A Seminar Paper
On

Present Status of Broodstock Management at Carp Hatcheries in Jessore

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Present Status of Broodstock Management at Carp Hatcheries in Jessore [1]

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ABSTRACT

Sustainable aquaculture production depends on the proper management of broodstock. In this regard, multiple survey studies were reviewed to assess the present status of management of carp broodstock at Jessore region in Bangladesh. A total of 40 hatcheries were selected in Jessore. The areas of ponds were ranged from 33.33 to 400 decimal and shape with maximum rectangular. The green color water of pond was varied from 82.0% to 84%. Most of the farmers applied liming doses were ranged from 500- 1200 gm dec-1. Most of the farmers used rotenone (41%) to control predators in the broodstock pond. Different sorts of fertilizers both organic and inorganic were applied. Most of the broodstocks were collected from the hatcheries (range from 61% to 67%) and the rest of them were collected from the natural sources including Halda River and Padma River. Moreover, 4 carp species (rui, catla, mrigala and kalbashu) among 13 endemic and 4 exotic carp species (silver carp, grass carp, bighead and common carp) out of 6 exotic carps species were used for seed production. Negative selection of broodstock was performed in few hatcheries in order to reduce the cost for collecting or purchasing good quality broods. The formulated feed which contained 20-30% protein for carp broodstock were prepared using the indigenous ingredients including mainly rice bran, mustard oil cake, vitamin and mineral premix, wheat flour, fish meal and soya bean flour and maize flour. Finally these survey findings indicate that proper broodstock management could be a good approach to attain the main purpose of aquaculture.

Keywords: Indian major carps; broodstock; management; hatchery

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[1]A seminar paper for the course GFB, Summer'18.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

Bangladesh is the 4th largest country in freshwater fish production all over the world (FRSS, 2017) as well as annual fish production of this country is 4.2 lakh MT (DoF, 2017). About 56.44% of fish production obtained from freshwater culture fisheries and about 98-99% fish seed collected from the hatcheries (DoF, 2017). Among these fish production, more than 80% fish production come by from carps (DoF, 2017). Carps are the main species for the aquaculture system in Bangladesh, and the production of these species completely depends on timely and adequate supply of quality seeds. Since middle of nineties, stock deterioration was reported because of poor brood stock management and inbreeding depression and still though both public and private hatcheries and nurseries are producing fish seeds. The production is increasing gradually day after day with some problems. However the fish feeds are formulated in unplanned way just enhancement of fish production. Moreover, the hatchery owners used inbreeding effected broodstocks in order to enhance their profit. Consequently, the human being is facing the different type of health disorders like devastating cancer, allergy and heart disease etc and the supplied fish seeds and fingerlings are unhealthy, less disease-resistant due to inbreeding problems in hatcheries ultimately reducing fish production. In this regard, the survey study should perform throughout the country in order to assess the present status of broodstock management in the hatcheries. Adequate quality and quantity of broodfish is needed for fulfilling annual demand of fish seed. Production of good quality broodfish need proper broodstock management practices.

Bangladesh is blessed with enormous inland water bodies which are very rich in diversity of aquatic species (Samad *et al*., 2013a). For last two decades or so Jessore areas of Bangladesh have faced an intense growth of fish breeding industries. The success of hatchery mainly

depends on improved quality brood rearing technique consisting pond management, including fertilization, liming, feeding and water quality management. Four native carp species mainly (*Catla catla, Labeo rohita, Cirrhinus cirrhosus* and *Labeo calbasu*) and six introduced species (*Ctenopharyngodon idellus, Hypophthalmichthys molitrix, Aristichthys nobilis, Mylopharyngodon piceus,* and *Cyprinus carpio*) are being used for major seed production in these hatcheries. In the recent past years, the natural stocks of these species have become threatened by habitat destruction, climate change, industrial pollutions, genetic pollution etc. resulting a gradual loss of genetic diversity. Most of the governments hatcheries have own broodstock with 25 percent yearly recruitments. On the other hand, some hatcheries have their own broodstock and maintain them more or less scientifically but there are many private hatcheries that do not have the adequate number of broods. These hatcheries were mostly breed rohu, catla, mrigel, silver carp, grass carp, common carp, bighead carp, kalbaus, bata thaiputi and often black carp (Asif *et al.*, 2014). Most of the hatchery owners are not aware that liming was depended upon pH of the pond water and spread lime over the pond bottom 5-6 times in a year. The feed of brood fishes were maintained very carefully. Few brood fish takes 3 to 4 year to breed. When a brood are ready to spawn then it is selected for breeding and separated from other. The brood fishes were placed in the rectangular tanks for conditioning for 6-7 hours respectively. The male and female were kept separately, prior to administration of the inducing agents in conditioning tank. The brood ponds should have no weed and predator and should be enriched with manures and fertilizers (Ali *et al*., 2015). The applied doses of fertilizers ranged from 1000-1200 gm/dec (Asif *et al.*, 2014). The present study is conducted to review the present status of Indian major carp brood stock management at the hatcheries in Jessore region of Bangladesh.

