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Possibilities of natural spawning ground of carp species at Surma and Kushiara River in Sylhet

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Abstract

The study was conducted to identify the possibilities of natural spawning ground of carp fishes in Surma and Kushiara river in Sylhet for a period of four months during April to July 2015. Four locations were selected for this study to explore the existence of spawning ground and availability of carp spawn in the Sylhet haor basin. The sampling points were Hetimganj point (Surma river), Bhadeswar point (Kushiara river), Monumukh point (Kushiara river) and Atgram point (Surma river). The research was done by setting up two Savar nets at each sampling points of river site for the collection of fish seed sample. It was observed that 3105 g of carp seeds was collected from Hetimganj point and 50 g from Bhadeswar point. The carp spawn fishing intensity was 186.56 g day⁻¹net⁻¹ in new moon and 20 g day⁻¹ net⁻¹ in full moon at Hetimganj point. No carp fish seeds were found in Monumukh and Atgram point. The water quality parameters of the sampling sites were found within the suitable range and no significant differences of the parameters among the sampling sites. The availability of carp spawn in the study area indicated the possibilities of spawning ground of carp species in the Surma river.

Keywords: carp species, fish seed, possibilities, spawning ground, sampling sites

1. Introduction

Bangladesh is one of the world's leading fish producing countries with a total production of 41.34 lakh MT, where aquaculture contributes 56.44% to total production [1]. Last 10 years average growth performance of this sector is almost 5.43%. According to FAO statistics 2018, Bangladesh is ranked 3rd in world inland water capture production and ranked 5th in world aquaculture production [2].

During sixties and early seventies aquaculture activities included mainly rearing of natural carp hatchlings collected from the river Jamuna, Padma, Boral, old Bramaputra and fertilized eggs from the river Halda of Chittagong and other natural sources during the monsoon. Based on the differences in the spawning grounds, spawning seasons, and geographic distribution, the major carp in Bangladesh are often divided into four stocks named by the respective river system: i) Brahmaputra -Jamuna stock, ii) Upper Padma stock, iii) Upper Meghna stock, and iv) Halda stock [3, 4]. Availability of hatchlings from natural sources is being declined due to habitat destruction and change in ecological system. In the mid 60s, due to reduction in the availability of wild carp seeds in the rivers, the Department of Fisheries (DoF) initiated research and studies on artificial propagation of carps and their seed rearing. In 70s, fisheries scientists have succeeded in it and developed artificial sustainable technology of carp seed production. Consequently, the increased fish culture efforts demands increased carp seeds production. At the same time, as the natural fish seeds were not able to meet the demand of the fish farmers. So the Government has established fish hatcheries to produce quality fish seed and to extend induced breeding technology. Over the last decade there has been a major shift in demand from wild-caught major carp spawn to hatchery-produced spawn. This has mainly been due to establishment of numerous private and government hatcheries and nurseries. The production capacity, especially that of the private facilities, has increased many fold, and their services and communications have also improved, thus providing a very attractive alternative to wild caught spawn. Furthermore, by purchasing hatchery-raised fry, the customer is assured of getting the desired species, whereas with wild-caught spawn there is often the risk of getting spawn that includes several fish species. However, many hatchery operators use poor quality brood stock, producing inferior quality fry, thus creating a negative image among potential

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customers. In 2017, the seed production from artificial source contributes 99.24% and from natural source contributes only 0.76% to the total production of hatchlings depicting the extent of environmental degradation [1]. At present the country is self-sufficient in carp seed production, though quality fish seeds are produced in a limited scale.

Aquaculture of Bangladesh will be benefited with the good quality fish seed support from public and private hatcheries. The quality of fish seeds in Bangladesh has declined over the years. The quality reduction is mostly observed in private hatcheries. There are many reasons for the low quality, for instance, inbreeding, inter-specific hybridization and cross breeding are threatening the genetic diversity of indigenous wild stocks of Indian Major Carps. Once the natural spawning ground of carp species were available in the different river of greater Sylhet specially Surma, Kushiara and Monu river [5]. Now-a-days the spawning grounds are supposed to be closed or going to be extinct due to various man-made and natural causes. However it needs to be proper study to investigate the existence of spawning ground and availability of carp spawn in Sylhet haor basin.

