing between producer and fish farmer is rarely practiced. **In** most cases, producers channel their produced fish seed through agents so that they can concentrate their energies on production. Marketing channel is the sequence of intermediaries through which fish seed passes from hatchery operator to fish farmer. This channel may be short or long depending on size and species, and quality of fish seed marketed, available marketing services and the prevailing social and physical environment. In the present study the major species, both indigenous and exotic carps, which covered more than 80% of fish seed market were selected to determine the marketing channel, marketing cost, marketing margin and net margin of market participants involved in fish seed marketing. The channels of distribution of spawn and fry or fingerlings (Figs. 1 and 2) show that, apart from fish seed producers, the market participants were nurserers, fry traders and fish farmers and they are discussed in the following subsections.

Fish seed producers

In Mymensingh and other areas of Bangladesh, the hatchery operators or owners of FSFs sell their fish seed specially spawn and to some extent, fingerlings at the farm gate or premises of the hatchery (Table 1). The marketing channel and supply chain of spawn (Fig. 1) and fry or fingerlings (Fig. 2) indicate that hatchery operators sell about 80 - 90% of spawn and fry to nurserers and rest 10 - 20% to fry trader but in case of selling fingerlings, it was only 10% to nurserers and 90% to fry trader.

Nurserers

Nurserers play pivoted role in distributing fish seed to fish farmers. In one sense, they are the distributing agents but in other sense, they also act as a producer of fish seed. Actually,

they prefer to buy spawns from the hatchery and rear them in their nursery ponds. When the spawns are raised upto fingerlings stage, they themselves sell it to fish farmers. But in most cases, fry traders act as an agent or intermediary who buy fry and fingerlings from nurserers and sell to fish farmers. Figs. 1 and 2 clearly depicted that more than 80% of fish seed in different stages were distributed through fry traders to fish farmers.

Fig. 1 Marketing channel, supply chain and distribution system of fish seed (spawn) from FSFs

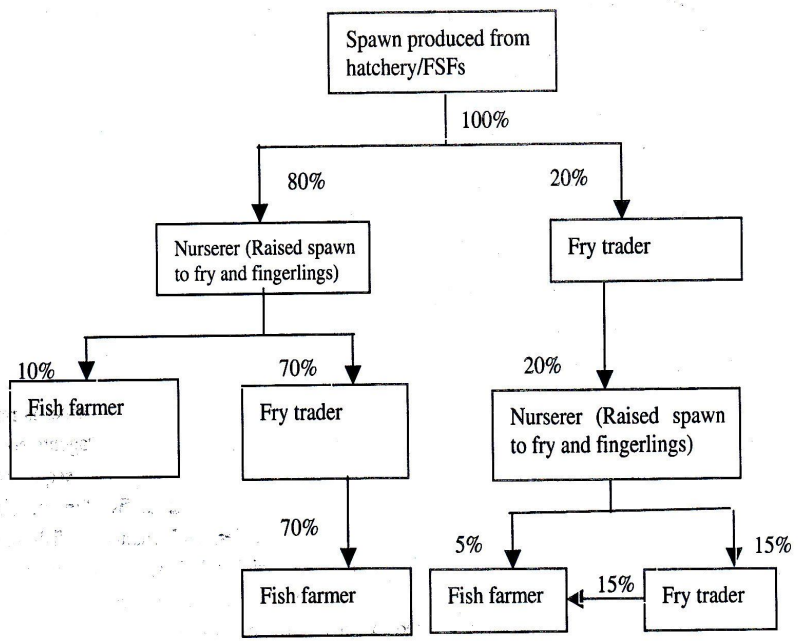
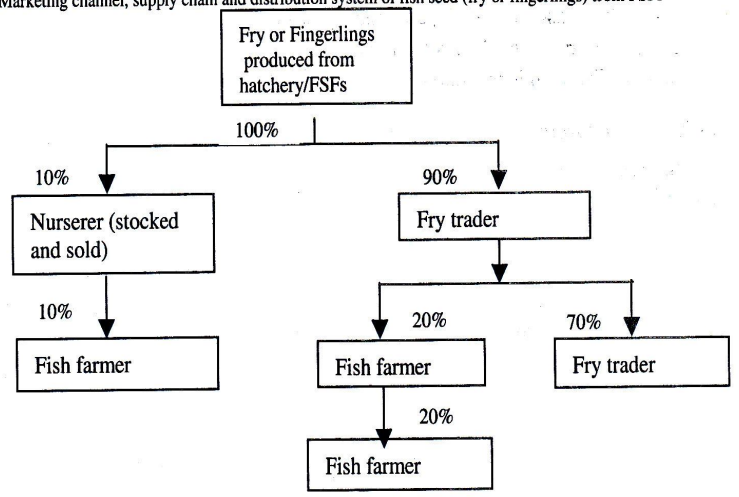


