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# Culture potentials of mola (*Amblypharyngodon mola*), chela (*Chela cachius*) and punti (*Puntius sophore*) under monoculture system

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**Abstract**
To assess the production potentials of small indigenous fish species (SIS) in semi-intensive monoculture system, an experiment was carried out with *Amblypharyngodon mola*, *Chela cachius* and *Puntius sophore*. Three treatments each with three replications were tested with mola, chela and punti individually and the stocking density of each species was 100,000/ha. Organic fertilizer was applied to the ponds at the rate of 1,000 kg/ha at fortnightly and rice bran was supplemented daily at 3% of the total fish biomass. Partial harvesting was made after three months of stocking. Gross production of 805±52.94, 1,120±41.62 and 509±48.81 kg/ha, respectively for mola, chela and punti over a period of six months were obtained. The yield of punti was found to vary significantly ($P<0.05$) from that of mola and chela.

**Key words:** SIS, *A. mola*, *C. cachius*, *P. sophore*, Semi-intensive culture

## Introduction

Small fishes play a vital role in the inland capture fisheries of Bangladesh. In the past, these indigenous fish species were abundantly available in rivers, streams, ponds, beels, ditches and flood plains of the country. But now a day, these species have gradually been disappearing from the systems which in turn severely affecting the biodiversity of our aquatic ecosystem. There are many small fish in our country such as *Puntius* spp., *Gudusia* spp., *Amblypharyngodon* spp., *Chanda* spp., *Ompok* spp., *Rohtee cotio*, *Colisa* spp., *Corica soborna*, *Esomus danricus* etc. which are potential to aquaculture.

Culture of small indigenous fish species needs special attention because these fish provide us plenty of vitamin, iron, calcium, and minerals. Besides it is affordable to the poor people due to its low market price compared to carps. Nutrition surveys conducted in Bangladesh revealed that there has been high prevalence of vitamin-A deficiency in rural population especially among the pre-school children. About 75% of the rural children in Bangladesh suffer from malnutrition and 25% of them below 5 years of age die due to malnutrition (Ahmed and Hassan 1983). Researches have shown that small indigenous fish species have a high nutritional value in terms of both protein content and the presence of micro-nutrients, vitamins and minerals that are not usually available in large carps (Thilsted *et al.* 1997).

In spite of great importance of small indigenous fish species, few attempts have been made to study their biological and cultural potential. Since 60s, UNICEF, Dhaka tried to attract the attention of the people to culture the small fish in small water bodies (Alam 1979, Ameen *et al.* 1982). Preliminary attempt was made to culture small indigenous fish mola, bata and kholisa in ponds (Akhteruzaman *et al.* 1997) and polyculture of carps with mola and chapila in small ponds were also tried (Kohinoor *et al.* 1997, Hossain *et al.* 1998). The present study has been devised to assess the production potentials of three important small fish, mola, chela and punti in monoculture system.

## Materials and methods

### *Pond preparation*

The study was carried out for a period of six months from May to October'98 in nine ponds of Field Laboratory of the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. The ponds were with an area of 100 $m^2$ each and an average depth of about 1.5 m. Water of all the experimental ponds was drained out and all fish species and other animals were removed in April. The pond bottoms were treated with lime at the rate of 250 kg/ha. After 5 days of liming, the ponds were filled up with water and fertilized with organic manure (cow dung) at the rate of 1,000 kg/ha. After five days of fertilizer stocking of fish was done.

### *Fish stocking and management*

Three treatments each with three replicates were tested. Mola, punti and chela with the average size of 1.80±0.27, 2.50±1.80 and 1.55±0.29g, respectively were stocked individually in treatments 1, 2 and 3 at the stocking density 100,000/ha. Fine rice-bran was fed to fishes at the rate of 3 % of their standing biomass. Ponds were also fertilized with cow dung at the rate of 1,000 kg/ha at fortnightly intervals.