2. Materials and Methods

2.1 Study area and period

A study was carried out to explore the existence of spawning ground in Surma and Kushiara river for a period of four

months during April to July 2015. Four (04) sampling points were selected from different suitable location of Surma and Kushiara river site with the help of local Upazila Fisheries Office, Fishermen Community and other stakeholders. The selected sampling sites were Hetimganj and Atgram point in Surma river; and Bhadeswar and Monumukh point in Kushiara river (Table 1 and Figure 1).

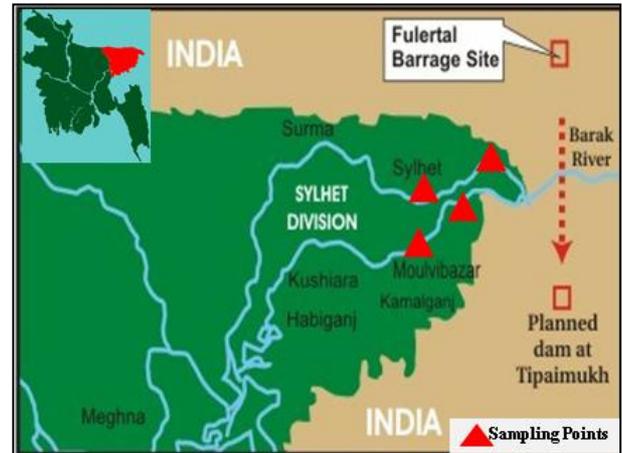


Fig 1: Map showing of the spawn collection points at Surma and Kushiara river

Table 1: Selected sampling sites for identification of natural spawning ground of carp species

Site no.	Sampling Site	Location in the River	District	Comments
1.	Hetimganj point	Surma river at Golapganj Upazilla	Sylhet	Four sites were selected after proper visit of proposed sites and according to the information collection from different stakeholders
2.	Bhadeshwar point	Kushiara river (Adjacent of Bhatershar bazar with the location Indian Border)	Sylhet	
3.	Monumukh point	Monu river; This river is connected with Kushiara	Maulovibazar	
4.	Atgram point	Surma river at Kanaighat Upazilla area (near connected the Borak river from Indian Border)	Sylhet	

2.2 Natural fish spawn collection

The Indian major carp spawn fishing gear that has traditionally been used in the two major river systems (Ganges-Padma and Bhrhamaputra-Jamuna) is a funnel shaped fixed net, popularly called ‘Savar net’ [6]. This is a type of set bag net specially designed to fix the net at the shallow, gently sloping shoreline of the rivers, where the

depth of water is negotiable without any aid. The ‘Savar net’ is usually small, with a collection pocket at the tail end. The net is made of a fine mesh that traps tiny eggs or spawn that drift with the water flow during the monsoon months. The upper edge of the tail bag is kept about 4–5 cm above the water surface to prevent the escape of spawn (Figure 2).

