

Broodstock management and seed production at the hatcheries in Rajshahi region of Bangladesh

Dil Afroza Khanom¹, Nahida Sultana¹, Mst. Rima Aktar¹, Sadicunnar Shikha² and Md. Abu Sayed Jewel*¹

¹ Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh

² Department of Fisheries, Ministry of Fisheries and Livestock, Government of the People's Republic of Bangladesh

ARTICLE INFO

Article History

Received: January 27, 2020

Accepted: March 23, 2020

Online: October 25, 2020

Keywords

Broodfish
Management
Hatchery operation
Rajshahi
Natore

ABSTRACT

A study was carried out to reveal brood stock management and fish seed production of the hatcheries in Rajshahi and Natore district of Bangladesh. Data were collected from 25 hatcheries of Rajshahi and Natore district from January to July, 2019. The hatchery area ranged from 97 to 208 decimal and brood stock pond area varied from 50 to 100 decimal with an average depth of 5 feet. Drying, liming and fertilization were done for pond preparation where urea, TSP (Triple Super Phosphate), MP (Murate of Potash), DAP (Di-ammonium Phosphate) were used as fertilizer before stocking and also during culture period. Underground water was the main source for hatchery operation. Mustard oilcake, wheat bran, maize bran, auto rice bran, fish meal, and blood were used as supplementary feed. Argulosis was noted as the most common disease for brood fish and was found in 100% hatcheries of Rajshahi and 75% hatcheries of Natore. It was found that, about 69% hatcheries in Rajshahi and 50% hatcheries in Natore collected brood fish from their own hatchery pond, other sources include, river (Padma, Jamuna and Halda) and Mymensingh, brood bank. Duration of breeding season extended for 10 months from November to August. A total of seven native and seven exotic fish species were used as brood fish for seed production. PG (Pituitary Gland) hormone injection were found to be used as single inducing agent and the injection doses varied from species to species whereas 17 α methyl testosterone were used for tilapia monosexing. Lack of skilled manpower, high cost of hormone, less price of hatchling were noted as major problems. Proper training of hatchery operator, good quality brood fish and managing the hatchery in scientific way can enhance the production of good quality fish seed and able to meet the upgrowing demand of fish farmer.

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Introduction

Bangladesh is one of the world leading fish producing country with a total production of

41,34,434 mt. and ranked 4th in aquaculture (FAO, 2018). Good quality fish seed is essential for contributing the up growing trend in aquaculture. The main source of fish seed in Bangladesh are spawn produced in government (1.93%) and private hatcheries (98.07%) whereas a small portion is collected from rivers (Bhuiyan *et al.*, 2011). At present, about 6,96,028 kg spawn are

*Address of correspondence

Department of Fisheries

University of Rajshahi, Rajshahi-6205, Bangladesh.

E-mail: jewel75@yahoo.com (Md. Abu Sayed Jewel)

being produced from 902 hatchery; of which 84 are government and 818 are public owned (DoF, 2018). To ensure the supply of good quality fish fry is very important for sustainable aquaculture. Only a reliable induced breeding and fry rearing technique can ensure a steady supply of quality fish seeds (Mollah *et al.*, 2008). Broodstock management and hatchery practices has been well documented for Jashore by Sabuj *et al.*, (2015) and Hossain *et al.*,(2016); and for greater Sylhet by Roy *et al.*, (2016). Bhuiyan *et al.*, (2011) reported about training status, funding source, hatchery facilities and average fry production of hatcheries at 6 upazila in Rajshahi. Therefore, the present study was carried out to gather all the information regarding broodstock management and fish seed production of Rajshahi and Natore districts.

Materials and Methods

Study area and period

There were 25 hatcheries in the study area of Rajshahi and Natore district and all of them were studied for a period of seven months from January to July, 2019.

