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Technology of artificial breeding of catfish species in the hatcheries in Jessore Region, Bangladesh

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Abstract
The present study was carried out to know the artificial breeding of Ompk pabda, Heteropneustes fossilis and Pangasius hypophthalmus using pituitary gland (PG) from June to August 2014, in the hatcheries in Jessore region. Brood stock of Pangus, Shing, and Pabda was developed in the hatchery. A total of 10 hatcheries were included in the study. Brood fishes were reared in the brood rearing pond by providing artificial diet for good health and full maturation. Brood fishes were injected with PG in different months June to August. Both male and female were injected with PG. In Pabda, Shing and Pangus first PG dose was applied at 8-10, 30-35 and 1-2 mg PG/kg of body weight of females respectively. After 1st PG dose of Pabda, Shing, and Pangus (6 hours later) female were treated with 2nd doses at 10-12, 60, 8-10 mg PG/kg of body weight, respectively. At the time of second dose of female, the males were also treated with single PG dose. The males of Pabda, Shing and Pangus were treated with 8-10, 30-35 and 1-2 mg PG/kg body weight respectively. It was observed that the female and male brood fishes eject eggs and milt within 12-14 hours respectively. Ovulation occurred in Pabda, Shing, and Pangus naturally after, 6-7 hours. The fertilized eggs of Pabda, Shing and Pangus were hatched within 22-24 hours. The temperature, pH, dissolved oxygen and transparency ranged from 22-34 ^{0}C, 6-8.5, 5-7.5 ppm and 22- 32 cm of the water of brood rearing ponds respectively. The average spawn production and body weight of female Pabda, Shing and Pangus were 11500/kg and 120/gm, 21000/kg and 130/gm, 44500/kg and 3.5/kg, respectively. The average fertilization, hatching and survival rate of Pangus (80%, 73% and 64%), Shing (73%, 68% and 58%) and Pabda (78%, 65% and 60%) respectively. The male and female ratio was maintained as 1:2 for each fishes.

Keywords: artificial breeding, catfish species, Jessore Region

1. Introduction
Aquaculture of various catfish in Bangladesh is widely spreading. However, constant supply of good quality fingerlings is vital for the culture of any fish species. Although, major sources of fry and fingerlings for aquaculture were the capture fishery due to the limited capacity of the then existing hatchery facilities in the past, nonetheless, induced breeding techniques have continually improving in Bangladesh. The catfish is a commercially important fish species in Bangladesh. Catfishes have a great demand among the consumers. This is primarily a fish of ponds, ditches, beels, swamps and marshes, but sometimes found in muddy rivers [18, 11]. The catfish is an important edible air sac is bimodal breather because it can respire aerially by gulping air at various intervals when the oxygen content of water is low [22]. Due to its high market value, fast growth, tolerance to high stocking densities, ability to survive in oxygen-low waters [9], and its low fat, high protein and iron content medicinal value [11]. Catfishes is an ideal fish species for aquaculture [30, 12]. However, the culture of catfishes requires constant supply of good quality fingerlings. Previously the major sources offingerlings for aquaculture were mainly the capture fishery and other natural water bodies due to the limited capacity of the existing hatchery facilities to produce fish fingerlings. Artificial breeding refers to a process in which some stimulants, hormones or pituitary extracts are injected in the brood fishes, which do not spawn in the closed water bodies causing the fishes to spawn [7]. Induced spawning of local carps through hypopHysation became a common practice in Bangladesh since 1967 [5]. Meanwhile a large number of hatcheries in the private sector (estimated at over

700) have been established with the introduction of artificial breeding of exotic species [6]. Induced spawning has opened the door of new era in the production of fish throughout the world. In Bangladesh, successful induced spawning was first done by Ali (1967) in carps through hypopHysation [13, 17, 1, 3]. The pond or tank in which brood fish are held must be a suitable size to hold and condition the brood stock dependent on the species involved need to alter the number of individuals, and often separate the sexes. Sex separation enables the brood stock males and females to be subjected to different conditions where necessary. The characteristics of the water in which the mature broodstocks are held must be manipulated. The aquaculturist must consider the appropriate oxygen concentration, temperature, and pH of the water all of which can be species specific. The feeding regime of brood stock is species specific and requires consideration of timing and composition of the food. Protein, lipid and fatty acid composition is particularly important. The quantity of food which is needed for spawning and maturity, for example low rations have been shown to reduce the number of fish reaching maturity. The main objective of the work was to know the artificial breeding (spawning, hatching rate, fertilization rate and survival rate) of Pangus, Shing and Pabda in the hatcheries in Jessore region.

2. Materials and Methods

Study area

The present study area was selected in the catfish hatcheries in the Jessore region, Bangladesh.

Fig 1: Location of the study area

Study Period

Survey of data was collected for a period of three months from June 2014 to August 2014 in the catfish hatcheries in the Jessore region, Bangladesh. A number of 10 hatcheries were taken under the survey in the Jessore region named Ma fish hatchery,

Muktaseri fish hatchery, Lulu fish hatchery, Sagor fish hatchery, Ma-Fatema fish hatchery, Adunic fish hatchery, Suvra fish hatchery, Rita fish hatchery, Anan fish hatchery and Kapototokkoh fish hatchery.