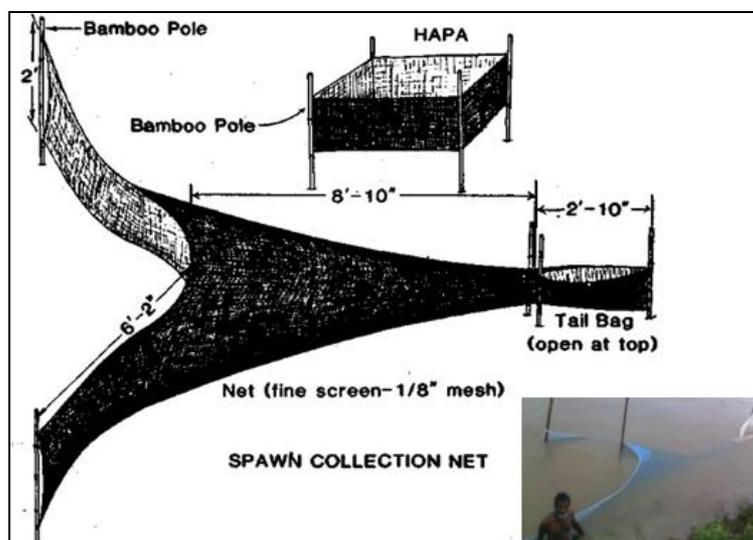


Fig 2: Design of ‘Savar net’ which was used to collect spawn

The savar net has a wide mouth (anterior opening) and a small tail (posterior) opening. The mouth has two lateral extensions, each 6'-2" long and 2' wide (deep). The tail opening is round and it has 9" diameter. Its edge is stitched in a ring of split bamboo. The tail bag is a receptacle, which collects spawn trapped in the net. It is rectangular in shape made of gamcha (local cloth) or other finely woven cloth.

2.3 Collection and transportation of fish seed samples

The research was conducted by setting up two 'Savar net' at each sampling point for the collection of fish seed sample. The sampling works was done by a skilled fisherman at each site in Surma and Kushiara rivers through collection of fish seed sample. The sampling net was observed four times in a day at 6 hours interval. Fish seed sample were collected at six hours interval from the sampling points and samples were collected through oxygen bag. The collected samples were transferred and stocked immediately in a small pond (1 decimal) at the Fish Seed Multiplication Farm (FSMF), Golapganj. For ponds were used separately for four sampling sites.

2.4 Spawn rearing and species identification

The collected samples were reared for a period of 15 days for species identification. The fish seeds were reared properly for 15 days with necessary management technique. After 15 days, the sizes of the fish spawn were about 2.5-3.0 cm and they were easily identified. The identification of fish species was done by visual investigation.

$$\text{Carp Spawn fishing intensity} = \frac{\text{Total Catch}}{\text{Total days} \times \text{fishing net}}$$

2.5 Water quality parameters

Water quality parameters such as water temperature, turbidity, pH, dissolved oxygen (DO), acidity, alkalinity, ammonia, CO₂, chloride, hardness, nitrate, TDS were estimated at monthly interval from 09.00 to 10.00 am. Water temperature was recorded with a Celsius thermometer, and turbidity was measured with a Secchi disc of 20-cm diameter. Dissolved oxygen, pH and other parameters were measured by a digital HANNA instruments. The Enumerator (MS student) was involved there closely with each sampling site for sample collection and other activities. Technical supports and laboratory facilities were provided from the Department of Fish Biology and Genetics, Sylhet Agricultural University.

2.6 Data processing and analysis

The collected data were summarized and scrutinized carefully before the actual tabulation. For processing and analysis purpose, MS Excel and SPSS have been used.

3. Results and Discussion

The overall results of fish seed sampling and water quality parameters as recorded from the different sampling sites have been presented as follows:

3.1 Fish seed

The relative contribution of different fish seeds in four sampling points are presented in Figure 3.

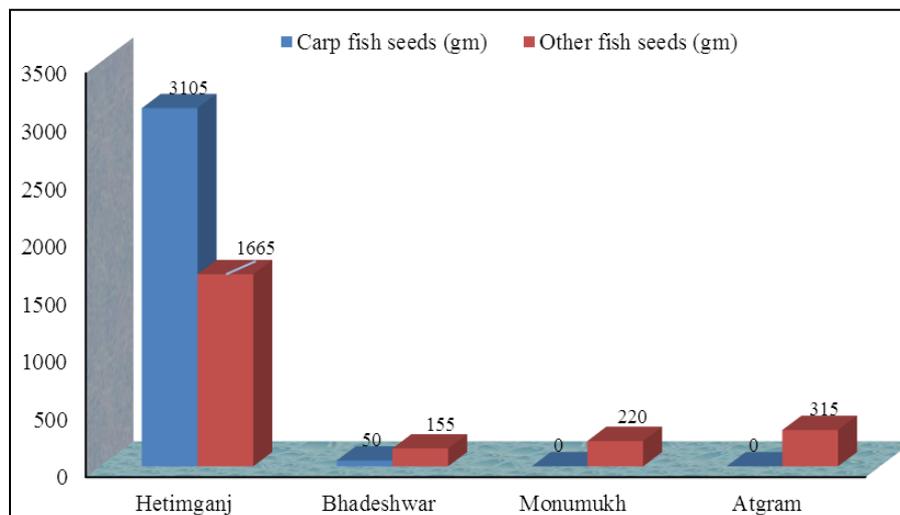


Fig 3: The relative contributions of fish spawn collection in four sampling points

