

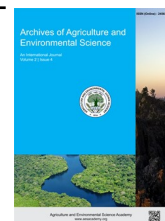


e-ISSN: 2456-6632

This content is available online at AESA

Archives of Agriculture and Environmental Science

Journal homepage: journals.aesacademy.org/index.php/aaes



ORIGINAL RESEARCH ARTICLE



Value chain analysis of carp fish seed farms in some selected areas of Mymensingh district in Bangladesh

Nazia Tabassum^{1*}, Dilshad Zahan Ethen², Eshrat Jahan Mahfuza² and Md. Asraf Mahmud Hasif³

¹Professor, ²Assistant Professor, ³MS Student, Department of Agribusiness and Marketing, Bangladesh Agricultural University, Mymensingh - 2202, BANGLADESH

*Corresponding author's E-mail: nazia.am@bau.edu.bd/naziabau@yahoo.com

ARTICLE HISTORY

Received: 10 December 2022
Revised received: 01 May 2023
Accepted: 20 May 2023

Keywords

Carp fish seed
Net margin
Value addition
Value chain

ABSTRACT

This study is an attempt to analyze the prevailing value chain of fish seed farms in some selected areas of Mymensingh district in Bangladesh. Data were collected from 280 fish seed farms owners (56) and traders (224) covering four Upazilas of Mymensingh district namely Mymensingh Sadar, Gauripur, Muktagacha, and Trishal from the period of July 2019 to October 2019 through purposive random sampling technique. Three important fish seed species of carp; namely Rui, Catla, Mrigel were selected to address the following objectives: typical value chain map and marketing system of fish seed farms, determination of the net value addition of fish seed production and marketing, and problems impacting different actors in the value chain. Total net marketing margin per 10 Kg. spawn and per 100000 pieces' fingerlings are Tk. 20204 (190.43 USD) and Tk. 43148 (406.69 USD), respectively. Among all three intermediaries, the net marketing margin of the retailer is the highest. A large percentage of value addition is covered by paiker for both cases and that is 20.85% and 31.2%. The study finds that fish seed farms with hatcheries are more profitable than fish seed farms with nursery. The yearly net return from spawn production in the hatchery is Tk. 4324775 (40763.15 USD) and from fingerling production in the nursery is Tk. 2388126 (22509.27 USD). The owners and traders have currently been facing some difficulties. Lack of information about good quality seed, the higher price of inputs, and lack of extension service is some of the examples. If these problems could be solved, fish seed farms and market intermediaries could earn a higher profit than the existing level.

©2023 Agriculture and Environmental Science Academy

Citation of this article: Tabassum, N., Ethen, D. Z., Mahfuza, E. J., & Hasif, M. A. M. (2023). Value chain analysis of carp fish seed farms in some selected areas of Mymensingh district in Bangladesh. *Archives of Agriculture and Environmental Science*, 8(2), 97-104, <https://dx.doi.org/10.26832/24566632.2023.080201>

INTRODUCTION

Because of the blessings of a favorable geographic position, Bangladesh has great potential in the aquaculture and fisheries sector. This country is surrounded by inland open waters i.e., rivers, canals, natural and man-made lakes, freshwater marshes, estuaries, brackish water impoundments, and floodplains (Azim *et al.*, 2017). It has the world's largest flooded wetland and the third-largest aquatic biodiversity in Asia after China and India (Shamsuzzaman *et al.*, 2017). The annual fish production is around 4.62 million MT and it is one of the leading fish-producing countries in the world (DoF, 2022). Currently, the

fisheries sector is one of the most promising sectors and a major source of employment for many people. Both at macro and micro levels, fisheries contribute to food security, job creation, income, and foreign exchange earnings (Azim *et al.*, 2017). Approximately 17 million people (including 1.4 million women) in this country, are intensively engaged in the fisheries sector and earn their livelihood through fishing, farming, fish handling, and processing. This sector contributes 3.69% to the gross domestic product (GDP), 2.06% to the total export earnings, and around 23% of the total agricultural production of the country (BFTI, 2016, Islam *et al.*, 2017; FRSS, 2016). Fish is an important source of protein and it fulfills approximately 60% of people's

daily animal protein intake (DoF, 2016).

