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Seasonal Kitchen Pond as an Ideal Source for Propagation of *Amblypharyngodon mola* (Hamilton, 1822)

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Abstract The role of small indigenous fish species (SIS) is very important in India. These fishes provide food, nutrition, subsistence and supplementary income. Until recently, possibilities of culture them in combination with the Indian major carps were unexplored. So, an experiment in this regard was carried in the FFRTC, Kulia, Kalyani, Nadia, West Bengal from August 2017 to May 2018. Polyculture of Indian major carps with small indigenous fish species (*Amblypharyngodon mola*) was conducted to evaluate the production potential. Three treatments with two replicates were tested. Indian major carps and small indigenous fish species were stocked at the rate of 7500/ha and 20/deci, 40/deci and 60/deci respectively. Observed ANOVA value of 4.0078 at 5% level of significance showed no significant difference between the replicate though the productions in three treatments were different. The highest production 1783.33 kg was obtained in treatment-3 where Indian major carps were cultured with *Amblypharyngodon mola* with an inoculums of 60/deci. It is observed that if partial harvesting is made, polyculture of Indian major carps with small fish is a better proposition in terms of biological production.

Keywords Small indigenous fish species, Specific growth rate, Fecundity, Morphometry, Gonadosomatic index.

Introduction

Small indigenous fish species like *Amblypharyngodon mola, Puntius ticto, Puntius sarana, Chela cahius* were abundant in the ponds of West Bengal. But rampant use of mohua oil cake which is used to eradicate predatory fishes has diminished the stock of small indigenous fishes to almost nil and so the price of SIS in the market is high. Anthropogenic pollution is another cause for the declining stock of these species.

Three species of Indian major carp viz : *Catla catla, Labeo rohita* and *Cirrhinus mrigala* and three species of exotic carp viz : *Hypopthalmychthys mo-*

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litrix, Ctenopharyngodon idella and *Cyprinus carpio* are presently cultured in the ponds of West Bengal. The culture methods are tradition and extensive, so the production is low. The majority of fish eaten by the rural poor people is the small indigenous fish species which have been defined as species which grow to a maximum length of about 25 cm. Among the SIS, *Amblypharyngodon mola, Puntius ticto, Puntius sarana, Chela cahius, Gadusia chapra* and *Mystus vittatus* are of special interest to the fish culturist because of their high nutritional value.

Lack of research and information has led to limited propagation of SIS, most of which are hardly in nature and adapt easily to shallow water conditions. It is also proved that these species can be cultured without any supplementary feed. Small scale aquaculture of *Amblypharyngodon mola* (mola) *Puntius sophore* (puti), *Osteobrama cotio* (dhela),*Cirrhinus reba, Labeo bata* (bata), *Gudusia chapra* (chapila) along with IMCs has been reported (Sarkar 2010). There are also reports of successful captive breeding of some SIS.

Considerable work has been done on the culture and breeding of Indian major and Chinese carps, but no serious attempt has yet been made to culture them with carps in polyculture management. But the culture of these small indigenous fish species with Indian major carps may contribute to the diet of the rural poor. In view of the aforesaid context, the aim of this study was to assess the production potential of small indigenous fish species, *Amblypharyngodon mola* with carps under low cost management systems.

The small indigenous fish *Amblypharyngodon mola* is eaten whole by the rural poor and as such the bones of the fishes are crushed within the mouth and it contributes to the calcium intake of the body. It has also been proved that *Amblypharyngodon mola* is a good source of retinol and it maintains the health of the eye.

If the low lying fallow water resources of the country, presently largely unutilized, are brought under need based culture practices, with a focus on locally important SIS, the food security of the country could be increased (Sugunan 2010). There is now a marked decline in the availability of these species, in paddy fields, for example-The habitat of these species should be protected to conservation. There is need to consider their introduction in paddy fields, particularly in starvation affected area (Poniah 2010).

Fig. 1. Experimental site.

Materials and Methods

Site of experiment : The experiment was conducted at Berbari village of Chakdah Development Block located longitude 88.52 E and latitude 23.07 N (Fig. 1).

