Journal of Fisheries
Volume 2 Issue 3 Pages 209–214 December 2014
Peer Reviewed | Open Access | Online First

eISSN 2311-3111
pISSN 2311-729X

DOI: https://doi.org/10.17017/j.fish.92

Original article

Fry production, induced breeding practices and cost-profit analysis of the hatcheries of Rajshahi district in Bangladesh

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Received: 13 Oct 2014, Received in revised form: 14 Dec 2014, Accepted: 29 Dec 2014, Published online: 31 Dec 2014

Citation: Aktar N, Bhuiyan AS and Islam MN (2014) Fry production, induced breeding practices and cost-profit analysis of the hatcheries of Rajshahi district in Bangladesh. Journal of Fisheries 2(3): 209–214. DOI: 10.17017/j.fish.92

Abstract

This study was conducted on the 13 hatcheries of Rajshahi district from March to December 2013 to know about the fry production status, induced breeding practices and cost-profit status. Average fry production of *Labeo rohita*, 93.38±83.32 kg, *Catla catla*, 62.00±60.84 kg, *Cirrhinus cirrhosus*, 77.46±58.61 kg, *L. calbasu*, 14.20±14.60 kg, *L. bata*, 53.73±50.56 kg, *L. gonia*, 10.00±0 kg, *Heteropneustes fossilis*, 5.00±0 kg, *Clarias batrachus*, 20.00±0 kg, *Hypophthalmichthys molitrix*, 149.77±138.45 kg, *Aristichthys nobilis*, 104.54±148.11 kg, *Ctenopharyngodon idella*, 19.20±15.35 kg, *Cyprinus carpio* 108.08±77.39 kg and *Barbonymus gonionotus*, 23.10±14.04 kg were recorded in the surveyed hatcheries. Two types of hormone injections PG (pituitary gland) and HCG (Human chorionic gonadotropin) were used for induced breeding. The rate of 1st dose of injection of PG varied from 1 to 2 mg/kg and HCG from 100-150 IU/kg and the rate of 2nd dose of injection of PG varied between 5 and 8 mg/kg. The incubation period and hatching rate in different fish species varied from 10 to 72 hours and 55% to 80%, respectively. The average total cost, gross return and net profit of the hatcheries were 0.667±0.798, 1.152±1.636 and 0.485±0.846 million BDT respectively.

Keywords: Fish fry, hatchery, induced breeding, inducing agents, PG, HCG, brood fishes, hatching, cost-return-profit

INTRODUCTION

Bangladesh is an agro-based developing country having an extensive water resource. Fisheries is one of the major components of agricultural activities and play a very significant role and deserve potential for future development in the agrarian economy of Bangladesh in terms of animal protein supply, foreign currency earning, employment and poverty alleviation. In 2012-2013, fisheries sector contribute 4.37% to the national gross domestic product (GDP) and almost one-fourth (23.37%) to the agricultural GDP and 2.01% export earning and 60% of the total protein supply in the diet of the people of Bangladesh (DoF 2014). Bangladesh is one of the world's leading fish producing countries with a total production of 3.410 million mt in the last fiscal year 2012-13 (DoF 2013). The availability of fish fry is an essential prerequisite for fish culture. The main sources of fish fry in Bangladesh are spawn produced in government and private hatcheries, and some collected from rivers. At present the total number of fish hatcheries are 936 of which government fish seed multiplication farms are 77, other government hatcheries are 7 and private fish hatcheries are 852 (DoF 2013). Rajshahi is one of the richest districts of Bangladesh in respect of its vast, diverse and unique fisheries resources in the form of physical, biological and others. There are 2 public and 11 private fish hatcheries in Rajshahi district (DoF 2013). In the year 2013, the total fry production from hatcheries in Bangladesh was 487,453 kg, of which 9,890 kg was from public hatcheries and 477,563 kg was from private hatcheries. The total fry production from govt. hatcheries was 390 kg and from private hatcheries it was 8,372 kg in the year 2013 from Rajshahi district

(DoF 2013). Nowadays due to the degradation of ecological balance, natural resources of fish fry are destroyed. So, hatchery is now the main source of fish fry production. The term "Hatchery" is considered in broadest sense as the facilities where fish fry and fingerlings suitable for stocking in growth ponds are produced in artificial manner by the process of induced breeding technique. Induced breeding is a technique whereby ripe brood fishes are stimulated by treating them with inducing agents to breed in captivity. The stimulation promotes a timely release of eggs and milts from ripe breeders. It is now used as a widely accepted means of artificial propagation to overcome constraints in fish fry supply particularly for species that do not breed in captivity.

