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Present status and scope of fisheries culture at chalan beel in Bangladesh

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Abstract

A study was conducted to assess the present status and scope of fisheries culture at chalan beel for a period of six months from August, 2013 to January, 2014 in three different locations where two from Shingra and Gurudaspur Upazilla under Natore district and one from Chatmohor Upazilla under Pabna district. The study was conducted on 3 aquaculture locations of the Chalan beel. The mean stocking weight of fish was 0.25Kg, 0.20 Kg and 0.24Kg with locations $L_{1,}$ L_2 and L_3, respectively. Feed and fertilized based farming was followed in all the locations. Mean value of water temperature, transparency, DO, pH and alkalinity varied from 25.54±1.89ºC (L_3) to 25.83±1.99ºC (L_1), 27.43±1.35cm (L_3) to 27.88±1.65cm (L_1), 6.53±0.40mg/1 (L_2) to 7.01±0.35mg/1 (L_3), 7.74±0.18(L_1) to 7.88±0.18(L_3) and118.50±4.95(L_3) to 122.75±4.54mg/l (L_1), respectively. Mean final weight (kg), weight gain (kg), SGR (% bwd^{-1}), survival rate (%) and total net yield (Kg/ha/6 months) varied from 1.01±0.33(L_1) to 1.09±0.36(L_2), 0.81±0.27(L_1) to 0.89±0.29(L_2),0.93±0.21(L_1) to0.98±0.14(L_3), 66.26±9.51(L_3) to 69.10±10.56(L_2) and 1227.00(L_1) to 1547.46(L_2), respectively. Total cost (Tk/ha), total income (Tk/ha), net profit (Tk/ha) and CBR varied from 98393.00(L_1) to 116478.00(L_3), 224350.50(L_1) to 269863.60(L_2), 125057.00(L_3) to 161749.60(L_2) and 1.07(L_3) to 1.50(L_2), respectively. Findings indicated that all the locations that mean aquaculture areas of the Chalan beel show the aquaculture suitability and it has a great potential for further aquaculture promotion. And this greatest water resource will be a lucrative source for aquaculture business for the adjacent people as well as the people of the country.

Keywords: Scope, weight, aquaculture, suitability and business

Introduction

The present world population is expected to grow from 6.1 billion people to 9 billion by 2050 (UN, 2000). As a result, the demand for food including fish is increasing. The demand of aquatic products for human consumption will grow to 121.1 million metric tons by 2010 (Wijkstrom, 2003) from its present production level of 101 million metric tons (FAO, 2004). This goes beyond total capture fisheries supply. The shortfall in supply will largely filled in through aquaculture. Since 1970 the global aquaculture production increased 40 times and is expected to quintuple in the coming 50 years (Avnimelech et al., 2008). Globally, aquaculture is the fastest growing food sector and its economic importance is increasing concomitantly (FAO, 2009). Fish is considered as a main protein source for over one billion people in developing countries and accounts for nearly 7.5% of the world's food production. Capture fisheries and aquaculture supplied the world with about 148 million tons of fish in 2010, of which about 128 million tones was utilized as food for people, and preliminary data for 2011 indicated increased production of 154 million tones, of which 131 million tones was destined as food (FAO, 2012). The world market for aquatic products is suffering a supply crisis due to rising levels of per capita consumption. As wild captured fisheries cannot meet the future demand for fish, the only option to meet this demand is aquaculture. The insufficient population of wild fish to meet the global appetite is forcing aquaculture industry to increase fish farming in order to narrow the gap between demand and supply.

Bangladesh is a land of high potential as far as its water resources are concerned. Fish and fisheries have been linked to the development of the human's earliest civilization. Bangladesh is a small country of south Asia with a 1, 47,570 square kilometer landmass. It has enormous closed water bodies (6, 78,724 ha) and open water bodies (40, 24,934 ha) of inland fisheries (DoF, 2012). Fisheries resources in Bangladesh are diversified, having more than 260 freshwater fish species, 24 freshwater prawns, 475 marine fish species, 36 marine or brackish water shrimps and 20 exotic species (DoF, 2010). Aquaculture is predicted to play a major and ever increasing role in meeting human needs for protein. The inland water resources of the country enfold an area of 4,575,706 ha of which 88% comprise of open waters and 12% closed water bodies (DoF, 2010). Presently fish and fisheries sector contribute 60% of total animal protein intake in the daily diet, 3.74% to GDP, 22.23% to agricultural production as well as 3% to foreign export earning of the nation (DoF, 2012).