Objectives

i. To review the status of broodstock management and practices in Jessore

ii. To get acquainted with the major issues regarding broodstock management and practices and

iii. To review the possible means of solution to existing issues occurring in broodstock management

Chapter 2

MATERIALS AND METHODS

This seminar paper is exclusively a review paper. All the information has been collected from the secondary sources. During the preparation of the review paper the various sources including relevant books, journals, proceedings, reports, and internet so on are followed. Moreover, most of the information was collected with the help of the library facilities of Bangabandhu Sheikh Mujibur Rahman Agricultural University. Fortunately, my major professor as well as course instructors also provided much valuable suggestions to prepare this seminar paper. After collecting all the available information, collected information were compiled finally to prepare this seminar paper. The existing data related to this study were collected from different books, journals and websites.

Chapter 3

REVIEW OF FINDINGS

3.1. Physical and chemical condition of pond

3.1.1. Area of pond

Field survey showed that the areas of broodstock pond of different hatchery in Jessore varied from 33.33 decimal to 400 decimal. The shapes of broodstock pond were rectangular, square and irregular. Number of pond regarding to area and shape are given in Table 1 and Table 2 respectively.

Table 1. Broodstock ponds according to area

Area (Decimal)	No. of pond
<42	38
42-84	36
84-126	58
126-168	24
168-210	14
210-252	12
252-294	8
294-336	6
>336	4
Total	200

Source: (Samad *et al*., 2013 b).

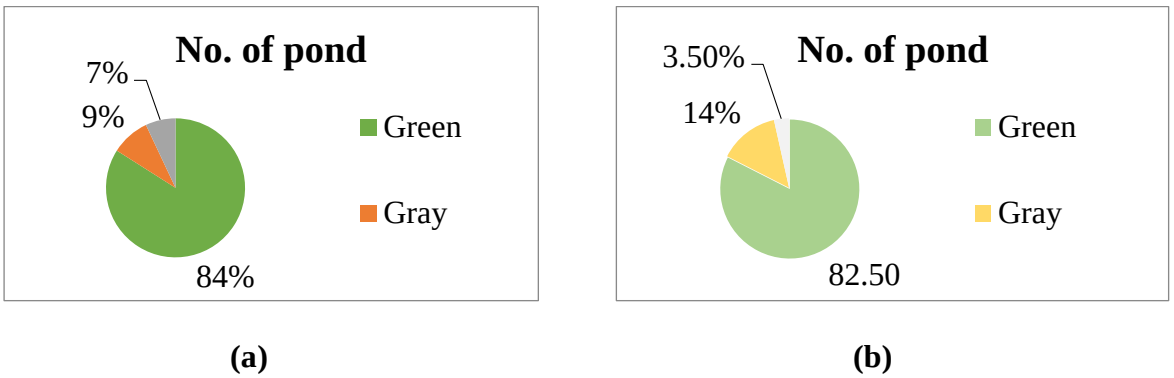
Table 2. Broodstock ponds according to shape

Shape	No. of pond
Square	22
Rectangular	74
Irregular	27
Total	123

Source: (Hossain *et al*., 2016).

3.1.2. Water color

Hossain *et al*. showed that 9% of pond water color was gray and 7% was transparent and rest 84% was green. Samad *et al*. showed 82.5% was green where 14% and 3.5% were gray and transparent respectively. Different watercolors are shown in Figure 1.



(a) **(b)**

Figure 1. Water color of brood ponds.

Source: (a: Hossain *et al*., 2016 ; b: Samad *et al*., 2013b)

3.1.3. Water depth

The mean water depth of pond during rainy season was less than 6 to 12 feet. The depth of study area's pond is presented in Table 3.

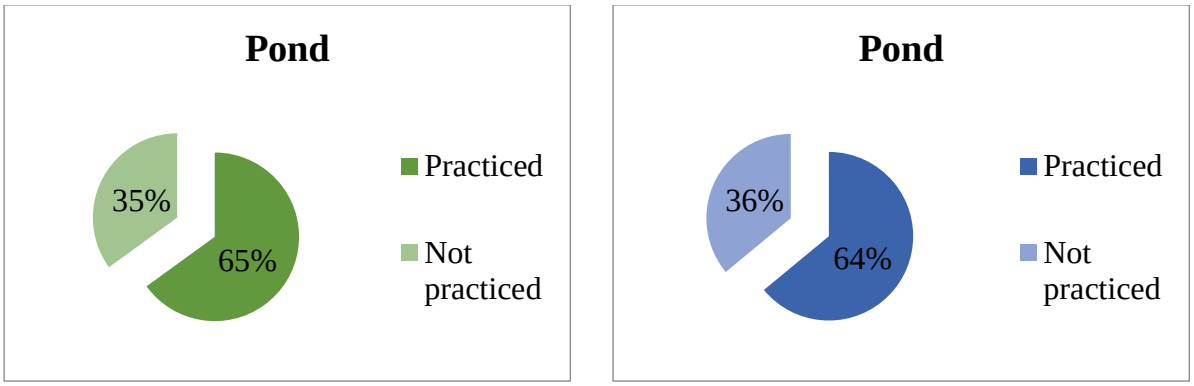
Table 3. Depths of broodstock pond

Depth(ft)	No of ponds
<6	25
6-7	41
7-8	45
8-12	12
Total	123

Source: (Hossain *et al*., 2016)

3.2. Pond drying

Most of the surveyed pond retained water all the year round but some ponds were completely drained out by pumping to dry by sunlight for 7-10 days. Figure 2 shows the dryness condition of surveyed ponds.