Stocking density : *A. mola* was stocked with Indian major carp in 6 (six) tanks in 3 ratios of n, 2n, 3n where n=100. There was a duplicate for each arrangement. A control without small indigenous fish was added to compare the difference between the two treatments. IMC was stocked uniformly @ 7500/ha in all the six tanks.

Preparation of Pond

Deweeding : The water hyacinths of the ponds were cleaned by labor. The marginal weeds were irradicated by using glyphosate.

Irradication of carnivorus fishes : Carnivorus fishes like *Channa punctatus, Channa marulius* were irradicated by application of mohua oil cake @ 2500kg/ham. The small indigenous fishes along with Indian major carp were released after 3 weeks of application of Mohua Oil Cake. The toxicity of mohua oil cake ceases after 21 days and it changes into a manure which helps in the production of plankton.

Table 1. Water quality parameters in the tanks of Chakdah.

Parameter	Aug to Dec				Jan-Jun			
	T_1	T_2	T_3	T_c	T_1	T_2	T_3	T_c
Depth (ft)	4.5 ± 0.03	4.4 ± 0.05	4.2 ± 0.02	4.5 ± 0.05	4.3 ± 0.02	4.3 ± 0.02	4.4 ± 0.02	4.6 ± 0.04
Temp (°C)	30.8 ± 0.5	30.6 ± 0.4	30.8 ± 0.5	30.7 ± 0.5	32.1 ± 0.6	32.2 ± 0.6	31.0 ± 0.6	32.1 ± 0.5
pH	7.8 ± 0.04	7.7 ± 0.06	7.2 ± 0.03	7.6 ± 0.04	7.9 ± 0.05	7.8 ± 0.04	7.3 ± 0.04	7.8 ± 0.04
DOmg l^{-1}	4.8 ± 0.03	4.7 ± 0.03	4.9 ± 0.02	4.8 ± 0.02	4.7 ± 0.03	4.7 ± 0.02	5.1 ± 0.03	4..9 ± 0.04
Total alkalinity (mg l^{-1})	77 ± 2.5	75 ± 2.25	82 ± 2.4	83 ± 2.5	77 ± 2.0	76 ± 2.0	81 ± 2.2	80 ± 2.1
Plankton density (ml 50 l^{-1})	4.7 ± 0.04	4.6 ± 0.02	4.8 ± 0.03	4.7 ± 0.03	4.6 ± 0.02	4.4 ± 0.02	4.6 ± 0.04	4.4 ± 0.02

Liming : Limestone was dissolved in water the previous day and broadcasted on the pond in the early morning next day. It was applied @ 500kg/ha. 20% of the total dose was applied when the pond was prepared and the rest 80% was divided into 20 equal installments and applied at an interval of 15 days.

Manuring : Organic manure (cowdung) was added with inorganic manure (urea and phosphate) and mixed in a pit to make a juice. Cowdung was applied @ 10,000kg/ha, Urea @ 350kg/ha and Single super phosphate @ 500kg/ha. The juice was applied in the tanks instead of raw fertilizers. Direct manuring was avoided as it often leads to eutrophication.

Feeding : Small indigenous fishes were fed with 0.8 mm pelleted feed and eventually fed with 2mm feed. Indian major carp were fed with 2 mm feed and eventually switched onto 4 mm feed. The feeding was done twice in a day i.e. in the early morning and late afternoon @ 3% of the total biomass of the pond. Kitchen waste was used as an supplementary feed to reduce the cost of feeding.

Water quality : The water quality was tasted monthly by using Merck UN 3316 Kit made in Germany.

Sampling : Each tank was sampled fortnightly by using drag net of 1/4 inch. The length and weight was recorded on each sampling date and the specific growth rate (SGR) was calculated using the following formula

$$SGR = \frac{\text{In (find wt)} - \text{In (initial wt)}}{\text{No.of days}} \times 100$$

Harvesting : The final harvest was done at the end of 10 months for Indian major carp by using drag net. Since small indigenous fishes have planktonic life, they were harvested in 4 months interval and the length and weight of different size groups were recorded separately.

