

INDUCED BREEDING AND SEED PRODUCTION PRACTICES OF THE FISH HATCHERIES IN GREATER SYLHET BANGLADESH

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ABSTRACT

A study was conducted on the fish hatcheries of the greater Sylhet region Bangladesh to know about their induced breeding practices. Most of the hatcheries are mainly produced carp fish seed. The total seed production in greater Sylhet was about 12179 ± 690.86 kg in 2014 where district wise production was about 659 ± 25.45 , 5764 ± 296.57 , 2987 ± 197.52 and 2769 ± 189.72 kg in Sylhet, Moulvibazar, Sunamganj and Hobiganj district, respectively. It was observed that, 8 native fish species viz. Rui (*Labeo rohita*), Catla (*Catla catla*), Mrigel (*Cirrhinus cirrhosus*), Bata (*Labeo bata*), Kalibaus (*Labeo calbasu*), Gonia (*Labeo gonius*), Magur (*Clarius batrachus*), Shing (*Heteropneustes fossilis*) and 7 exotic fish species namely Silver carp (*Hypophthalmichthys molitrix*), Bighead carp (*Aristichthys nobilis*), Grass carp (*Ctenopharyngodon idella*), Common carp (*Cyprinus carpio*) and Thai puti (*Puntius gonionotus*), Thai koi (*Anabus testudineus*), Thai pangus (*Pangasius hypophthalmus*) were used for induced spawning. Mrigel was the highest produced fish seed (20%) in Sylhet region followed by Thai puti (16%), Rui (11%), Silver carp (9%), Grass carp (9%), Bighead carp (9%), Catla (8%), Bata (7%), Kalibaus (4%), Gonia (4%), Carpio (2%) and others (1%). Mainly three types of inducing agents like PG (pituitary gland), HCG (human chorionic gonadotropin) and Ovupin (GnRH α injection) were used for induced spawning. The rate of 1st dose of injection of PG varied from 1 to 4 mg/kg body weight, HCG varied from 100 to 200 IU/kg body weight and GnRH α (only one dose) varied from 0.2 to 1.00 ml/kg body weight. The rate of 2nd dose of injection of PG varied from 2 to 10 mg/kg body weight. The ovulation period and hatching rate in different fish species varied from 20 to 72 hours and 55% to 85%, respectively. Though the quantity of fish seed production is increasing day by day in this region but the fish seed quality produced by the hatcheries is not satisfactory.

KEY WORDS: Brood fishes, hatchery, induced breeding, inducing agents, seed production

INTRODUCTION

Bangladesh is one of the world's leading fish producing countries with a total production of 36,84,245 tonnes in the financial year 2014-15 (FRSS, 2016). The availability of fish fry is an essential prerequisite for fish culture. Fish culture today is hardly possible without the artificial propagation of fish seeds of preferred cultivable fish species. Once, the country was completely dependent on fish seed production from the natural water resources. The production of fish seed in natural waterbodies has been reduced gradually due to the destruction of breeding ground and degradation of ecological balance. Along with the collection of spawn from rivers, induced breeding of carps through hypophysation was initiated in 1967 (Sarder, 2007). With the success of

fish seed production through artificial breeding techniques, the Government of Bangladesh established a number of hatcheries in the public sector in different parts of the country with the course of time a remarkable number of hatcheries has been established in private sector. Now, the total number of fish hatcheries are 946 of which government hatcheries are 78 and private hatcheries are 868 (DoF, 2016; Roy, 2016). At present, the country is self sufficient in carp seeds production, though quality fish seeds are produced in a limited scale. For that reason, Department of Fisheries (DoF) has introduced fish Hatchery Act 2010 for quality hatchlings and fingerlings from the public and private hatcheries (DoF, 2014). In the year 2015, around 97.29% of total fish seed were produced in private hatcheries and rest of 1.91% in public hatcheries, and only 0.80% from natural sources (FRSS, 2016). The total fry production from hatcheries in Bangladesh was 547,549 kg of which 10,566 kg was from public hatcheries and 536,983 kg was from private hatcheries and only 4,412 kg from natural waterbodies (FRSS, 2016). Sylhet is one of the important *haor* based diverse and unique fish seed production region of Bangladesh where mostly the private owned hatcheries supply the major proportion of fish seed in greater sylhet (DoF, 2014).

