E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2018; 6(4): 479-483

www.fisheriesjournal.com
Received: 28-05-2018
Accepted: 29-06-2018

Dr. Anindya Sundar Ghosh
Deputy Director of Fisheries, (FFRTC) Freshwater Fisheries Research and Training Centre, Kulia, Kalyani, District- Nadia West Bengal, India

Shyamal Kumar Ghosh
Assistant research Officer, (FFRTC) Freshwater Fisheries Research and Training Centre, Kulia, Kalyani, District- Nadia West Bengal, India

Mousumi Ghosh
Assistant research Officer, (FFRTC) Freshwater Fisheries Research and Training Centre, Kulia, Kalyani, District- Nadia West Bengal, India

Azad Ali
Project Assistant, (FFRTC) Freshwater Fisheries Research and Training Centre, Kulia, Kalyani, District- Nadia West Bengal, India

Correspondence
Dr. Anindya Sundar Ghosh
Deputy Director of Fisheries, (FFRTC) Freshwater Fisheries Research and Training Centre, Kulia, Kalyani, District- Nadia West Bengal, India

Studies on biodiversity of selected indigenous fish species, in Beels and Baors of South Bengal and their breeding potential through habitat modification

Dr. Anindya Sundar Ghosh, Shyamal Kumar Ghosh, Mousumi Ghosh and Azad Ali

Abstract
Small indigenous fishes are the cheap sources of animal protein, vitamins, calcium, iron etc. In recent past number of different small indigenous fish species are disappearing from beels, ox-bow lakes due to destruction of breeding ground and several other reasons. A survey on biodiversity of small indigenous fish species in five beels of Nadia and North 24 Parganas districts of West Bengal, India was carried out and five commercially important species were identified to propagate and culture. Breeding behavior of these five species was studied with different habitat modification and critical breeding factor was identified. Population of *Gudusia chapra* and *Chela achius* was re-established in Mathura beel, Kanchrapara through erection of pen and certain habitat modification. On the other hand natural breeding of *Amblypharyngodon mola* and *Puntius sophore* in farmers' pond were established. Inundation, flooding and escape of fishes are some of the constraints for which the exact quantification of selected fish recruitment was sometimes difficult to accomplish.

Keywords: Small indigenous fishes, beels, natural breeding, seasonal ponds

1. Introduction
Beels and Baors of West Bengal harbor an enviable spectrum of small indigenous fishes. Abundantly available hitherto, stock of these valuable native species is dwindling at an alarming rate. Habitat destruction, maximum harvesting rate, agricultural surface run off containing pesticides, are mainly causing the destruction. In recent past implementation of flood control, drainage and irrigation projects have considerably reduced the area and duration of flooding (Hussain et. el 1997) [1] which resulted loss of natural habitat and breeding ground of small indigenous fish. Apart from being delectable to the Bengali palate, these fishes form an integral part of the ecosystem of the natural water bodies. Since small fish are normally consumed with bones, they are important source of calcium (Roos *et al*., 1999) [2] Small indigenous fishes are not only the cheap sources of animal protein but also an ideal source of essential nutrients like iron, vitamin etc. Trials have been made for culture of some of those small fish in experimental pond but standardization of culture package is still awaited. On the other hand propagation and re-establishment of the other small species in their natural environment through ranching followed by seed production is also not practicable due to several reasons like predation and aquaculture pressure. Furthermore, captive environments often differ substantially from wild habitats causing behavioral differences to arise as a result of differential experience (Price, 1999) [3]. Few conservation studies have specially investigated the relationship between rearing environment and behaviors that are likely to be fundamental to post-release survival. (Kelley et. al, 2005) [4]. Five different small individual species (*Amblypharyngodon mola, Puntius sophore, Mystus vittatus, Gudusia chapra, Chela cachius*) with high consumer preference was taken in the present study for higher production and as well as restoration in their natural environment. The small size of these species makes it impractical to propagate them through induced breeding technique. Hence this project was taken up with an objective to study their breeding behavior under natural condition and congenial environment for their propagation.