### *Water quality determination*

Water quality parameters such as water temperature ($^0$C), secchi depth (cm), $p^H$, dissolved oxygen (mg/L), total alkalinity (mg/L), nitrate-nitrogen (mg/L), phosphate-phosphorus (mg/L), ammonia-nitrogen (mg/L) and chlorophyll-*a* ($\mu$g/L) were monitored at weekly intervals at 9.00-10.00 am.

### *Plankton estimation*

Ten liters of pod water were taken each time from different locations and depths from each pond and were filtered through a fine mesh plankton net (25$\mu$). Filtered sample was taken into a measuring cylinder and a standard volume of 50 ml was made carefully. Then the collected plankton samples were preserved in 5% buffered formalin in small plastic vials for subsequent studies. In the laboratory, a 1 ml sub-sample of each 50 ml sample was examined under a binocular microscope using a Sedgewick-Rafter cell. All planktonic organisms were counted from ten squares of the cell chosen at random.

### *Harvesting of fish*

Partial harvesting of mola, chela and punti in all the treatments was done after three months of stocking. All the ponds were completely harvested after six months of rearing, first by seine netting and then by de-watering the ponds with a submersible low lift pump (Pedrollo 2 HP). The harvested fishes were counted and their lengths and weights were measured.

### *Data analyses*

The experiment was set up following the principles of Completely Randomized Design (CRD) and the data were analysed using a statistical package, Statgraphics version 7 and Microstat.

## Results

### *Water quality parameters*

The mean values with standard deviation of the different water quality parameter as recorded from the experimental ponds under three treatments are presented in Table 1. ANOVA was performed to observe the degree of difference among the treatments.

The water temperature as recorded from ponds belonging to treatments- 1, 2 and 3 was found to vary from 27.6 to 33.0, 27.8 to 32.8 and from 27.7 to 33.0°C, respectively. However, no significant difference was observed among the treatments when DMRT was applied.

The highest values of transparency were 38.17 cm in treatment-1 in June, 32.25 cm in treatment-2 in July and 39 cm in treatment-3 in September. Again the lowest values were 27.18 cm in October in treatment-1, 21.88 cm in October in treatment-2 and 31.67 cm in October in treatmnet-3. The mean values did not show any significant difference when analysed statistically.

**Table 1.** Mean value ±SD and range (in parenthesis) of water quality parameters of experimental ponds under three treatments

| Parameter | Treatment-1 | Treatment-2 | Treatment-3 |
|---|---|---|---|
| Temperature (°C) | 29.62±0.47[a] (27.6-33.0) | 29.66±1.28[a] (27.8-32.8) | 29.64±1.33[a] (27.7-33.0) |
| Transparency (cm) | 34.28±8.70[b] (27.18-38.17) | 27.67±4.81[a] (21.88-32.25) | 33.92±10.28[b] (31.67-39.0) |
| $p^H$ | 7.54±0.34[a] (7.10-8.41) | 7.65±0.31[a] (7.03-8.53) | 7.62±0.13[a] (7.08-8.59) |
| Dissolved oxygen (mg/L) | 3.83±1.07[a] (1.9-7.0) | 3.92±1.02[a] (2.1-6.7) | 4.30±1.20[b] (2.2-6.6) |
| Alkalinity (mg/L) | 128.56±32.03[ab] (65-220) | 121.88±33.17[a] (50-185) | 132.18±26.40[b] 80-168) |
| Ammonia-nitrogen (mg/L) | 0.48±0.33[a] (0.01-1.27) | 0.47±0.37[a] (0.0-1.45) | 0.51±0.30[a] (0.03-1.55) |
| Nitrate-nitrogen (mg/L) | 2.59±0.78[a] (1.2-5.2) | 2.55±0.79[a] (1.4-5.8) | 2.61±0.84[a] (1.1-4.0) |
| Phosphate-phosphorus (mg/L) | 0.90±0.77[a] (0.10-2.75) | 0.58±0.49[b] (0.10-2.28) | 0.76±0.59[ab] (0.11-2.05) |
| Chlorophyll-*a* ($\mu$g/L) | 99.04±49.57[ab] (21.42-198) | 111.91±41.73[b] (14.28-190) | 85.42±46.37[a] (20.23-199) |

*Figures in the same row having the same superscript are not significantly different (P>0.05).