The knowledge of artificial breeding is a key aspect as it permits intensive production of a given species in controlled conditions. Only a reliable induced breeding and fry rearing technique can ensure a steady supply of quality fish seeds (Mollah *et al.*, 2008). Pituitary gland (PG) extract and Human Chorionic Gonadotropic (HCG) hormone were commonly used as inducing agents for induced breeding though some other agents like Ovupin, Ovaprim, Ovaclean, Flash etc. were also used for both indigenous and exotic fish species. 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. Broodstocks are maintained in fish ponds with unplanned management and ripen breeders are induced for ovulation by hormone injections. But it is a matter of shock that the local hatcheries of Sylhet region cannot meet up with the actual demand of fry and fingerlings. Some nursery owners and hatchery owners sometimes fetch a definite amount of fry from other areas to meet the demand of farmers. The present work was done with a view to know about the seed production, induced breeding techniques and practices in the hatcheries of Sylhet region in Bangladesh.

MATERIALS AND METHODS

Study Area and Duration: The study was carried out with the focusing of qualitative and quantitative seed production for a period of 6 months from March to August, 2014. Data were collected on induced spawning practices from 26 hatcheries (7 public and 19 private) in four different districts (Sylhet, Sunamganj, Habiganj and Moulvibazar) under greater Sylhet division (Table 1). The geographical locations of the hatcheries are shown in the Map (Figure 1).

Data Collection: A survey schedule was prepared and the data of induced spawning practices, fry production in the hatcheries were collected from the hatchery owners and operators by direct interview methods; other relevant data and information were collected from District and Upazila Fishery Offices of DoF. To find out the present situation of seed production in greater Sylhet, all existing fish hatchery sites were visited and interviewed properly. On the other hand, information with their opinions had been shared with different stakeholder those who are involved with fish hatchery, fish or brood cultivators and fingerling growers.

Table 1. Name and addresses of the hatcheries under the study area in greater Sylhet

SL	Name of hatchery	Address	District
01*	Fish Seed Multiplication Farm	Kadamtoli, Golapgonj	Sylhet
02*	Fish Seed Multiplication Farm	Khadimnagar, Sylhet	Sylhet
03	Chowdhury Hatchery	Alamnagar, Jokiganj	Sylhet
04	Dream Agro Fisheries Limited	Biswanath	Sylhet
05	Rifat Agro Hatchery	Golapganj	Sylhet
06*	Kulaura Mini Hatchery	Kulaura	Moulvibazar
07*	Fish Seed Multiplication Farm	Moulvibazar Sadar	Moulvibazar
08	Hokadaria and Lotifia Pvt. Ltd.	Moulvibazar Sadar	Moulvibazar
09	Mama Vagina Hatchery	Kontinala, Juri	Moulvibazar
10	Sagarnal Fish Hatchery	Sagarnal, Juri	Moulvibazar
11	BRAC Fish Hatchery	Motiganj, Sreemongal	Moulvibazar
12	British Bangla Agro Ltd.	Motiganj, Sreemongal	Moulvibazar
13	Raja Fishery & Hatchery Pvt. Ltd.	Motiganj, Sreemongal	Moulvibazar
14*	Carp Hatchery Complex	Shantiganj, South Sunamganj	Sunamganj
15	Suranjit Sen Gupta Fish Farm	Notunbagbari, Dirai	Sunamganj
16	Bhai-Bhai Fish Hatchery	Tengratila, Duarabazar	Sunamganj
17	Md. Abul Kashem Fish Hatchery	Lotargaon, Bishwambharpur	Sunamganj
18	Golam Mostofa Fish Hatchery	Satarkola, Bishwambharpur	Sunamganj
19	Md. Ashique Ali Moula Hatchery	Narai, Chatak	Sunamganj
20*	Fish Seed Multiplication Farm	Shayestaganj	Hobiganj
21*	Carp Hatchery Complex	Kurshi, Nobiganj	Hobiganj
22	Surma Fisheries	Kurshi, Nobiganj	Hobiganj
23	Shahjalal Fish Hatchery	Hobiganj Sadar	Hobiganj
24	Bodorshah Fish Hatchery	Hobiganj Sadar	Hobiganj
25	Sonai Fish Hatchery	Madhobpur	Hobiganj
26	Ruposi Bangla Agro Fishery	Madhobpur	Hobiganj

* Government hatcheries

Data Processing and Analysis: The collected data were checked and cross-checked for reliability and accuracy. All the collected data were carefully summarized and scrutinized and finally a number of relevant tables were prepared and analyzed by MS Excel.