Restoration of breeding ground and measures to popularize culture practice of these fishes in village ponds by providing ideal breeding and rearing condition would be the task ahead for scientists, extension personnel and fish farmers.

Prior to breeding trials, biodiversity of small indigenous fish species was measured through monthly sampling in different beels and information on abundance of these species was collected.

Small fishes such as *Puntius sophore* and *Amblypharyngodon mola* (Hamilton, 1822) [5] breed naturally in Beels. But availability of *A. mola* is less due to its soft structure, sluggish movement rendering it susceptible to predation. Repeated netting being the mainstay of capture fisheries makes the delicate seeds of *Amblypharyngodon mola* even more vulnerable to physical injury. Freshwater flush plays an important role in natural breeding of *Puntius sophore* and *Mystus vittatus*. *Gudusia chapra* is a prolific breeder under favorable conditions and breed up to five times a year. But its stock is found to decline after few years in different beels that may be attributed to changes in hydro biological condition of beels. Being a fast swimming pelagic fish, infestation of floating weeds may be a cause of sudden decline of huge stock of this fish as per records of the Fishermen co-operative society that manage these large water bodies.

Experimennt to study breeding behavior of the Indian river shad *Gudusia chapra* was conducted at Mathura Beel, Kanchrapara. Results of the experiment were quite encouraging and comprehensive. But the natural breeding experiment of *Mystus vittatus* was partially successful. Breeding of this fish took place in the enclosure with freshwater flush and in farm ponds of FFRTC (Freshwater Fisheries Research and Training Centre), Kalyani, West Bengal India, but it was very difficult to collect and quantify the off springs of this fish due to its nocturnal habit and the species also do not respond in drag netting to measure the recruitment.

Silver hatchet, Chela, *Chela cachius* is a small, slender food fish that needs immediate attention as its availability is highly localized but in first phase it could not be stocked in our experiment. It took some time to create a sizable stock of this bentho-pelagic fish by collection from various sources. Growth and breeding biology of *Chela cachius* has been studied in FFRTC farm ponds as well as in Mathura Beel in the similar habitat modification as in the case of *Gudusia chapra.*

2. Materials and Methods

2.1 Location of Experiment

Mathura beel, Kanchrapara (Latitude: 22.949230 Longitude: 88.42092) was selected as an experimental site for *Gudusia chapra* and *Chela cachius* due to its proximity to our institute as well as ease of management. Study of breeding behavior of *A.mola, P sophore* and *M. vittatus* and growth with IMC of six farmers' ponds was carried out at Berbari, Chakdaha, (Latitude 23.083333. Longitude: 88.516667) Nadia. All the species were stocked at experimental farm of FFRTC (Freshwater Fisheries Research and Training Centre, Latitude: 22.9851 Longitude: 88.4333) to study their breeding behavior.

2.2 Species diversity indices

Information regarding ideal habitat for breeding of different indigenous fish species was collected through a survey based on questionnaires. Present status, availability of this species in five different beels were studied through monthly sampling. Simpson's dominance index was calculated issuing the formula

$d = Nmax / N$

where Nmax is the number of individuals in the most abundant species and N is the number of individuals.

Diversity of small indigenous fish fauna of five different beels were calculated using shanons indices.

ii) $\mathbf{H=\sum (P_i \text{ X } \ln p_i)}$

H= Samon Weaver Index

Pi= Number of individuals of Species /Total number of species

While calculating both the indices, population of Indian Major Carp & other catture species of Carp was not taken to into account.

2.3 Habitat modification for *A. mola, P. sophore, M. vittatus, G. chapra.*

Different modification of habitat was identified based on instinctive knowledge of farmers and previous information. As *P. sophore, M. vittatus* was reportedly shown better spawning performances in water body with fresh water flush, arrangement of natural water flush from encatchment area through hume pipe & artificial water flush through pump operation form the same pond has been made. A third pond with 20% sewage contamination was taken to observe the effect of contaminated water on breeding performance, and forth pond without any modification was taken as control. *A. mola* having no specific breeding habitat been included in the same three modification along with the above two species. All the three ponds of nearly (0.1) hector were stocked with 200,300,500 nos of *P. sophore, M. vittatus, A.mola* respectively. 100 nos. of each of the three species were also kept in three separate. Hapas (2.0 x 2.0 m) in duplicate.