Fig. 2 Marketing channel, supply chain and distribution system of fish seed (fry or fingerlings) from FSFs



Fry traders

In fish seed marketing, fry traders (locally called 'Paikers') are professional fish seed traders and they purchase mainly fingerlings from nurserers and to some extent, spawn and fry from hatchery operators and sell their consignment to the fish farmers, the ultimate users of fish seed. Usually, they purchase fish seed from the producers in respective farm areas and bring their product to different areas of Bangladesh for sale. It was reported that fry traders purchased fish seed from FSFs located in Gouripur and Mymensingh Sadar and sold to the farmers of Sylhet, Hobiganj, Dhaka, Naraanganj, Comilla, Kishoreganj and Netrokona. They are the professional businessmen and have wide experience in fish seed marketing. Sometimes even they help nurserers and provide their labour in catching fingerlings from the nursery ponds. Almost entire marketing function of the fish seed industry is conducted through fry traders. Figs. 1 and 2, and Table 3 show that, about 80 - 90% fish seeds were distributed by fry traders in the study areas.

Fish farmers

The fish farmers form the last link in the fish seed marketing chain. They buy mainly fingerlings from the fry traders or nurserers to stock in the fish pond. In most cases, the fry traders purchase fingerlings from nurserers and hatchery operators and make them available to fish farmers.

Profit of Market Participants

Fish seed has two stages of production such as Spawn and fry or fingerlings. Spawns are produced in the hatchery and supplied to nurserers to raise them upto fry or fingerling stage. Finally, fish farmers stock fingerlings in their ponds to produce fish for home consumption and sale. However, for distributing fish seed from production to fish farmers, two marketing channels and supply chains were identified for marketing of spawn and fry or fingerlings respectively (Figs. 1 and 2). In each of the two stages of fish seed marketing, there are some intermediaries performing useful commercial function in a chain formation all the way from the producers (FSFs) to the final users (fish farmers). The commercial units comprising the fish seed marketing system can be grouped into four categories - fish seed suppliers (hatchery operators), nurserers (raising spawn upto fry and fingerlings), fry traders *(paikers)* and fish farmers.

Production and supply of fish seed

Each FSF usually own two types such as jar type and circular type of hatchery. In general FSFs possess two types of ponds, i.e., brood pond and nursery pond. The brood ponds are stocked with adult fish to use them for breeding by artificial means. The nursery ponds are used for raising spawn to fry and fingerling stages. All the selected GFSFs had brood pond and nursery pond and they were provided with jar type and circular type hatchery. In the case of FSFs, with few exceptions, almost all of them were furnished with these hatching facilities. The physical conditions of these hatcheries so far recorded have been shown in Table 1.

Amount of spawn production of FSF depends mainly on number of hatchery irrespective of jar type and circular type owned by a farm, and number and size of brood pond and nursery pond managed and quality and number of brood fish reared. It can be seen from Table 1 that average farm size was almost the same for government FSFs *(3.60* ha) and private FSFs *(3.50* ha) but the average number of hatcheries, and total pond area and pond size were exceptionally higher in PFSFs compared to GFSFs. Accordingly, production of spawn per farm in PFSFs *(1495* kg) was more than three times higher compared to GFSFs *(450* kg).

Fingerlings are produced by the operators of FSFs and nurserers. Nurserers usually buy spawn directly from fish hatchery or from fry trader and rear them upto fingerling stage, and then sell them to fish farmers. *Secondly,* along with the production and selling of spawn, FSFs also produce fingerling in a small-scale in nursery ponds located in hatchery areas. It was reported that *75 - 100 %* FSFs produced fish seed of major carps such as Rui, Catla, Mrigel, Silver Carp, Grass Carp, Calbaus, Bighead and Rajputi and all these fish seeds are supplied to nurserers and fry traders.

Table 1. Physical characteristics of fish seed farms.