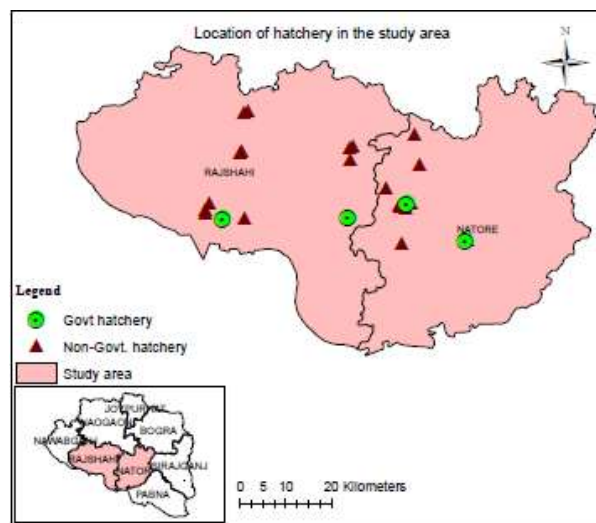


Fig. 1. Study area showing the location of hatchery.

Data collection and analysis

A questionnaire was prepared emphasizing on the objective for collecting data from farm manager, hatchery owners, hatchery technicians and labour. For identifying exact location of hatchery GPS meter (GARMIN: eTrex Legend H)

were used. Data were analyzed using MS Excel software- 2010.

Results

The list of the studied hatcheries (13 hatcheries in Rajshahi and 12 hatcheries in Natore) including their address, foundation year are presented in table-1.

Table 1. Name and address of hatchery of Rajshahi and Natore District

Sl. No.	Name and address of Hatchery of Rajshahi	Name of the Owner	Estt. Year
1.	Matshow Beej Utpadon Khamar, Metropolitan city, Rajshahi	Government	1968
2.	Matshow Beej Utpadon Khamar, Puthia, Rajshahi	Government	1969
3.	Shuvo-Erin Matshow Prokolpo Hatchery, Puthia, Rajshahi	Md. Ataur Rahman	1994
4.	Hasibul Matshow Hatchery, Paba, Rajshahi	Md. Abdul Hakim	2010
5.	Arif Motshow Hatchery, Paba, Rajshahi	Md. Ariful Islam	1993
6.	Masud Matshow Hatchery, Paba, Rajshahi	Md. Masud Rana	2008
7.	Mamun Matshow Hatchery, Paba, Rajshahi	Md. Mamun-or-Rashid	1990
8.	Dui vai Sonali Matshow Hatchery, Mohonpur, Rajshahi	Md. Saber Ali	1997
9.	Sarkar Matshow Hatchery, Mohonpur, Rajshahi	Md. Abdul Aziz Sarkar	2010
10.	Foysal Matshow Hatchery, Mohonpur, Rajshahi	Abdul Ohab Mondol	1993
11.	Satota Matshow Hatchery, Mohonpur, Rajshahi	Md. Robiul Islam	2005
12.	PutulMatshow Hatchery, Bagmara, Rajshahi	Md. Surat Ali	1991
13.	Mrs Monika Hatchery, Bagmara, Rajshahi	Khondokar Touhidul Karim	1989
14.	Matshow Beej Utpadon Khamar, Natore Sadar, Natore	Government	1964

15.	Nabin Matshow Chasi Bohumukhi Prokolpo, Natore Sadar, Natore	Md. Golam Mostofa	1988
16.	Shanirvor Matshow Utpadon Khamar, Natore Sadar, Natore	Md. Ruhul Amin	1990
17.	G.M. Matshow Khamar, Natore Sadar, Natore	Saiful Islam	1991
18.	Kobita Matshow Hatchery, Natore Sadar, Natore	Md. Kamrul Islam	1992
19.	Natore Adhunik Matshow Chas Prokolpo Ltd., Natore Sadar, Natore	Md. Golam Nabi	2012
20.	Sonali Matshow Khamar Natore Sadar, Natore	Md. Oasimuddin Joradar	2015
21.	Matshow Beej Utpadon Khamar, Boraigram, Natore	Government	2017
22.	Mrs Al-Amin Matshow Hatchery, Boraigram, Natore	Md. Tofazzol Hossain	2007
23.	North-Bengal Hightec Tilapia Hatchery, Noldhanga, Natore	Md. Fazlur Rahman	2012
24.	Jui Matshow Khamar, Noldhanga, Natore	Arunkumar Das	2010
25.	Natore Hatchery and Agro Complex Ltd. Bagatipara, Natore	Md. Anisur Rahman	2008

Physical condition of the hatcheries

The average area of hatchery complex and hatchery building (excluding pond) were 297 and 24 decimal in Rajshahi and 208 and 23 decimal in Natore. Water carrying capacity of overhead tanks ranged from 10,000-50,000 liters. Total number of circular tank ranged from 1 to 3. About 38% hatcheries in Rajshahi and 58% hatcheries in Natore had no circular tank. The number of cistern ranged from 5 to 22. In each hatchery the number of incubation tanks ranged from 5 to 26. All the hatcheries in Rajshahi had some sorts of drainage system and released their used water in pond, beel or river. On the other hand, 17% hatchery in Natore had no well drainage system and released used water within the hatchery. Total number of workers ranged in between 2-12.