2.4 Habitat modification of *G. chapra* & *C. cachius.*

Gudisia chapra is a pelagic and potamodromous species (Reide, 2004) [6] and occurs in lakes, ponds ditches and inundated fields. (Rahman, 1989) [7] It is a freshwater clupeid distributed widely in river system and so is *Chela cachius*. Both the species are reportedly needs high air flow of on water surface creating natural wave. As per survey report from farmers, *G. chapra & Chela cachius* was found to have disappeared from several beels which perhaps caused by floating weeds infestation and sewage contamination. Keeping the above facts in view two big pens (30m x 30m)m was erected in Mathura Beel resulting high wave caused by air flow. One of the pen was inoculated with water hyacinth as flowing weed and other kept blank. Third small pen (20m x 20m) was erected to provide less air circulation and wave as a modification. Two ponds of similar size (nearly 400 sq.m.) with 20% domestic swage contamination and the other with no modification was set as control. 80 nos. of gravid *G. chapra* and & *C. cachius* each was released in five sets of modification including control.

Stocking in all the sets were completed by April. Sampling was done at monthly interval to measure no. of breeding incidence, GSI, recruitment /Stock ratio fecundity, relative fecundity gonadal development and breeding performance under different modifications. Breeding incidence in a year and gestation period was calculated through indirect assay. Most of the species spawn in batches therefore after 1st breeding few numbers of. apparently spent brooders were restocked in hapa. 2nd spawning date was noted to calculate

spawning interval. On the other hand appearance of pick values of GSI at different time was also noted. Intervals from the two values tentative gestation period was calculated.
GSI was estimated as per June, 1953 [8]
GSI was calculated using the formula

$$GSI = \frac{\text{Weight of Gonad}}{\text{Body weight}} \times 100$$

2.5 Morphometric features and gonadal development
Some morphometric features viz wet, total length, standard length, fin length, head length, breadth, were also observed from the offsprings to see the maturity level of different age group/cohort.
Length was measured using scale and weight of fish was taken in a fine digital balance with a range of 1.0mg. to 100g.
Gonadal development was estimated by weighing the ovary and counting the number of eggs to estimate fecundity. Weight of egg was also taken in a fine balance.

2.6 Recruitment Stock ratio
Recruitment is a direct measure of number of offspring produced by the whole population Number of recruitment was estimate after repeated netting with fine net although in natural condition recruitment is affected by predation, aquaculture pressure. The recruitment stock ratio was calculated using formula R/S x100 were is R is the total no. of recruitment and S is the no. of individual/brooder already stocked.

2.7 Fecundity
Collected ovaries were kept in Gilson's fluid (6) for fixation, softening of overian tissue and hardening of the egg. After about six weeks ova washed with tapwater & kept on filter paper to dry and numbers was counted (Pal and Mahapatra, 2016) [9] Morpho metric features were estimated using centimeter scale and fine electronic balance.

3. Result and discussion
Survey of Beels under study shows 26 numbers of small indigenous fish species are abundantly available in these water bodies. Variation of species diversity was More or less same in all the Beels under study Fig-2 except in Sasadanga. This may be attributed to the fact that harvesting of fish through drag netting is less in Sasadanga, particularly in rainy season in comparison to the other beels due to which natural breeding and survival of spawns is much higher. Moreover. this large water body is connected to the river Ichhamati and there are several inlets through which water from catchment area flows into the beel during rainy season. Several riverine species are therefore present in Sasadanga along with its own rich stock. Relative abundance of *Puntius sophore* is more pronounced in Bhomra beel compared to others (Fig-1) *A. mola* is found in all the beels but its relative abundance is higher in Bhaluka, Chamta and Mathura beel. Relative abundance of *A. mola* is lowest in Bhomra beel that may be due to regular netting operation resulting in physical injury, disturbance in breeding ground of this soft bodied fish which has a long breeding season from March to October. Mystus vittatus is found in all the beels except Bhaluka but its abundance was more in Chamta. Dearth water flush from catchment area during monsoon may be the reason for absence of this species in this particular water body. Relative abundance of *Gudusia chapra* was found in Sasadanga and Bhaluka. *Chela cachius*, an endangered fish was found only in Mathura beel.