But the recent trends in fishery production in the country are very disquieting because aquaculture has not yet been able to cope with the increasing demand for fish. The total fisheries production in Bangladesh was 28.99 lakh mt. in which inland fisheries and marine fisheries comprised 25, 15,354 mt. and 5, 46,333 mt. respectively. Besides, closed water fisheries shrimp production were 2, 39, 460 mt. This production level reflects per capita per year availability of 18.94 kg of fish where the minimum requirement is about 20.44 kg per year (DoF, 2012). After the successful operation of Daudkandi floodplain aquaculture model-2006 in Comilla district, the floodplain and beel aquaculture have become a very attractive and lucrative business and earning sources for the villagers around the floodplains and beels. Farmers are found more interested in farming different types of fish in their floodplains and beels with the Community Based Fisheries Management (CBFM) system. Farmers mainly practice carp polyculture in their floodplains and beel. In some areas, farmers stock predatory species like Chitol, Boal, Aire, Shol, Gojar etc. for their high value and demand in the markets. But these predators are harmful to other carps and Small Indigenous Species (SIS).

Materials and Methods

Location and description

A total of 3 different aquacultured parts of the greatest Chalan beel were selected for the present study (plate-1). These three parts were located at the different locations of the Chalan beel covering two districts. Two parts from Shingra and Gurudaspur upazilla under Natore; whereas one parts from Chatmohor upazilla under Pabna district. The aquaculture area of the parts varied from 75 ha to 100 ha. Initial stocking weight (Kg/ha) of fishes were 94.00Kg, 93.00Kg and 90.00Kg with locations $L_{1,}$ L_2 and $L_{3,}$ respectively.To enhance the natural feeds the organic and inorganic fertilizers (Cowdung: 500Kg/ha; Urea:50Kg/ha and TSP: 50Kg/ha) were used monthly.

Duration of study

The study was conducted for a period of 6 months from (August, 2013 – January, 2014)

Study design

This study was conducted under three different parts (locations) of the Chalan beel by the farmer managed carp polyculture. The three locations were as follows:

L_1: Located at Shingra upazilla under Natore district;
L_2: Located at Gurudaspur upazilla under Natore district and
L_3: Located at Chatmohor upazilla under Pabna district

Aquaculture management

Community Based Fisheries Management (CBFM) was followed for all of the aquaculture areas. Before the rainy season the broken embankments were repaired. Bamboo and net made 'bana' was placed to confine the culture area and also placed at the entrance of the culverts to protect the fish from escape.Stocking of fish was done at the month of August-2013. Seeds were collected from the nearby hatcheries. Polyculture of 8 carps were stocked same in all the aquaculture areas.

Table1: Stocked species in the study floodplains (plate-4)

SI. No.	Species	Scientific name	Native/ Exotic	Feeding habit
1.	Silver carp	*Hypophthalmichthyes molitrix*	Exotic	Planktivore
2.	Rui	*Labeo rohita*	Native	Planktivore
3.	Catla	*Catla catla*	Native	Planktivore
4.	Mrigel	*Cirrhinus mrigala*	Native	Bottom feeder
5.	Black carp	*Mylopharyngodon piceus*	Exotic	Omnivore
6.	Common carp	*Cyprinus carpio* var. *communis*	Exotic	Bottom feeder
7.	Chitol	*Notoptorus chitala*	Native	Carnivore
8.	Aire	*Mystus aor*	Native	Carnivore

Initial stocking weight (Kg/ha) of fishes were 94.00Kg, 93.00Kg and 90.00Kg with locations $L_{1,}$ L_2 and $L_{3,}$ respectively.To enhance the natural feeds the organic and inorganic fertilizers (Cowdung: 500Kg/ha; Urea:50Kg/ha and TSP: 50Kg/ha) were used monthly.

Feeding

Supplementary feeds (mustard oil-cake: 100Kg/ha, rice bran: 70Kg/ha and wheat bran: 50Kg/ha) were also used. Feeds were used twice a week at 3% of fish body weight.

Water quality monitoring

Water quality parameters such as temperature (°C), transparency (cm), pH, dissolve oxygen (mg/l) and alkalinity (mg/l) were measured monthly at 9:00-10:00 am. Water quality parameters monitored in the different 3 spots of a single aquaculture area.Water temperature was recorded by an ordinary Celsius thermometer (0°C to 120°C). Similar process was followed three times and finally average value was recorded as floodplain water temperature. The data, thus obtained were expressed as secchi disc depth in cm. The dissolved oxygen, pH, total alkalinity of water were measured by using a HACH Kit (FF2, USA).

Plankton monitoring

The qualitative study of phytoplanktn and zooplankton were done after Ward and Whipple (1954), Needham and Needham (1962) and Prescott (1964).

