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Brood management and breeding techniques of some selected hatcheries in Jamalpur region

Md. Nazmul Hossen*, Md. Saiful Islam, Md. Moniruzzaman, Sonia Sku and Saymuna Tarin Lupa

Scientific Officer, Bangladesh Fisheries Research Institute (BFRI), Mymensingh-2201, Bangladesh

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***Corresponding Author**

M. N. Hossen
nazmulpisces@gmail.com

ABSTRACT

The purpose of this study is to summarize experienced on brood management and breeding techniques in Jamalpur region of Bangladesh from March to August 2016. The total number of hatcheries at Jamalpur was 29, maximum of which was carp hatchery. Ten hatcheries were randomly selected from Jamalpur sadar and Melandah upazilla where 5 hatcheries (50%) produced carp with catfish, 1 hatchery (10%) produced tilapia with catfish, 2 hatcheries (20%) produced only carp, 1 hatchery (10%) produced tilapia with prawn, 1 hatchery (10%) produced only catfish. They collected brood fish from rivers and other sources. Among 10 hatcheries 6 hatchery owners (60%) collected brood from their own ponds, 2 hatchery owners (20%) collected brood from the other hatcheries, 1 hatchery owner (10%) collected broods from the natural sources like Jamuna and Old Brahmaputra river and 1 hatchery owner (10%) collected broods from govt. hatchery. The hatchery owners used cloth bag, aluminium pot and drum to carry the brood from rearing pond to hatchery. They also maintained proper age and weight of broods for spawning and followed the guideline of hatchery operation so that the quality of spawn and fry they produced were good in quality. It was found that the hatcheries produced fish seed of a variety of species like Indian major carps (*Labeo rohita, L. calbasu, L. bata, Catla catla, Cirrhinus cirrhosus etc.*), Carpio(*Cyprinus carpio*), Thai Sarpunti (*Barbonymus gonionotus*), Silver carp (*Hypophthalmichthys molitrix*), Grass carp (*Ctenopharyngodon idella*), Pabda(*Ompok pabda*) Magur (*Clarias batrachus*), Shing (*Heteropneustes fossilis*), Thai pangas (*Pangasius sutchi*), Tilapia (*Oreochromis mossambica*) as well as Freshwater prawn (*Macrobrachium rosenbergii*). Generally, the hatchery production activities took place starting from February and continued up to September. The study revealed that the hatchery management system in Jampapur region was good and broom management system was satisfactory. However, all hatcheries are suggested to follow the systematic broodstock management and breeding techniques in order to produce good quality seed that could provide quality fish for aquaculture.

INTRODUCTION

Bangladesh is an agro-based developing country and is uniquely endowed with natural fisheries resources. For this reason, aquaculture plays a vital role in the national economy as well as fulfillment of the animal protein demand, opportunity for employment, poverty alleviation and earning foreign currency of our country. But aquaculture production is greatly depends upon the continuous supply of fish seed and hatchery can fill up this demand. Major source of fry for fish culture is hatchery and hatchery produced about 98% fry of the country (Amin, 2002).So hatchery is an important factor for aquaculture production. In 2017-18, this sector contributes 3.57 percent to the national GDP and more than one-fourth (25.30 %) to the agricultural GDP (Fisheries Statistical Yearbook of Bangladesh, 2017-2018). During the recent past decades, hatchery and nursery developed very rapidly which helped commercializing aquaculture. But the seed quality

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of both finfish and shrimp/prawn is now a major threat for aquaculture expansion. Fish seed deteriorated mainly because of inbreeding and scarcity of quality brood stock, while shrimp seed quality deteriorated due to scarcity of virus-free mother shrimp (Fisheries Statistical Yearbook of Bangladesh, 2017-2018).According to FAO report The State of World Fisheries and Aquaculture 2018, Bangladesh ranked 3rd in inland open water capture production. Millions of eggs and spawn were collected from major rivers such as the Halda, the Jamuna, the Padma, and their tributaries during the monsoon season (Chakraborty, 2002).