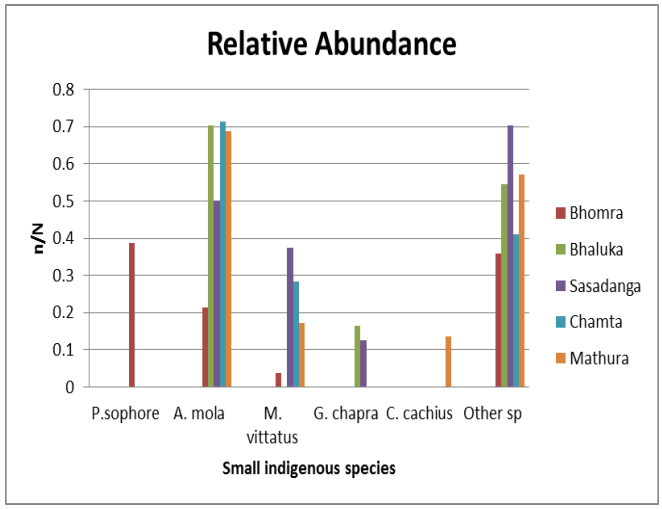

Fig 1

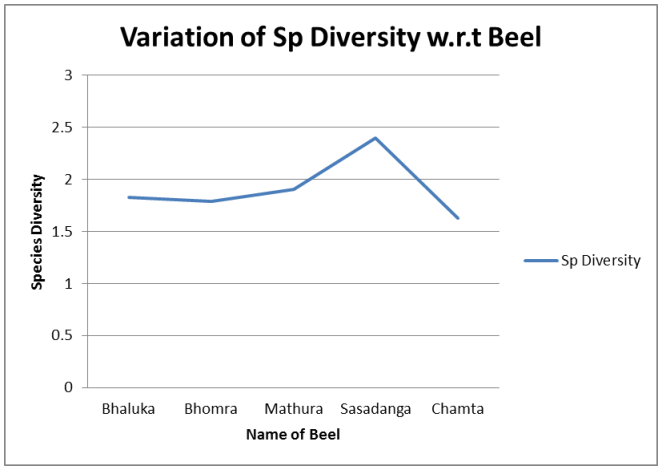

Fig 2

Table 1: Gonadal development and breeding performance of *A. mola*, *P. sophore* and *M. vittatus* under different habitat modification

Sl no.	Treatments	*A. mola*			*P. sophore*			*M. vittatus*		
		No of breeding incidence in a year	GSI	recruitment - stock-ratio after 1st batch of breeding	No of breeding incidence in a year	GSI	recruitment - stock-ratio after 1st batch of breeding	No of breeding incidence in a year	GSI	recruitment - stock-ratio after 1st batch of breeding
1.	T1	5	14.09±3.72	500	3	12.22±2.72	350	1	23.16±0.25	+ve
2.	T2	5	13.56±3.02	550	2	11.02±2.52	270	1	20.0±0.27	+ve
3.	T3	5	14.10±3.72	500	1	10.10±2.02	200	0	-	-ve
4.	control	5	14.02±3.72	560	1	10.22±2.32	220	0	-	-ve

Index: T1=Pond with natural water flush, T2= Pond with water through pump, T3= Pond with 20% domestic sewage, control= Pond with no modification.

Table 2: Gonadal development and breeding performance of *G. chapra* and *C. cachius* under different modification

Sl no.	Treatment	*Gudusia chapra*			*Chela cachius*		
		No of breeding incidents in a yr.	**GSI**	**recruitment - stock-ratio after 1st batch of breeding**	**No of breeding incidents in a yr.**	**GSI**	**recruitment - stock-ratio after 1st batch of breeding**
1.	T1	3	4.49±0.82	108.75	1	8.90+ 0.97	-ve
2.	T2	2	5.28±1.065	330.00	1	10.19+2..27	+ve
3.	T3	4	4.89±0.965	137.50	2	10.10+3.39	+ve
4.	T4	2	3.1±0.650	73.75	-	8.89+2.10	-ve
5.	Control	2	3.0±0.550	50.00	-	8.80+1.73	+ve

N.B. T1= Big pen with aquatic weed, T2= Big pen without aquatic weed, T3= Small pen without aquatic weed, T4= Pond with sewage contamination, Control= Pond with no modification.