During the study period, 3105 g of carp fish seeds and 1665 g of other fish seeds were collected from Hetimganj point in Surma River (Figure 3). The highest amount (3105 g) of carp fish seeds were collected from Hetimganj point where small amount (50 g) of carp seed were observed in Bhadeshwar point. No carp fish seed was observed at Atgram point in Surma and Monumukh point in Kushiara River. But some small indigenous species of fish (SIS) seeds were present in all sampling points. The massive catch (1500 g) of carp species was observed in 3 June 2015 and it was about half of

the total amount of carp fish seeds (Figures 4 & 5). Carp fish seeds were caught in two steps. The period of 1st step was 30 May to 08 June 2015 (5 June off-day due to damage of tail ending hapa) which was observed new moon and 2nd step was 19 to 21 June 2015 that was observed full moon. In 1st step, the largest amount (2985 g) of carp fish seed was collected where in 2nd step, small amount (120 gm) of carp fish seeds was collected. The carp spawn fishing intensity of 1st step was about 187 g day⁻¹ net⁻¹ whereas in 2nd step it was 20 g day⁻¹ net⁻¹.



Fig 4: Fish seed was collected from savar net



Fig 5: Collected fish seed and shown in plate

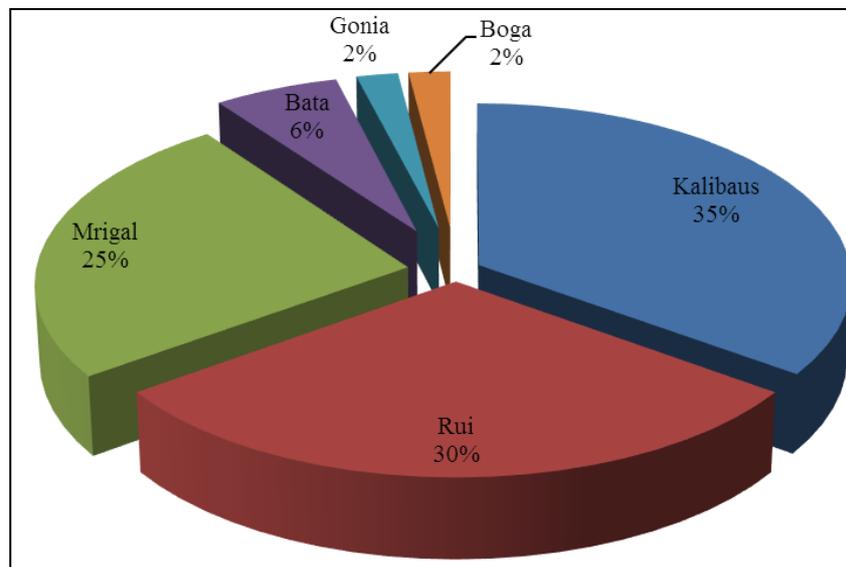


Fig 6: Species composition (%) of collected spawn at Hetimganj point

The age of carp fish seeds was 2-3 days and size 1.0-1.5 cm. After 15 days rearing in FSMF, fish seeds were identified. The major portion of carp fish seeds were Kalibaas (*Labeo calbasu*), Rui (*Labeo rohita*), Mrigal (*Cirrhinus cirrhosus*) and minor portion of carp seeds were Gonja (*Labeo gonja*), Bata (*Labeo bata*) and Bhangon (*Labeo boga*). It was also investigated that the species contribution was Kalibaas 35%, Rui 30%, Mrigal 25%, Bata 6%, Gonja 2% and Boga 2%

(Figure 6). Some small indigenous fish species (SIS) such as Mola (*Amblypharyngodon mola*), deshi Puti (*Puntius sp.*), Darkina (*Esomus danricus*), Chela (*Chela cachius*), Tengra (*Mustus sp.*), Baim (*Mastacembelus sp.*) etc. were also found in savar net when the fish sample was collected (Table 2). The SIS was comparatively bigger size than carp species. The size range of SIS was 2.5 cm to 4.0 cm and the size variation was observed due to different fish species.