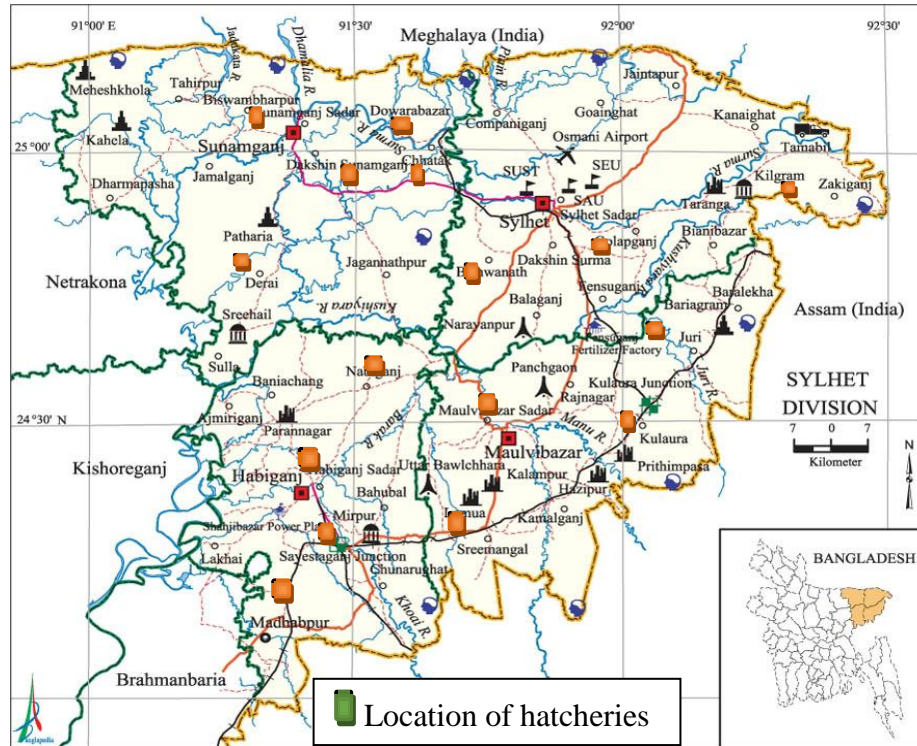


Figure 1. Map of Sylhet division with different districts showing the study areas

RESULT AND DISCUSSION

Selection of Brood Fishes for Spawning: The hatchery managers mainly select the brood fish depending upon the weight and age of the brood fish that were given in the Table 2. Table 2 presents, species wise, the minimum and maximum length, age and weight of the brood fish which are used in the hatcheries under this study. It was observed that the age between 1 to 8 years and weight between 0.2 to 6+ kg were selected as brood fish of different species for breeding. For successful induced breeding it is necessary to select proper brood fish (Penman and McAndrew, 1998; Islam and Chowdhury, 1976). The present results corroborate with those of Bhuiyan *et al.* (2008) who demonstrated that induced spawning of *Labeo rohita* was dependent on selecting healthy brood fishes. Similar observation of selection of brood fish was observed in the hatcheries of Rajshahi, Bangladesh (Bhuiyan and Aktar, 2011).

The selection of brood fishes were mainly based on physical characteristics such as size, coloration and growth rate, with little recognition of the long term genetic impact that such selection imposes on the stocks. Many technologies are available for broodstock development to improve the health of cultured stocks, but producers must be aware of the inherent advantages and disadvantages of each method.