Table 3: Maturity stages and development of gonads in relation to Length and weight of offspring of small indigenous fish

SI no.	Species name	Batch	Weight (g.) Mean±SD	TL (cm.) Mean±SD	SL(cm.) Mean±SD	FL(cm.) Mean±SD	HL(cm.) Mean±SD	BD(cm.) Mean±SD	Weight of Ovary (g.) Mean±SD	GSI Mean±SD	Fecundity Mean±SD
1.	*Gudusia chapra*	1 st batch of offsprings	23.09±	14.08±1.35	11.86±1.31	12.38±1.409	1.98±0.13	3.86±0.47	1.046±0.385	4.48±0.82	1248±979.04
		2nd batch of offsprings	10.03±3.67	10.6±1.29	8.75±1.2503	9.3±1.26	1.72±0.15	2.7±0.34	0.29±0.20	2.76±1.04	275±35.35
		3rd batch of offsprings	2.01±0.401	6.12±0.377	4.875±0.18	5.25±0.31	0.8±0.141	-	-	-	-
2.	*Amblypharyngodon mola*	1 st batch of offsprings	4.98±0.14	7.1±0.25	6.125±0.170	6.725±0.22	0.97±0.221	1.92±0.05	0.685±0.044	13.82±0.841	1129.5±261.96
		2nd batch of offsprings	3.3±0.28	6.78±0.26	5.44±0.25	5.88±0.303	0.76±0.26	1.72±0.109	0.39±0.125	11.79±3.72	491±181.39
		3rd batch of offsprings	0.94±0.099	4.3±0.28	3.5±0.2	3.84±0.207	0.42±0.0836	0.96±0.089	-	-	-
3	*Puntius sophore*	1 st batch of offsprings	9.13±1.38	8.26±0.42	6.78±0.349	7.38±0.420	4.34±0.192	2.46±0.207	1.47±0.71	15.55±4.82	2808±1030.77
		2nd batch of offsprings	3.016±0.39	6±0.435	4.74±0.32	5.3±0.244	0.62±0.192	1.66±0.270	0.137±0.062	4.402±2.065	282.25±133.38
		3rd batch of offsprings	1.05±0.1006	3.96±0.321	3.06±0.23	3.4±0.3464	0.43±0.0577	1.06±0.0577	-	-	-

N.B. TL= total length, SL= standard length, FL= fork length, HL= head length, BD= body depth.

Table -1. shows data related to gonadal development and breeding performance of *A. mola, Puntius sophore* and *Mystus vittatus* In the present experiment *A. mola* was found to breed 5 times in a year in all the four modified set-ups. As per Bhuiyan A.L., 1964, [10] egg laying tendency of *A. mola* increases at the commencement of the rains. This is in conformity with our observation as on all the occasions of spawning there was an incidence of rainfall prior to its natural breeding. This was assessed indirectly from various size groups of fry. There was no remarkable difference in spawning of *A. mola* in all the experimental modification. Recruitment -Stock ratio in first batch of breeding was in the ranged of 500 to 560 percent in all the ponds. Gonadosomatic index was in the range of 13.56 to 14.10. It may be inferred that *A. mola* can breed easily in all types of environment in suitable weather conditions.

In case of *Puntius sophore* spawning was observed in 3 different occasions in pond with natural water flush where as in the pond with artificial water flush, spawning was observed only twice during a span of 1 year. Stock- recruitment ratio follows the same pattern with a higher value of 350 in pond with natural water flush as compared to the pond with artificial water flush that recorded a lower value of 270. Breeding incidence dropped to only once during a year in the ponds with no water flush. Highest GSI value was recorded in pond with natural water flush (12.22) where as in the pond with domestic sewage it was 10.10. There is no remarkable difference in values of GSI in different treatments From this observation it may be inferred that *Puntius sophore* does attain maturity in different environments but natural water flush plays an important role in its spawning.