(a) **(b)**

Figure 2. Dryness condition of surveyed broodstock ponds.

Source: (a: Hossain *et al*., 2016; b: Samad *et al*., 2013b)

3.3. Liming

The rate of liming mostly depended upon pH of the pond water. But most of the farmers were not aware of it. They usually spreaded lime over the pond bottom 5-6 times in a year. Most of the farmers applied lime during drying and others during culture period when they considered. The applied doses were ranged from 500- 1200 gm dec-1. Some farmers also sprayed diluted calcium carbonate on the surface of pond water during rearing when water got deteriorated, however the dose used was always lesser than in pond preparation. Liming rate of different hatcheries has been given below in figure 3.

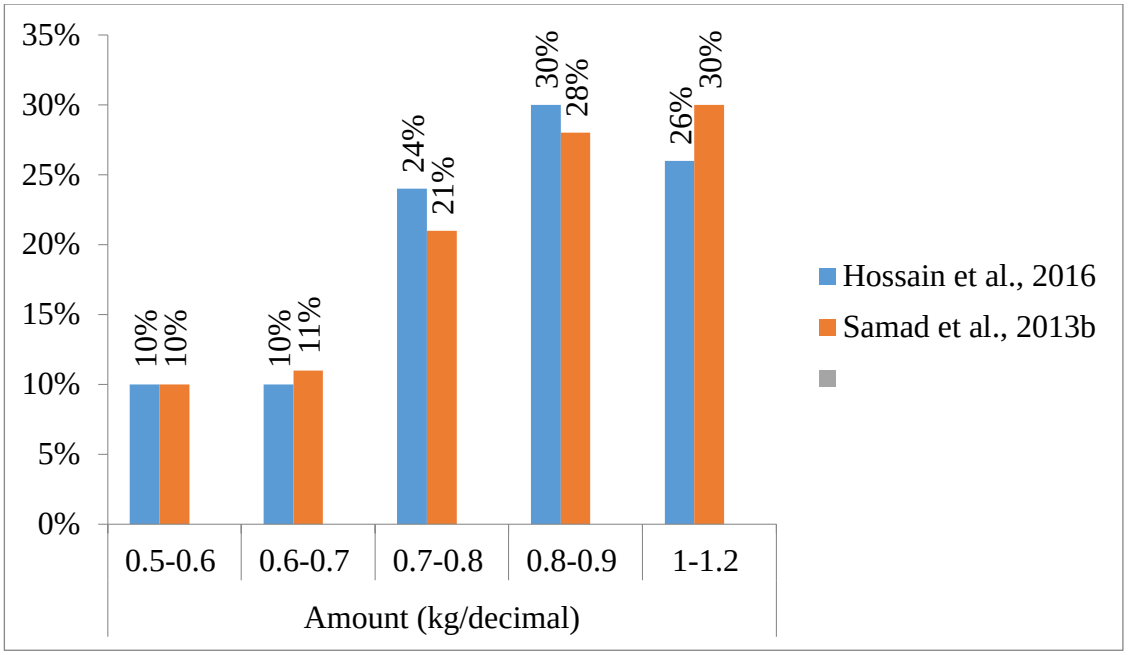


Figure 3. Liming rate of different hatcheries.

Source: (Hossain *et al*., 2016; Samad *et al*., 2013b)

3.4. Predator control

Surveyed ponds were experienced with predatory problems. Most farmers used rotenone to control predators before stocking broodstock in the pond. In outdoor nursery ponds, broodstocks were prone to predation not only by predatory fish but also avian predator, reptiles, amphibians like frogs etc. A few hatcheries used fostoxin, dimochrome, endrin in the pond (Figure 4).