Study design

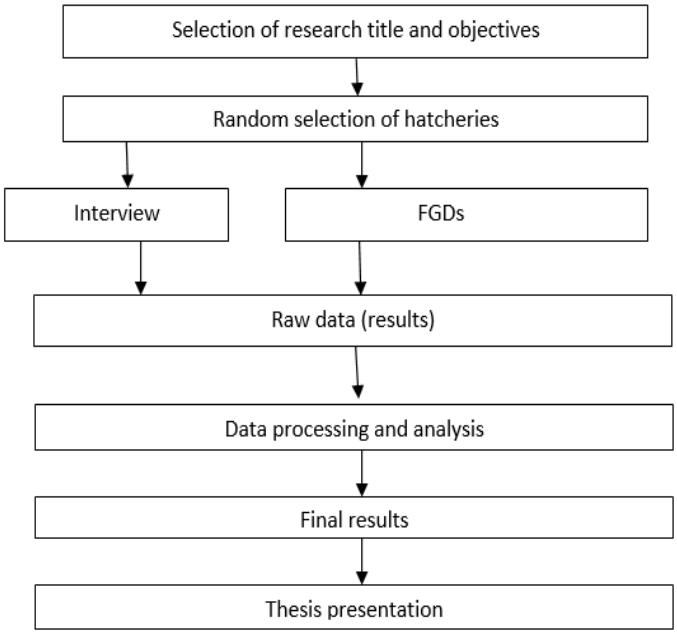

Fig 2: A flow chart followed for the study

Preparation of questionnaire

The questionnaire was prepared empHasizing on the objective mentioned earlier. Before finalization of the questionnaire, it was pre-tested through a field visit. Then the questionnaire was finalized and prepared for survey work. The questions were specific and free from any kind of influence.

Data collection Method

Data were collected through a structured questionnaire, by the method of direct interviews and focused group discussion (FGD). Primary data collected by the direct interviews of the hatchery owner and the hatchery owner with a set of interview schedule deigned for this study each respondent was given a brief introduction about the nature and purpose of the study during the interview. The existing data related to this study were collected from Freshwater Substation, Bangladesh Fisheries Research Institute (BFRI), Jessore; Department of Fisheries (DoF); BRAC, WorldFish Center (WFC) and other Government and Non-government organization, different aquaculture books, project reports, maps, thesis paper, journals and websites.

Fertilization rate

The fertilization rate was measured by the hatchery owner by following formula:

$$\text{Fertilization rate (\%)} = \frac{\text{No. of fertilized eggs}}{\text{Total no of eggs}} \times 100$$

Hatching rate

The hatching rate was measured by the hatchery owner by following formula:

$$\text{Hatching rate (\%)} = \frac{\text{No of hatching}}{\text{Total no of eggs}} \times 100$$

Survival rate

The survival rate was measured by the hatchery owner by following formula:

$$\text{Survival rate (\%)} = \frac{\text{No. of hatchings of survives}}{\text{Total no of eggs}} \times 100$$

Data processing and analysis
The collected data summarized and processed for analysis. These data were verified to eliminate all possible errors and inconsistencies. Tabular technique was applied for the analysis of data by using simple statistical tools like averages and percentages. Finally the processed data transferred to a master sheet from which classified tables were prepared revealing the finding of the study. All the collected data were analyzed through different software by using computer. Statistical and different type's grapHs were done by MS Excel 2010; Adobe PHotoshop 7 was used to arrange the picture.

3. Results

Hatchery information in the study area
Jessore are very much rich in aspects of hatchery. Two types of hatcheries were recorded in the study area. These are catfish and carp fish hatchery. There is about 80 fish hatchery in the Jessore region. Most of the hatcheries in this region breed generally carp fishes.

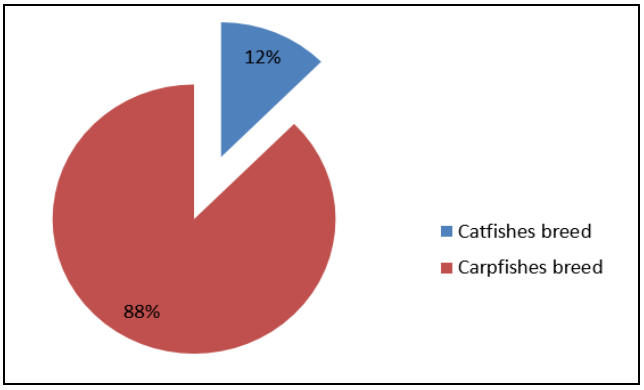

Fig 3: Breeding rate (%) of catfishes in the hatcheries in the Jessore region

Among them 10 cat fish hatcheries (Figure 3) are used for breeding of catfishes named Ma fish hatchery, Muktaseri fish hatchery, Lulu fish hatchery, Sagor fish hatchery, Ma-Fatema fish hatchery, Adunic fish hatchery, Suvra fish hatchery, Rita fish hatchery, Anan fish hatchery and Kapototokkoh fish hatchery. Pangus, Shing and Pabda were selected for artificial breeding in the hatchery in this region.

Sources of Catfishes Brood
Brood fish for the artificial breeding of Catfishes were obtained from the different sources of water body and abroad. Brood fish of Pabda, Shing were reared in the own hatcheries including ponds 30%, local beels 20%, local canals 50% (Figure 4).