Categories of FSFs	AverageFarm size (ha)	No. of hatchery per farm		No. of ponds per farm	Average Pond size (ha)	Average spawn production kg/farm/yr
		Jar type	Circular type			
Govt. FSFs	3.60	9.25	2.75	16.50	2.62	450
Private FSFs	3.50	24.75	1.75	17.42	3.75	1495
All FSFs	3.53	18.55	2.15	17.05	3.30	1077

Marketing Cost of Fish Seed

Marketing costs represent the cost of performing various marketing functions which are needed to transfer a commodity from the place of production to the ultimate consumers or users. In fish seed marketing the nature and types of costs at different stages of marketing process are not identical due to dissimilarities of marketing function at various stages. As fish seed, spawn, fry and fingerlings are marketed by different agents or intermediaries. Whatever may be kind of seed, hatchery operators sell it from their farmgate to nurserers and fry traders. Accordingly, no marketing cost is involved for the spawn producers. On the other hand, in most cases fish farmers usually receive fish seeds from fry trader who make it available at home for fish farmers. As a result, fish farmer also has no marketing cost in purchasing fish seed. However, the fry traders and nurserers - the main intermediaries or market participants incurred marketing cost as they perform different marketing operations and function in fish seed marketing. It was observed that there was a small variation of marketing cost between fry trader (Tk. 820) and nurserer (Tk. *735)* since they performed almost same kinds of marketing functions (Table 2). It may be noted here that fry traders usually carry fish seed from producers to long distance and also covered long channel which made the marketing cost higher for them compared to nurserers. After purchasing fish seed from producers, fry traders as well as nurserers carry it by themselves to the farmers of local areas and also other districts where there is easy access and communication and great demand of fish seed.

Determination and estimation of marketing unit in fish seed marketing

Fish seed has two stages of production as shown in Figs. 1 and 2, such as spawn and fry or fingerlings. As a result, it is rather complicated to make same `marketing unit' for two different stages of fish seed supplied through respective marketing channel. However, to make the analysis simple and better understanding, marketing channel was considered into two channel (Table 2) i.e. production of spawn and then fry and fingerlings. In fish seed marketing, spawns are supplied and marketed on kg basis while fry and fingerlings are marketed and distributed on number basis. However, to make the `marketing unit' similar to each level of production of fish seed, first, production cost (Tk. 1160 for PFSFs and Tk. 1650 for GFSFs) and sales price (Tk. 1660 for PFSFs and Tk. 2250 for GFSFs) of 1 kg spawn was estimated as reported by hatchery operators. Then for determining the production cost and sale price of fry and fingerlings produced from 1 kg of spawn, nurserers were asked to estimate these respective values. Accordingly, estimated production cost and sale price of nurerers who purchased fish seed from GFSFs and PFSFs are shown in Table 2. In fact, fry traders purchase fry and fingerlings directly from nurserers and to some extent, hatchery operator and then sell it to fish farmers. Since they do not rear fry and fingerlings and they have no production cost. But they incurred small amount of cost for performing marketing function.

Marketing Channel and Profit of Market Participants

Different types of market participants such as hatchery operators, nurserers, fry traders and fish farmers are involved in fish seed marketing and distribution. Short and long marketing channel of different stages of fish seed are shown in Figs. 1 and 2 but the involvement of market participants or intermediaries and their marketing margin, marketing cost and marketing profit are shown in Table 2. In this table short and long marketing channels have not been differentiated but one channel was considered to estimate the marketing units from producing spawn to fry and fingerlings.

From Table 2 it may be observed that purchase and sales price were main determinants in making profit in fish seed marketing. Considering both government and private FSFs, per Kg sale price of spawn for GFSFs (Tk. 2250) was higher compared to PFSFs (Tk. 1660). Since the GFSFs produced good quality fish seed with better management, its cost of production of spawn (Tk. 2250/kg) was also higher than PFSFs (Tk. 1650/Kg). However, with these production costs and sales price, both marketing margin and profit were higher by Tk. 100 for GFSFs compared to that of PFSFs.

Usually nurserers purchase spawn directing from FSFs to stock them in the nursery pond. After 20 - 25 days, spawn grows upto fry stage and then fingerlngs stage. One Kg spawn may be stocked in 30 decimal nursery pond. About 0.8 - 1.0 lacs fly and fingerlings may be produced from 1 Kg of spawn. In such circumstances the average cost of production of rearing 1 Kg spawn to fry and fingerlings stage by the nurserers was estimated to be Tk. 15440. Nurserers reported that production cost of producing fry and fingerlings in the nursery pond was almost same irrespective of whether the spawn being collectec' rom private and government FSFs. On the other hand, sales price of fry and fingerlings produced from

government hatchery supplied spawn was higher by Tk. *1185* compared to sales price of fry and fingerlings produced from spawn supplied by private hatchery which also made profit higher by Tk. *555* for the nurserers who purchased spawn from GFSFs.