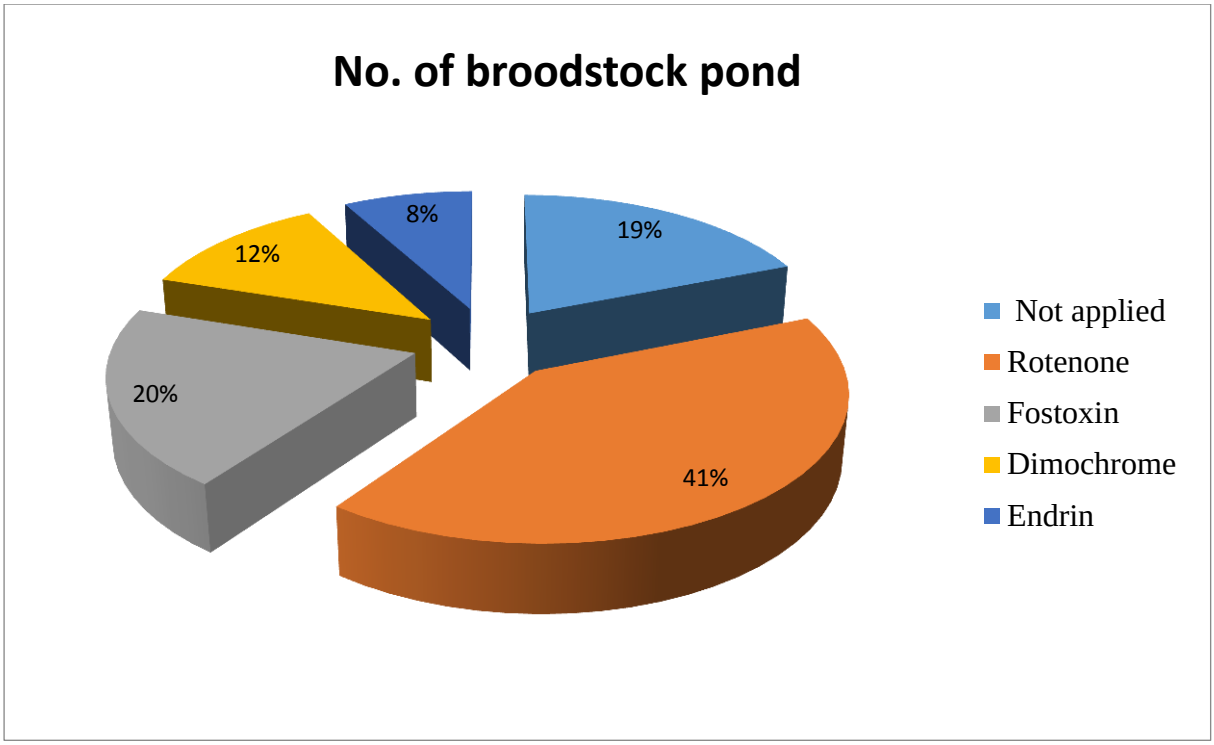


Figure 4. Variation of usage of pesticides for predator control.

Source: (Hossain *et al*., 2016)

3.5. Fertilization

Farmers were generally applied different type of fertilizers including urea, triple super phosphate (TSP), organic cow drop and poultry manure in broodstock pond. Sometimes farmers used to apply murate of potash as fertilizer. Amount of fertilizer used in the ponds in a season by farmer in different pond are shown in figure 5.

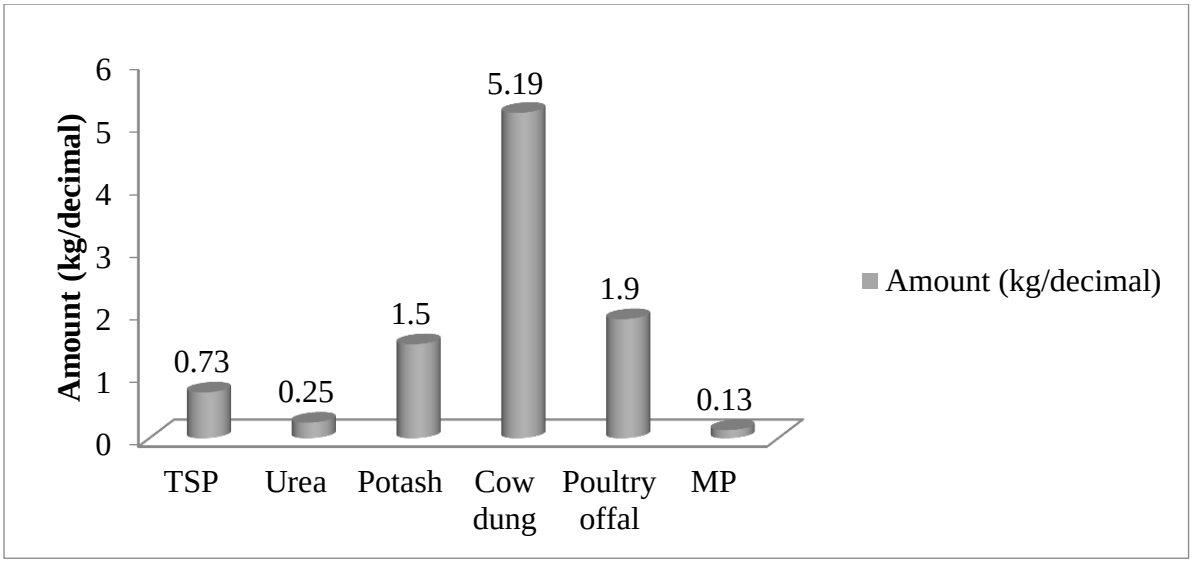


Figure 5. Usage of fertilizer (kg/decimal).

Source: (Hossain *et al*., 2016: Samad et al., 2013b; Hassanuzzaman 1997)

3.6. Sources of brood

Most of brood fish were collected from world fish center, BFRI, Halda river, the Padma river, Govt. brood bank and own hatchery. The percentages of source of brood are presented in Figure 6.