In view of the economic importance and culture potentials of the fishes the study was done to find out the way to standardize the fish hatchery sector. This study will be helpful to the hatchery owners, fish culturists, farm managers, hatchery operators, production specialists, policy makers and extension workers to run a hatchery effectively and efficiently and as well as to improve the breed and stock, improve quality fish fry and increase the fry production rate.

METHODOLOGY

***Study area and duration*:** This study deals with 13 hatcheries (Table 1) of Rajshahi district, Bangladesh. The study was carried out over a period of 10 months from March to December 2013. Rajshahi district is situated in the southwestern part of Rajshahi division and lies between 24°6′N and 25°13′N latitudes and between 49°02′ and 49°21′E longitudes (Figure 1).

Figure 1: Map of Rajshahi district showing the study areas.

***Data collection*:** For data collection, a reasonable size of sample was considered. A survey schedule was prepared and the data on fry production, induced breeding and cost profit were collected by survey and interview; other relevant data were collected from district and Upazila fishery offices.

Data analysis: All the collected data were checked, summarized and scrutinized carefully and analyzed by MS Excel.

Table 1: Name and addresses of the hatcheries under study area in Rajshahi district of Bangladesh

Sl.	*Hatchery name*	*Location*
1*	Rajshahi Matshow Beej Utpadon Khamar	Ambagan, Rajshahi City Corporation
2	Mashud Matshow Hatchery	Horogram, Rajshahi Court, Rajshahi City Corporation
3	Hashibul Matshow Hatchery	Meherchandy, Rajshahi City Corporation
4	Mamun Matshow Hatchery	Horogram, Rajshahi Court, Rajshahi City Corporation
5	Arif Matshow Hatchery	Mollapara, Rajshahi Court, Rajshahi City Corporation
6*	Puthia Matshow Beej Utpadon Khamar	Puthia, Rajshahi
7	Shuvo Irin Enterprise Matshow Hatchery Prokolpo	Puthia, Rajshahi
8	Faisal Matshow Hatchery	Mougachi, Mohanpur, Rajshahi
9	Duivai Sonali Matshow Hatchery	Fulshow, Mohanpur, Rajshahi
10	Delwar Matshow Hatchery	Fulshow, Mohanpur, Rajshahi
11	Sarkar Matshow Hatchery	Mougachi, Mohanpur, Rajshahi
12	Monika Matshow Hatchery	Taherpur, Bagmara, Rajshahi
13	Hanif Matshow Hatchery	Goalkandi, Bagmara, Rajshahi

** Government Hatcheries*

RESULTS AND DISCUSSION

Fry production: Annual fry production capacity and species wise fry production of the surveyed hatcheries are shown in Table 2. From the investigational study, it was observed that fry production are not sufficient than production capacity. More or less similar observation was found in the study of Bhuiyan *et al.* (2011), Islam *et al.* (2002) and Hossain and Siddique (2009). The annual production capacity (kg) of the surveyed hatcheries ranged from minimum 115 to maximum 2,500 kg. The total production of fry were lowest 115 to highest 2,120 kg in the hatcheries under survey.

Table 2: Showing the annual production capacity, species wise fry production and total fry production in the surveyed hatcheries (in kg).

