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EFFECT OF PRACTICING OPTIMUM STOCKING MODEL ON FISHERMEN'S ACCESS INTO THE LARGE WATER BODIES

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ABSTRACT

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The main purpose of the study is to quantifying the relationship between fishermen's stocking and cost decisions towards the output measure or yield-kg into the Large Water Bodies (LWBs). The duration of the study covered a period of over 48 months (4 years), financial years 2000-01 to 2003-04. One privately managed large water body (PMLWB) namely Morshina, Keshobpur Upazilla; one Government managed large water body (GMLWB) namely Kathgora, Chowgacha upazilla and the last but the least, community managed large water body (CMLWB) namely Purakali, Avoynagar Upazilla were taken for this study through randomly basis. The LWBs were taken from the mentioned different upazillas of the same district namely Jessore. The CMLWB was taken as experimental and the rests were taken as control water bodies. Optimum Stocking Model (OSM) was only practiced in CMLWB but into the rests stocking practices were commonly conducted. Different physical and limnological parameters were taken to analyze optimum stocking condition of the large water body. These included secchi disc depth (cm), standard water area (ha), stocking density (fingerlings/ha), yields of cultured species (kg/ha). In a culture based fisheries exploitation of a semi-closed water body, one of the few management tools available is the stocking strategy; i.e., choice of fish species stocked, fingerling stocking weight, stocking density (total and by species), the time of stocking and the last but not the least targeted sales volume. Among all LWBs in CMLWB highest result of carp yield was found in the year 2003-04 among the all LWBs, 1354.89 kg/ha at a stocking density 3148 fings/ha, standard water area 55.08 ha and secchi depth 49.90 cm. Comparing year wise yields it was found that the linear relationship of stocking density and yields existed up to the limit of stocking density 3148 fings/ha in CMLWB. After that yields were decreased in terms of increased stocking density. Following Cost Volume Profit (CVP) analysis fishermen's targeted sales volumes were prepared and significant difference ($P<0.03$) were found between year wise targeted and actual sales volumes (kg).

Keywords: Optimum Stocking Model (OSM), Cost Volume Profit (CVP) analysis, Catch composition

INTRODUCTION

Fishermens' access into the LWBs were not ensured from the very beginning due to lack in involvement into decision making of fish culture, investment into as well as profit enjoyment thereby from the LWBs. In the CMLWB, Purakhali lake under Aquaculture Development Project (IFAD) such problems were endeavored to reduce. Fishermen were involved into stocking; harvesting and cost decisions into the LWB as well they invest and achieved whole profit there. In the first screening of possibly significant parameters, both dependent Stocking density (No. /ha/ year), standard water area (ha) and secchi depth (cm) and independent variable (yield of carp production (Kg/ ha/ year) were tested in regression analysis. The regression analysis of stocking density and standard water area and secchi depth on carp yield (Kg /ha/ year) were performed in Oxbow Lake Project II. Hasan, M.R. and Middendorp, H.A.J., 1997a. Similar positive interactions between silver carp and mrigal and between rohu and common carp were observed considering the yield data over the year 1994-95 to 1995-1996 for twenty oxbow lakes of Oxbow Lake Project, 1997. Using CVP analysis target sales volume (kg) of LWBs in different years was calculated from the equation given by Kaplan and Atkinson, 2002: Target sales – variable expenses – fixed expenses = target net income.

METHODS

Primary productivity of each LWB was measured by secchi disc depth (cm) twice in a month every year. Through observations standard water areas (ha) were collected three times in a year with respect to lean season, rainy season and winter season. Information regarding stocking densities (fingerlings/ha) of three Indian Major carps and three exotic carp species viz. silver carp, grass carp, common carp, catla, rohu and mrigal were recorded timely. Structured questionnaires and annual work plans of Aquaculture Development Project (IFAD) and Beel-Baor Fisheries Development Project (Revenue) were used to collect information. Stocking density was the estimated numbers of fingerling per hectare water area. Catch compositions (Kg/ day/ ha) were recorded and collected from the daily catch records of the stocked carps. Rearing periods of carp stocked were measured from the mean daily catch data of different sizes of carp yields. The size frequency of different carp yields limits from 0.4 kg to 3.0 kg. Based on mean data of the carp yields per day, relationships among the cultured species were

achieved for Purakhali LWB through correlation matrix. Through CVP analysis target sales volume (kg) each year were identified before undergoing operation into the CMLWB.