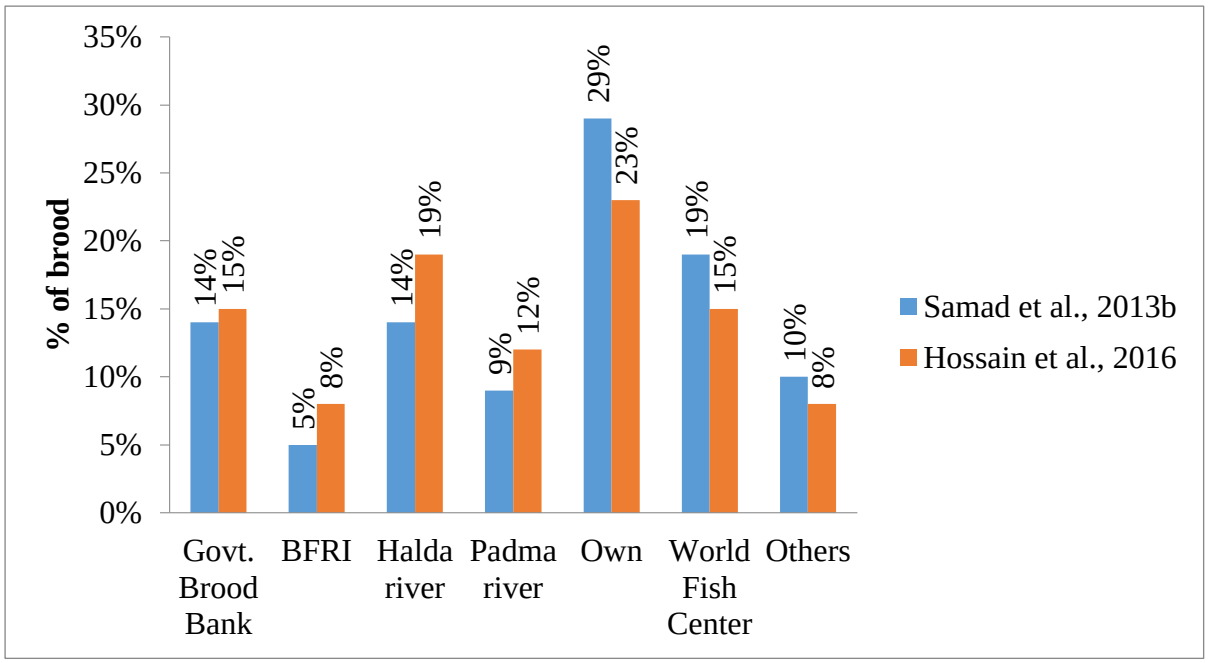


Figure 6. Source of brood.

Source: (Hossain *et al*., 2016) and (Samad *et al*., 2013)

3.7. Selection of broodstock

Preferably big size, healthy, good looking and matured males and females should be selected and collected from the natural sources (rivers, lakes, and reservoirs) as brood stock. Brood should be of the same sized, matured and healthy. The weight varied from 3 kg to 8 kg and 1-3 years old (Table 4) . Table 5 and table 6 show available native and exotic carp species.

Table 4. Suitability of various cultivable carps depending on their weight and age as brood fish

Fish	Weight (kg)	Age (Yr)
Catla	>3.0	3
Rohu	>1.0	2
Mrigal	>1.0	2
Grass Carp	>2.0	2
Silver Carp	>1.5	2
Common Carp	>1.0	1

Source: (Khatun *et al*., 2017; Sarder *et al*., 2002)

Table 5. List of endemic carp species of Bangladesh

Family	Species	Common name	Local name
Cyprinidae	*Labeo rohita*	Rohu	Rui
	Catla catla	Catla	Katla
	Cirrhinus cirrhosus	Mrigal	Mrigal
	Cirrhinus ariza	Reba	Laachu, Bhangan
	Labeo calbasu	Calbashu	Kalibaush
	Labeo bata	Bata	Bata
	Labeo boga	Boga labeo	Bhangan
	Labeo gonius	Gonius	Gonnia
	Labeo nandina	Nandina labeo	Nandil
	Bengala elonga	Bengala barb	Along
	Puntius sarana	Barb	Sarpunti
	Tor tor	Tot mahseer	
	Tor putitora	Putitor mahseer	Mahashoal

Sources: (Hasan, 1990; Rahman, 1985; Hussain and Mazid 2001).

Among above 13 species only 4(rui, catla, mrigala, calbasu) are used in seed production in Jessore region.

Table 6. List of exotic carp species available in Bangladesh

Species	Common name	Source	Year of introduction
Ctenopharyngodon idellus	Grass carp	Hongkong	1966
		Nepal	1979
		Japan	1970
		China	1994
Mylopharyngodon piceus	Black carp	China	1983
Hypophthalmichthys molitrix	Silver carp	Hong Kong	1969
		China	1994
Aristichthys nobilis	Bighead carp	Nepal	1981
		China	1994
Cyprinus carpio var. communis	Common carp	China	1960
		Vietnam	1995
Cyprinus carpio var. specularis	Mirror carp	Nepal	1979
		Hungary	1982

Sources: (Hasan, 1990; Rahman, 1985; Hussain and Mazid 2001).

3.7.1. Stocking time

Grower fish were collected from mid-September to March to produce brood fish and stocked in brood stock pond.