Due to the high demand for fish, there is always a growing demand for quality fish seeds as it is the major input for fish farming (Rahman et al., 2019). The demand for a continuous supply of quality fish fry and fingerlings is increasing day by day. Hatcheries are the primary suppliers of fish seeds in Bangladesh (Parvez et al., 2018). The uncertainty in the quantity of riverine fish seed collection led to the development of many private hatcheries in the country. There are 935 private and 103 government hatcheries that supply fish seed (DoF, 2020). In the recent past, a growth of carp seed hatcheries has taken place in the private sector. Currently, the country is self-sufficient in carp seeds production, though quality fish seeds are produced on a limited scale. At present, there are 899 carp fish seed farms that produce a total of 663462 kg. Among these 85 for Government Fish Farm producing 12826 kg, and 814 for Private Hatchery producing 650636 kg of seed respectively (DoF, 2017).

Though fish seeds are being produced by both the public and private sectors yet are not sufficient enough (Rahman et al., 2019). The shortage of carp fish seed is considered as one of the constraints for the aquaculture development of Bangladesh. The supply of fish seed does not depend only on the collection of spawn from the hatcheries and the natural sources, but it also depends on the survivability of spawn to fingerlings in the nursery ponds. On the other hand, seed collection in the hatcheries through induced breeding is not increasing as rapidly as it is expected to meet the growing demand for fish seed from the farmers. To increase fish production, the hatchery owner should use improved modern technology and take proper marketing strategies to capture the profit. So, it is important to know how market intermediaries operate along with value chains and how the revenue from trade is distributed over the entire fish value chains for making the market efficient and effective. Therefore, this present study is an attempt to examine the value chain as well as the whole marketing system of fish seed aiming to determine the profit of market participants. To be more specific, the present study is designed to map the typical value chain of fish seed farms, to examine the marketing system of fish seed farms, and to determine the net value addition and associated problems of fish seed farmers and other actors in the value chain. By doing so, this study will help to understand the future prospect of fish seed farms in terms of marketability and profit as an agribusiness entrepreneur.

Sampling procedure for fish seed farms and traders.

Category of Fish Farms	Carp fish seed farms	Types of Fish Seed	Carp fish		
			Paiker	Wholesaler	Retailer
Hatchery	14	Spawn	14	21	21
Nursery	14	Fingerling	14	21	21
Total	28	Total	28	42	42

MATERIALS AND METHODS

Selection of study area

For the present study, Mymensingh was selected purposively because a large number of fish seed farms have been established here and this area is famous for supplying fish seed all over the country. For conducting the research, four Upazilas of Mymensingh district namely Mymensingh Sadar, Gauripur, Muktagasa, and Trishal was carefully selected for this study.

Selection of sample and sampling technique

Primary data was collected from fish seed farms (producers), and traders by using face to face interview method. A purposive random sampling technique was utilized for collecting data covering a sample of a total of 280 where 56 for fish seed farm owners, and 224 for fish traders. Total 14 hatcheries and 14 nurseries, and 28 paikers (14 for spawn and 14 for fingerlings), 42 wholesalers (21 for spawn and 21 for fingerlings), and 42 retailers (21 for spawn and 21 for fingerlings) were selected. Three carp fish species Rui, Catla, and Mrigel were chosen. Two sets of survey schedules, one for fish seed farms (Hatchery and Nursery), and one for fish seed traders were prepared in such a way that all the information was covered. After pre-testing the final survey schedule was developed with necessary corrections, modifications, and adjustments. Lastly, three Focus Group Discussion was conducted in the study areas.

Analytical method

In order to realize the first objective, value chain mapping of fish seed farms, a flow chart and descriptive statistics (i.e., mean, percentage, etc.) were used. For addressing the other objectives, net return for fish seed hatchery and nursery owners, marketing cost, marketing margin, net marketing margin, and net value addition were calculated accordingly.

$$\Pi = P_s \cdot S - (TVC + TFC), \text{ and}$$

$$\Pi = P_f \cdot F - (TVC + TFC)$$

Where;

Π = Profit per hatchery or nursery.