Mainly purchase and sales price of fry and fingerlings determines the profit of fry trader. However, in relation to purchase price, sale price was higher (Tk. *43715)* for the *fry* trader who purchased fry and fingerlings from GFSFs compared to those who purchased from PFSFs. In all respect, fry traders received average marketing profit varying from Tk. *8805 - 10460* for distributing and selling of *0.8 - 1.0* lacs fry and fingerlings. Lastly, fish farmers purchased fish seed *(0.8 - 1.0* lacs fingerlings) from fry traders by Tk. *43715* and Tk. *40875 if* the seeds were supplied from GFSFs and PFSFs respectively.

It is interesting to note that in fish seed marketing, nurserers received the highest profit (Tk. *13455 - 14010)* followed by fry traders (Tk. *8805 - 10460)* and owners *of* FSFs (Tk. 500 - *600).* Due to quality fish seed production, sale price, marketing margin and profits *of* respective market participants, all were higher in GFSFs compared to PFSFs. Apparently, it appeared that owners *of* FSFs received small amount of profit from 1 Kg of spawn produced and sold by them. But it was reported that according to the capacity of each hatchery, especially PFSF produced more than *30* - 50 Kg spawn per week depending on demand for fish seed in the market. However, whatever amount of fish seed produced by FSFs, always they earned a reasonable profit as shown in Table *2.* Secondly, nurserers and fry traders perform some marketing functions and accordingly their profit per unit of different level of fish seed was relatively higher in fish marketing of Bangladesh.

Changes in Price of Fish Seed and Its Impact on Fish Production

From the present study it appeared that mainly carp fish seed are sufficiently produced by FSFs and the nurserers and fry traders made them available to fish farmers in time (Figs. 1 and *2).* For the last two decades, both government and private FSFs developed significantly and produced fish seed according to requirement and demand for fish seed by fish farmers. Table *3* shows the trend of changing in prices of fish seed during the period from *1992 - 93* to *2004 - 05.* It was reported by FSFs that during *1990's,* price of fish seed, both spawn and fingerling was higher but it started decreasing year by year with the increase production and more supply of fish seed to fish farmers. All the FSFs has certain level of capacity to produce fish seed and usually they accommodate and increased their production to meet up the market demand. Specially PFSFs took this opportunity to capture the market and earned higher profit. Secondly, PFSFs sometimes sell fish seed to nurserers and fry traders on credit basis when there is over production but low demand. The most important issue/aspect may be noted here that, in most cases PFSFs do not produce the quality fish seed due to poor management of brood fish. Nurserers and fish farmers reported that, there was no short supply of fish seed during their production period but the seed bought from PFSFs was not good enough to raising fingerling from the spawn and then fish production was affected for stocking poor fingerlings. Most of the PFSFs produced poor quality fish seeds which caused high mortality and slow growth of fingerlings in the nursery pond and fish farmers preferred to buy seed from GFSFs even by paying higher prices compared to PFSFs.

Table2.Marketing channel, marketing margin and marketing cost of market participants in marketing of fish seed (spawn, fry and fingerlings).

Market participants	Particulars of marketing (Marketing unit: Tk/Kg for spawn and Tk/0.8 - 1.0 lacs for fry and fingerlings produced and sold from 1 Kg spawn)					
	Production cost[a]	Purchase price	Sales price	Marketing margin	Marketing cost	Marketing profit
1	2	3	4	5=4-(2+3)	6	7=(5-6)
Govt FSFs						
Owners of FSFs Mainly spawn produced & sold	1650	-	2250	600	-	600
Nurserers Purchased & sold spawn, fry and fingerlings	15440[6]	2250	32435	14745	735`	14010
Fry traders Mainly fingerlings purchased & sold	-	32435	43715	11200	820[d]	10460
Pond fish farmers Purchased fingerlings	-	43715	-	-	-	-
Private FSFs						
Owners of FSFs Mainly spawn produced & sold	1160	-	1660	500	-	500
Nurserers Purchased & sold spawn, fry and fingerlings	15440[b]	1660	31250	14190	735`	13455
Fry traders Fingerlings purchased & sold	-	31250	40875	9625	820[d]	8805
Pond fish farmers Purchased fingerlings	-	40875	-	-	-	-

[a] Production cost of FSFs (hatchery operator): Estimated cost of producing 1 Kg of spawn by FSF (Tk 1650 and Tk. 1160 for GFSFs and PFSFs respectively)

[b] Production cost of nurserers: Production cost of rearing and raising 1 kg spawn to fry and fingerling was estimated (Tk. 15440). Usually, 1 Kg spawn produce 80000 - 100000 fingerlings and their average sales price was Tk. 31250 and Tk. 32435 as estimated by the nurserers

[c] Marketing cost items of nurserers: Cost for oxygen bag, transportation, loading and unloading, containers, self wages and salary and mortality. Here estimated cost of marketing of fry and fingerling produced from 1 Kg spawn was Tk. 735

[d] Marketing cost items of fry traders : Cost for transportation, loading and unloading, containers, self wages and salaries and mortality. Here estimated cost of marketing of fry and fingerling produced from 1 kg spawn was Tk. 820.

