

Induced breeding practices of the fish hatcheries in the north-western region of Bangladesh

Abstract

This investigational study was conducted on the fish hatcheries of the north-western region of Bangladesh to know about their induced breeding practices. It was observed that 6 native species viz. Rui (*Labeorohita*), Catla (*Catlacatla*), Mrigel (*Cirrhinus cirrhosus*), Calibaush (*Labeo calbasu*), Bata (*Labeobata*) and Gonia (*Labeo gonius*), 2 catfishes such as Shing (*Heteronopneustes fossilis*) and Magur (*Clarius batrachus*) and 7 exotic species viz. Silver carp (*Hypophthalmichthys molitrix*), Bighead carp (*Aristichthys nobilis*), Grass carp (*Ctenopharyngodon idella*), Common carp (*Cyprinus carpio*), Black carp (*Mylopharyngodon piceum*), Thai pangus (*Pangasius sutchi*), Thai puti or raj puti (*Barbonymus gonionotus*) were used in the surveyed hatcheries for induced breeding purpose. Three types of inducing agents viz. PG (Pituitary Gland), HCG (Human Chorionic Gonadotropin) and GnRH_a (Gonadotropin Releasing Hormone analogues) were used for induced breeding. The rate of the 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_a (only one dose) varied from 0.10 to 0.90 ml/kg body weight. The rate of the 2nd dose of injection of PG varied from 4 to 10 mg/kg body weight. Finally, the incubation period and hatching rates in different fish species varied from 10 to 70 hours and 55 to 85% respectively.

Keywords: Induced breeding, Inducing agents, PG, HCG, GnRH_a, Brood fishes, Hatching

Volume 2 Issue 6 - 2015

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Received: August 19, 2015 | **Published:** October 14, 2015

Abbreviations: PG, Pituitary Gland; HCG, Human Chorionic Gonadotropin; GnRH_a, Gonadotropin Releasing Hormone Analogues; GDP, Gross Domestic Product; DoF, Department of Fisheries; UN's, United Nation's; FAO, Food and Agricultural Organization; SD, Standard Deviation

Introduction

Bangladesh is blessed and enriched with vast water resources, which show a wide range of variation in nature. As a consequence, natural fisheries resources are scattered all over the country. According to DoF, 2014, the contribution of fisheries sector to the national GDP (gross domestic product) is 4.37% and 2.01% to the export earning of Bangladesh. Bangladesh presently stands fourth in fresh water aquaculture according to this year's (2014) report of UN's Food and Agricultural Organization FAO.¹ Nowadays, due to the degradation of the ecological balance, changing catchments, construction of drainage structures and flood control, siltation, soil erosion, washing of industrial pollutants and agrochemicals, the capture fisheries in open waters of Bangladesh is under great danger. In 2012-13 inland capture fisheries contributed only to 28.2% of the total fish production. For that reason, aquaculture has been developed in this country, which mainly depends on fish hatcheries, a place for artificial breeding, hatching and rearing through the early life stages of fish Coche & Crespi.²

By fish hatchery we refer to a place where brood fish are stocked in growth ponds, eggs are fertilized and hatched up to fingerlings in artificial conditions by the process of induced breeding. According to Bhuiyan et al.,³ induced breeding is a process where the fish, which do not breed in stagnant water bodies, will do so under the influence of some stimulants or hormones injected in their bodies. Induced breeding, also called *hypophysation* or artificial propagation, has now overcome the problems of fish seeds production for the particular fish which do not breed in captivity. In this process, some stimulating agents or hormones are injected into the ripe brood fish and hence the

stimulation promotes the releasing of eggs and milk from these ripe breeders timely in captive condition.

Induced breeding is done for artificial propagation of fish and it has been established as a dependable source of fish seeds since the mid-1960s in fish hatcheries for production of fry or fingerlings which contributes significantly to the overall aquaculture production of Bangladesh Rahman et al.⁴ Along with the problem of significant reduction of stocks of natural fisheries, there is an increasing need to develop artificial reproduction technology for high commercially valuable species in order to improve their reproductive potential and consequently the production of fingerlings for fish culture and restocking. Spawning induction in freshwater fish is usually performed using the hypophysation method Arantes et al.⁵

Materials and methods

Study area and duration

The study deals with fish hatcheries of north-western region of Bangladesh (Figure 1). The north-western region of Bangladesh consists of two divisions, named Rajshahi and Rangpur. Rajshahi division is in the north western part of Bangladesh. The famous Padma River borders Rajshahi division on the south and another famous river, Jamuna, lies across the eastern border. In the north and west, Rajshahi division shares a border with India. Rajshahi division is located in between 23°48' and 25°16' north latitudes and in between 88°01' and 89°48' east longitudes. On the other hand, Rangpur division lies in the northwestern corner of Bangladesh, a few miles south from the Teesta River. Rangpur division is located in between 25°20' and 26°37' north latitudes and in between 88°50' and 89°53' east longitudes. The study areas are shown in the location map Figure 1.