Physical condition of brood stock pond

The survey report displayed that, most of the brood-stock pond (49% in Rajshahi and 38% in Natore) varied from 50-100 decimal. The range of

water depth was 3-9 feet, about 47% pond was 4 - 6 feet.

Preparation of broodstock pond

Round the year most of the ponds retained water but dewatering (54% in Rajshahi and 67% in Natore) was done in some ponds by pumping and sun drying. Underground water was the main source of water and every hatchery had deep well for continuous water supply. Liming was done during pond preparation and also culture period for 4-5 times in a year and it was 0.40-1.20 kg/decimal. Fertilization was done before stocking of fish and during culture period when it is required. All the hatcheries of the study area (100%) used Urea and TSP (Tripple Super Phosphate) along with MP (Murate of Potash) and DAP (Di- ammonium Phosphate) as fertilizer. No hatchery was found to use cow dung and poultry manure.

Feeding of brood fish

Feed ingredients for brood fish were more or less common in all studied hatcheries. Mustard oilcake, wheat bran, fish meal, maize bran, auto rice bran and blood were used as supplementary feed.

Diseases

Different type of disease such as Argulosis, Gill rot, Dropsy, EUS etc were found in the studied hatcheries. Among them Argulosis was very common and occurred 2-3 months' interval in the brood stock pond.

Source of brood fish

54% hatchery in Rajshahi collected their brood fish from river (Padma 46%, Jamuna 23%, Halda 8%), followed by 23% from Govt. Brood Bank and 19% from own pond. In case of Natore, 25% hatchery collected their brood from river (Padma 17%, Jamuna 8%), 17% from Govt. Brood Bank and 50% from own pond. Brood Tilapia were collected from BFRI, Mymensingh.

Duration of hatchery operation

Duration of hatchery operation time was same for Rajshahi and Natore district which was 5-10 months (February-August).

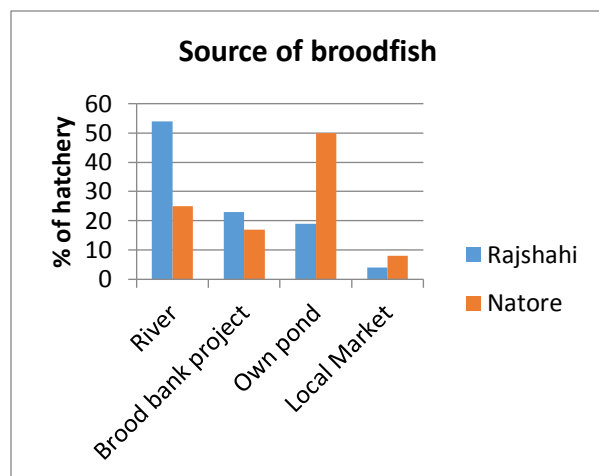


Fig. 2. Source of brood in the study area.

Brood fish selection

Different type of morphometric characteristics, body colour, size, ripening stage, swimming activities etc. were considered for brood fish selection. Mature male had rough pectoral fins whereas in female it was smooth which was used for sex determination. mature male brood were sorted out by means of milky white milt and female by pinkish genital papilla. But sometimes the hatchery operators used their own hatchery produced small sized broods for breeding purpose because of unavailability and high cost of brood. More or less similar situation was prevailing in both districts. The age and weight of brood fish varied from species to species which is given below (Table 2).