The observed mean values ±SD for the above treatments were 7.54±0.34, 7.65±0.31 and 7.62±0.13 respectively (Table-1).

The mean dissolved oxygen concentration ±SD values for above treatments were 3.83±1.07, 3.92±1.02 and 4.29±1.20 mg/L, respectively (Table-1). The mean values as obtained for treatments-1 and 2 were significantly higher than that of treatment-3 (P<0.05), but no significant difference was observed between the values of treatments-1 and 2 (P>0.05). The maximum concentration of dissolved oxygen was 7.0 in treatment-1 and the minimum was 1.2 in treatment-3.

Total alkalinity of water of the experimental ponds was found to range from 65 to 220 mg/L in treatment-1, from 50 to 185 mg/L in treatment-2 and from 80 to 168 in treatment-3. When the mean values of all ponds were compared, a significant difference (P<0.05) was found between treatments-1 and 3.

Total ammonia content in water of the experimental ponds under treatments-1, 2 and 3 was found to range from 0.01 to 1.27, from 0.0 to 1.45 and 0.03 to 1.55 mg/L, respectively. The difference among treatments was not statistically significant. During the experimental period, the highest value of total ammonia content was recorded to be 1.55 mg/L in treatment-3 in June while the lowest in treatment-2 in May.

During the study period, nitrate-nitrogen content in water of the experimental ponds was found to range from 1.2 to 5.2, 1.4 to 5.8 and from 1.1 to 4.0 mg/L in treatments-1, 2 and 3, respectively. It seems that there was difference among treatments but that was not statistically significant.

Phosphate-phosphorus content in water of the ponds under treatments-1, 2 and 3 was found to range from 0.10 to 2.75, from 0.10 to 2.28 and from 0.11 to 2.05 mg/L, respectively. However, significant difference ($P<0.05$) was found among the mean values of different treatments.

Chlorophyll-*a* content in water of the ponds under treatments-1, 2 and 3 was found to range from 21.42 to 198, from 14.28 to 190 and from 20.23 to 199 $\mu$g/L, respectively. When these values were analysed statistically, a significant difference was observed between treatments-2 and 3, but none with Treatment-1.

### *Plankton enumeration*

The planktonic organisms recorded from the water of the experimental ponds have been presented in Table 2.

The recorded phytoplankton population comprised of 4 broad groups *viz.*, Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae. A total of 27 genera of phytoplankton were recorded from treatment-1, 28 from treatment-2 and 29 from treatment-3. Out of 27 genera of phytoplankton, 5 genera belonged to Bacillariophyceae, 12 to Chlorophyceae, 7 to Cyanophyceae and 3 to Euglenophyceae in treatment-1. In treatment-2 out of 28 genera 5 belonged to Bacillariophyceae, 14 to Chlorophyceae, 6 to Cyanophyceae and 3 to Euglenophyceae. Whereas in treatment-3 out of 29 genera, 4 belong to Bacillariophyceae, 16 to Chlorophyceae, 7 to Cyanophyceae and 3 to Euglenophyceae. However, the recorded zooplankton population comprised of 2 groups *viz.*, Crustacea and Rotifera. A total of 11 genera of zooplankton were recorded in treatments-1 and 3, of which 5 genera belonged to Crustacea and 6 to Rotifera. While in treatment-2, out of 10 genera, 4 belonged to Crustacea and 6 to Rotifera.