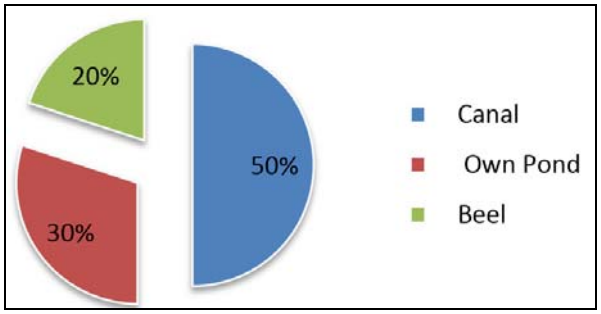

Fig 4: Sources of Brood fishes of Shing and Pabda

The brood fishes of Pangus were collected from Thailand 56%, Vietnam 22% and the hatcheries owner ponds 22% (Figure 5).

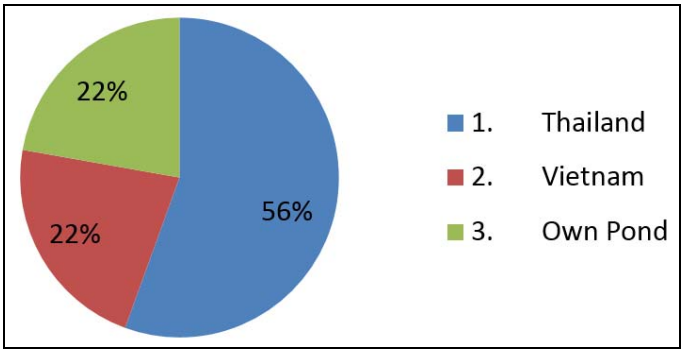

Fig 5: Sources of Brood fishes of Pangus

All the brood fishes were acclimatized before the induced breeding and breeding procedures and were kept separately in ponds before the start of the breeding season.

Brood fish selection Criteria
It was observed that hatchery owners of Jessore region, followed several criteria to select the brood of catfishes. During the selection process of Pangus the hatcheries owners checked female through the abdomen when it is soft and swollen, large in size, good looking, gonadal development, healthy, whereas, male broods were selected through the good looking, small in size healthy and normal appearance. During the selection process of Shing the hatcheries owners
Checked female through the abdomen when it is soft and swollen, round and blunt genital opening and prominent reddish vent,

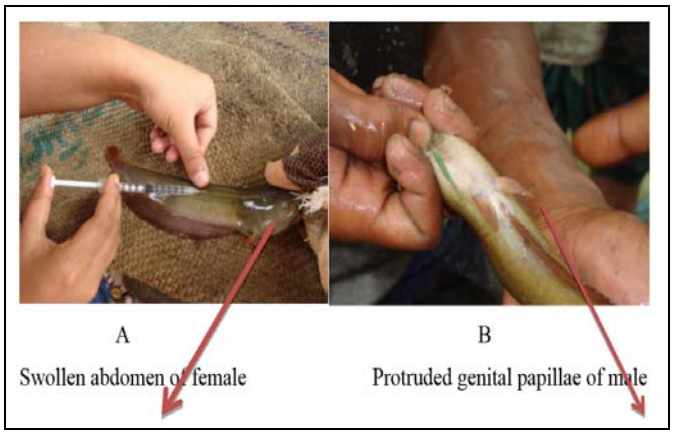

Fig 6: Mature male and female Shing

Whereas, male broods were selected through slim and streamlined body and to observe the normal vent (Figure 6). During the selection process of Pabda the hatcheries owners checked female through large in size, through the abdomen when it is bulging, elastic and soft, body robust and pigmented and good looking, Whereas, male broods were selected through small in size, abdomen normal, and body slender and less pigmented (Figure 7).