Table 2. Weight and age of brood fish

Local name	Name of fish	Weight (kg)	Age (year)
Rui	<i>Labeo rohita</i>	2-5	2+
Catla	<i>Catla catla</i>	3-10	3+
Mrigel	<i>Cirrhinus cirrhosus</i>	2-3	2+
Calibaus	<i>Labeo calbasu</i>	1-3	2+
Bata	<i>Labeo bata</i>	0.2-0.8	1+
Singh	<i>Heteropneustes fossilis</i>	0.1-0.2	1+
Raikhor	<i>Cirrhinus reba</i>	0.2-0.5	1+
Silver carp	<i>Hypophthalmichthys molitrix</i>	2-7	2+
Big head carp	<i>Aristichthys nobilis</i>	3-10	2+
Grass carp	<i>Ctenopharyngodon idella</i>	3-8	2+
Common carp	<i>Cyprinus carpio</i>	2-8	1+
Thai sarputi	<i>Puntius gonionotus</i>	0.4-0.8	1+
Thai pangus	<i>Pangasius sutchi</i>	3-4	2+
Tilapia	<i>Oreochromis niloticus</i>	0.3-0.8	1+

Sex ratio

In carp hatcheries, the ratio of male and female was maintained as 2:1 because sometimes one male milt might not work properly. In tilapia hatchery, the ratio of male: female was 1:2 or 1:4.

Chemical used in the hatchery

Different types of chemicals such as detergent, bleaching powder, potassium permanganate etc. were used to wash hatchery equipment and to keep free from pathogen. Formalin was used to store PG (Pituitary gland).

Conditioning period for brood fish

All the hatcheries were practiced conditioning of brood fish and it ranged from 6-24 hours. About 62% hatcheries in Rajshahi and 58% hatcheries in Natore conditioned their brood for 5-10 hours.

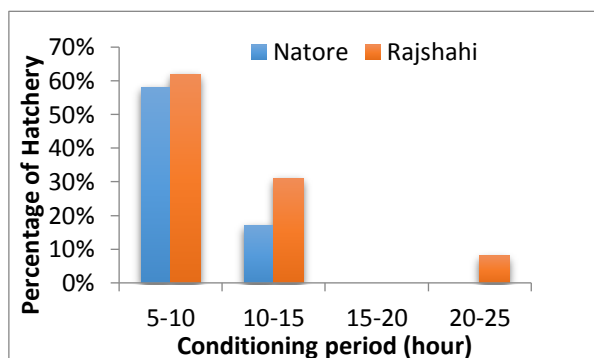


Fig. 3. Conditioning period of brood in the study area.

Hormone injection

All the studied hatcheries used Pituitary gland (PG) hormone injection for induced breeding. In tilapia hatchery 17-alpha methyl testosterone hormone were used for producing monosex male. Only one hatchery in Natore used synthetic hormone for this purpose but it was very risky. The overall hormonal treatment process in the study area is given below (Table 3).

Hatching rate and price

Generally hatching rate depends on the breeding season of fish. In 33% hatcheries hatching rate was 80-90 % and about 67% hatcheries it was 90-95%. In Rajshahi, the

Table 3. Hormonal doses used for induced breeding

SL No.	Local name	Sex	PG (mg/kg body wt.)		Interval between 2 doses (hours)	Ovulation (hours after 2 nd dose)	Hatching time (hours after fertilization)	Mode of ovulation
			1 st dose	2 nd dose				
01	Rui	Female	1.5-2	6-8	5-6	4-6	12-24	Hand stripping & Natural
		Male	-	0.5-1.5				
02	Catla	Female	1.5-2	6-8	5-6	4-6	12-24	Hand stripping & natural
		Male	-	0.5-1.5				
03	Mrigel	Female	1.5-2	6-8	5-6	4-6	12-24	Hand stripping & natural
		Male	-	0.5-1.5				
04	Calibaus	Female	1.5-2	6-7	5-6	4-6	12-24	Hand stripping & natural
		Male	-	0.5-1.5				
05	Bata	Female	1-1.5	2-4	5-6	6-7	12-20	Hand stripping & Natural
		Male	-	1-1.5				
06	Raikhor	Female	1-1.5	2-4	5-6	6-7	12-20	Hand stripping & natural
		Male	-	1-1.5				
07	Singh	Female	2-4	4-10	5-6	6-7	20-30	Hand stripping
		Male	-	2-3				
08	Silver carp	Female	2-3	6-7	6-8	5-6	20-30	Hand stripping
		Male	-	2-3				
09	Big head carp	Female	2-3	6-7	6-8	5-6	20-30	Hand stripping
		Male	-	2-3				
10	Grass carp	Female	1-2	4-6	6-8	5-6	20-30	Hand stripping
		Male	-	2				
11	Common carp	Female	0.5-1.5	6-8	6-8	6-8	48-72	Hand stripping & natural
		Male	-	0.5-1.5				
12	Thai sarputi	Female	1	2-4	6-7	6-7	12-18	Hand stripping & natural
		Male	-	1				
13	Thai pangus	Female	2-3	6-8	5-6	5-6	18-20	Hand stripping & natural