**Table 2.** Mean abundance of plankton in water of the ponds under three treatment

| Plankton group | Treatment-1 | Treatment-2 | Treatment-3 |
|---|---|---|---|
| Bacillariophyceae | $4.62\pm9.39^{a}$ | $4.51\pm7.16^{a}$ | $3.65\pm7.70^{a}$ |
| Chlorophyceae | $12.13\pm16.76^{a}$ | $16.80\pm22.99^{b}$ | $17.29\pm23.07^{b}$ |
| Cyanophyceae | $9.25\pm12.62^{a}$ | $12.57\pm10.69^{a}$ | $10.72\pm12.56^{b}$ |
| Euglenophyceae | $4.02\pm10.41^{a}$ | $7.11\pm9.04^{b}$ | $4.37\pm9.39^{ab}$ |
| Total phytoplankton | $30.02\pm3.86^{a}$ | $40.79\pm5.48^{b}$ | $36.08\pm6.29^{ab}$ |
| Crustacea | $2.77\pm3.78^{a}$ | $2.26\pm2.95^{a}$ | $2.34\pm2.58^{a}$ |
| Rotifera | $3.31\pm5.13^{a}$ | $4.50\pm6.62^{a}$ | $4.00\pm5.34^{a}$ |
| Total Zooplankton | $6.08\pm0.38^{a}$ | $6.76\pm1.51^{a}$ | $6.34\pm0.96^{a}$ |

*Figures in the same row having the same superscript are not significantly different ($P>0.05$)

No significant difference ($P>0.05$) was found in the abundance of Bacillariophyceae. Chlorophyceae was the most dominant group in all the Treatments. DMRT showed that the values of treatment-2 and 3 were significantly higher than that of treatment-1. The abundance of Cyanophyceae did not show any significant difference among treatments when tested statistically. The abundance of Euglenophyceae was significantly higher in treatment-2 than those of treatments-1 and 3.

The mean abundance of total phytoplankton in water of the ponds belonging to treatments-1, 2 and 3 were $30.02\pm3.86$, $40.79\pm5.48$ and $36.03\pm6.29\text{x}10^3$/L, respectively. ANOVA and subsequent DMRT analyses showed that the value of treatment-2 was higher than those of treatments-1 and 3, but there was no significant difference between the values of treatment-1 and treatment-3.

Crustacea was present in relatively lower numbers in all the treatments. The maximum abundance ($6.76\pm11.51\text{x}10^3$/L) was obtained in treatmnet-2 while the minimum ($6.08\pm0.38\text{x}10^3$/L) in Treatment-1. But no significant difference was observed when tested.

*Growth and production of fish*

Size distributions of mola, punti and chela during the study period are shown in Figures 1, 2 and 3, respectively. The bar charts for mola showed that, the weight of mola was 2.41 and 3.28g in the month of May and June, no fry was seen in the net during sampling. But in the next successive months, mola fry were found during the sampling. The mean fry weight of mola was 0.67, 0.84, 0.71 and 0.87g in the month of July, August, September and October, respectively. But in case of adult mola, the average weight decreased in July and August, but increased in the following months (Fig. 1). In case of punti, the growth trend was not similar to that of mola as may be seen in Fig. 2. The average weight of adult punti was found to increase gradually in the first two months. However, the fry was first found during sampling in the month of July and the average weight was 1.02g. In July and August, the fry weight was more or less similar but in September and October, the mean weight were increased gradually. While the mean weight of adult punti did not increase during the months of July and August but increased gradually in the following months. The growth pattern of chela was similar to that of mola as seen in Fig. 3. The weight of adult chela was the highest in October and the lowest in May. Fry of chela was found in the month of July and the weight was found to be 0.65g. The fry weight increased gradually in the following months. Comparatively less weight of adult chela was observed in the month of July and August than in other months.

The stocking and harvesting statistics of mola, punti and chela are presented in Table 3. The numbers at harvest (partial and final harvest) of each species of mola, punti and chela were higher than their initial number. At harvest, the total number of mola was significantly higher ($P<0.05$) than those of punti and chela. But the total number of punti and chela did not show any significant difference ($P>0.05$). The number of mola, punti and chela harvested were 7,069, 2,910 and 2,550, respectively.