Sl. of hatchery	Annual production capacity	Fry production of native species								Fry production of exotic species					Total
		L. rohita	*C. catla*	*C. cirrhosus*	*L. calbasu*	*L. bata*	*L. gonia*	*H. fossilis*	*C. batrachus*	*H. molitrix*	*A. nobilis*	*C. idella*	*C. carpio*	*B. gonionotus*	
1	275	60	25	60	5	30				30	30	5	30		275
2	1200	100	200	80		35				300	125		100	40	980
3	920	75	140	90		20				110	100		170	20	725
4	850	50	50	55		15				170	60		90	30	520
5	750	55	60	55		30				140	100		95	25	560
6	115	24	11	12	6	11				22	7	6	10	6	115
7	2000	145	30	60		155		5	20	90	65		30	25	625
8	1000	100	25	105	10	50				80	62		110	10	552
9	1000	90	25	100		45				95	75	15	260	15	720
10	250	40	20	20						60	15		60		215
11	500	75	20	70		150				50	20	30	250	10	675
12	2500	350	150	250	40	50	10			500	580	40	100	50	2120
13	800	50	50	50	10					300	120		100		680
Min	115	24	11	12	5	11	10	5	20	22	7	5	10	6	115
Max	2500	350	200	250	40	155	10	5	20	500	580	40	260	50	2120
Mean ±SD	935.38± 676.29	93.38± 83.32	62.00± 60.84	77.46± 58.61	14.20± 14.60	53.73± 50.56	10.00 ±0.00	5.00 ±0.00	20.00 ±0.00	149.77± 138.45	104.54± 148.11	19.20± 15.35	108.08± 77.39	23.10± 14.04	674.00± 493.77

Fry of a total of 13 species were found to be produced in the surveyed hatcheries. Of these, induced breeding of six species, including three major carps (*L. rohita, C. catla and C. cirrhosus*) and three Chinese carps (*H. molitrix*, *A. nobilis* and *C. carpio*) was practiced in all the hatcheries. There were three species (*L. gonia*, *H. fossilis* and *C. batrachus*) whose artificial breeding was carried out only in a single hatchery during the period of study.

Maximum mean fry production was found for silver carp, *H. molitrix* which was 149.77±138.45 kg followed by common carps, *C. carpio* (108.08±77.39 kg) and bighead carp, *A. nobilis* (104.54±148.11 kg). The minimum seed production (5 kg) was recorded for stinging catfish, *H. fossilis*. Artificial breeding of *L. gonia* was also reported and the amount of production was 10 kg. However, small amount of seeds (20 kg) of another indigenous catfish species, *C. batrachus* was also produced.

Induced breeding: For producing quality fish fry, induced breeding techniques are applied in the hatcheries. Mainly two types of inducing agents *viz.* pituitary gland (PG) and the human chorionic gonadotropin (HCG) were used for induced breeding practices in the surveyed hatcheries. PG was used for all fishes except the silver and bighead carps where HCG was used. For the 1st and 2nd doses, PG of 1 to 2 mg/kg and 5 to 8 mg/kg, respectively were applied. On the other hand, 100-150 IU/kg HCG were applied only as the 1st dose (Table 3). Fontenel (1955), Atz and Pickford (1959), Das and Khan (1962), Chaudhuri (1976), Mirza *et al.* (1993) and Alam and Bhuiyan (1999) adopted more or less similar practices for induced breeding in various fishes. It was found that fishes with correct dose of hormone injection, breed under artificial condition and gave good results. According to Ahmed (1945) PG influenced the spawning of *Labeo rohita*. In agreement with the present doses, Khan (1938), Alikunhi *et al.* (1960), Haque (1975), Chaudhuri (1977), Moitra and Sarker (1978), Khan *et al.* (1992), Mahanta *et al.* (1998) and Bhuiyan *et al.* (2008) and Bhuiyan and Aktar (2011) used more or less similar doses for induced spawning in common carps.

Table 3: Hormonal doses used in different brood fishes for induced breeding in the hatcheries of Rajshahi.