Data collection

For data collection, the selection of sample size was one of the crucial aspects for the study. Therefore, a reasonable sample size and

a schedule for survey were considered for data collection on induced breeding of fish hatcheries in the North-western region of Bangladesh. The primary data were collected by interview and survey, whereas secondary data were collected from divisional and district fishery offices.

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.

Results and discussions

Brood fishes selection for induced breeding

According to Hasan & Ahmed,⁶ three Indian major carps (ru, 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. Bhuiyan et al.⁷ stated that healthy brood fish selection is important for induced spawning of *Labeo rohita*. The present results corroborate the previous results of the mentioned scientists (Table 1).

Table 2 presents, species wise, the minimum and maximum length, age and weight of the brood fish and minimum-maximum stocking density of the brood fish which are used in the hatcheries under study.

Inducing agents and hormonal dose selection

In the studied hatcheries, three types of inducing agents such as pituitary gland (PG), human chorionic Gonadotropin (HCG) and Gonadotropin Releasing Hormone analogues (GnRH_a) under the trade name Ovupin (100 mg Domperidone + 0.2 mg S-GnRH_a), were used for induced breeding purposes (Table 3).

Ahmed⁸ stated that PG influenced the spawning of *Labeo rohita*. Atz & Pickford⁹ and Chaudhuri¹⁰ have discussed various aspects of the fish pituitary gland and its role in modern aquaculture (Figure 2). From the investigational study, it was observed that the fish breed well under artificial conditions when the appropriate doses of hormonal injections were applied. Alikunhi et al.¹¹ Haque,¹² Mahanta et al.¹³ Alam & Bhuiyan¹⁴ and Bhuiyan & Aktar¹⁵ corroborate the doses of hormones under the present study.



Figure 1 Map-I showing the locations of the study areas of Rajshahi and Rangpur division of Bangladesh.

Data processing and analysis

The collected data were checked and cross-checked for reliability

Table 1 Doses of Ovupin® for the induced breeding of the fish

Species	Sex	Ovupin® dose / Body weight (ml/kg)		
		Minimum	Maximum	Mean ±SD
Rui, catla, mrigel, Calibaush, bata, Gonia and raj puti	Male	0.1	0.3	0.2±0.14
	Female	0.3	0.5	0.4±0.14
Silver carp, bighead carp, grass carp, common carp, black carp, Thai pangus, Shing and Magur	Male	0.2	0.4	0.3±0.14
	Female	0.5	0.9	0.7±0.28

Table 2 Species wise brood stock selection (length, age, weight and stocking density)

Species	Length (cm)			Age (year)			Weight (kg)			Stocking Density (UNIT??)			
	Min.	Max.	Mean ±SD	Min.	Max.	Mean ±SD	Min.	Max.	Mean ±SD	Min.	Max.	Mean ±SD	
Native Species	Rui (<i>Labeo rohita</i>)	45.5	76	60.75±21.57	2	3	2.50±0.71	2	8	5.00±4.24	25	35	30.0±7.07
	Catla (<i>Catla catla</i>)	64	88.5	76.25±17.32	3	5	4.00±1.41	3	15	9.00±8.49	8	20	14.0±8.49
	Mrigel (<i>Cirrhinus cirrhosus</i>)	45.5	76	60.75±21.57	2	3	2.50±0.71	2	8	5.00±4.24	15	25	20.0±7.07
	Calibaush (<i>Labeo calbasu</i>)	30.5	50.8	40.65±14.35	2	3	2.50±0.71	2	5	3.50±2.12	4	5	4.5±0.71
	Bata (<i>Labeo bata</i>)	17.5	22.5	20±3.530	1	2	1.50±0.71	0.4	1	0.70±0.42	8	25	16.5±12.02
	Gonia (<i>Labeo gonius</i>)	45.5	96.5	71±36.06	1.5	3	2.25±1.06	1.5	10	5.75±6.01	4	5	4.5±0.71
Cat Fish	Shing (<i>Heteronopneustes fossilis</i>)	15	20	17.5±3.54	1	2	1.50± 0.71	0.15	0.2	0.18±0.04	25	50	37.5±17.68
	Magur (<i>Clarius batrachus</i>)	15	20	17.5±3.54	1	2	1.50± 0.71	0.15	0.2	0.18±0.04	25	50	37.5±17.68
Exotic Species	Silver Carp (<i>Hypophthalmichthys molitrix</i>)	45.5	82	63.75±25.81	2	3	2.50±0.71	2	8	5.00±4.24	14	25	19.5±7.78
	Bighead Carp (<i>Aristichthys nobilis</i>)	50.5	100	75.25±35.00	2	3	2.50±0.71	2	8	5.00±4.24	5	8	6.5±2.12
	Grass Carp (<i>Ctenopharyngodon idella</i>)	50.5	89	69.75±27.22	3	4	3.50±0.71	3	4	3.50±0.71	5	10	7.5±3.54
	Common Carp, (<i>Cyprinus carpio</i>)	40.5	63.5	52±16.26	3	4	3.50±0.71	3	4	3.50±0.71	5	15	10±7.07
	Black Carp (<i>Mylopharyngodon piceum</i>)	45	120	82.5±53.03	2	3	2.50±0.71	2	10	6.00±5.66	3	4	3.5±0.71
	Thai Pangus (<i>Pangasius sutchi</i>)	43.5	96.5	70±37.48	1	2	1.50±0.71	1.5	12	6.75±7.42	5	10	7.5±3.54
	Thai Puti or Raj Puti (<i>Barbonymus gonionotus</i>)	20.5	30.5	25.5±7.07	1	2	1.50±0.71	0.5	1.5	1.00±0.71	5	10	7.5±3.54