Different groups of phytoplankton and zooplankton were identified up to genus level.

N = (A ò 100 ò C) / (V ò F ò L)

(Striling, 1985)

Where, N = Number of plankton cells per liter of original water

A = Total number of plankton counted

C = Volume of final concentration of the sample in liter

V = Volume of a field

F = Number of field counted

L =Volume of original water in liter.

Growth of fish

Firstly, weight of fish was taken during stocking and finally, different growth parameters were studied as follows:

- Final weight(g)= Weight of fish at harvest
- Mean weight gain (g)= Mean final weight-Mean initial weight
- Survival rate (%) = No. of fish harvested/ No. of fish stocked × 100
- SGR (%, bwd^{-1}) = $\frac{L_n\text{ (final weight) - }L_n\text{ (initial weight)}}{\text{Culture period}} \times 100$

(Brown, 1957)

- Production(Kg/ha) = Fish biomass at harvest - fish biomass at stock

Economics

A simple cost-benefit analysis was done to explore the economics of aquaculture under different treatments. The total cost (Tk) of inputs including associated harvest, total return (Tk) from fish sale and net benefit (Tk) (Total return – Total cost) were calculated based on the local market price. CBR (Total benefit / total cost) was also determined for the present study.

Statistical analysis

Water quality data and plankton abundance data were subjected to one-way analysis of variance (ANOVA) using the SPSS (Statistical Package for Social Science, evaluation version-16.0). Significance was assigned at the 0.05% level. The mean values were also compared to see the significant difference through DMRT (Duncan Multiple Range Test) after Zar (1984). And production data were calculated using the MS excels software.

Results

Mean variation

The variations in the mean values of different water quality parameters under different treatments by the total of all months are presented in the table.

Table2. Mean variations in the values of water quality parameters under different locations of Chalan beel at the study period (August, 2013 – January, 2014)

Water quality \ Locations	L_1	L_2	L_3
Water temperature (°C)	25.83 ± 1.99^a	25.78 ± 2.09^a	25.54 ± 1.89^a
Transparency (cm)	27.88 ± 1.65^a	27.50 ± 1.36^a	27.43 ± 1.35^a
DO (mg/l)	6.77 ± 0.26^a	6.53 ± 0.40^a	7.01 ± 0.35^a
pH	7.74 ± 0.18^a	7.78 ± 0.13^a	7.88 ± 0.18^a
Alkalinity (mg/l)	122.75 ± 4.54^a	119.08 ± 5.10^a	118.50 ± 4.95^a

Each value is expressed as mean ± SE. Mean values followed by common superscript letter(s) do not differ significantly ($p<0.05$)

Phytoplankton

Table3: Variation in the concentration (cells/1) of phytoplankton under different samples during the study period

Phytoplankton group	Sample		
	T1	T2	T3
Cyanophyceae	8257.92±2420.46a	6591.67±1816.49a	6351.58±1735.63a
Euglenophcceae	881.92±190.21a	990.33±188.85a	1140.08±205.27a
Bacillariophyceae	169.58±55.84a	203.33±72.32a	264.83±84.43a
Dinophyceae	45.50±20.33a	40.08±21.18a	101.17±53.22a
Chlorophyceae	2518.42±459.a42	2664.83±507.92a	3156.67±582.54a
Total	9969.58±1224.47a	10490.33±1246.97a	12918.97±12918.58a

Figures in a row bearing common letter do not differ significantly

Zooplankton

Table4: Variation in the concentration (cells/1) of Zooplankton under different samples during the study period. `

Zooplankton group	Sample		
	T1	T2	T3
Copeopda	514.17±32.47a	526.17±29.53a	582.00±26.89a
Rotifera	658.00±16.01a	652.08±15.27a	655.00±31.25a
Cladocera	784.67±43.99a	749.92±45.22a	762.67±44.55a
Crustacean larvac	340.17±22.05a	364.25±19.08a	346.58±29.41a
Total	2297.17±68.14a	2292.83±76.63a	2346.17±82a

Figures in a row bearing common letter do not differ significantly

Table5: Cost benefit (Tk/ha) for fish culture at three locations in Chalan beel during the study period

Parameter	L_1	L_2	L_3
Total income (Tk/ha)	224350.50	269863.60	241535.00
Total cost (Tk/ha)	98393.00	108114.00	116478.00
Net profit (Tk/ha)	125957.50	161749.60	125057.00
CBR	**1.28**	**1.50**	**1.07**