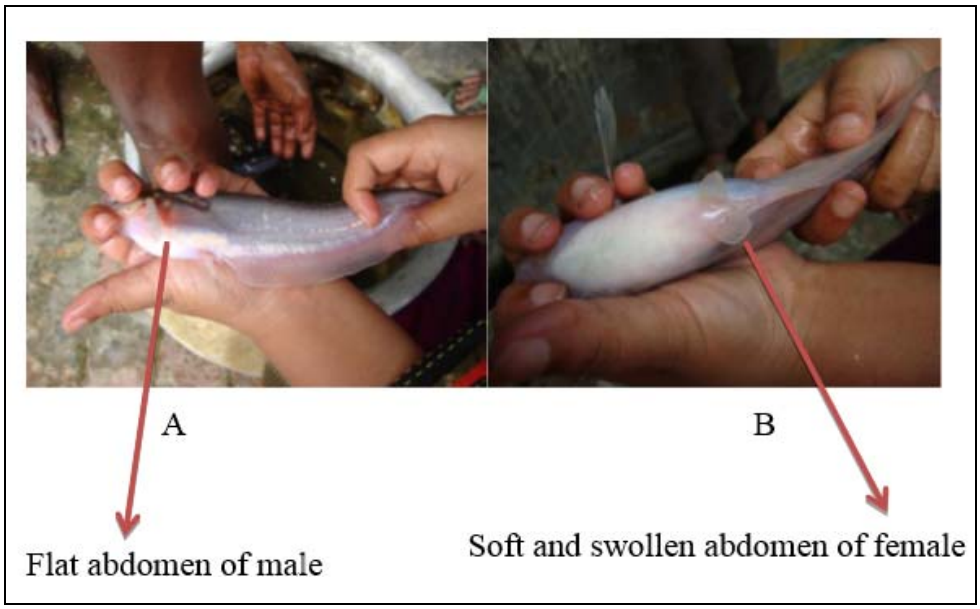

Fig 7: Mature male and female of Pabda

Table 1: Criteria followed by mature breeders of catfishes

Catfish species	Selection criteria	
	Female	Male
Pangus	1.Large in size 2. Good looking, healthy 3.gonadal development	1. Small in size 2. Good looking, healthy 3. Normal appearance.
Shing	1.Abdomen is swollen and soft 2.Round and blunt genital opening 3. Prominent reddish vent	1. Slim and streamlined body 2.Genital papilla elongated and pointed 3.Normal vent
Pabda	1.Relatively large in size 2.Abdomen is swollen and soft 3.Round and blunt genital opening 4. Prominent reddish vent	1.Small in size 2.Slim and streamlined body 3.Genital papilla elongated and pointed 4. Normal vent

Brood stock management

Brood fishes were properly managed in the brood rearing ponds. In the present study, the broods of catfishes were properly managed by the proper stocking

Density in the brood rearing ponds in the catfish's hatcheries. It was found that the pangus, Shing and Pabda brood fishes

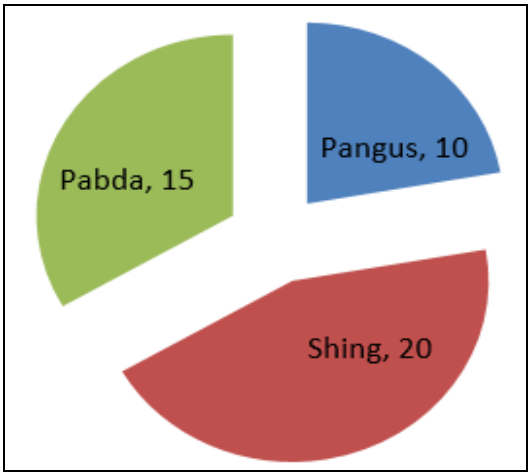

Fig 8: Stocking density (kg/decimal) in the brood rearing ponds in The hatchery

Density was 10 kg, 20 kg, 15 kg/decimal respectively in the catfish's hatcheries brood rearing ponds (Figure 8). The

Catfishes hatcheries owner were used fertilizer in their brood rearing ponds. The catfish's hatcheries farmers in the Jessore region feed brood rearing fish according to their body weight. It was observed that the hatchery farmers feed Pangus, Shing and Pabda were 3-5% of body weight in their brood rearing ponds. The catfishes hatcheries farmers in the Jessore region used standards feed in their brood rearing ponds for the brood stock management. The hatcheries farmers used rice bran 20%, wheat bran 15%, and Mustard oil cake 15%. Meat and bone meal 10%, fish meal 30%, viatamin and mineral 1%.

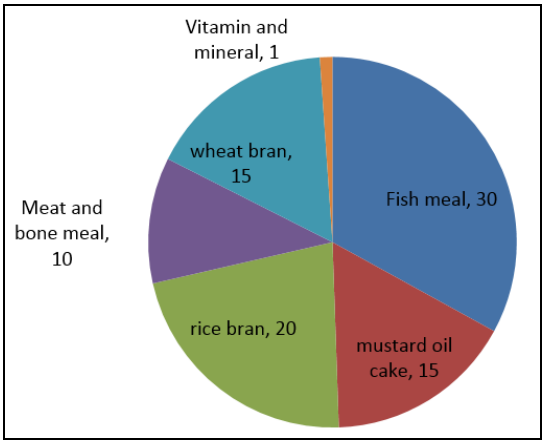

Fig 9: Application rate (%) feeding in hatchery in Jessore region

In the brood rearing ponds for the proper brood stock management (Figure 9).

Age and weight of Catfishes brood

Table 2: Age and weight of brood fishes in hatcheries in jessore region

Name of the species	sex	Minimum age (years)	Minimum weight (kg)
Pangus	Male	2	2-2.5 kg
	Female	3	3-3.5 kg
Shing	Male	1.5	100-110 gm
	Female	1.5	100-130 gm
Pabda	Male	1.5	100-120 gm
	Female	1.5	120-130 gm

Sources of brood catfishes feed

The hatchery owners of Jessore regions followed several criteria to buy the feed. During the selection process of feed, it was observed the standard quality of feed.

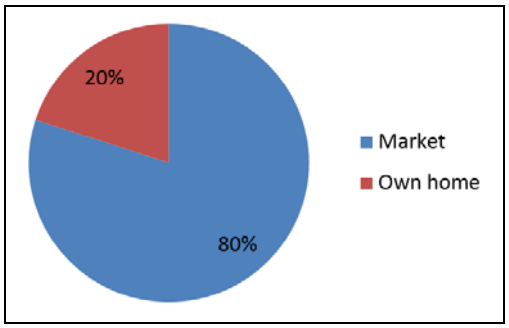

Fig 10: Feed sources of brood catfishes

Most of the brood catfishes feed were collected from market 80% and own home 20% in the hatcheries (Figure 10).

Feeding rate of brood fishes in brood stock Pond

The following proximate composition are used for the brood of cat fish in study area.