Table 2. Age and weight of selected brood fishes in different species under the study area

Type	Common name	Scientific name	Weight (Kg)		Age (Years)	
			Minimum	Maximum	Minimum	Maximum
Native	Rui	<i>Labeo rohita</i>	1	4	2	8
	Catla	<i>Catla catla</i>	2+	6+	3+	7
	Mrigel	<i>Cirrhinus cirrhosus</i>	1	4+	2	8
	Bata	<i>Labeo bata</i>	0.2	0.8	1	3
	Gonia	<i>Labeo gonius</i>	0.8	1	2	5
	Kalibaus	<i>Labeo calbasu</i>	1	2	2	6
	Shing	<i>Heteropneustes fossilis</i>	0.2	0.4	1+	3
	Magur	<i>Clarius batrachus</i>	0.4	0.8	1+	4
Exotic	Thai puti	<i>Puntius gonionotus</i>	0.3	0.8	1	5
	Thai koi	<i>Anabus testudineus</i>	0.25	0.5	1	3
	Silver carp	<i>Hypophthalmichthys molitrix</i>	2+	4+	2	6
	Grass carp	<i>Ctenopharyngodon idella</i>	3+	5	2+	4
	Bighead carp	<i>Aristichthys nobilis</i>	2	3	2	6
	Pangus	<i>Pangasius hypophthalmus</i>	1.5	3	2	4
	Common carp	<i>Cyprinus carpio</i>	2	5	1+	5

Fry Production: Fry production of fish hatcheries in greater Sylhet is increasing day by day. At present total fry production in greater Sylhet is about 12,179±742.22 kg. Fry production status of different fish species in different districts of Sylhet in 2014 are presented in the Table 3.

In 2014, total fry production in greater Sylhet was about 12,179±742.22 kg where district wise production was about 659±28.94, 5764±329.64, 2987±203.06 and 2769±193.33 kg in Sylhet, Moulvibazar, Sunamganj and Hobiganj, respectively (Table 3). From the study, it was observed that the highest fry production was recorded in Moulvibazar district where Sylhet district was the lowest. It was also observed that Mrigel, Rui, Catla, Thai puti, Silver carp, Bighead and Grass carp were the dominant for fish production. Mrigel (*C. cirrhosus*) was contributed highest quantity of fry production (20%) when Thai koi (*A. testudineus*) was contribution lowest amount of fry production (0.17%). According to Hasan and Ahmed (2002), three Indian major carps (Rui, Catla and Mrigel) and three exotic carps (Silver carp, Grass carp and Common carp) were the dominant fish species used as brood fish in most hatcheries of Bangladesh. From this 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.* (2008), Islam *et al.* (2002), and Hossain and Siddique (2009).

Fry of a total of 15 species were found to be produced in the surveyed hatcheries in greater Sylhet. Among them 7 species (Mrigel, Rui, Catla, Thai puti, Grass carp, Silver carp and Bighead carp)

were dominant. Sarder (2007) reported that 14 endemic finfish species are used in hatcheries for seed production. Among them Catla, Rui, Mrigel, Kalibaus and Asian catfishes (Desi magur and shing) are predominant. Other species are being used for seed production either under limited scale or for conservation purpose. These findings are more or less similar to the present study. Siriwardena (2007) also reported that mainly following fish species are produced as fish seed in Bangladesh, such as-*Catla catla*, *Labeo rohita*, *Cirrhinus cirrhosus*, *Labeo calbasu*, *Labeo bata*, *Labeo gonia*, *Puntius sarana*, *Hypophthalmichthys molitrix*, *Cyprinus carpio*, *Ctenopharyngodon idella*, *Aristichthys nobilis*, *Puntius gonionotus*, *Pangasius sutchi*, *Oreochromis niloticus*, *Anabas testudineus*, *Clarias batrachus*, *Heteropneustes fossilis*, *Ompok pabda*, *Mystus cavasius*, *O. mossambicus*, *O. niloticus* etc.