Table 2: SIS collected from four sampling site during the study period

Sl.	Family name	Local name	English name	Scientific name
1	Cyprinidae	Mola	Mola carplet	<i>Amblypharyngodon mola</i>
2		Bata	Minor carp	<i>Labeo bata</i>
3		Darkina	Gangetic scissortail rasbora	<i>Esomus danricus</i>
4		Tit punti	Ticto barb	<i>Puntius ticto</i>
5		Jatpunti	Pool barb	<i>Puntius sophore</i>
6		Chela	Large razorbelly minnow	<i>Salmostoma bacaila</i>
7	Clupeidae	Kachki	Ganges river sprat	<i>Corica soborna</i>
8	Bagridae	Tengra	Striped dwarf catfish	<i>Mystus vittatus</i>
9	Mastacembelidae	Guchi	Barred spiny eel	<i>Macrognathus pancalus</i>
10	Ambassidae	Chanda	Elongate glassperchlet	<i>Chanda nama</i>
11	Gobiidae	Bele	Tank goby	<i>Glossogobius giuris</i>
12	Palaemonidae	Chatka chingri	Monsoon river prawn	<i>Macrobrachium malcolmsonii</i>
13	Osphronemidae	Khalisa	Banded gourami	<i>Colisa fasciata</i>
14	Nandidae	Bheda	Gangetic leaffish	<i>Nandus nandus</i>

It was revealed that the Hetimganj point situated in Surma river have some possibilities of natural spawning ground of carp fish species due to create some sanctuary in *beel* area and established 10 kua/katha across 50 km distance in river site. Local DoF officials and fishermen also stated that there are some deeper portion (locally called as Dor) situated upstream of Hetimganj point in the Surma river where local fishermen was established some fish shelter (Kua/katha) to protect and conserve the fish biodiversity and ecosystem in *haor* area. Carp brood fish was available there and as a result the carp spawn collected by savar net during the study period.

Once upper Meghna stock was the important natural carp spawn stock in Bangladesh. The major tributaries in the area include the Surma, Kushiara and Khoai rivers that originate in the Letha Range, as well as the Boulai River that originates in the southern slope of the Assam hills of India. There is relatively little information on carp spawning grounds and spawn collection centers on the upper Meghna in Bangladesh. Unlike other river systems, there are no commercial carp spawn collection centers in the upper Meghna river basin [7]. Spawning of this stock may take place long distances upstream in India, or the spawning may be so limited that it does not attract fry/spawn collectors. However, some authors indicate that there are spawn collection centers located at the headwaters of the Surma River in Manipur province, and some in the Tripura province in India [5]. Paul (1997) [8] does mention some locations where local fishermen collect carp spawn from the wild, noting seven carp spawn collection points in the greater Sylhet basin: i) Juri river in the Hakaluki haor upstream from the Fenchugonj Bridge; ii) Kawani river near Daulatpur and Milonpur, the Boroiya river near Shanbari bazaar, and the Baulai river near Mukshedpur in Dharampasha Upazila; iii) Baulai river near Alamduarer bank in Tahirpur upazila; iv) Surma river near Sunamgonj; v) Dhanu river near Ranichapur and Chalamati of Khaliajuri upazila; vi) Kalni river near Maruli of Derai Upazila; and vii) Khoiltajuri river near Dighirpar in Companigonj Upazila. However, these sites have not been investigated, and thus detailed information on the natural carp spawns collection and breeding grounds in the area is not available. Tsai and Ali

(1985) [6] stated that the upper Meghna stock has declined greatly in the Sylhet-Mymensingh basin, where there has been no spawn fishery. They also reported that overfishing in the carp fishery (post-recruitment phase), not the spawn fishery (pre-recruitment phase), is the most important factor responsible for the decline of major carps in the existing open waters in the river system.