Table 3: Proximate composition of the feeds in the catfishes brood stock pond

Food ingredients nutrients	Feeding rate
Crude protein	29.35%
Lipid	8.68%
Ash	12.76%
Moisture	13.16%
Carbohydrate	29.25%
Crude fiber	5.80%
Vitamin	1%

Water quality parameters

Water quality parameters such as, temperature (^{0}C), pH, dissolved oxygen and transparency were found out in the brood ponds during the period from June to August and values of the parameters are shown in (Table 4). The parameters were observed by the companies aqua parameter kit.

Table 4: water quality parameters in different brood rearing ponds in the Hatchery fortnightly during the study period from June to August, 2014.

Name of Hatchery	Parameters			
	Temperature (^{0}C)	pH	DO (ppm)	Transparency(cm)
1.Ma fish hatchery	22-30	6-7	5-7	22-28
2.Muktaseri fish hatchery	28-30	8-8.5	5.5-6.5	30-32
3.Lulu fish hatchery	30-34	7-8.5	6-7	22-29
4.Sagor fish hatchery	27-32	7-8.5	6-7	22-28
5.Ma-Fatema fish hatchery	28-31	8-8.5	6-7	23-30
6.Adunic fish hatchery	28-30	7-8	5-7.5	24-30
7.Suvra fish hatchery	28-32	6-8.5	5.5-7	22-27
8.Rita fish hatchery	22-31	7-8	6-7	22-30
9.Anan fish hatchery	28-31	7-8	6-7.5	23-30
10.Kapotokkah fish hatchery	28-32	7-8.5	6-7	22-29

Conditioning of brood fishes

In the present study, the brood fishes Pabda, Shing and Pangus were transferred to the conditioning tanks kept for 6-7 hours. During conditioning the male and female were kept separately, prior to administration of the inducing agents. Continuous water flow by shower was given in the conditioning tank to ensure proper aeration.

Hormone injection in catfishes

It was observed that the PG injection was administered into the muscular basal region of the pectoral fin (Figure 11). During injection the brood fishes were handled carefully.

Fig 11: Hormone injection in brood catfish of Shing

The fishes were kept over foam and head region of the fish was wrapped by a wet and soft towel or cloth. The injection was done very carefully with a 1 ml syringe. The needle was inserted at about 45^0 angles to the body surface.

Doses of PG used for cat fishes

In the present study, artificial breeding of cat fishes such as pangus, shing and pabda, Pitutary gland (PG) solution were used as inducing agent in the catfishes hatcheries in Jessore regions. It was observed that the early of the breeding season more PG solution was required for responding to the breeding of catfishes in the hatcheries. On the other hand, it was observed normal amount of PG solution was required in peak season. The females of pangus, Shing and Pabda 3-3.5/kg, 100-120/gm and 120-150/gmthe males of Pangus, Shing, and Pabda 2.5/ kg, 100-120/ gm and 100-120/ gm were given the following doses (Table 5).

Table 5: Doses rate of brood catfishes in the hatcheries in Jessore region.

Catfish,s	Dose rate(mg PG/kg) and time interval			
		1st dose rate (mg PG/kg)	Time interval (hours)	2nd dose rate (mg PG/kg)
Pangus	Female	1-2	6 hours	10-12
	Male			1-2
Shing	Female	30-35	6 hours	50-60
	Male			30-35
Pabda	Female	8-10	6 hours	10-12
	Male			8-10

Breeding behavior of catfishes

In the present study, breeding behavior was recorded continuously after the PG injection. Just after the PG injection both male and female of Pangus, Shing and Pabda shows normal activities and movement. At that time they stay on the bottom at the corner of the tank. After 6 hours of injection the activities and movement of male Pangus, Shing and Pabda fishes were increased. It was recorded that the male fish started to move around the female fish; it started to nudge with its snout at the ventral region of female fish after 6 hours of injection. At that time higher of opercula movement was observed in female fish. It was found out the activities of female and the male bents its body sideways and tried to bring its genital papilla in proximity of females genital pore. It was observed that on the breeding condition the male brought the female fishes at the surface of the water. Pressure was created by the central region of the male fishes to the abdomen of the female fishes. Eggs were ejected and the same time male released milt. It was observed the female and male activities when eggs and milt was released. It was found that fishes become calm and quite after spawning. After releasing eggs and milt, fishes were shifted in another tank. At that time they were found to stay on the bottom of the tank. It was found that breeding behavior was observed continuously after the PG injection.

Fertilization rate (%)

The average fertilization rate of Pangus, Shing and Pabda were recorded 80%, 73% and 78% respectively during the whole study period (Figure 12). The highest fertilization rate of Pangus, Shing and Pabda were 86%, 84% and 82% in June, and lowest fertilization rate were 68%, 74% and 70% respectively in August, 2014.