production of hatching ranged from 100-2000 kg with an average of 678 kg and in Natore, it was 15-1200kg with an average of 529 kg.

Price of hatchling

In the study area fish fry were sold at different price because it depends on season, species, demand, availability of hatchling and competition with other hatchery. Price of hatchling in the studied areas is shown in table 4.

Table 4. Price of hatchlings.

Name of fish species	Price of hatchling /kg	
	Highest	Lowest
<i>Labeo rohita</i>	4000	1500
<i>Labeo bata</i>	4000	1500
<i>Catla catla</i>	4000	1500
<i>Hypophthalmichthys molitrix</i>	4000	1200
<i>Aristichthys nobilis</i>	3000	1000
<i>Ctenopharyngodon idella</i>	3000	1200
<i>Cyprinus carpio</i>	4000	1000
<i>Puntius gonionotus</i>	3000	900

Cross breeding

One hatchery in Rajshahi and 2 hatchery in Natore practiced cross breeding of Rui (*Labeo rohita*) with Calibaus (*Labeo calbasu*) for rapid growth.

Problems found in the hatchery

During the study period different types of problems were found to be faced by the hatchery owners including lack of skilled manpower, necessary knowledge about exact dose and timing of PG injection; insufficiency of good quality brood fish; high cost of hormone; less price of hatchling; sudden death of hatchling; competitive market etc.

Discussion

Physical facilities of hatchery

From the survey, it was found that hatcheries were not evenly distributed but in cluster, this may

be due to the success of one motivates others to establish the same in the locality (Fig.1 and Table1). There was no hatchery in 5 upazilas of Rajshahi and 3 upazilas of Natore. 22 hatchery out of 25 has been established within last 30 years, though the 1st three were above 56 years old. Culture fish production in Bangladesh has also been significantly increased from 1968 to 2006 showing spectacular growth at 10.5% per annum (Dey *et al.*, 2008). Average area of hatchery building (excluding pond) were about 23.5 decimal in the study area, the same was reported by Bhuiyan *et al.*, (2011) in Rajshahi as 5 to 33 decimal. Average hatchery area was found 297 decimal in Rajshahi and 208 decimal in Natore which was reported 49-2038 decimal by Amin (2005). The area of each broodstock pond varied from 50-200 decimal in the present study, which was reported 33.33-400 decimal in Jashore (Samad *et al.*, 2013; and Hossain *et al.*, 2016). Average depth of pond was found 3-9 feet, in Jashore during rainy season it was 6-12 ft (Hossain *et al.*, 2016). Water carrying capacity of overhead tanks were noted 10,000 to 50,000 liter which was reported 9091.90 to 4,09,135.5 liter in Rajshahi at 2009 (Bhuiyan *et al.*, 2011). Beside this, the number of circular breeding tank was found only 1 to 3, which remained unchanged for 10 years. But the number of incubation tank has increased from 1-3 to 5-26. At the same time total number of permanent worker has also increased from 2-6 to 2-12 (Bhuiyan *et al.*, 2011). Increase in physical facilities implies increased production capacity.