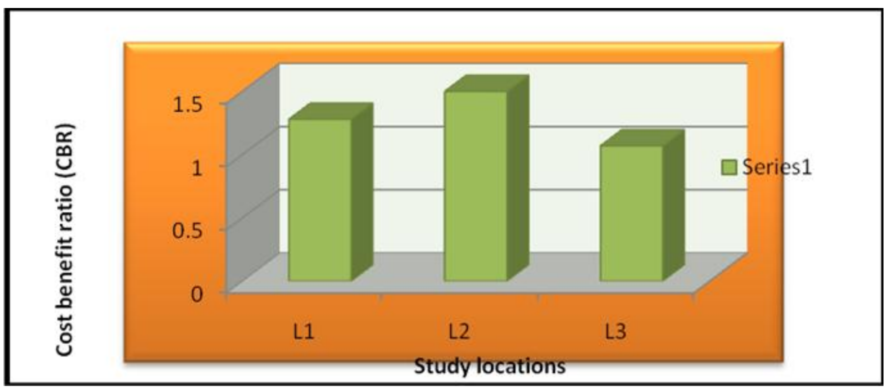

Fig:1. Cost benefit ratio (CBR) of different study locations in Chalan beel during the study period

Discussion

Water temperature

The mean water temperature obtained during the study varied from 25.54± 1.89°C (L_3) to 25.83±1.99°C (L_1). According to Hossain (2000) water temperature is directly and closely related with air temperature but sometimes exceptions may occur when water temperature may be slightly higher than air temperature.

Water transparency

In the present study, the mean value of water transparency varied from 27.43±1.35 cm (L_3) to 27.88±1.65 cm (L_1). Saran and Adoni (1982), Rai and Rathore (1993) stated that low values of water transparency which could be attributed to rich phytoplankton density and higher budgets of suspended and particulate matter due to heavy pollution by organic matter. Hossain *et al.* (2000) found the transparency value ranged from 24.75 to 29.59 cm.

pH

The mean value of pH varied from 7.74±0.18 (L_1) to 7.88±0.18 (L_3). According to Swingle (1967), pH of 6.5 to 9 is suitable for fish culture. In the present study the alkaline pH range in all locations indicate good pH condition for biological production and fish culture.

Dissolved oxygen

The mean value of dissolved oxygen in this study varied from 6.53±0.40 mg/1 (L_2) to 7.01±0.35 mg/1 (L_3). The result is strongly agreed with Singh and Singh (1975).

Alkalinity

The recorded mean total alkalinity varied from 118.50±4.95 (L_3) to 122.75± 4.54 mg/l (L_1). No significant difference was found in total alkalinity among the locations. Boyd (1998) stated that the natural fertility of water increases with increase in total alkalinity up to at least 150mg/l. Alikunhi (1957) reported that total alkalinity more than 100mg/l should be present in high productive water bodies. Kohinoor (2000) and Haque *et al.* (2005) found the average total alkalinity values above 100mg/l in their experiments.

Plankton

Results indicated that a total of five groups of phytoplankton were identified in the present study. Chlorophyceae ranked the first position followed by myxophyceae, cyanophyceae, euglenophyceae and bacillariophyceae.These finding more or less agreed with Hossain and Akhteruzzaman (2007).

Results indicated that a total of four groups of zooplankton were identified in the present study. Rotifera ranked the first position followed by cladocera, copepoda and Crustacea. These finding more or less agreed with Hossain and Akhteruzzaman (2007).

Overall findings indicate that the inclusion of silver carp in polyculture pond is favourable regarding the utilization of natural feed in pond. Therefore, present findings proved again that silver carp played significant role in maintainig good water quality in carp polyculture pond. This statement is strongly agreed with Hossain and Bhuiyan (2007).

Species based yield (kg/ha/6 months)

Among the different species the yield (kg/ha/6 months) was observed in *H. molitrix* as 250.00 (L_1) to 357.50 (L_3) (kg/ha/6 months), *Catla catla* as 181.24 (L_1) to 246.93 (L_1) (kg/ha/6 months), *Labeo rohita* 195.00 (L_3) to 266.40 (L_2) (kg/ha/6 months), *Cirrhinus mrigala* as 132.16 (L_1) to 199.24 (L_2) (kg/ha/6 months), *Cyprinus carpio* as 84.60 (L_1) to 124.74 (L_2) (kg/ha/6 months), *N. chitala* 84.60 (L_1) to 124.74 (L_2) (kg/ha/6 months), *M. aor* 61.56 (L_3) to 69.70 (L_2) (kg/ha/6 months) and *M. piceus* as 155.10 (L_1) to 187.20 (L_2) (kg/ha/6 months). The yield (kg/ha/6 months) is lowest with the location L_1. The yield (kg/ha/6 months) is found highest with the location L_2.Chandra *et al.*(2010) reported the carps production in floodplain aquaculture is silver, bighead, catla, rui, mrigel, carpio, grass carp 626,235,69,152,270,208 and 50 Kg/ha, respectively. In these findings some species are simillar some are not. Among these species the growth performance of silver carp was best.