Hatchling production of govt. hatchery in Mymensingh division 2018 is 1,429.00 kg and hatchling production of private hatchery in Jamalpur 2018 is 2,483.00 kg (Fisheries Statistical Yearbook of Bangladesh, 2017-2018). Currently, due to consequently destruction of natural habitats the natural availability of fish seed has largely gone down and the aquaculture ventures are now fully dependent on the hatchery-produced fry/fingerling. There is an increasing demand of substantial supply of quality fish spawn, fry and fingerlings. During 1980's about 95% fish spawn used to be collected from natural sources. Currently more than 98.41% fish spawn is produced in the hatcheries (Chowdhury, 1996). Considering the present demand and future potentials, large number of private producers and traders dominate the supply of fish seed to farmers and important promoters (Barman, 2002).

The success of hatchery mainly depends on quality broods rearing techniques, pond management, including liming, fertilization and feeding and water quality management. Hatcheries are located all over the country, but comparatively maximum numbers of hatcheries are in greater Mymensingh district. Keeping this fact in mind, Southern region of Jamalpur district were selected as phenomenal growth in number of hatcheries in private and public sector in this area. The study was undertaken to investigate the present status of brood management and the techniques used by them in order to suggest possible improvement practices that can enhance the quality of fish seed production.

MATERIALS AND METHODS

Collection of data

Primary Sources

Data collection was conducted at Melandah and Jamalpur sadar upazilla under Jamalpur district from March to August 2016For collection of data, a structural questionnaire was prepared keeping consistent with the objectives of the study. Before finalization of the questionnaire; it was pre-tested through a field visit. Then the questionnaire was finalized and prepared for survey work. Data collected through interviewing different hatchery owners involved in hatchery operation.

Secondary Sources

The secondary sources of the data were central library, Bangladesh Agricultural University, Mymensingh, library of Bangladesh Fisheries Research Institute (BFRI), Mymensingh, different websites and journals, district Fisheries Office, Jamalpur and upazilla Fisheries Office, Jamalpur Sadar and Melandah of Jamalpur region.

Data processing and analysis

Qualitative data were categorized and analyzed mainly based on descriptive statistical analysis by MS excel and "SPSS". All the collected data were processed and analyzed to extract the findings of the study following careful accumulation.

RESULTS AND DISCUSSION

Types of hatchery

There are 29 hatcheries in Jamalpur region. Among the hatcheries maximum are carp and catfish hatcheries where some of them produced other fish such as prawn, tilapia etc. Among the visited 10 hatcheries it was found that 5 hatcheries (50%) produced carp with catfish, 1 hatchery (10%) produced tilapia with catfish, 2 hatcheries (20%) produced only carp, 1 hatchery (10%) produced tilapia with prawn, 1 hatchery (10%) produced only catfish (Table 1). At the beginning of the breeding season they prepared and repaired ponds and tanks when needed. Hatchlings of several species are produced in these hatcheries in

every successive 5 days interval during the breeding season.

Sources of broods

The most of hatchery owners used brood from their own ponds. Some of the hatchery owners used brood from natural sources. Among the visited 10 hatcheries it was found that 7 hatchery owners (70%) collected brood from their own ponds, 2 hatchery owners (20%) collected brood from the other hatcheries and only 1 hatchery owner (10%) collected broods from the natural sources like Jamuna and Old Brahmaputra river (Figure 1).

Table 1
Different types of hatcheries in Jamalpur region.

Sl	Types of hatchery	No. of hatchery	Percentages (%)
1	Carp	2	20
2	Carp + catfish	5	50
3	Tilapia + catfish	1	10
4	Tilapia + prawn	1	10
5	Catfish	1	10

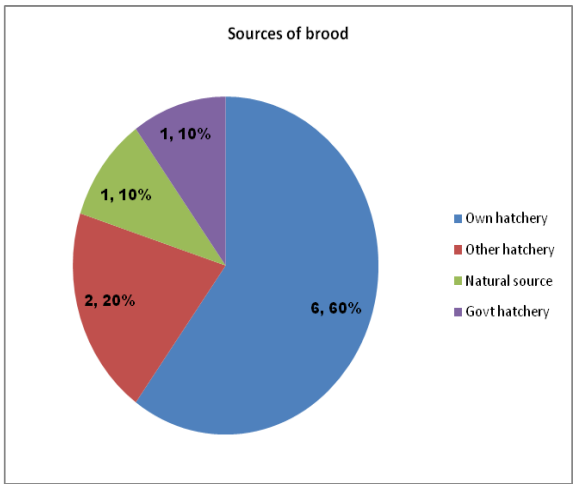

Figure 1:
Various sources of broods used at the different hatcheries in Jamalpur region.