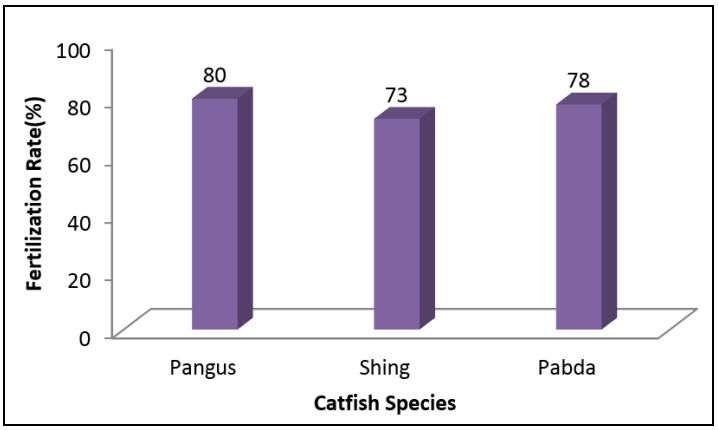

Fig 12: Average fertilization rate (%) of catfishes during the study period

Hatching rate (%)

The average hatching rate of Pang us, Shing and Pabda were 73%, 68% and 65% respectively during the whole study period (Figure 13). The highest hatching rate of Pangus, Shing and Pabda were 80%, 78%, and 76% in June, and lowest hatching rate was 66%, 60% and 54% respectively in August, 2014.

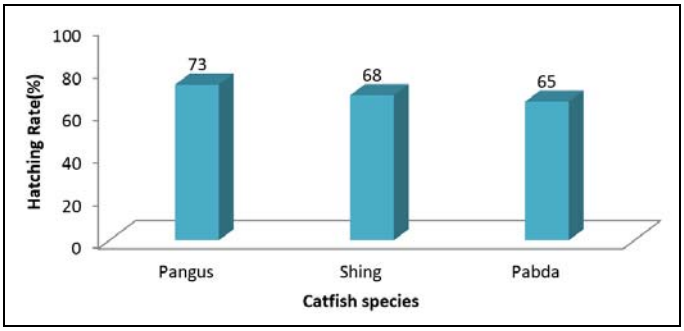

Fig 13: Average hatching rate (%) of cat fishes during the study period.

Survival rate (%)

The average survival rate of Pangus, Shing and Pabda were 64%, 58%, and 60% respectively during the whole study period (Figure 14). The highest survival rate of Pangus, Shing and Pabda were 72%, 68% and 70% in June, and lowest survival rate was 54%, 58% and 54% respectively in August, 2014.

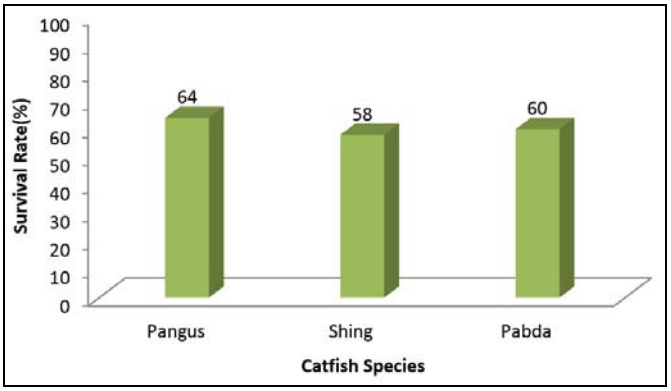

Fig 14: Average survival rate (%) of cat fishes during the study period.

Estimation of spawn production

By direct counting method the spawn production was estimated. During the study period the average spawn

production female of Pangus, Shing and Pabda was 44500/ kg, 11500/ kg and 21000/ kg.

4. Discussion

Hatchery information in the study area

It was found that hatcheries of Jessore region were categorized into two major groups such as catfish and carp fish hatchery. It was observed among them 10 hatchery named Ma fish hatchery, Muktaseri fish hatchery, Lulu fish hatchery, Sagor fish hatchery, Ma-Fatema fish hatchery, Adunic fish hatchery, Suvra fish hatchery, Rita fish hatchery, Anan fish hatchery and Kapototokkoh fish hatchery were generally breed catfishes in the hatchery. Breeding rate of catfishes in the hatchery are 12% and rest 88% hatchery are breed carp fishes. Most of the hatcheries practiced carp seed production which similar to Rahadujjaman [25] there are 105 fish hatcheries in Bogura region and maximum of which was carp hatcheries.

Species selection

It was found that Pangus, Shing and Pabda are selected for artificial breeding in the hatcheries in Jessore region. Khan [19] select Pangus and Shing for artificial breeding in the hatcheries in Punjab.

Sources of Catfishes brood

The Catfishes broods of Pabda, Shing were collected from hatcheries owner's ponds 30%, local canals 50% and local beels 20%. Broods of Pangus were collected from Thailand 56%, Vietnam 22% and hatcheries owner ponds 22%. Kuddus [21] recorded that in Bangladesh most of the catfish brood are collected from natural sources and abroad.

Brood selection criteria

It was observed that to see different appearances brood fishes were generally selected for the breeding purposes. It was found that to select the broods generally abdomen, size, genital papilla, healthy, normal appearances are considered in the hatcheries. Edwards [10] suggested criteria for selecting good quality brood for breeding purpose.

Brood stock management

Brood stock is properly managed in the brood rearing pond until the breeding. Stocking density is generally done in the hatcheries ponds as Pangus, Shing and Pabda 10, 20 and 15 kg/decimal. It was observed that the hatchery owners give feed for Pangus, Shing and Pabda 3-5% according to their body size. It was found that the hatchery farmers used Fish meal (30%), Rice bran (20%), wheat bran (15%) and others feed (20%) in the hatchery ponds for brood stock management. Kimsleang [20] said that standard quality brood stock management gave good results for artificial breeding.