Total fish production

The total fish production varied from 1227.00 Kg/ha (T_1) to 1547.46 Kg/ha (T_2).The production of SIS was 57.00 Kg/ha (L_2) to 63.00 Kg/ha (L_3). The maximum production of SIS in location L_3 due to the absence of predatory fishes. The available SIS in location L_3 was koi, shing, magur, puti, chanda, pabda, guchi, gutum, taki, darkina, baim, tengra etc.

Ahmed *et al.* (2007) reported the standing crop ranged from 245 to 1047 kg (av. 584 kg) and 270 to 630 kg (av. 433 kg) from a mean area of 40 decimal katha for the first and second harvesting respectively.

Economics

The total cost was 98393.00 Tk/ha, 108114.00 Tk/ha and 116478.00 Tk/ha with locations $L_{1,}$ L_2 and L_3, respectively.The net profit was 12597.50 Tk/ha, 161749.60 Tk/ha and 125057.00 Tk/ha with locations $L_{1,}$ L_2 and L_3, respectively.The CBR was 1.28, 1.50 and 1.07 with locations $L_{1,}$ L_2 and L_3, respectively. The study highest CBR found 1.50 at location L_2 which is slightly similar with Khaleque *et al.* (1998).

Conclusion

The findings of the present study indicate that fish culture could be successfully undertaken in Chalan beel by using the modern floodplain aquaculture technologies at community based fisheries management tools. Present aquaculture trends are very significant for the spontaneous aquaculture development of the country. All the wetland areas need to be used for the aquaculture purposes. As Chalan beel is a largest flooded area of our country the proper aquaculture technologies should be adopted for the proper uses of Chalan beel.

References

Avnimelech, Y., Verdegem, M.C.J., Kurup, M., Keshavanath, P. 2008. Sustainable land-based aquaculture: rational utilization of water, land and feed resources. Mediteranean Aquaculture Journal 1, 45–55.

Alikunhi, K. H. 1957. Fish culture in India Farm, Bull. No.20. India *Conc. Agric. Res.* New Delhi, pp.144. Aquaculture development—lessons from Asia. Food Policy 22 (2), 125–141.

Ahmed, M., Latifa, G.A., Hossain, M.B. and Islam, M.S. 2007. Relationship of the size of sanctuaries and dry season water area in Goalkhola-Hatiara beel, Narail. *Bangladsh J. Fish*., 30:145-151.

Bhuiyan, A. S. and Nessa, Q. 1998. Seasonal variation in the occurrence some zooplankton in a fish pond. *Bangladesh J. Fish. Res.* 2(2):201-203.

DoF, 2010. Matshaw Pakhaw (10-24 August, 2010) Sankalon.Employment and Management of Fisheries Development, Ramna, Dhaka. Pp-84.

DoF, 2012. Matshya Saptah Sankolon. Department of Fisheries, Ministry of Fisheries and Livestock, Matshya Bhaban, Dhaka.

FAO, 2005. Fishery Information. Data and Statistics Unit, FAO, Rome, Italy.

Hossain M. A. and Bhuiyan, A. S. 2007. Study of water quality in fish ponds under the red soil zone of northern Bangladesh. *J. Subtrop. Agric. Dev.* 5(5): 347-351.

Kohinoor AHM 2000. Development of culture technology of three small indigenous fish mola (Amblypharyngodon mola), with notes on some aspects of their biology, PhD Dissertation, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh.

Khaleque, M.A., A. Masud, K.S. and Mirza, J.A. 1998. Economics of fish production under semi-intensive culture and management. *Bangladesh J. Train. Dev.*, 2(1-2): 81-86.

Rath, R. K. 2000. Freshwater aquaculture (2nd ed.) scientific publishers, Jodhpur, India

Stirling, H.P., 1985. Chemical and Biological Methods of Water Analysis for Aquaculturists. 1st Edn, Institute of Aquaculture, University of Striling, Scotland, p. 119.

Swingle, H.S. 1967. Standardization of chemical analyses for waters and pond muds. *FAO Fish Report*, 4(4): 397-421.

Wijkstrom, U.N., 2003. Short and long-term prospects for consumption of fish. Veterinary Research Communications 27, 461–468.

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