Table 3 Doses of PG and HCG for the induced breeding of the fish

Species	Sex (M = Male, F=Female)	1st doses PG (mg/kg) and HCG* (IU/kg)			2nd doses PG (mg/kg)			
		Mini	Max	Mean ±SD	Mini	Max	Mean ±SD	
Native Species	Rui	M	1	2	1.50±0.71	6	8	7.0±1.41
		F	1	1.5	1.25±0.35			
	Catla	M	1	2	1.50±0.71	6	8	7.0±1.41
		F	1	1.5	1.25±0.35			
	Mrigel	M	1	1.5	1.25±0.35	5	6	6.5±2.12
		F	1	1.5	1.25±0.35			
	Calibaush	M	1	2	1.50±0.71	6	8	7.0±1.41
		F	1	1.5	1.25±0.35			
	Bata	M	1	2	1.50±0.71	6	8	7.0±1.41
		F	1	1.5	1.25±0.35			
Gonia	M	1	2	1.50±0.71	6	8	7.0±1.41	
	F	1	1.5	1.25±0.35				
Cat Fishes	Shing	M	2	4	3.00±1.41	4	10	7.0±4.24
		F	1	2	1.50±0.71			
	Magur	M	2	4	3.00±1.41	4	10	7.0±4.24
		F	1	2	1.50±0.71			
Exotic Species	Silver Carp	M	150*	200*	175±35.36	6	8	7.0±1.41
		F	100*	150*	125±35.36			
	Bighead Carp	M	150*	200*	175±35.36	6	8	7.0±1.41
		F	100*	150*	125±35.36			
	Grass Carp	M	1.5	2	1.75±0.35	4	6	6.0±2.38
		F	1	2	1.50±0.71			
	Common Carp	M	1.5	2	1.75±0.35	6	8	7.0±1.41
		F	1	1.5	1.25±0.35			
	Black Carp	M	1	3	2.00±1.41	6	8	7.0±1.41
		F	1	2	1.50±0.71			
Thai Pangus	M	1.5	2	1.75±0.35	6	10	8.0±2.83	
	F	1	1.5	1.25±0.35				
Thai or Raj Puti	M	1	2	1.50±0.71	6	8	7.0±1.41	
	F	1	1.5	1.25±0.35				



Figure 2 Pictures of induced breeding techniques in Asian modern aquaculture.

Incubation and hatching

During the survey, it was recorded that the incubation period of different fish species ranged from a minimum of 10 to maximum of 70 hours and the fish hatching rate in different hatcheries ranged from 50% to 85% (Figure 3). Singh et al.¹⁶ found that the hatching rate of *Labeo rohita* ranged between 90-95%.

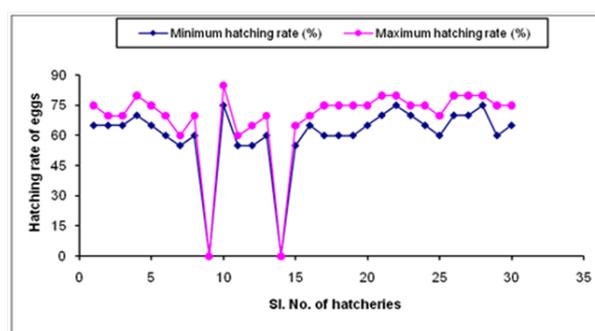


Figure 3 Hatching rates in the surveyed hatcheries.

Conclusion

From the investigational study on the survey of the fish hatcheries in the north-western region of Bangladesh, it was observed that fish hatcheries contribute to a remarkable part of inland fish production as well as to the aquaculture development of Bangladesh. This study also indicates the necessity of seed production by the induced breeding process or *hypophysation*. In the fisheries sector, induced breeding has opened the door of a new era throughout the world. For high quality and high quantity of fish production, it is important to give financial as well as logistic support, to share knowledge, and to organize workshops and seminars conducted by DoF¹⁷ and Universities.

It is also necessary to develop hatchery facilities which include induced breeding techniques for the development of aquaculture in Bangladesh.

Acknowledgments

None.

Conflicts of interest

None.

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