Table 3. Fry production (kg) of different fish species under different districts in 2014

Name of fish species	Districts wise fry production (kg)				Species wise total fry production (kg)	Spp. wise total fry production (%)
	Sylhet	Moulvibazar	Sunamganj	Hobiganj		
<i>Labeo rohita</i>	72	668	343	320	1403	11.52
<i>Catla catla</i>	56	347	283	297	983	8.07
<i>Cirrhinus cirrhosus</i>	95	1110	623	648	2476	20.33
<i>Ctenopharyngodon idella</i>	67	470	288	267	1092	8.97
<i>Aristichthys nobilis</i>	62	505	274	240	1081	8.88
<i>Hypophthalmichthys molitrix</i>	67	530	257	239	1093	8.97
<i>Labeo bata</i>	30	497	152	132	811	6.66
<i>Labeo gonius</i>	20	336	43	34	433	3.56
<i>Labeo calbasu</i>	25	286	70	62	443	3.64
<i>Puntius gonionotus</i>	85	842	574	462	1963	16.12
<i>Cyprinus carpio</i>	20	173	50	43	286	2.35
<i>Heteropneustes fossilis</i>	19	0	8	7	34	0.28
<i>Clarius batrachus</i>	18	0	5	8	31	0.25
<i>Anabus testudineus</i>	14	0	3	4	21	0.17
<i>Pangasius hypophthalmus</i>	9	0	14	6	29	0.24
Total	659	5764	2987	2769	12179	100.00
Mean	43.93	384.27	199.13	184.60	811.93	-
Standard deviation (SD)	28.94	329.64	203.06	193.33	742.22	-

Figure 2 presents, the highest fry production 2476 kg (20%) was observed in Mrigel which was followed by Thai puti (1963 kg, 16%), Rui (1403 kg, 11%), Silver carp (1093 kg, 9%), Grass carp (1092 kg, 9%), Bighead carp (1081 kg, 9%), Catla (983 kg, 8%), Bata (811 kg, 7%), Kalibaus (443 kg, 4%), Gonia (433 kg, 4%), Carpio (286 kg, 2%) and others species like Koi, Shing, Magur and Pangas (115 kg, 1%).