Ps = Per unit price (Tk.) of spawns

Pf = Per unit price (Tk.) of fingerlings

S = Total quantity of spawns produced per farm per year.

F = Total number of fingerlings produced per farm per year

TVC = Total variable costs of hatcheries or nurseries

TFC = Total fixed costs of hatcheries or nurseries

Gross marketing margin = Sale price – Purchase price

Net marketing margin = Gross marketing margin – Marketing costs

Net value addition of fish seed farmers = Sale price – Total production cost

$$\text{Value addition (\%)} \text{ of fish seed traders} = \frac{\text{Sale price} - \text{purchase price}}{\text{Purchase price}} * 100$$

RESULTS AND DISCUSSION

In the study areas, fish seeds move from the hatchery owners to the fish farmers through some market participants such as nursery owners, fingerling producers, packers, wholesalers, retailers, and fish farmers. The fish seed value chain starts from brood fish management. Hatchery owners collect sufficient amounts of brood fishes from pond fish producers (farmers) of Trishal, Gouripur, Mymensing Sadar, and Muktagacha regions, and stock those in their ponds for hatching to produce spawn. After producing spawn, hatchery owners sell some of them to

the spawn traders and a major portion (53%) directly to nursery owners. On the other side, Spawn traders with some profit sell the spawn to the nursery owner (Figure 1). The nursery owners stock spawns in their nursery to produce fingerlings. Later after, they sold the major share of the fingerlings to the pond fish farmers who are the ultimate customer of fish seed (Figure 2). A little share also goes to the fingerling traders and this amount also goes to the pond fish farmers finally. It is mentioned worthy that, all the hatcheries maintain their production all year round and each production cycle is about 6 months.

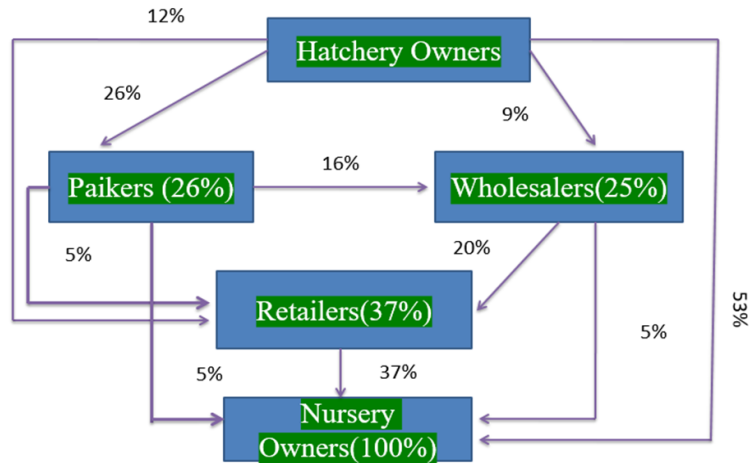


Figure 1. Value chain map of carp fish seed (spawn).

- Channel I: Hatchery Owners → Paikers → Wholesalers → Retailers → Nursery Owners
- Channel II: Hatchery Owners → Paikers → Wholesalers → Nursery Owners
- Channel III: Hatchery Owners → Wholesaler → Retailer → Nursery Owners
- Channel IV: Hatchery Owners → Retailers → Nursery Owners
- Channel V: Hatchery Owners → Wholesaler → Nursery Owners
- Channel VI: Hatchery Owners → Paikers → Retailers → Nursery Owners
- Channel VII: Hatchery Owners → Nursery Owners