Gonado somatic index : It was studied using the formula given below :

$$GSI = \text{Weight of Gonad/Weight of the fish} \times 100$$

An incision from Genitoanal pore to the base of the pelvic fin was made. The two sides of the skin was stretched to open up the thoracic and abdominal cavity. The gastro-intestinal contents were removed. The ovary was taken out with the help of forceps.

Fecundity : The absolute fecundity was measured by with the help of sedwig rafter cell. The female gonad was kept in absolute alcohol to dissolve the adipose tissue containing fat. It was left over night so that the individual eggs become free and can be counted easily in the sedwig rafter cell.

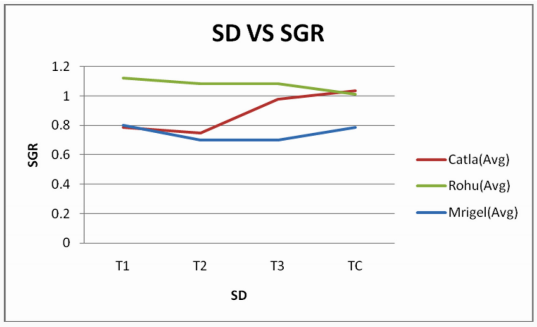

Fig. 2. Specific growth rate of Catla, rohu and mrigel.

Table 2. Production of the tanks at the time of final harvest.

	T_1		T^1_2		T_2		T^1_3		T_3		T^1_3	
	Total wt (kg)	Mean individual± SD wt (g)	Total wt (kg)	Mean individual ± SD wt (g)	Total wt (kg)	Mean individual ± SD wt (g)	Total wt (kg)	Mean individual ± SD wt (g)	Total wt (kg)	Mean individual ± SD wt (g)	Total wt (kg)	Mean individual ± SD wt (kg)
Water area	0.043 ha		0.043 ha		0.043 ha		0.043 ha		0.043 ha		0.043 ha	
C. catla	32.4	443.83 ±9.5	34.5	442.26 ±8.2	35.9	491.78	36.3	487.89 ±5.2	44	431.37 ±9.3	43.2	428.46 ±6.2
L. rohita	24.6	416.94 ±9.14	25.6	415.85 ±8.26	18.5	313.5 ±8.2	19.4	310.21 ±6.2	39	481.48 ±9.7	40.6	483.12 ±4.2
C.mrigala	11.2	212 ±7.1	10.5	215 ±6.7	11.5	223 ±7.2	12.4	240.45 ±2.8	24	331.4 ±8.3	23.8	335.62 ±3.6
IMC production (kg/ha)	1586.04	–	1641.86	–	1532.5	–	1583.72	–	1783.33	–	1750	–
Survival (%)	86.1	–	85.3	–	84.2	–	85.7	–	85.5	–	86.6	–
A. mola	19	1.2 ±0.301	20.4	1.1 ±0.254	22	0.901 ±0.04	21.5	1.1 ±0.206	24.3	1.6 ±0.08	24.9	1.5 ±0.109
A. mola production (kg/ha)	883.72	–	925.58		1023.25	–	997.67		1125.58	–	1106.97	–

Results and Discussion

Stocking density of *A. mola* was 20, 40, and 60/ decimal. Kohinoor et al. (1998) reported adverse growth of IMC particularly rohu at *A. mola* pond. But in this case the stocking density of *A. mola* was much higher i.e.50—100/decimal (Table 1).

Ahmed et al. (2008) demonstrated that consumption of SIS is typically much higher in geographic areas close to inland capture fisheries, where people consumed 48.5–50.4 g per capita per day of SIS compared to 5.9–7.1 g per capita per day, in other areas. This indicates that inclusion of mola and other SIS in polyculture systems in areas without access to inland capture fisheries may be an important strategy to increase the quantity and diversity of SIS consumption.

Furthermore, systems with large fish and SIS produce more micronutrients than homestead ponds managed under traditional carp (large fish) polyculture regimes and are therefore uniquely placed to contribute to improved nutrition (Castine et al. 2017).