Species	Hormonal doses of Injection			
	1st dose of PG (mg/kg) and HCG* (IU/kg)		2nd dose PG (mg/kg)	
	Min	Max	Min	Max
Labeo rohita	1.5	2	6	8
Catla catla	1	2	6	8
C. cirrhosus	1.5	1.5	5	6
L. calbasu	1.5	2	6	8
L. bata	1.5	2	6	8
L. gonia	1	2	6	8
H. fossilis	1	1.5	6	8
C. batrachus	1	1.5	6	8
H. molitrix	100*	150*	6	8
A. nobilis	100*	150*	6	8
C. idella	1	1.5	5	6
C. carpio	1.5	2	5	8
B. gonionotus	1	2	5	6

Incubation and hatching: The incubation period of different fish species varied from minimum 10 to maximum 72 hours. The hatching rate of fishes in the surveyed hatcheries ranged between 55% and 80% which is shown in Figure 2. These findings corroborate the observations of Alikunhi *et al.* (1964), Ali (1967) and Sing *et al.* (2000).

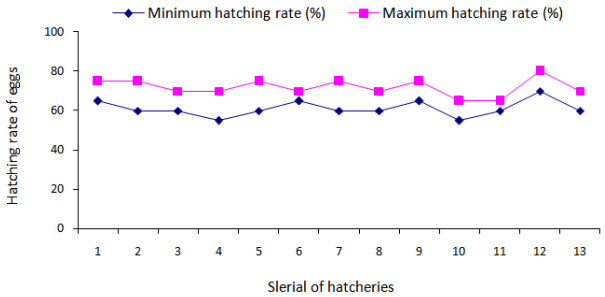

Figure 2: Hatching rates of eggs in different hatcheries under study

Total cost, gross return and net profit:

Total cost: Fish fry production in the hatcheries is a profitable business in the surveyed area. The cost of production was the major determining factor for net earning in fish fry production. The total cost ranged from BDT 0.125 million to BDT 3.180 million with an average of BDT 0.667±0.798 million in the surveyed hatcheries in the year 2013 (Figure 3).

Gross return: Gross return depends on the production capacity, demand of fry, well management system and market price of fry. It was observed that, the gross return of the surveyed hatcheries ranged from BDT 0.184 million to BDT 6.360 million with an average of BDT 1.152±1.636 million in the year 2013 (Figure 3).

Net profit: It was observed that among the surveyed hatcheries, the net profit ranged from BDT 0.0575 million to BDT 3.18 million with an average BDT 0.485±0.846 million in the year 2013 (Figure 3).

No previous study was found on the cost-benefit of hatchery operation in Bangladesh so it was not possible to compare the present findings with previous one. However, average benefit from the hatchery operation was found much more than carp culture in ponds in the study area, a study by Mohsin *et al.* (2012) reported 194,231.99±118,168.48 BDT/ha/yr benefit from grow out ponds of carps in Rajshahi area.

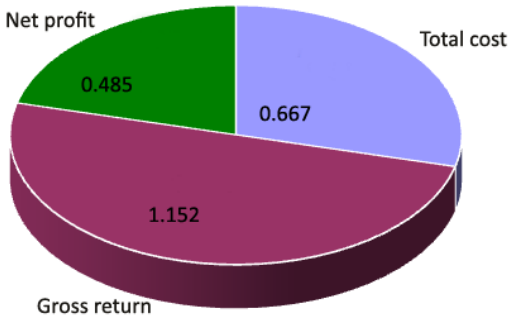

Figure 3: Graph showing average total cost, gross return and net profit of the surveyed hatcheries (in million BDT)

CONCLUSION

The production quantity of fish fry and profit of government hatcheries was less than the private hatcheries in pursuance of production capacity. To get the maximum quantity and high quality fry, the proper doses of hormone injection and use of quality brood fishes should be maintained. Emphasis should be given on expansion of hatchery facilities to supply high quality and quantity of fish fry required to support aquaculture development. More future works are necessary on different aspects of fish fry production. The government and NGOs should provide all modern facilities in connection with the quality fish fry production in Bangladesh.

ACKNOWLEDGEMENTS

The authors are thankful and grateful to the hatchery owners, managers, fishery officers, staffs etc. for their kind help to supply data and information related to the hatcheries.

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