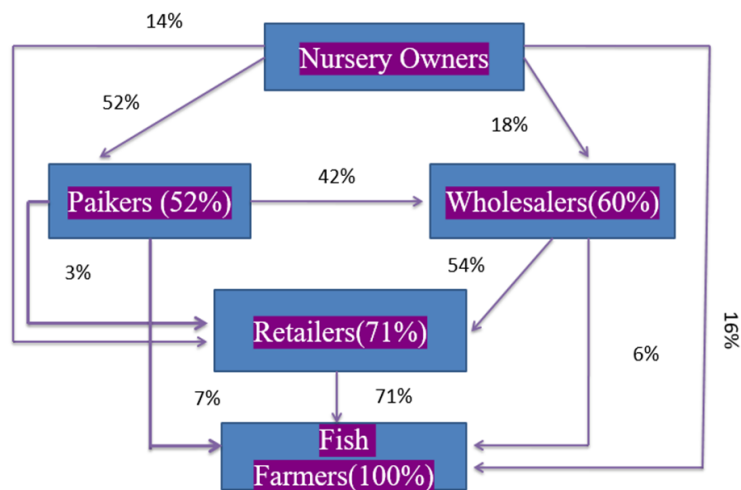


Figure 2. Value chain map of carp fish seed (Fingerling).

- Channel I: Nursery Owners → Paikers → Wholesalers → Retailers → Fish Farmers
- Channel II: Nursery Owners → Paikers → Wholesalers → Fish Farmers
- Channel III: Nursery Owners → Wholesaler → Retailer → Fish Farmers
- Channel IV: Nursery Owners → Retailers → Fish Farmers
- Channel V: Nursery Owners → Wholesaler → Fish Farmers
- Channel VI: Nursery Owners → Paikers → Retailers → Fish Farmers
- Channel VII: Nursery Owners → Fish Farmers

Marketing participants involved in fish seed farms

The study revealed that there is a movement of fish seed from the point of production to the point of consumers (fish farmers) through some actors forming a chain in the fish seed market.

Hatchery owners: Hatchery owners are the main actors and play a dominant role in the fish seed value chain. They produce spawn and sell them to the nursery owners through different intermediaries. Spawn is the source for rearing fingerlings and these fingerlings are eventually the inputs for pond fish farming. For producing spawn, they collect brood fish first and then stock them in a brood pond to further produce spawn from them. The time of operation of a hatchery is twelve months in a year but the length of the production cycle for each of the species is six months.

Traders of spawn: Three types of traders are engaged in fish seed farming i.e., paiker, wholesaler, and retailer. They have two types of work i.e., spawn trading and fingerling trading.

Paikers: Paikers are relatively big and professional traders in the study area. They purchased fish seeds from the hatchery owners of Dhalla, Gouripur, Muktagacha, and Mymensingh sadar sell them to wholesalers and retailers of Dhalla Bazar, Gouripur Bazar, Muktagacha, and Shombhuganj Bazar. They do not have any permanent business establishment and they are non-licensed traders.

Wholesaler: Wholesalers are fish seed traders who purchase fish seed from hatchery owners in bulk quantities. They invest a big amount of capital for purchasing spawn for a short period of time. They are very influential in the marketing network. In the survey area, wholesalers of Dhalla Bazar, Gouripur Bazar, Muktagacha, and Shombhuganj Bazar bought fish seeds from the Paikers and hatcheries and sold them to retailers and nursery owners.

Retailer: The retailers of Dhalla Bazar, Gouripur Bazar, Muktagacha, and Shombhuganj Bazar serve as the last link in the channels of the fish seed supply chain by selling spawn to the nursery owners. They procure spawn from Paikers and wholesalers and also maintain permanent space in the market.

Nursery owners: Nursery owners bought spawns as inputs from hatcheries for producing fingerlings. To be precise, nursery owner's input is spawn and the output is fingerlings. Here, wholesalers and retailers are found in the same area. Most of the fingerlings are normally sold to the pond fish farmers who are the actual customer of fish seed and a few amounts are being sold to traders.

Traders of fingerlings: Paikers bought fingerlings from nursery and sold them to wholesalers; wholesalers purchased their

fingerlings from Paikers and nursery owners and sold them to retailers and fish farmers. Lastly, retailers purchase their fingerlings from nursery owners and wholesalers and sold them to fish farmers.

Fish farmers: The final destination of these fingerlings is to the pond fish farmers. The farmers bought fingerlings either from the intermediaries or the major portion from the nursery owners. These fish farmers are located in Trishal, Gouripur, Shibpur, Mymensinghsadar, Gouripur, and Muktagacha. With these fingerlings farmers cultured fish in their ponds.