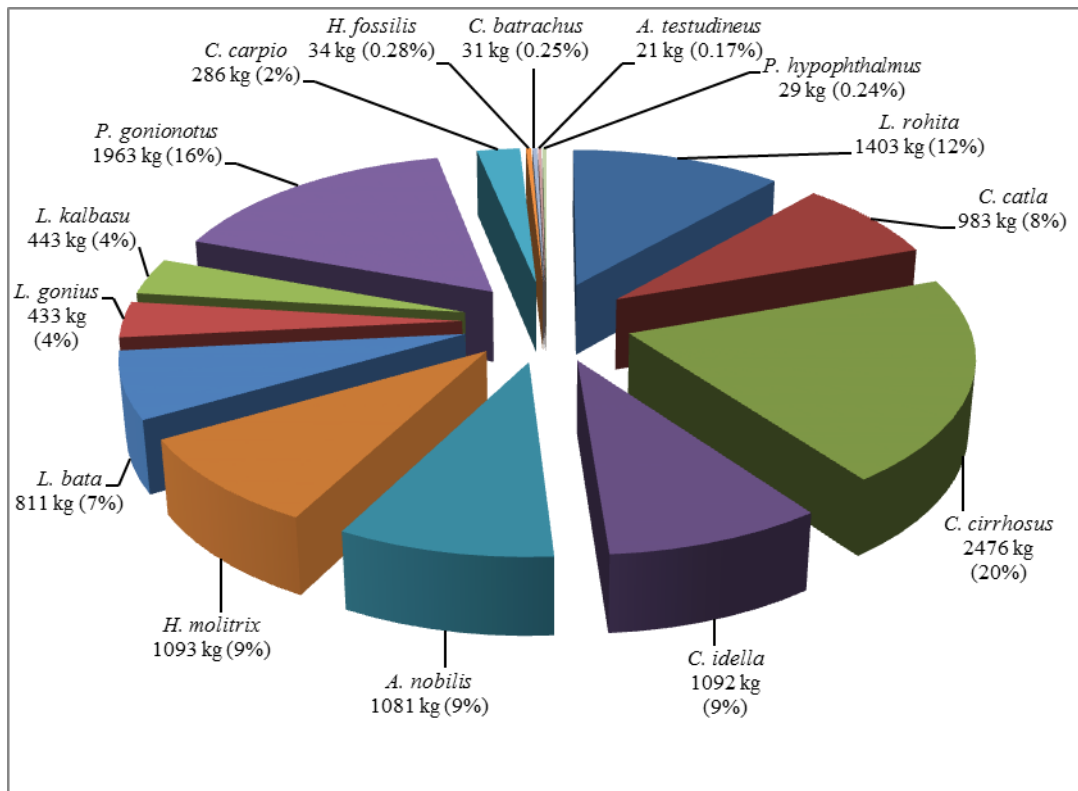


Figure 2. Species wise fry production (kg with %) from the hatcheries of Sylhet

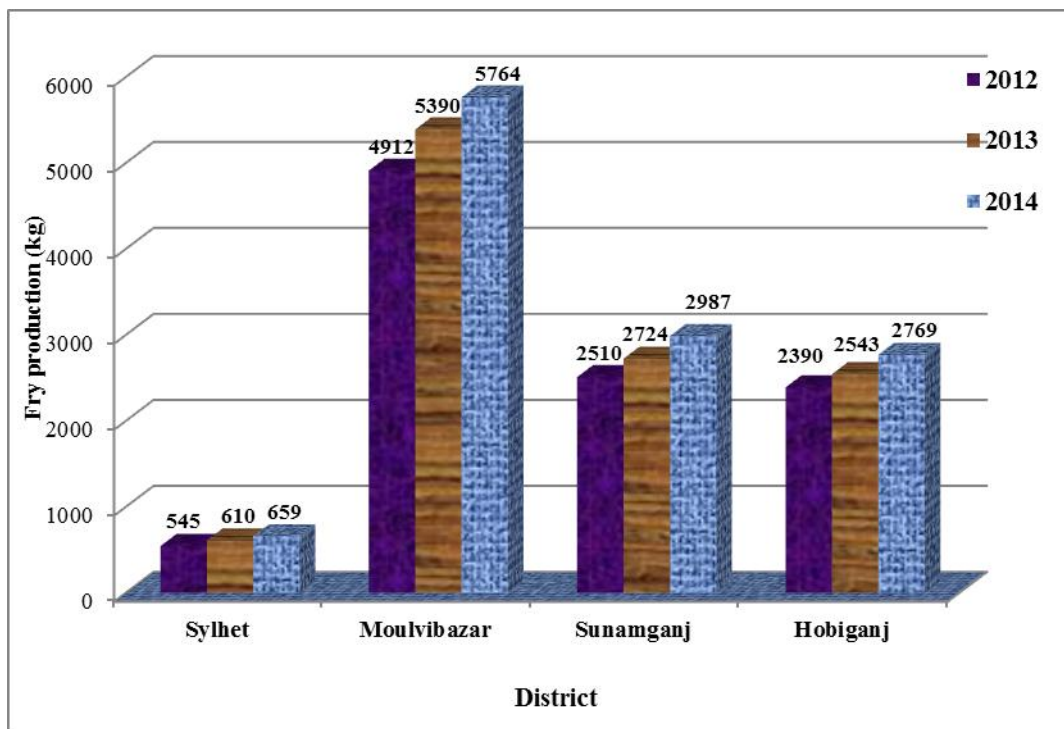


Figure 3. Comparative fry production in different districts during last 3 years

From the Figure 3, it was observed that fry production was highest in Moulvibazar district and lowest in Sylhet district. In Sylhet district, the fry production varies from 545-659 kg in last three years whereas in Moulvibazar district the figure varies from 4912-5764 kg. In Sunmaganj and Hobiganj district, the fry productions were ranges from 2510-2987 kg and 2390-2769 kg, respectively. The production scenario during last three years revealed that fry production was increasing gradually in the successive 3 years in greater Sylhet.

Although there are four running hatcheries in Sylhet district but among them only two hatcheries are carp based and the others are SIS (Koi, Shing and Magur) based. Moreover, most of the private hatcheries were established recently that's why the production in Sylhet district was comparatively lower than other districts. It was also reported that, three large category hatcheries are situated in Moulvibazar district that's why the fry production of Moulvibazar was highest than other districts. Indian major carps and Thai puti were abundantly produced in the entire districts. Exotic carp were also produced in a desirable amount. Some other fish seeds such as Koi, Thai pangus, Shing, Magur etc. were also produced in a negligible amount.