Age and weight of Catfishes brood

It was found that the cat fish brood of Pangus were generally minimum age of 2-3 years and weight were gained female 3-3.5/kg and male 2.5/kg, Shing were generally minimum age 1.5 year and weight gained were female 100-120 /gm and male 100-120/gm, Pabda were generally minimum age 1.5 year and weight were gained female 120-130/gm and male 100-120gm. Santigo et al. [26] who recorded that most of the catfishes gained maturity 1-3 years which is more or less similar to the present study.

Sources of brood catfishes feed

The feed of catfish were collected from the market 80% and own home 20% in the hatcheries. Kuddus [21] who recorded that brood fishes feed are collected mainly from the market.

Feeding rate of brood fishes in brood stock Pond

The hatchery owners in the Jessore region used fish meal 30%, rice bran 20%, wheat bran 15%, mustard oil cake 10%, meat and bone meal 10% and vitamin premixes 1%, supplementary diet in the hatcheries catfish brood stock pond. It was observed that the hatcheries farmers fed two times in a day according to the body weight of fishes. It was recorded that the proximate composition of the feed used in the catfish's brood stock pond, crude protein 29.35%, lipid 8.68%, ash 12.76%, moisture 13.16%, carbohydrate 29.25%, crude fiber 5.80% and vitamin 1. Hoque [14] reported that diets containing 1% vitamin premix showed better result in all aspects such as selectibility, spawning success, fertilization rate and hatching rate.

Water quality parameters

It was found that the water quality parameter was varied in the hatchery in Jessore region from June to August in the study period. The temperature was varied from 28-34 ^{0}C during the study. Hossain [15] recorded that in Bangladesh most of the catfishes breed from June to August when temperature remained from 29 to 33 ^{0}C.The optimum level of DO is required for fish culture and reproduction. In the present study, dissolved oxygen concentration in water varied from 5 to 7.5. Ali et al. [4] found dissolved oxygen concentration in water varied from 6-7.5 which is more or less similar to the present results. PH (Hydrogen ion concentration) indicates acidity-alkalinity condition of a water body. It is called productivity index of water body. Most water bodies have pH within the range of 6 to 8.5. The slightly alkaline pH is most suitable for fish culture. Acidic pH of water reduces of the growth rate, metabolic rate and other pH physiological activities of fishes [27], in study the range of pH varied from 7 to 7.3. The transparency is a gross measure of pond productivity. Boyd [8] recommended that the transparency ranged from 15 to 49 cm is appropriate for fish culture. The transparency ranged from 22 to 32 cm during the study, which was similar to findings of Rahman [24] and Uddin [29].

Conditioning of catfish's brood

The hatcheries owners are conditioning brood catfishes in the tank. The brood fishes of Pangus, Shing and Pabda were transferred to the conditioning tanks for 6-7 hours. During conditioning the male and female were kept separately, prior to administration of the inducing agents. Continuous water flow by shower was given in the conditioning tank to ensure proper aeration. Kuddus [21] who recorded that catfish brood were conditioned before artificial breeding in the hatcheries tank.

Hormone injection

The catfishes of Shing, Pabda and Pangus, PG were injected into the muscular basal region of the pectoral fin. During injection the brood fishes were handled carefully. The fishes were kept on foam and head region of the fish was wrapped by a wet and soft towel or cloth. The injection was done very carefully with a 1 ml syringe. The needle was inserted at about 45^0 angles to the body surface. Haniffa and Sridhar [12] was recorded that the PG hormone was injected into muscular basal region of the pectoral fin which gives the best result.

Doses of PG used for catfishes

Artificial breeding of catfishes such as Pangus, Shing and Pabda, Pitutary gland (PG) solution were used as inducing agent in the catfish hatcheries in Jessore regions. It was observed that the early of the breeding season more PG solution was required for responding to the breeding of catfishes in the hatcheries. Normal amount of PG solution was required in peak season. The females of pangus, Shing and Pabda 3-3.5/kg, 100-130 /gm and 100-130 /gm were given an injection of 1-2, 30-60 and 8-12 mg PG/kg of body weight. The males of Pangus, Shing and Pabda 2-2.5 kg, 100-110/gm and 100-120/gm were given an injection of 1-2, 30-35 and 8-10 mg PG/kg of body weight. The doses of PG were ranged between 2-12, 30-60 and 8-12 mg PG/kg of body weight female of Pangus, Shing and Pabda. The doses of PG were ranged between 1-2, 30-35 and 8-10 mg PG/kg of body weight of male of Pangus, Shing and Pabda. Islam [16] who recorded that the dose of pabda 8-12 mg PG/kg gives the body weight of male fishes which is more or less similar to the present study.

Breeding behavior of catfishes

Breeding behavior was recorded continuously after the PG injection. After 6-7 hours of injection the activities and movement of male of Pangus, Shing and Pabda fishes were increased. It was recorded that the male fish started to move around the female fish; it started to nudge with its snout at the ventral region of female fish after 6 hours later of injection respectively. It was observed that on the breeding condition the male brought the female fishes at the surface of the water. Pressure was created on the ventral region of the male fishes to the abdomen of the female fishes. Eggs were ejected and the same time male released milt. It was found that fishes become calm and quite after spawning. After releasing eggs and milt, fishes were shifted in another tank. At that time they were found to stay on the bottom of the tank. It was found that breeding behavior was observed continuously after the PG injection. Rahman [23] was able to breed Ompok pabda by the good condition breeding behavior, which is more or less similar to the present study. It was mentioned that the brood fishes of Pangus, Shing and Pabda were stocked in the breeding tank and maintained male and female ratio as 1:2. Brood fishes of Pangus, Shing and Pabda were injected by PG solution. After 6-8 hours spawning occurs naturally brood fishes of Pangus, Shing and Pabda. Fertilized eggs were kept in tank for hatching. The fertilized eggs of Pangus, Shing and Pabda were hatched after 22-24 hours.