Marketing functions of the market participants in the fish seed value chain: As discussed above a number of market participants like hatchery owners, paikers, wholesalers, retailers, and nursery owners are involved in the marketing of fish seed. In the study areas, all intermediaries are involved in buying and selling of fish seeds. Paikers usually do the functions of negotiation between hatchery owners to nursery owners for spawn selling and nursery owners to fish farmers for fingerlings respectively in return for the commission. Retailers sell the entire fingerlings to ultimate fish farmers in the study area. Hatchery and nursery owners, paiker, wholesalers, and retailers practiced open bargaining and going market prices method for fixing the price of their products in varying degrees. All of the retailers follow open bargains for selling their fish seed to its customer (fish farmers). The price depends on the quality, size, market condition, supply, and demand of fish seed. For selling and trading the fish seed, various modes of transport such as auto rickshaws, vans, rickshaws, trucks, passenger buses, pickup, Nasimon (locally made pick-up type van for transporting passengers and goods), head load, etc. are being used. Fingerlings are transported from one place to another place by using water in plastic drums. Poly bags, drums, baskets, Patil, and rope are used for fish seed transporting. Plastic and drums are usually used when fish seeds are transported to distant places like Dhaka, Tangail, Jamalpur, etc.

Another marketing function performed by the fish seed trader is called grading. Grading is roughly done according to the size and quality of the product by the hatchery and nursery owners and actors mostly based on the visual estimate. In Mymensingh, all intermediary grad fish seeds (spawn and fingerling) based on size and physical fitness. Again, for effective operation, financing has crucial importance in the whole marketing system of fish seed. The study shows that most of the hatchery owners, nursery owners, paikers, wholesalers, and retailers of fish seed were self-financed (Figure 3). Other sources of finance for farmers were banks, friends and relatives, and NGOs. A minor portion of sources of finance is banks friends and relatives. In the study areas, visiting the markets and use of telephone/mobile phones were the most common sources of collecting market information for all value chain actors.

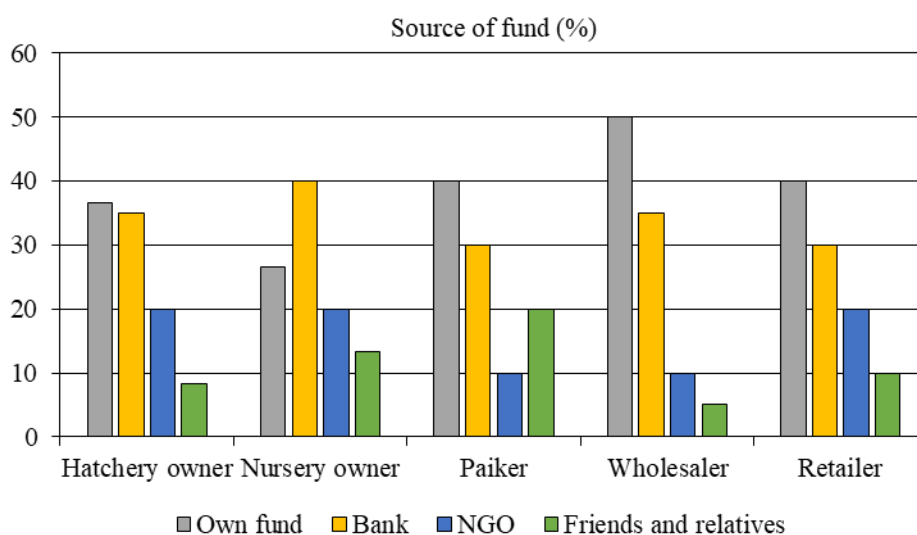


Figure 3. Sources of finance of hatchery and nursery owner and intermediaries.

Table 1. Per farm yearly total cost and return of hatchery and nursery owner for carp fish seed.