3.8. Food and feeding

3.8.1. Food ingredients used in feed preparation for brood in Jessore region

Generally rice bran, mustard oil cake, wheat flour, fish meal, vitamin and mineral premix, soyabean flour have been used to prepared feed containing required amount of protein.

3.8.2. Nutritional composition of food

Proximate compositions of food that were used in brood ponds in Jessore region are presented below in the Table 7.

Table 7. Nutrition composition of food stuff used in Jessore region for brood fish

Nutrition	Amount (%)
Protein	20-30%
Carbohydrate	25-35%
Phosphorus, Calcium, Vitamins and minerals	7-11%
Lipid	10-12%
Moisture	10-15%
Others	5-10%

Source: (Tripathi, 1990; Haque, 1991; Samad *et al*., 2013b)

3.9. Determination of sex

Farmers sorted out the mature male brood by means of gentle pressure along the abdominal portion to eject milky white milt. A female brood fish should have smooth pectoral fins with pinkish genital papilla and swollen abdomen.

3.10. Injection of hormone

Hormone treatment to the Indian major carp broodstock at the hatcheries in Jeshore region has been given below in Table 8.

Table 8. Hormone treatment to the Indian major carp broodstock

Species	Sex	PG, 1st dose (for each kg)	Interval (hours)	PG, 2nd dose (for each kg)	Ovulation (hours)
Rui	Female	2 mg	6.0	6 mg	4-6
	Male			1-2 mg	
Catla	Female	1-2 mg	6.0	5-6 mg	5-6
	Male			1-2 mg	
Mrigal	Female	1-1.5 mg	6.0	5-6 mg	4-6
	Male			1-1.5 mg	
Calbasu	Female	1-1.5 mg	6.0	4-5 mg	5-6
	Male			1.5-2 mg	
Silver carp	Female	2 mg	6.0-9.0	6 mg	6-8
	Male	-		2 mg	
Grass carp	Female	1.5- 2.0 mg	6.8-8.0	4-6 mg	5-7
	Male			2 mg	
Bighead carp	Female	2 mg	6.0-9.0	6 mg	6-8
	Male	-		2 mg	
Common carp	Female	1 mg	6	4mg	6
	Male			2 mg	

Source: (Khatun *et al*., 2017)

3.10. Hatching rate

Hatching rate of different species of Indian major carp at the hatcheries in Jeshore region has been given below Figure 7.

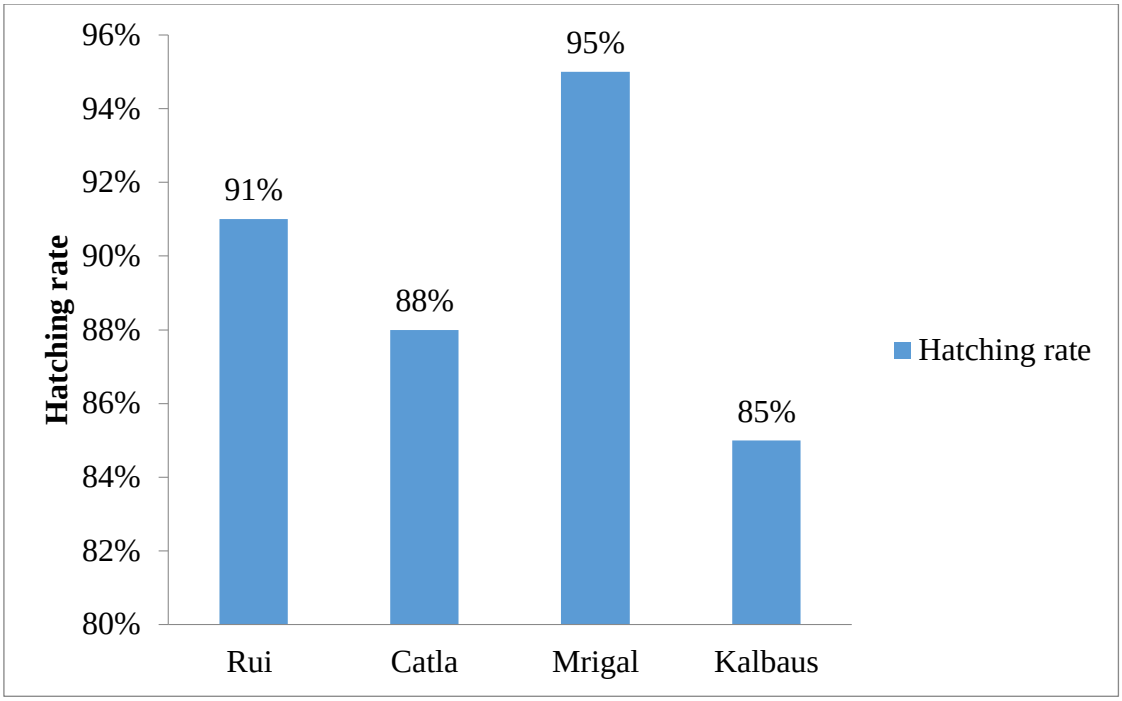


Figure 7. Hatching rate of different species of Indian major carp.