Number of off springs of *Mystus vittatus* could not be quantified as they take refuge in muddy pond bottom. However released eggs of *Mystus vittatus* were observed in hapa after first shower of monsoon. In pond with natural water flush as well as in the pond with artificial water flush breeding was observed but no recurrence of breeding incidence of the spent fishes was seen throughout the year. This needs further study to observe the breeding behavior of *Mystus vittatus* with natural water flush.

As per Vinci *et al*., 2005 [11] *Gudusia chapra* breeds 3 to 4 times per year. This is in conformity with breeding experiment conducted in pen and ponds of FFRTC as shown in Table-2 where number of breeding incidence is in the range of 2 to 4. Wave and wind action may also provide an ideal environment for breeding of these clupeids. It was found that *Gudusia chapra* breeds after an interval of 30 to 40 days. Chela cachius breeds freely in ponds, tanks and small streams (Talwar and Jhingran, 1991) [12]**.** This is close to our observation as the fishes in different treatments in the present experiment were found to breed naturally, albeit with different spawning rates. GSI values of female *Chela cachius* is in the range of 8.10 to 10.19 that have semblance with the GSI values recorded by Kohinoor *et al*., 2005 [13].

Table 3 shows morphometric and gonadal maturity of different batches of off springs produced by brooders of *Gudusia chapra, A. mola, Puntius sophore.* The fecundity of first batch of off springs of *G. chapra* was 1248 eggs per gram of body weight that is similar to the result of (1228 eggs per gram of body weight) Mondal and Kaviraj, 2010 [14]. *A. mola* offspring were found to attain maturity at 3.3g. of weight. Females of 6.78 cm. were found to be sexually mature where as those with a length of 4.3 cm. did not attain maturity. This observation is similar to that of Gupta and Banerjee, 2013 [15] Its prolific breeding in a temperature range of 25 to 34 ºC indicates that *A. mola* can breed easily even in polluted water in suitable weather condition. The GSI values of first and second batch of female off springs of *A. mola* was 13.82 and 11.79 respectively. This is within the range of GSI value of 1.39 to 12.75 observed by Mondal and Kaviraj, 2013 [16] In this experiment, minimum weight at which *Gudusia chapra* off springs attained maturity was about10.03g. It may be inferred from three different sizes of off springs during the experimental period that *Gudusia chapra* breeds at least three

times during a year (March to October) as and when different batches of fishes attain maturity. First signs of maturity of *Puntius sophore* offsprings were observed in fishes weighing about 3.016g.

4. Conclusion

Critical breeding factor of some small indigenous fishes in beels could be identified. But this experiment needs to be repeated over a period of time under different environmental conditions so as to confirm all the aspects related to breeding and survival of these valuable fishes.. Natural population of *Mystus vittatus,* is decreasing owing to high fishing pressure, aquatic pollution, loss of habitat, natural disasters, reclamation of wetlands, and excessive floodplain siltation (Dudgeon, 1992) [17] Restoration of natural breeding ground of this species will be the first step in conservation of this indigenous small fish. Some small indigenous fish, including *A. mola*. Our aim is to re-establish *Chela cachius* and *Gudusia chapra* in beels and to encourage farmers to cultivate *A. mola* and *Puntius sophore* with IMC with a suitable package in their ponds with nine to ten months water holding.

5. Acknowledgement

The authors sincerely acknowledge the Director of Fisheries, Government of West Bengal to provide necessary fund to carry the experiment. We are thankful to Sri Kamal Kumar Goon (District Fishery Officer), Sri Manas Dasgupta and Sri Snehasish Bhattacharyya (Assistant Research Officer Afrin Nahar, Assistant Research Officer, FFRTC and Amit Ghosh, Project Assistant for rendering all possible help for this research project. The authors also acknowledge CEO, Chairman, Secretary and all members of Kanchrapara Refugee Fisherman Co-operative Society Ltd., District- North 24 Parganas, West Bengal for extending all co-operation to carry out the experiment in Mathura Beel. We express our sincere gratitude to the fish farmers of Berbari, Chakdaha, District-Nadia, West Bengal for their active participation in study of breeding behavior of selected indigenous fishes in their ponds during the experimental period.