Item of costs	Hatchery (Tk)	Nursery (Tk)
Variable cost		
Feed cost	661493.87	204280.80
Brood fish cost/Procurement cost of spawn	136992.95	39421.36
Human labor cost	544086.33	625466.67
Fertilizer cost	11853.20	14806.53
Hormone, chemical, poison cost	123780.00	21212.67
Fuel cost	941.05	62871.87
Electricity cost	142333.33	70333.33
Plastic cost	10113.33	16006.67
Dewatering cost	22.93	28957.33
Re-excavation cost	133766.67	210400.00
Telephone bill cost	20866.67	14986.67
Others cost	177666.67	316329.26
Interest on operating Capital	88376.27	73128.29
Total variable cost	2052293.27	1698201.45
Fixed cost		
Land use cost of pond & hatcheries	254133.33	181466.67
Tools & equipment Costs	563917.33	356027.21
Cost of farm building & other Structure	1009289.34	146676.67
Total fixed cost	1827340.00	684170.54
Total cost	3879633.27	2382371.99
Gross return	8204408	4770498
Gross margin	6152115	3072296
Net return	4324775	2388126
BCR	2.11	2.00

Cost, returns, and value addition of carp fish seed production

This study is concerned with the assessment of the net value addition of fish seed farming. For this reason, the cost and returns of the two kinds of fish seed farms that is hatchery and nursery, and finally the profitability and value addition of the fish seed farming were estimated (Table 1). For carp fish seed, the per farm yearly total cost for hatcheries is relatively higher which is Tk. 3879633.27 (36567.47 USD) than the cost of the nursery that Tk. 2382371.99 (22455.04 USD) which is shown in Table 1. On the contrary, the yearly net return from spawn

production in the hatchery is Tk. 4324775 (40763.15 USD) and the net return from fingerling production in the nursery per year is Tk. 2388126 (22509.27 USD). On the basis of the discussions, it could cautiously be concluded that carp fish seed multiplication farming is profitable for both hatchery and nursery. On the basis of comparison, the hatchery operation is the most profitable than that the nursery operation. However, for both hatchery and nursery, BCR (Benefit Cost Ratio) is greater than one. It implies that fish seed farming is a good investment indeed.

Table 2. Total marketing costs of all intermediaries for Tk./10 Kg. spawn and Tk. / 100000 pieces of fingerlings for carp fish.

Cost Items	Paiker		Wholesaler		Retailer		Total cost		Percentage	
	S	F	S	F	S	F	S	F	S	F
Electricity bill	-	-	85	75	-	-	85	75	4.56	0.98
Security	-	-	-	8	-	-	-	8	-	0.10
House rent	-	-	269	315	-	-	269	315	14.4	4.13
Telephone bill	232	171	62	95	167	376	461	642	24.66	8.41
Transportation	28	1321	249	1312	98	1847	375	4480	20.07	58.72
Loading and unloading	3.8	497	42	192	17	340	63	1029	3.35	13.49
Packaging	1	38	109	20	50	-	161	57	8.61	0.75
Storage	-	-	-	93	34	-	34	93	1.80	1.22
Personal expenses	15	20	105	224	42	291	161	536	8.64	7.03
Wages and Salaries	17	16	223	210	13	-	253	225	13.53	2.95
Fish feeding	-	-	-	157	-	-	-	157	-	2.06
Tips and Donation	1	7 (F)	5	3	-	3	6	13	0.35	0.17
Total	298	2070	1149	2704	421	2856	1868	7630	100	100

*S indicates spawn, and *F indicates fingerling

Table 3. Average total marketing margin per 10 Kg. spawn and per 100000 pieces of fingerling for carp fish.

Intermediaries	Average marketing costs (tk.)		Gross margin (Average profit) (tk.)		Net marketing margin (tk.)		Value addition	
	S	F	S	F	S	F	S	F
Paiker	298	2070	6680	16578	6382	14508	20.85	31.2
Wholesaler	1149	2704	7658	15756	6509	13052	20.01	25.5
Retailer	421	2856	7733	18444	7313	15588	19.13	23.3
Total	1868	7630	22071	50778	20204	43148	59.99	80.00