Source: (Sharif and Asif, 2015)

3.11. Deformed hatchling

Deformed Hatching rate of different species of Indian major carp at the hatcheries in Jeshore region has been given below Figure 8.

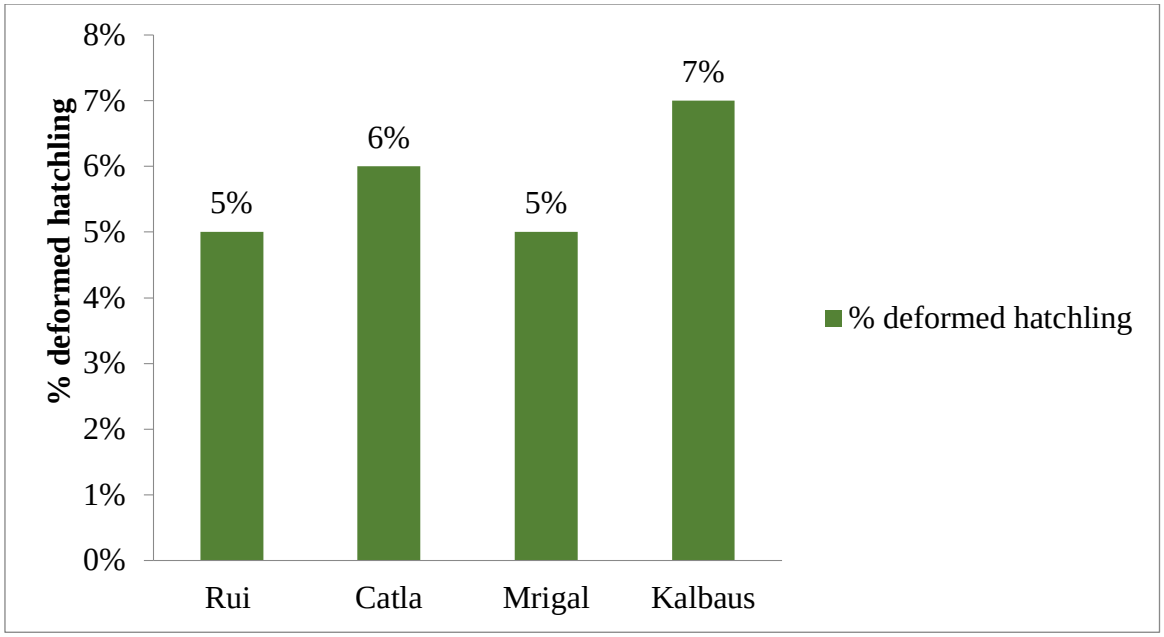


Figure 8. Percentage of deformed hatching of Indian major carp.

Source: (Sharif and Asif, 2015)

3.12. Broodstock selection process

Farmers selected the brood fish both positively and negatively. In study area the negative selection of brood was found 37% and positive selection was found 63% (Figure 9).

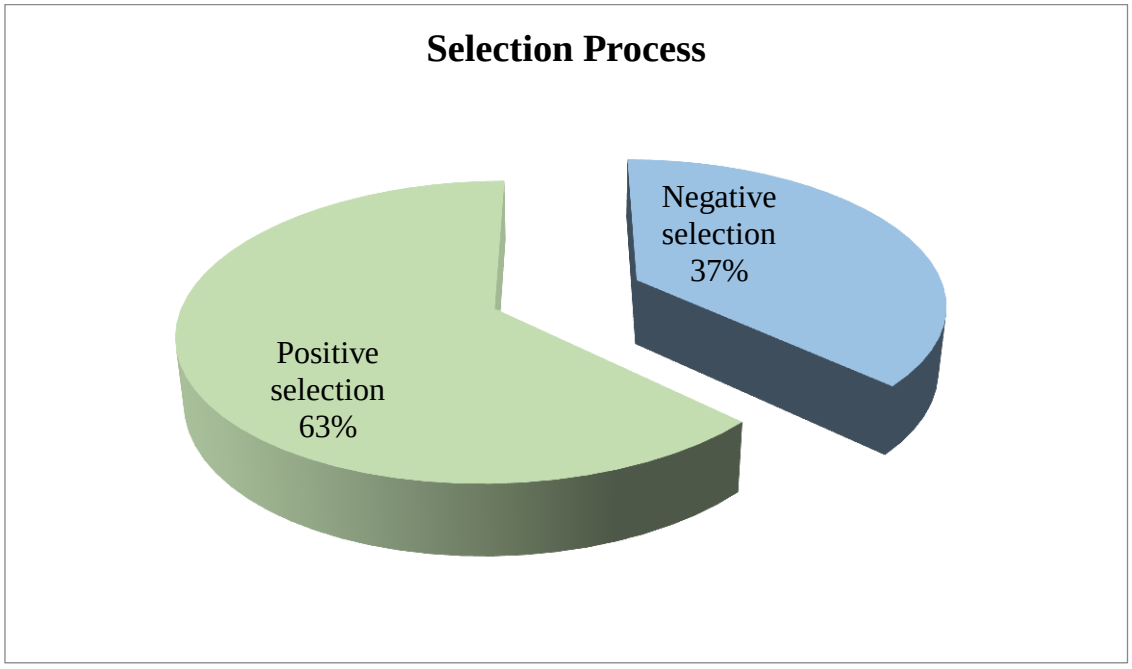


Figure 9. Selection of Indian major carp brood.