Brood stock management

The management techniques adopted by different hatcheries were varied from one another. Brood fishes were reared in ponds having the area of 0.5 to 1.0 acre and waters depth in between 1.5 -1.8 meters. During preparation of brood fish ponds, the usual practice was to eradicate the predator and weed fishes by dewatering and drying. Sometimes toxins such as rotenone, phostoxin, etc. were applied to kill the unwanted fish species. Aquatic weeds were removed manually. After cleaning the pond, lime was applied at the rate of 1-2 kg /decimal and five to seven days after liming organic manure was applied at the rate of 5-7 kg/decimal or 3-4 kg/decimal of poultry manure as organic fertilizer. Inorganic fertilizers such as urea, TSP were also used at the rate of 150 g, 75-100 g per decimal respectively. Wang and Zhang (1984) suggested a system of using phosphorous fertilizer in manure-loaded ponds. To acquire healthier seed production supplementary feed like oilcake, rice bran, molasses, wheat bran, wheat flour, fish meal, blood of cow and goat and vitamin are need to be supplied at 2-3% of total body weight regularly twice a day. Gupta et al., (1976) was the similar inspection.

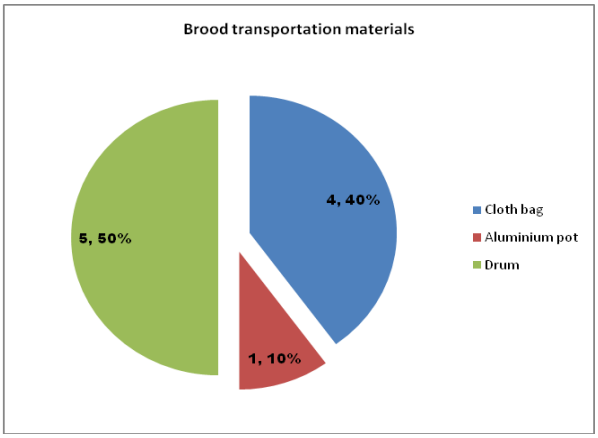

Figure 2
Brood transportation materials used at hatcheries in Jamalpur region.

The brood fish were first reared in the rearing pond with special care. In this case 25% protein level was maintained in the feed. The hatchery owners used cloth bags, aluminium pots, drums etc to carry the brood fish from rearing pond to hatchery (Haque, 1991). Sharif and Asif (2015) reported that broods were transported by plastic drum and other metal pots with hand shakeup of water. Among 10 hatcheries, it was found that 4 hatchery owners (40%) used cloth bag, 1 hatchery owners (10%) used aluminium pot and 5 hatchery owners (50%) used drum to carry the brood from rearing pond to hatchery (Figure 2). An individual brood fish usually used for 4-5 years and after that sold in the market because after five years this broods produce comparatively low spawns.

Age and weight of broods

Age and weight of broods vary from species to species. In Jamalpur region the hatchery owners used the same brood for 1-9 years. Minimum age and weight of the broods for successful spawning is shown in Table 2.

Table 2
Average age and weight of the broods used in breeding

Name of the species	Average age (years)		Average weight (kg)	
	Male	Female	Male	Female
Labeo rohita	2	2	1.5	1.5
Catla catla	3	3	4	4
Cirrhinus cirrhosus	2	2	1.5	1.5
L. calbasu	2	2	1.5	1.5
Ctenopharyngodon idella	2	2	3	3
Cyprinus carpio	1.5	1.5	1.5	1.5
Barbonymus gonionotus	0.6	0.7	0.3-0.4	0.5
Ompok pabda	0.6	1	0.2	0.2
Oreochromis mossambicus	1.5	1.5	0.4	0.5
Clarias batrachus	1	1	0.2	0.3
Heteropneustes fossilis	1	1	0.1	0.15
L. bata	1.5	2	0.15	0.25
Hypophthalmichthys molitrix	2	2	1.5	1.5
Pangasius sutchi	3	3	4	4

Hatchery equipment

In the study area most of the hatchery owner used overhead tank, hatching tank, brood and fry holding tank, egg collection tank, hatching jar/incubator, circular tank, water tank, shallow/deep tube-well, generator, pump, shed etc.

Sources of hormone

In the study area, maximum hatchery owners used local hormone and some used imported hormone which is introduced from different countries. Among 10 hatchery owners 5 were used S-GnRHa/Ovaprim^{TM}(China), 4 used local PG and 1 used imported PG.