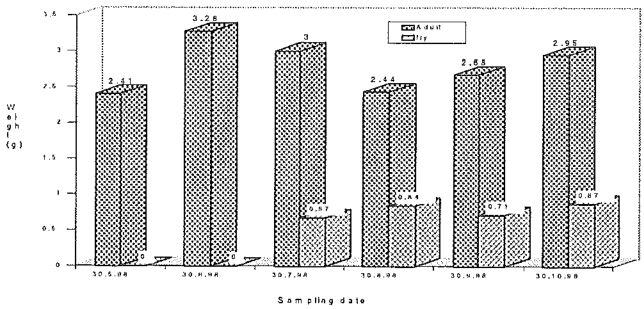


**Fig. 1.** Monthly average weight of fry and adult mola.

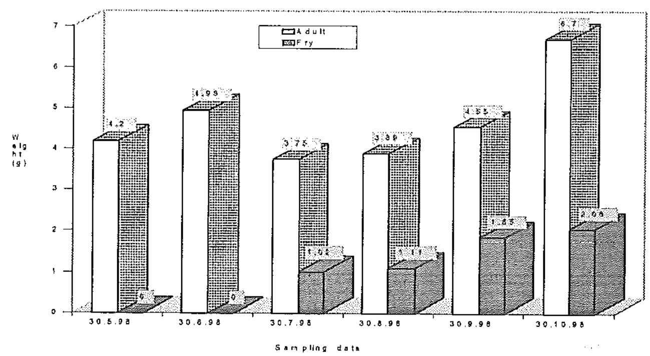


**Fig. 2.** Monthly average weight of fry and adult punti.

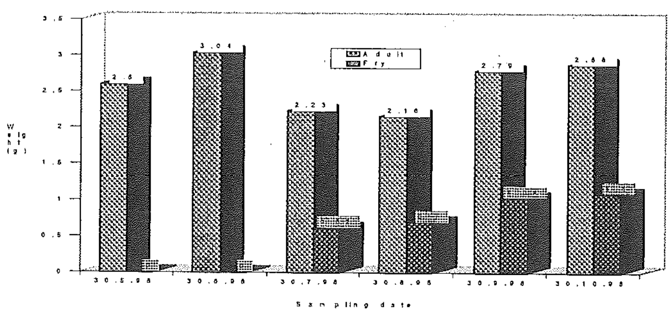


**Fig. 3.** Monthly average weight of fry and adult chela.

**Table 3.** Details of initial number and weight of fish at stocking, harvesting number and production of mola, punti and chela in monoculture system

| Treat-ments | SIS | At stocking | At harvesting | | |
|---|---|---|---|---|---|
| | | Av. initial wt (g) | Av. Final wt.(g) | Av. total no. of fish recovered | Total wt. of fish (kg/pond) |
| T-1 | Mola | 1.80±0.27 | 1.14±0.49 | 7,069[a] | 8.05 |
| T-2 | Punti | 2.50±1.80 | 3.85±2.74 | 2,910[b] | 11.20 |
| T-3 | Chela | 1.55±0.29 | 2.02±0.69 | 2,550[b] | 5.09 |

*Figures in the same row having the same superscript are not significantly different ($P>0.05$).

The gross yield of mola, punti and chela over a period of six months were 805±52.94, 1,120±41.62 and 509±48.81 kg/ha, respectively. The total production of punti was found to vary significantly from those of mola and chela. The production of punti was 39.13% higher than that of mola and 120% higher than that of chela. On the other hand, the second highest production was obtained from mola which was 58.15% higher than that of chela and the production of mola also showed significant difference ($P<0.05$) from that of chela (Table 3).