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 4 mg/kg and 2 to 10 mg/kg, respectively were applied. On the other hand, 100-150 and 150-200 IU/kg HCG were applied only as the 1st dose for male and female fish in some Chinese carp species (Table 3). 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 breed with the help of correct dose of hormone injection under artificial condition and gave good results in different hatcheries. In agreement with the present doses, Alikunhi *et al.* (1960), Haque (1975), 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 carp species.

Incubation and Hatching: The incubation period of different fish species varied from minimum 20 to maximum 72 hours (Figure 4). Valeta *et al.* (2013) was found that the incubation period decreased with increase in incubation temperature. It was also reported that the incubation period is generally dependent on water temperature and hatching may also be accelerated by increasing the water temperature up to about 30°C.

The hatching rate of different fish species in the surveyed hatcheries ranged between 55% and 85% which is shown in Figure 5. These findings corroborate the observations of Alikunhi *et al.* (1964), Ali (1967) and Singh *et al.* (2000).

Table 4. Hormonal doses used in different brood fishes for induced breeding in the fish hatcheries of greater Sylhet

Name of Fish Species	Dose of PG (mg/kg)			Dose of HCG (IU/kg)			Dose of Ovupin (mg/kg)	
	Male 1st	Female 1st	Female 2nd	Male 1st	Female 1st	Female 2 nd *PG (mg/kg)	Male (one dose)	Female (one dose)
Rui	2	2	4-6	-	-	-	0.2-0.3	0.3-0.5
Catla	2	2	6-8	-	-	-	0.2-0.4	0.4-0.6
Mrigel	2	1-2	3-4	-	-	-	0.2-0.3	0.3-0.5
Bata	1	1-1.5	2-4	-	-	-	0.2-0.3	0.3-0.5
Gonia	1	1-2	2-4	-	-	-	0.2-0.3	0.3-0.5
Kalbaus	2	2	4-6	-	-	-	0.2-0.3	0.3-0.5
Shing	2-3	2-4	4-10	-	-	-	0.2-0.4	0.5-1.0
Magur	2-4	2-4	4-10	-	-	-	0.2-0.4	0.5-1.0
Thai puti	1	1	2-4	-	-	-	0.2-0.2	0.3-0.4
Thai koi	2	2	4-6	-	-	-	0.2-0.4	0.5-1.0
Silver carp	-	-	-	100-150	150-200	*6-8	0.2-0.4	0.5-1.0
Bighead carp	-	-	-	100-150	150-200	*6-8	0.2-0.4	0.5-1.0
Grass carp	1.5-2	2	4-6	-	-	-	0.2-0.4	0.5-1.0
Thai pangus	2	2-3	6-10	-	-	-	0.2-0.5	0.5-1.0
Common carp	1-1.5	1.5-2	6-8	-	-	-	0.2-0.5	0.5-1.0