6. References

1. Hussain MG, Kohinoor AHM, Akhteruzzaman M, Rahman MA, Mazid MA. Biodiversity of small indigenous fishes and FRI research activities for production and conservation. Proceedings of National Workshop on Small Indigenous Fish Culture in Bangladesh. Rajshahi University, 1997, 45-55.
2. Roos N, Islam Md. M, Thilsted SH, Ashrafuddin Md. Mursheduzzaman DM, Mohsin DM *et al*. Culture of Mola (*Amblypharyngodon mola*) in Polyculture with carps – Experience from a Field Trial in Bangladesh. Naga, The ICLARM Quarterly April to June 1999; 22(2):16-19.
3. Price EO. Behavioral development in animals undergoing domestication. Applied Animal Behavior Science. 1999; 5:245-271
4. Kelley JL, Magurran AE, Garcia CM. The influence of rearing experience on the behavior of an endangered Mexican fish, *Skiffia multipunctata, Biological Conservation*, 2005; 122:223-230.
5. Hamilton E. (Buchanan), An account of Fishes found in the river ganges and its branches, Edinburgh and London, Fishes Ganges, 1822, 1-405.
6. Reide K. Global register of migratory species- from global to regional scales. Final Report of R & D- Project 808 05 081. Federal Agency for Nature Conservation, Bonn, Germany, 2004, 329.
7. Rahman AKA. Freshwater fishes of Bangladesh. Zoological Society of Bangladesh. Department of Zoology, University of Dhaka, 1989, 364.
8. June FC. Spawning of Yellow fin Tunain Hawaiian waters. US Fish Wild Serv. Fish Bull. 1953; 45:47-64
9. Pal M, Mahapatra BK. International journal of Fisheries and Aquatic studies. Fecundity and GSI of Mourola, *Amblypharyngodon mola* (Hamilton- Buchanan, 1822) from south Bengal district of West Bengal. 2016; 4(5):47-53.
10. Bhuiyan AL. Fishes of Dacca, Asiatic soc. Pakistan, Pub. 1964; 1(13):39-40.
11. Vinci GK, Suresh VR, Bandyopadhyaya MK. Biology of *Gudusia chapra* (Hamilton-Buchanan) from a floodplain Wetland in West Bengal, Indian Journal of Fisheries. 2005; 52(!):73-79.
12. Talwar PK, Jhingran AG. Inland fishes of India and adjacent countries, volume 1. Oxford & IBH Publishing Co Pvt Ltd, New Delhi-Calcutta, 1991a, 542.
13. Kohinoor AHM, Islam MS, Thilsted SH, Wahab MA. Reproductive Biology of three important indigenous small fish viz., Mola (*Amblypharyngodon mola*), Chela (*Chela cachius*) and Punti (*Puntius sophore*). Iranian Journal of Fisheries Sciences. 2005; 5(1):29-48.
14. Mondal Debjit Kumar, kaviraj Anilava. Feeding and reproductive biology of Indian shad *Gudusia chapra* in two Floodplain lakes of India. Electrinic Journal of Biology. 2010; 6(4):98-102.
15. Gupta S, Banerjee S. Studies on some aspects of Reproductive Biology of *Amblypharyngodon mola* (Hamilton-Buchanan, 1822). International Research Journal of Biological Sciences. 2013; 2(2):69-77.
16. Mondal Debjit Kumar, kaviraj Anilava. Feeding and reproductive biology of *Amblypharyngodon mola* (Cypriniformes: Cyprinadae) from floodplain lakes of India. Int. J Aquat. Biol. 2013; 1(3):125-131.
17. Dudgeon D. Endangered Ecosystems: A review of the conservation stats of tropical Asian rivers. Hydrobiologia. 1992; 248:167-191.