*S indicates spawn, and *F indicates fingerling

Total marketing cost of all intermediaries: Marketing costs are incurred when commodities move from the farm to the final market, whether they are moved by farmers, intermediaries, cooperatives, marketing boards, wholesalers, or retailers. The total marketing costs of carp fish seed (spawns and fingerlings) included all costs incurred by different types of intermediaries like paikers, wholesalers, retailers, etc. The item-wise total cost of all intermediaries has been shown in Table 2. The total marketing cost incurred by intermediaries is calculated at Tk. 1868 per 10 Kg. spawns, and Tk. 7630 per 100000 pieces' fingerlings. Among the cost items telephone bill and transportation cost is the highest cost items which are Tk. 461 (24.66% of total costs) for spawn and Tk. 4480 (58.72% of total costs) for fingerlings. On the other side, the lowest cost items are tips and donations, and security costs which are Tk. 6(0.35% of total cost) and Tk. 8 (0.10% of total cost), respectively.

Average total marketing margin for carp fish seed (spawn and fingerling): Average total marketing margin per 10 Kg spawn and per 100000 pieces' fingerlings are given in Table 3. The two table shows the average marketing cost per 10 Kg. spawn and per 100000 pieces' fingerlings is Tk. 1868 and Tk. 7630, respectively for all intermediaries. The gross margin (average profit) earned by all intermediaries is Tk. 22071 and Tk. 50778, respec-

tively. Total net marketing margin per 10 Kg. spawn and per 100000 pieces' fingerlings are Tk. 20204 and Tk. 43148 respectively. Among all three intermediaries' paikers, wholesalers, and retailers, the net marketing margin of the retailer was highest for both cases. A large percentage of value addition was covered by paiker for both cases and that is 20.85 percent and 31.2 percent respectively.

Problems and constraints of carp fish seed production and marketing

Because of several reasons, the hatchery and nursery owners along with the intermediaries could not achieve their production target and reasonable profit. Therefore, an effort has been made to explore and identify major problems in the production and marketing of fish seeds in the Mymensingh district. Inadequate access to financial capital, lack of extension service, the higher price of the input, and Lack of monitoring in the private hatchery are some common problems in the case of producing carp fish seed (Table 4). Moreover, almost all the intermediaries faced poor communication system problems followed by a lack of fish seed market, lack of institutional finance, and lack of methods for testing the quality of seed during transportation and marketing their products (Table 5).

Table 4. Production related problems for hatchery and nursery owners of carp fish seed.

Name of the problems	Strongly agree (%)		Agree (%)		Probably agree (%)		Probably disagree (%)		Not sure (%)	
	H	N	H	N	H	N	H	N	H	N
Lack of information about good quality seed	12.5	6.25	12.5	18.75	25	37.5	37.5	25	0	0
Lack of practical methods to monitor quality of fish seed before stocking	6.25	0	31.25	6.25	25	18.75	31.25	31.25	0	0
Lack of information from government to farmers on brood stock quality and management	0	0	25	12.5	31.25	25	31.25	12.5	6.25	12.5
Lack of monitoring and certification from government side on quality of seed produced by private hatchery	6.25	18.75	50	12.5	37.5	37.5	6.25	12.5	6.25	0
In breeding problem	0	0	18.75	12.5	18.75	31.25	18.75	12.5	37.5	12.5
Non availability of various inputs	0	6.25	12.5	0	18.75	12.5	50	43.75	6.25	6.25
Higher price of various inputs	18.75	18.75	37.5	12.5	12.5	12.5	25	18.75	0	0
Lack of financial capital	0	6.25	18.75	31.25	43.75	25	18.75	12.5	0	6.25
Lack of extension services	6.25	0	43.75	37.5	25	18.75	12.5	12.5	0	0

*H= Hatchery owner, *N= Nursery owner

Table 5. Marketing related problems for carp fish seed trader (spawn and fingerlings).