Induced breeding

Success of induced breeding relies on appropriate choice of broods. Khan and Mukhopadhay (1975) find out that, the success of induced breeding relies basically on the availability and right selection of brood fishes. Healthy, disease free and safe broods are preferred for the induced breeding. Brood recognition and choice are very significant for breeding management. Mature male and female brood fishes are chosen by their outer appearance (Chaudhury, 1959).

The hatchery owners mainly practiced induced breeding (Hussain, 2004). They use stimulants to enhance breeding. They use PG and S-Gn RH∝ / OvaprimTM (China) for carp species. They also

used 17∝ methyl testosterone (sex reversal hormone) to produce mono-sex tilapia. At first the broods kept in rearing tanks for 4-7 hours. After completing the first dose the broods kept at rest for 6-8 hours. Then the second dose was administrated. After 6-7 hours of the second dose, the broods became ready to spawn (Islam, 1976). Then the eggs and sperms were collected and mixed. The fertilized eggs were kept in hatching tanks for hatchling. After 18-24 hours the fertilized eggs are hatched. The hatchery owners kept the new hatchling for 70-72 hours in tanks. After 72 hours of spawning first feed was given to the hatchling fry. The total procedure was completed with the involvement of skilled technicians in the hatchery. Then the larvae were sold to nursery owners. During this study, it was found that the hatchery owners usually breed carp fishes and catfishes but most of the hatchery owner reliant on carp breeding. The optimum female and male hormone doses for the artificial propagation of different carps are shown in Table 3.

Table 3
The optimum female and male hormone doses for the artificial propagation of different carps

Name of carp species	Brood (Male/ Female)	First dose (mg/kg body wt)	Interval (hrs)	Final dose (mg/kg body wt)	Ovulation hrs (after final dose)
Labeo rohita	Female Male	1.5 -	6 -	6 1.5	6-8
Catla catla	Female Male	2 -	6 -	7 2	6-8
Cirrhinus cirrhosus	Female Male	1.0 -	6 -	5 1.0	6-7
Labeo calbasu	Female Male	1.5 -	6 -	6 1.5	6-8
Ctenopharyngodon idella	Female Male	1.5 -	8 -	4.5 1.5	6-8
Cyprinus carpio var. *communis*	Female Male	1.5 -	6 -	7 1.5	5-6

Table 4
Doses of S-GnRHa/Ovaprim™

Species	Sex ratio (female: male)	Sex	Dose (mg/kg body weight)	Ovulation time (hrs)	Hatching time (hrs)	Mode of ovulation
Hypophthalmichthys molitrix	3:1	Female Male	14 7	6-8	18-20	Hand stripping
Labeo rohita	2:1	Female Male	12 6	6-8	15-18	Hand stripping
Catla catla	2:1	Female Male	10 5	6-8	15-18	Hand stripping
Barbonymus gonionotus	1:1	Female Male	8 4	6-8	12-14	Hand stripping

In case of S-GnRHa/Ovaprim™ (China) the optimum female and male hormone doses for the artificial propagation of different carps are shown in Table 4. After 6-8hrs of S-GnRHa/Ovaprim™ administration, rui (*Labeo rohita*) and Thai sharpunti (*Barbonymus*

gonionotus) bred naturally and silver carp (*Hypophthalmichthys molitrics*), catla (*Catla catla*) were breed by hand stripping. Fertilized eggs were kept in hatching tank and within 12-20 hrs spawns were come out. After 72 hrs of spawning first feed was given to hatchling fry.

CONCLUSION

The hatchery management system at Jamalpur region was found good. Among the visited 10 hatcheries it was found that 6 hatchery owner (60%) collected brood from their own pond, 2 hatchery owners (20%) collected broods from the other hatchery and 1 hatchery owner (10%) collected broods from the natural sources (Jamuna river) and 1 hatchery owner (10%) collected broods from govt. hatchery. The broodstock management was satisfactory. The hatchery owners were very much careful in hatchery operation to ensure the quality of fry/fingerling. They maintained proper age and weight of broods during spawning. They mainly practiced induced breeding. The hatchery owners were very much conscious to avoid inbreeding. They used the broods from different sources for spawning purpose. Therefore, the survival rate of the fry and fingerling was satisfactory. However, all hatcheries are suggested to follow the systematic broodstock management and breeding techniques to produce good quality seed. Good quality seeds will provide quality fish for aquaculture.

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