Source: (Kabir, 2009)

3.13. Disease

Most of the hatcheries Jessore were experienced with *Lernaeasis* which was known as "Anchor worm". No effective treatment was known to the farmers for this disease. All types of brood fish in the hatcheries and especially fry and fingerling were affected by *Lernaeasis* more seriously. The main problems of hatchling production in the Jessore region is Argulus diseases. 95% of hatchlings mortality is caused by Argulus disease (Sharif and Asif, 2015).

3. 14. Major Issues in carp Hatchery

Khatun *et al*. showed the major concerns in the carp hatcheries not only in Jeshore but also in Bangladesh as follows:

- Hatcheries without broodstock ponds;
- Main objective is the production of mass seed rather than quality seed;
- Lack of knowledge on genetic status of hatchery stocks;
- Lack of knowledge of hatchery and nursery operators;
- Lack of knowledge on effects of open water stocking on wild stock;
- Brood stock replacement is from leftover fish;
- Degradation in genetic quality of seeds due to inbreeding & negative selection and due to hybrid introgression in some major carp species;
- Genetic drift due to small numbers of parent stocks;
- Genetic erosion of domesticated stocks.

3. 15. Means of increasing Carp Fish Production

There are many important factors for increasing carp fish production in a hatchery which is discussed below:

1. Before selecting brood fish for spawning, small size and young fish should be avoided. Although most carps attain first maturity in their 1 to 2 years, there is an optimum age and weight at which they should be selected for induced breeding.
2. The basic input for quality carp fish production in a hatchery depends on the healthy brood fish. Different brood fish strains should be collected from various sources of origin. The fish seeds produced from different strains at a hatchery should then be marked and reared to the size of fingerling. Already to some extent, the gene pools of our indigenous varieties of carps viz : Rohu, Catla & Mrigal have been contaminated. As a result, in near future it is feared that pure seeds of these indigenous carps, endemic to this region shall gradually disappear from the culture system. Lack of quality fish seeds may be one of the primary reasons for the low fish production. In a word, a quality brood fish produces quality seed which increase the carp fish production.
3. Inbreeding depression should be avoided because it contaminates the seed production which will inhibit fish production. It may be avoided by the following ways:
    - Hatchery operators should have detailed information's on pedigree of brood stock;
    - Cultured populations should be identified using a proper marking system;
    - Females & males have to be originated from two different lines;
    - Inbreeding in commercial fish farm should be handled carefully or avoided;
    - Individual fish with poor constitutional conditions or anatomical abnormalities should be culled.

4. Day by day the quality of seed has deteriorated due to inbreeding, hybridization, negative selection and improper brood stock management. Special attention should be paid to improve the quality of seed. In this regard, live brood and cryogenic gene banks need to be established.
5. The government in collaboration with private entrepreneurs should take necessary steps to establish brood banks in different parts of the country. Quality broods from the brood banks should be distributed to the hatcheries as required and its maintenance monitored.
6. Carp fish sanctuaries should be established and monitored in open water bodies as much as possible in order to promote natural recruitment.
7. Catching or killing of broods and fry during breeding season should be banned and in this regard alternate employment for fishermen during breeding season should be arranged.
8. Loss and destruction of breeding and nursery grounds due to construction of flood control dams, roads and embankments and irrigation should be stopped. Inter-departmental co-ordination needs to be developed to minimize the damage to fish habitats.
9. Necessary training on brood stock management, breeding technology, nursery technology, disease control, etc. should be provided to hatchery and nursery operators, farm managers, and fish farmers. Awareness building of private hatchery operators and fish farmers should be further extended.
10. The Government should impose rules strictly to the hatchery operators for maintaining proper protocol of induced breeding, selective breeding, line crossing, hybridization, nursery management etc. so that fish seed production does not

contaminate. Government field laboratories should be established for testing the quality of fish of different hatcheries locally and regionally.

11. A live gene bank initially for the IMC (Indian Major Carp, viz. Catla, Rohu, Mrigal etc.) should be established to supply pure strains of these indigenous carps and Govt. may support establishing such facilities.
12. Trading networks should be developed by the government and other developing partners so the carp fish farmers can get their actual benefit.

Chapter 4

CONCLUSION

Many hatcheries in Jessore rear their own broodstock and usually do not recruit broodstock from natural sources (rivers) although some may obtain broodstock from other aquaculture sources. For that in genetically closed hatchery systems, potential selective pressures exerted on finite and often small culture populations by various farm management practices such as the selection of founder stock, number of breeders maintained, method used for replenishing broodstock, stocking density, feeding regime, etc. can result in "indirect" or negative selection, inbreeding and genetic drift. Few of the hatchery operators have no knowledge of simple broodstock management practices and do not follow any principles or guidelines in selecting adequate sized breeders, injecting hypophysation dosage and mating unrelated male and female spawners.

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