Name of the problem	Paiker (%)		Wholesaler (%)		Retailer (%)	
	S	F	S	F	S	F
Lack of hatchery units	25	13	0	0	0	13
Lack of development of ancillary units	25	60	40	27	20	13
Lack of transportation facilities	44	47	0	0	20	0
Mortality during transportation	44	53	20	67	47	100
lack of fish seed market	69	100	0	93	27	100
Lack of institutional finance	50	67	33	20	47	27
Lack of training and extension network	19	73	47	47	87	60
Lack of methods for testing the quality of seed during transportation	56	47	40	33	73	47
Price fluctuations	94	0	0	0	40	7
Unexpected marketing competition	31	60	33	47	7	40
Poor communication system	25	93	100	100	93	100

*S means spawn trader, and *F means fingerling trader

Conclusion and recommendation

The major finding from the study is that carp fish seed farms with hatchery are more profitable than carp fish seed farms with nursery in the Mymensingh district. Net return from spawn production in the hatchery is Tk. 4324775 (40763.15 USD) and net return from fingerling production in nursery is Tk. 2388126 (22509.27 USD) annually. However, carp fish seed traders in this district faced numerous problems that affect the profitability and total return from this business. Lack of information about good quality seed, the higher price of various inputs, lack of proper monitoring of the extension service, and price fluctuations are among of these production and marketing related problems. To solve all these problems, effective measures should be taken by the government immediately. Government should determine

appropriate policies and provide incentives for the development of fish seed farms. Hatchery operators should be trained on appropriate technologies concerning selective breeding, broodstock management, etc. Primary markets should be free from the control of paiker to make the market competitive. A well-organized fish seed selling market should be established that can ensure effective marketing of the seed. Hopefully, all these actions will facilitate and encourage the expansion of fish seed farming in the country as a whole.

Open Access: This is an open access article distributed under the terms of the Creative Commons Attribution NonCommercial 4.0 International License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) or sources are credited.

REFERENCES

- Azim, M. S., Tarannum, L., & Patwary, A. K. (2017). The Effects of Leadership Style into Fisheries Business Sector in Bangladesh. *International Journal of Business and Technopreneurship*, 7(1), 13-22.
- BFTI (2016). Bangladesh foreign trade institute, study on sector based need assessment of business promotion council- fisheries products. Kawran Bazar, Dhaka.
- DoF (2016) National fish week, compendium (In Bengali), Dhaka: Department of Fisheries, Ministry of Fisheries and Livestock, Government of Bangladesh.
- DoF (2017). Annual Report 2017, Ministry of Fisheries, Government of Peoples Republic of Bangladesh, Dhaka, Bangladesh, 14.
- DoF (2020). Annual Report 2020, Ministry of Fisheries, Government of Peoples Republic of Bangladesh, Dhaka, Bangladesh.
- DoF (2022) National fish week, compendium (In Bengali), Dhaka: Department of Fisheries, Ministry of Fisheries and Livestock, Government of Bangladesh, 160p.
- FRSS (2016). Fisheries resources survey system (FRSS), fisheries statistical report of Bangladesh, Bangladesh: Department of Fisheries. 32, 1-57.
- Islam, M. M., Shamsuzzaman, M. M., Mozumder, M. M. H., Xiangmin, Z., Ming, Y., Jewel, M. A. S. (2017). Exploitation and conservation of coastal and marine fisheries in Bangladesh: Do the fishery laws matter? *Marine Policy*, 76, 143-151.
- Parvez, M.S., Rahman, M.A., Hasan, M.J., Rasel, M.S.E., Shaikh, M.M., Molla, M.H.R., Chowdhury, S. H., & Billah, M. M. (2018). Role of Hatchery on Fish Seed Production in Patuakhali District of Bangladesh: An Overview. *International Journal of Chemical, Environmental and Biological Science*, 6, 1-7.
- Rahman, M. M., Tabassum, N., Sabur, S. A., Ethen, D. Z., & Mahfuza, E. J. (2019). Value chain analysis of tilapia fish seed in some selected areas of Mymensingh district in Bangladesh. *Progressive Agriculture*, 30(4), 387-394.
- Shamsuzzaman, M. M., Islam, M. M., Tania, N. J., AL-Mamun, M. A., Barman, P. P., & Xu, X. (2017). Fisheries resources of Bangladesh: Present status and future direction. *Aquaculture and Fisheries*, 2(4), 145-156.