Fertilization, hatching and survival rate

The average fertilization rate ranged of Pangus 80% for dose of 2-12 mg PG/kg. Present finding of fertilization rate coincide with the result of Akthteruzzaman et al. [2], who recorded a fertilization rate of Pangus 75% at the dose of 3-10 mg PG/kg body weight for females and 1 mg PG/kg of body weight for male in hapa, among which doses of 2-10 mg PG/kg fish gave the best results. The average fertilization rate ranged of Shing 73%, for dose of 30-60 mg PG/kg. Present finding of fertilization rate coincide with the result of Ahmed [1], who recorded a fertilization rate of Shing 72% at the dose of 56 mg PG/kg body weight for females and 25 mg PG/kg of body weight for male of catfishes in hapa, among which doses of 30-50 mg PG/kg fish gave the best results. The average fertilization rate of Pabda, 78% for dose of 30-56 mg PG/kg. Present finding of fertilization rate coincide with the result of Ahmed [1], who recorded a fertilization rate 76% at the dose of 6-10 mg PG/kg body weight for females and 6-8 mg PG/kg of body weight for male of catfishes in hapa, among which doses of 8-12 mg PG/kg fish gave the best results

It was observed that the average hatching rate of Pangus was 73% during the present study. Rahman [23] found hatching rate of Pangus was 70% in hapa by administration of a single PG dose of 2 and 10 mg PG/kg fish to the female and 1-2 mg PG/kg fish to the male. Sultana reported (2001) reported the average hatching rate of Pangus 80% when treated with PG doses of 2-12 mg/kg body weight of fish. The average hatching rate of Shing was 68% during the present study. Rahman [23] found a hatching rate of Shing 65% in hapa by administration of a single a PG dose of 30-55 mg PG/kg fish to the female and 28 mg PG/kg fish to the male. The average hatching rate of Pabda was 65% during the present study. Rahman [23] found a hatching rate of Pabda was 68% in hapa by administration of a single a PG dose of 8 and 12mg/kg fish to the female and 8 mg/kg fish to the male. Ahmed [1] reported the hatching rate of Pabda was 70% when treated with PG doses of 8-12 mg PG/kg body weight of fish. It was observed that the average survival rate of Pangus, Shing and Pabda 64%, 58% and 60% respectively during the whole study period. The highest survival rate of Pangus, Shing and Pabda were 72%, 68% and 70% in June and lowest rate was 54%, 50%, and 54% respectively in August 2014. Islam [16] conduct an experiment by PG dose of 14-20 mg/kg body weight for female and 12 mg/kg body weight of male and found highest survival rate at a dose of 18 mg/kg fish twenty one days after breeding experiment.

Estimation of spawn production

It was recorded that the average spawn production of female Pangus, Shing and Pabda was 44500/ kg, 11500/kg and 21000/kg. These findings were more or less similar to the findings of Tsadik et al. [28].

5. Conclusion

Studies on artificial breeding of cat fishes of pangus, shing and pabda were carried out at fish hatchery in Jessore region of Bangladesh during June to August. For the Pabda, Pangus, Shing the breeders were conditioned for a period of 6-7 hours in conditioning tank during this study period respectively. Both male and female were injected with PG dose. In Pabda, Shing and Pangus first PG dose was applied at 8-10, 30-35 and 2 mg PG/kg of body weight of females respectively. After 1st PG dose application of Pabda, Shing and Pangus (6 hours later) female were treated with 2 nd doses at 10-12, 60, 12 mg PG/kg of body weight respectively. At the time of 2 nd PG dose application of female, the males were also treated with single PG dose. The males of Pabda, Shing and Pangus were treated with 8-10, 30-35 and 1 mg PG/kg of body weight respectively. It was observed that the female and male brood fishes eject eggs and milt respectively at the contemporary times. Ovulation occurred in Pabda, Shing and Pangus naturally (6-7) hours of the study. The fertilized eggs of Pabda, Shing and Pangus were hatched within 22-24 hours respectively. The temperature, pH, dissolved oxygen and transparency ranged from 22-34 ^{0}C, 6-8.5 and 22- 32 cm in the brood rearing ponds respectively. The average spawn production and body weight of female Shing, Pangus and Pabda were 11500/kg and 120/gm, 44500/kg and 3.5/kg, 21000/kg and 130/gm, respectively. The average fertilization, hatching and survival rate of Pangus (80%, 73% and 64%),

Shing (73%, 68% and 58%), and Pabda (78%, 65% and 60%) respectively. Generally catfishes a relatively high market price and a fish popularly sought after in eastern Indian states. Spineless except a soft vertebral column, the fish has good quality flesh and taste and is widely accepted by the consumers of East Asian countries. The technology for breeding and fry production had been developed and we anticipated that a cat fishes grow out industry would emerge among progressive fish farmers in due course. Successful aquaculture of this species may bring about socioeconomic sustainability of the rural people.

6. References

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