Brood pond management

In Jashore, most of the ponds retained water round the year and some ponds were dried out by pumping or by sunlight for 7-10 days (Samad *et al.*, 2013; and Hossain *et al.*, 2016); more or less similar situation prevails in the study area. Liming was done for 4-5 times in a year without considering the pH of pond soil. The doses were found 0.4-1.2 kg/decimal. More or less similar result were reported by Samad *et al.*, (2013) and Hossain *et al.*, (2016) in Jashore as 0.5-1.2 kg/decimal. Underground water was the main source of water and every hatchery maintain continuous water supply using deep tube well which was also same for Jashore (Samad *et al.*, 2013). Fertilizer application rate differs from region to region. (Islam *et al.*, 2002). In the studied

hatcheries Urea and TSP were used as fertilizer along with MP (Murate of Potash) and DAP (Di-ammonium Phosphate), but not cow dung and poultry liter. Similar types of fertilizer were also found to use in Jashore region (Hossain *et al.*, 2016). Mustard oilcake, wheat bran, fish meal, maize bran, auto rice bran and blood were used as supplementary feed. In addition, with these cooked rice, meat bone, vitamin and mineral premix, soybean flour were found to use in Jessore (Hossain *et al.*, 2016 and Samad *et al.*, 2013). It indicates that, feeds are mainly prepared on the basis of locally available ingredients.

Argulosis, Gill rot, Dropsy and EUS were common disease found in the surveyed hatchery; among them Argulosis was the most common. Sabuj *et al.*, (2015) reported sudden spawn mortality, Argulosis, *Lernaesis*, gill rot and fin rot in Sylhet region whereas Hossain *et al.*, (2016) found *Lernaesis* as the most harmful disease in Jessore region. So, it can be said that same disease does not prevail all over the country.

In Rajshahi different source of brood fish included, river (Padma, Jamuna, Halda), Govt. Brood Bank, own pond and local market. Besides these sources brood fish were also collected from Mymensingh (monosex tilapia) in Natore. Samad *et al.*, (2013) and Hossain *et al.*, (2016) demonstrated that the main source of brood fish in Jessore were World Fish Center, BFRI, Halda river, Padma river and Govt. Brood Bank. Different types of morphometric characteristics, colour, size, ripening stage, swimming activities etc were the basis of brood fish selection. Age and weight of brood fish varies from species to species which was 1-3 years and (0.4-10) kg. Similar types of characteristics were also considered for brood fish selection in Jessore where the weight of brood fish varied from 0.7- 8 kg (Hossain *et al.*, 2016).

Hatchery management

Pituitary gland (PG) hormone were used for induced breeding. Only one hatchery in Natore also used synthetic hormone for this purpose. First dose of hormone was known as primer dose and second as booster dose. Hormonal dose, interval, ovulation and hatching period (Table 3) were found very similar to that of Jessore (Hossain *et al.*, 2016), Sylhet (Roy *et al.*, 2016) and Rajshahi (Bhuiyan *et al.*, 2008 and 2011).

Several problems were found in the studied hatchery which include, lack of skilled manpower, necessary knowledge about exact dose and timing of PG injection; insufficiency of good quality brood fish; high cost of hormone; less price of hatchling; sudden death of hatchling; competitive market etc. In addition to that, insufficient water in dry season, poor drainage system, lack of credit and marketing facilities, theft, joint partnership, taking lease of pond, flood, insufficient number of brood stock pond and lack of technological knowledge existed in the Jashore region (Sabuj *et al.*, 2015).

Conclusion

Good quality fish seed is the pre-requisite for successful and sustainable aquaculture. In order to produce good quality brood and seed brood fish management is the fundamental consideration. At present, Rajshahi and Natore is one of the most emerging fish producing region in Bangladesh. In 2017-18 pond fish production in Rajshahi and Natore pond were 4.46 MT/ha and 4.51 MT/ha which were higher than the average production (4.43 MT/ha) of Rajshahi division (DoF, 2018.). Everyday a huge amount of live fishes is transported in Dhaka city from here. So, if we want to continue this current trend we should ensure the continuous supply of fish seed. Government should address the problems in this sector for ensuring good quality seed supply for meeting the demand of emerging aquaculture sector.

Acknowledgments

The authoresses are grateful to Ministry of Science and Technology for NST fellowship and also thankful to the hatchery operators, hatchery owners of the investigated hatchery and to personnel of Upazila and District Fisheries office of Rajshahi and Natore for their kind assistance of providing information during the study period.

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How to cite this article: Dil Afroza Khanom, Nahida Sultana, Mst. Rima Aktar, Sadicunnar Shikha and Md. Abu Sayed Jewel (2020). Broodstock management and seed production at the hatcheries in Rajshahi region of Bangladesh. *Bangladesh Journal of Agriculture and Life Science* 1(1): 33-39.