Ponds adjacent to the homestead offer an ideal opportunity for women to engage and participate in fish culture, in contrast to other forms of aquaculture and capture fisheries, from which women are often excluded due to cultural and social barriers and due to their being located away from the homestead (Sultana

Table 3. Morphometric measurements of *Amblypharyngodon mola.*

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
Amblypharyngodon mola	1st batch of offsprings	4.48 ±0.13	6.9 ±0.21	5.925 ±0.160	5.725 ±0.20	0.94 ±0.201	1.62 ±0.04	0.585 ±0.034	12.82 ±4.741	1021.5 ±241.36
	2nd batch of offsprings	3.6 ±0.29	6.98 ±0.28	5.94 ±0.27	8.28 ±0.403	0.96 ±0.36	1.92 ±0.169	0.49 ±0.225	09.79 ±3.72	691 ±142.39
	3rd batch of offsprings	1.094 ±0.99	4.9 ±0.29	4.05 ±0.5	4.084 ±0.237	0.52 ±0.0936	1.06 ±0.189	-	-	-

Table 4. Data of reproductive biology of *Amblypharyngodon mola*.

	T^1_1	T^1_1	T_2	T^1_2	T_3	T^1_3
No. of breeding incidence in a year	3	3	3	3	3	3
GSI	15.09 ±4.72	14.79 ± 3.38	14.56±4.02	15.46±3.05	15.10±4.72	14.69=4.77
Recruitment stock-ratio after 1st batch of breeding	400	390	350	365	380	392

and Thompson 2008). According to Ali et al. (2016), production of carp was higher ($p<0.05$) in demo farms (3.42 ± 1.64t ha^{-1}) than non-demo farms (2.49 ±1.46 t ha^{-1}) and also differed significantly ($p<0.05$) by sub-district.

Jha et al. (2018) used one way analysis of variance (ANOVA) was used to compare effects of water quality parameters on fish growth and production among treatments. Higher production of *A. mola* was reported by Ali et al . (2016) at 0.68 t/ha. At harvest the weights of *A. mola* ranged from 19 to 24.9 kg (Table 2).

Sultana (2012) recorded that the pond production ranged from 326.16 to 2187.40 kg/ha. The ratio of SIS and big fish production was calculated maximum as 1 : 0 : 10 (by number) and 1.746 (by weight). On the basis of final growth attained by each species, it was observed that among all the species, the highest average weight was attained by mrigel is which is in conformity with the result obtained by Kohinoor et al. (1998). The average net production of mola was 58.67 kg/ha/4 months. At harvest the weights obtain by mrigel was 11.2/10.5 kg. 11.5/12.4 kg, and 24/23.8 kg; by catla was 32.4/34.5kg, 35.9/36.3 kg, and 44/43.2 kg; by rohu was 24.6/25.6kg, 18.5/19.4 kg, and 39/40.6 kg in treatment T_1, T_2 and T_3 respectively (Fig.2).

The specific growth rate of rohu was between 1.31 to 1.36. The highest specific growth rate was obtained in treatment no. -3 followed by treatment no.-2 and 1. The SGR value of Catla was again higher in treatment no. -3. In treatment no.-1 and 2, the SGR value of Catla was same. The SGR value of mrigel range from 0.93 to 1.02. For mrigel, Treatment no. 1 showed better result than treatment no.-3 which is opposite to the results obtained for catla.

Table 3 shows morphometric and gonadal maturity of different batches of offsprings produced by brooders of *A. mola.* Pal and Mahapatra (2016) reported that *A. mola* breeds twice in a year. *A. mola* offspring were found to attain maturity at 3.3 g 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. Its prolific breeding in a temperature range of 25 to 34°C indicates that *A. mola* can breed easily even in polluted water in suitable weather condition. The GSI values of female offsprings of *A. mola* ranged from 14.69±4.77 to 15.46 ±3.05 (Table 4).

In the present experiment *A. mola* was found to breed 3 batches in a year in all the three modified set-ups as also found by Ghosh et al. (2018a). 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 350 to 400% in all the ponds. Gonadosomatic index was in the range of 13.56 to 14.10 Ghosh et al. (2018b). It may be inferred that *A. mola* can breed easily in all types of environment in suitable weather conditions.

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