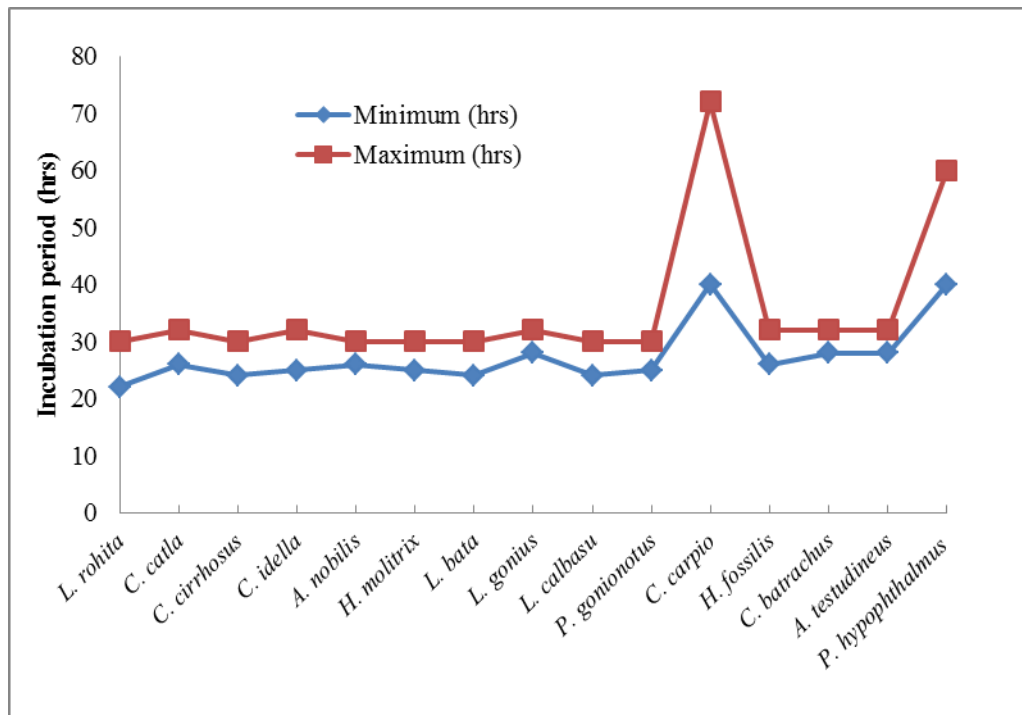


Figure 4. Incubation period of different fish species in the fish hatcheries of greater Sylhet

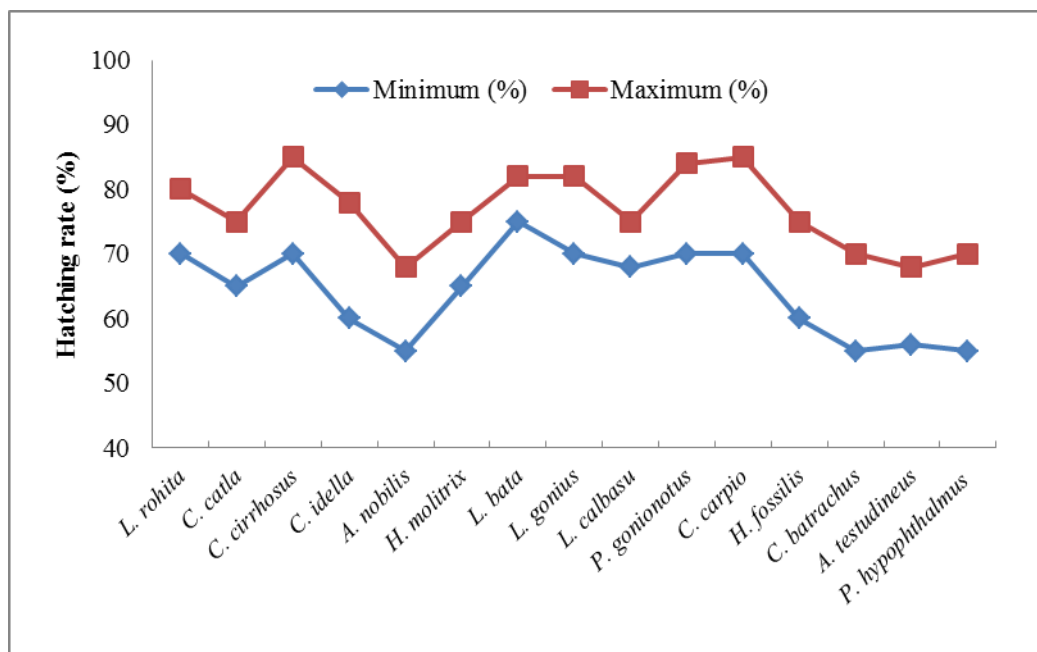


Figure 5. Hatching rate of different fish species in the fish hatcheries of greater Sylhet

CONCLUSION

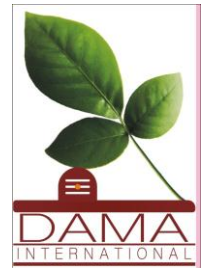
It was observed that fish hatcheries contribute to a remarkable part of fish seed production as well as to the aquaculture development in greater Sylhet region. This study also indicates the necessity of seed production by the induced breeding process. To get the maximum quantity and high quality fish seed, the proper doses of hormone injection and use of quality brood fishes should be maintained. Though the seed quality is not so good in Sylhet region, however, the quantity of fish seed is increasing day by day. For quality seed production, brood condition of a hatchery should be well enough. But it is a matter of regret that brood management status is not satisfactory in most of the hatcheries of this region. Emphasis should be given on expansion of hatchery facilities to supply high quality of fish seed required to support aquaculture development.

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