3.2 Water quality parameters

Water quality parameters such as temperature, turbidity, acidity, alkalinity, CO₂, pH, dissolved oxygen (DO), chloride, Hardness, Nitrite, TDS have been measured throughout the study period. The overall results of water quality parameter in different sites are presented in Table 3. Water quality parameters were analyzed in each site to observe any appreciable changes that might have occurred in response to different place. In the present study, the water quality parameters were found some variations and fluctuate almost within the optimal ranges in different sites. The water quality parameters were comparatively good at Hetimganj point from other three sites. In Hetimganj point, the investigation showed that the levels of temperature, turbidity, DO, CO₂, pH, chloride, nitrite and acidity were within the standard limit set for fisheries. TDS, alkalinity and hardness were comparatively low due to monsoon period. According to Rahman (1992) [9] the standard limit of Alkalinity is >100 ppm and transparency is 40 cm or less. Huq and Alam (2005) [10] reported that the standard limit of TDS is 165 ppm and hardness is 123 ppm, where Das (1997) [11] reported the standard limit of pH is 6.5-8.5 and DO is 5.0 ppm. However, the values of water quality parameters were not significant difference among different sampling sites. Although water quality parameters showed some variations among different sampling points, they do not have any definite trend in respect of fish seed combinations as well as presence or absence of carp species with various densities. All water quality parameters of the four sampling points were found to be within the acceptable ranges for fisheries and there was no abrupt change in any parameter during the tenure of study.

Table 3: Water quality parameters of different sampling points

Water Quality Parameters	Hetimganj Point	Bhadreshar Point	Monumukh Point	Atgram Point
Acidity (total) mg/l	20.1±1.23	22.4±1.92	22.3±1.50	24.1±1.05
Acidity (Mineral) mg/l	52.7±0.96	49.8±0.29	47.2±0.86	44.4±0.46
Alkalinity (mg/l)	78.6±2.56	74.1±1.95	80.2±2.74	72.8±3.40
Ammonia (mg/l)	0.18±0.03	0.19±0.05	0.21±0.03	0.20±0.06
CO ₂ (mg/l)	6.1±0.10	6.0±0.05	6.7±0.07	7.2±0.12
Chloride (mg/l)	62.3±2.50	74.6±4.12	72.5±3.50	71.6±2.54
DO (mg/l)	8.2±0.32	7.8±0.25	6.5±0.43	7.1±0.43
Hardness	85.4±3.85	73.8±2.32	80.2±4.76	70.2±3.05
Nitrite (mg/l)	0.04±0.01	0.03±0.02	0.03±0.02	0.05±0.01
pH	6.9±0.02	7.1±0.03	7.5±0.04	6.7±0.05
Temperature (° C) (at surface)	29.4±1.25	30.3±1.42	29.1±1.56	30.2±1.34
Temperature (° C) (at 1m depth)	28.1±1.64	29.5±1.05	28.3±1.56	29.4±1.32
Turbidity (cm)	19.6±1.50	23.5±1.34	22.4±1.90	21.6±2.21
TDS (mg/l)	88.4±2.43	78.7±3.65	91.4±2.75	83.7±3.08

4. Conclusion

The study revealed that only one sampling point had positive response for the availability of carp spawn out of four sampling points in Surma and Kushiara River. The availability of carp fish seed at Hetimganj point may be indicated the existence of natural spawning ground in the Surma River. Water quality was also in good condition at

Hetimganj point in Surma compared to other three points which was positively related to carp seed production. There were so many limitations such as- very short duration of study period, small numbers of fishing gear (savar net) used, limited sampling points and shortage manpower with small budget etc. for conducting this study. Therefore an advance and comprehensive study should be required to identify the actual

spawning ground of carp seeds in Surma and Kushiara River. Furthermore, public responsiveness should be amplified about importance of natural spawning ground, unused illegal gear, implementing rules and regulation, establishment of sanctuary and over fishing during breeding season will be recommended.

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