## Discussion

Water temperature is one of the most important factors, which influence the physico-chemical and biological events of a water body. The range of water temperature (27.6 to 32.8°C) as recorded from the experimental ponds agreed well with the findings of Mollah and Haque (1978) and Wahab *et al.* (1995) from ponds of Bangladesh Agricultural University (BAU) campus. Water transparency was found to fluctuate widely (14-60 cm) in the present study. The highest transparency was recorded during June and the lowest after fertilization, which might be due to the presence of higher plankton population and suspended organic matter. Islam *et al.* (1974) recorded the minimum transparency in January and maximum in June. Dewan (1973) recorded a good correlation of transparency of water with the water depth and rainfall. Boyd (1982) recommended a transparency between 15-40 cm as appropriate for fish culture. The observed $p^H$ range of (7.03-8.59) agreed well with the findings of Hossain *et al.* (1997) who found the $p^H$ range of 6.7-8.3, and Kohinoor *et al.* (1998) who obtained the $p^H$ range of 7.18-7.24 in the research ponds of Bangladesh Agricultural University campus, Mymensingh. Dissolved oxygen level in water of the experimental ponds as recorded (1.9 to 7.0 mg/L) in the present study agreed well with the findings of Wahab *et al.* (1995), who recorded a lower dissolved oxygen ranging from 2.0-7.2 mg/L during their experiment in the BAU campus. Ahmed (1993) also reported a similar trend of lower dissolved oxygen from fertilized and fed carp fingerling ponds in BAU campus.

Application of manure and supplementary feed might reduced the level of dissolved oxygen.

Natural waters, which contain 40 mg/L or more total alkalinity, are considered as hard waters for biological purposes. Hard waters are generally more productive than soft waters. Bhuiyan (1970) reported that the total alkalinity of medium productive water ranged from 25-100 mg/L. Sudipti (1998) found the average total alkalinity values were above 100 mg/L in some BAU campus ponds. The observed alkalinity level (50 to 220 mg/L) of water of the experimental ponds indicated that the productivity of the ponds was medium to high. In any culture condition, the lower concentration of ammonia-nitrogen is better for fish. The level of ammonia-nitrogen (0.01 to 1.55 mg/L) as recorded from the experimental ponds in the present study is lower than that was reported by Dewan *et al.* (1991), who recorded 0.05 to 6.20 mg/L. Kohinoor *et al.* (1998) recorded ammonia-nitrogen ranged from 0.05-0.25 mg/L. Haque *et al.* (1998) also found ammonia-nitrogen level of 0.11 to 0.13 mg/L in BAU research ponds. However, the present level of ammonia-nitrogen content in the experimental ponds was not lethal to the stocked fishes. The amount of nitrate-nitrogen (1.4 to 5.98) as recorded from water of the experimental ponds was higher than that of Mollah and Haque (1978), who recorded 0.091 to 0.77 mg/L, and Haque *et al.* (1998) recorded 0.86 to 0.90 mg/L in ponds in BAU campus. Bhuiyan (1970) reported the range of nitrate-nitrogen from 0.06 to 0.10 ppm as a suitable one for aquaculture. The possible reason for higher values of nitrate-nitrogen in the present study was fertilization, which was a routine practice in the experimental ponds. David *et al.* (1969), Munawar (1970) and Islam *et al.* (1974) recorded higher amount of nitrate-nitrogen after heavy rainfall.

Phosphorus is considered to be the most critical single element in the maintenance of aquatic productivity. The observed phosphate-phosphorus contents (0.10 to 2.75 mg/L) in water of the experimental ponds were higher than those reported by Mollah and Haque (1978), who recorded phosphate-phosphorus to be 0.55 to 0.35 mg/L. Azim *et al.* (1995) found mean phosphate-phosphorus as 0.807 mg/L in the research ponds at the of BAU campus. The probable reason behind higher phosphate-phosphorus content was heavy rainfall during this study, which might increased the amount of phosphate-phosphorus in the experimental ponds.

The probable reason behind fluctuation in chlorophyll-*a* concentration (42 to 198 μg/L) in water of the experimental ponds during the study period was the periodicity of phytoplankton, which was enhanced by manuring. Khatrai (1984) reported that phytoplankton and chlorophyll-*a* had a positive relationship with primary production. Dewan *et al.* (1991) recorded 12-30 μg/L chlorophyll-*a* in their experiment, where as Haque *et al.* (1998) found 59-159μg/L chlorophyll-*a* in their experiment.