Table 3. Changes in price of fish seed during 1992 - 93 to 2004 - 05.

Year	Spawn, Price/Kg				Fingerlings Price/1000				
	Silver carp	Grass carp	Catla	Rui	Silver carp	Grass carp	Catla	Rui & Mrigel	Thai Sorputi
1992-95	4000 - 6000	6000-7000	8000-10000	6000-8000	200-500	800-900	900-1200	1000-1500	2000-4000
1996-99	3000-5000	4000-6000	6000-8000	4000-5500	200-300	500-600	800-1000	500-600	800 - 1000
2000-03	2000-4000	3000-5000	5000-7000	3000-4000	150-200	300-500	500-700	200-300	1000-1500
2004 -05	800-2000	1500-3000	2000-4000	1500-2500	120-150	250-300	400-500	130-200	300-600

Source: FSFs, Gouripnur, Mymensingh, 2005

Table 3 shows that prices of fish seed varied largely over the period from 1992 - 95 to 2004 - 05. However, the seasonal price variation of fish seed for the year 2004 - 05 and its cause and effect on demand - supply on fish seed has been reflected in Table 4. Usually in response to high demand for fish seed from mid February to April in each year, per kg spawn of major carp was sold by Tk. 3000 - 3500 and the prices of fingerlings of respective species also varied (Tk. 400 - 600/1000 no. of fingerlings) in the early season. In general, during March - April and subsequently in peak season i.e. May - June, there was high demand for fish seed but the FSFs could not or can not produce sufficient seed because the brood fish yet to be matured enough to be used for breeding. Moreover, with this production and marketing system, FSFs specially PFSFs try to produce more seed using full capacity of their farms to meet up the demand for fish seed by nurserers and fish farmers. However, stocking these poor quality seed yielded slow growth and caused high mortality of fish in the nursery pond and fish pond. Accordingly, the fish seed produced from GFSFs has high demand even with higher prices.

Table 4. Demand for and supply of fish seed and seasonal price variation as reported by hatchery operators, 2004.

Fish seed production period	Major carp: Rui, Catla, Silver carp, Grass carp		Cause and effect on demand - supply of fish seed
	Spawn, Tk/Kg	Fingerlings, Tk/1000	
16 February - April	3000 -3500	400 - 600	• Moderate environment to start production of fish seed • Immatured brood fish to produce adequate seed • Less production of fish seed • High demand for fish seed • High price for fish seed • No unsold of fish seed
May - June	1500- 2000	300-400	• Peak season and good environment for production • Increased production and supply of fish seed • High demand of fish seed

Fish seed production period	Major carp: Rui, Catla, Silver carp, Grass carp		Cause and effect on demand - supply of fish seed
	Spawn, Tk/Kg	Fingerlings, Tk/ 1000	
			• Relatively low price of fish seed • Usually no unsold of fish seed
July - August	500-700	200-250	• High production of fish seed • Low demand of fish seed • Low price of fish seed • Small amount unsold of fish seed • Stocked unsold spawn in the nursery pond of hatchery
Sept - October	500-700	150-200	• Low production of fish seed • Low demand of fish seed • Low price of fish seed • Small amount unsold of fish seed • Stocked unsold spawn in the nursery pond of hatchery

Source: FSFs, Gouripur, Mymensingh, 2005.

CONCLUSIONS

The study revealed that fish seeds are almost adequately produced by FSFs. Fish seeds supplied from natural source has been replaced by the seeds produced from FSFs. Purchase and sale price were main determinants in making profit for market participants. Per kg sale price of spawn for GFSFs was higher compared to PFSFs. GFSFs produced good quality fish seed and accordingly, its cost of production and sales price of fish seed both were higher compared to PFSFs. As a result, marketing margin and profit for market participants who purchased seeds from GFSFs, were relatively higher compared to those participants purchased seed from PFSFs. The study revealed that the seasonal price variation arises in different months of a year and also in different years due to changes in demand and supply of fish seed.

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