The present recording of 34 genera of phytoplankton belonging to 4 broad groups *viz.*, Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae and 12 genera of zooplankton belonging to 2 groups *viz.*, Crustacea and Rotifera, agrees with the findings of Wahab *et al.* (1994) as reported 25 genera of phytoplankton belonging to Chlorophyceae. Bacillariophyceae, Euglenophyceae and Cyanophyceae and 5 genera of zooplankton belonging to Crustacea and Rotifera.

The higher abundance of plankton population (phytoplankton 30.02 x$10^3$, 4.079 x$10^3$ and 36.08 x$10^3$/L and zooplankton 6.08 x$10^3$, 6.76 x$10^3$ and 6.34 x$10^3$/L in treatments-1, 2 and 3, respectively) might be due to regular application of supplementary feed and fertilizers in the experimental ponds. Wahab and Ahmed (1991) reported mean phytoplankton population to be 17.72 x $10^4$, 9.26 x$10^4$ and 13.87 x$10^4$/L, and zooplankton to be 1.19 x$10^4$, 1.90 x$10^4$ and 1.07 x$10^4$/L from three sets of ponds, respectively. Wahab *et al.* (1994) recorded phytoplankton numbers ranging from 2.0-8.0 x$10^5$/L and zooplankton between 2.0-2.0x$10^5$/L. However, Kohinoor *et al.* (1998) recorded 22.50-27.83 x $10^3$/L phytoplankton and 5.20-6.34 x$10^4$/L zooplankton from polyculture ponds. Recording of the highest total plankton population in treatment-2, might be due to the fact that punti in treatment-2 consumed less amount of plankton than that of mola and chela which were stocked in the other treatments.

Culture of small fish has not yet been attempted on large scale in this country. Consequently, published information on production of small indigenous fish species in freshwater ponds are rather little. However, some of the notable works are Ameen *et al.* (1984), Hussain *et al.* (1989), Akhteruzzaman *et al.* (1990), Hossain *et al.* (1997) and Rahmatullah *et al.* (1998). In the present experiment, the mean weights of mola, punti and chela were 1.14, 3.85, 1.80g, respectively. Mustafa (1991) observed the mean weight of mola and punti were 3.03 and 7.65g, respectively in his monoculture experiment. Kohinoor *et al.* (1998) found the mean weight of mola in polyculture system was 0.74g, whereas, Hasan (1998) in his polyculture experiment with small fish observed the mean weights of mola, punti and chela as 1.10, 3.69 and 1.80g, respectively. Kamal (1996) also found the mean weight of *Puntius sophore* was 2.90g in monoculture system where the ponds were fertilized with urea and TSP. The weight of small fish in this experiment was low in comparison to the above findings

The production of mola, punti and chela as obtained in the present experiments were 505, 1,120 and 509 kg/ha/ 6 months, respectively which was more or less same as Mostafa (1991, who has reported to achieve an estimated production of 1,592, 2,373 and 1,764 kg/ha/yr from monoculture of mola, chola punti and colisha, respectively. Ameen *et al.* (1994) obtained a production of 1.75 tons/ha of mola (*A. mola*) and 8.0 tons/ha of chola punti (*P. sophore*) in monoculture and 4.49 tons/ha/8 months of mola and punti in composite culture. Akhteruzzaman *et al.* (1990) reported that in monoculture condition the production of *P. sarana* was 1,200 kg/ha/6 months, while, Kamal (1996) obtained a net production of 461 kg/ha/5 months from *P. sophore* in monoculture condition by fertilization only. Rahamatullah *et al.* (1998) reported to obtain a net yield of chapila to be 92.13 kg/ha and mola to be 57.88 kg/ha/3 months. The fish production as obtained in the present experiment was comparable to all the above mentioned findings except those of Ameen *et al.* (1994). A further trial including Ameens' technology is recommended for further study.

In view of the above, it may be concluded that the production of mola (*A. mola*), punti (*P. sophore*) and chela (*C. cachius*) was not very encouraging but small indigenous fish species (SIS) culture would add social benefit in that the fish farmer and the poor people may get a chance to consume them readily than sale them in to the market.

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