RESULTS

In CMLWB highest result of carp yield was found in the year 2003-04 among the all LWBs, 1354.89 kg/ha at a stocking density 3148 fings/ha, standard water area 55.08 ha and secchi depth 49.90 cm. Whereas in PMLWB, highest yield was observed in the year 2002-03, 607.71 kg/ha at the stocking density 1723 fings./ha, standard water area 20.50 ha and secchi depth 87.40 cm. Highest yield of GMLWB was observed in the year 2002-03, 227.97 kg/ha at the stocking density 906 fings./ha, standard water area 150.40 ha and secchi depth 87.50 cm. Besides comparing year wise yields in CMLWB it was found that in the year 2001-02 the stocking density was 4804 fings/ha & in the year 2003-04 it was 4175 fings/ha. The stocking densities were 34.47% higher in the year 2001-02 and 24.60% higher in the year 2002-03 comparing to that in the year 2003-04 but carp yields were not likely the same. In the year 2003-04, carp yields were 50.99% higher from the year 2001-02 and 19.20% higher from the year 2002-03 (Figure 4).

Table1. General physical information of the three LWBs management systems

Management systems	Year	Yield (kg/ha)	Stocking (No./ha)	Standard Water Area (ha)	Secchi depth (cm)
CMLWB	2000-2001	243.11	1268	56.70	50.90
	2001-2002	664.04	4804	55.35	49.70
	2002-2003	1094.69	4175	54.54	50.20
	2003-2004	1354.89	3148	55.08	49.90
PMLWB	2000-2001	391.31	897	22.50	85.30
	2001-2002	447.79	1856	21.30	88.30
	2002-2003	607.71	1723	20.50	87.40
	2003-2004	461.57	1586	22.20	84.30
GMLWB	2000-2001	171.41	416	150.30	89.20
	2001-2002	164.28	678	151.20	90.10
	2002-2003	227.97	906	150.40	87.50
	2003-2004	152.21	777	151.50	86.80

For every management system, the regression results showed positive relationship between yield and stocking density, yield and standard water area and yield and secchi depth. Subsequent variations between actual and planned carp yields were found during analyses of relationship between yield with stocking density or standard water area or secchi depth. (Figure1, 2&3)

Community Managed LWB (CMLWB)

1. Carp yield (Kg /ha/ year) and stocking density (No. /ha/ year)
   $Y = 0.1524X + 328.72$ ($R^2 = 0.2323$)
2. Carp yield (Kg /ha/ year) and Standard Water area (ha)
   $Y = -454.31X + 26016$ ($R^2 = 0.729$)
3. Carp yield (Kg /ha/ year) and Secchi depth (cm)
   $Y = -585.37X + 30210$ ($R^2 = 0.3953$)

Privately Managed LWB (PMLWB)

1. Carp yield (Kg /ha/ year) and stocking density (No. /ha/ year)
   $Y = 0.1264X + 285.51$ ($R^2 = 0.3422$)
2. Carp yield (Kg /ha/ year) and Standard Water area (ha)
   $Y = -89.729X + 2417.5$ ($R^2 = 0.7785$)
3. Carp yield (Kg /ha/ year) and Secchi depth (cm)
   $Y = 19.78X - 1230.4$ ($R^2 = 0.1565$)

Government Managed LWB (GMLWB)

1. Carp yield (Kg /ha/ year) and stocking density (No. /ha/ year)
   $Y= 0.0812X + 122.6$ ($R^2 = 0.2516$)
2. Carp yield (Kg /ha/ year) and Standard Water area (ha)
   $Y = -38.502X + 5987.1$ ($R^2 = 0.4592$)
3. Carp yield (Kg /ha/ year) and Secchi depth (cm)
   $Y = -4.6819X + 592.85$ ($R^2 = 0.0446$)

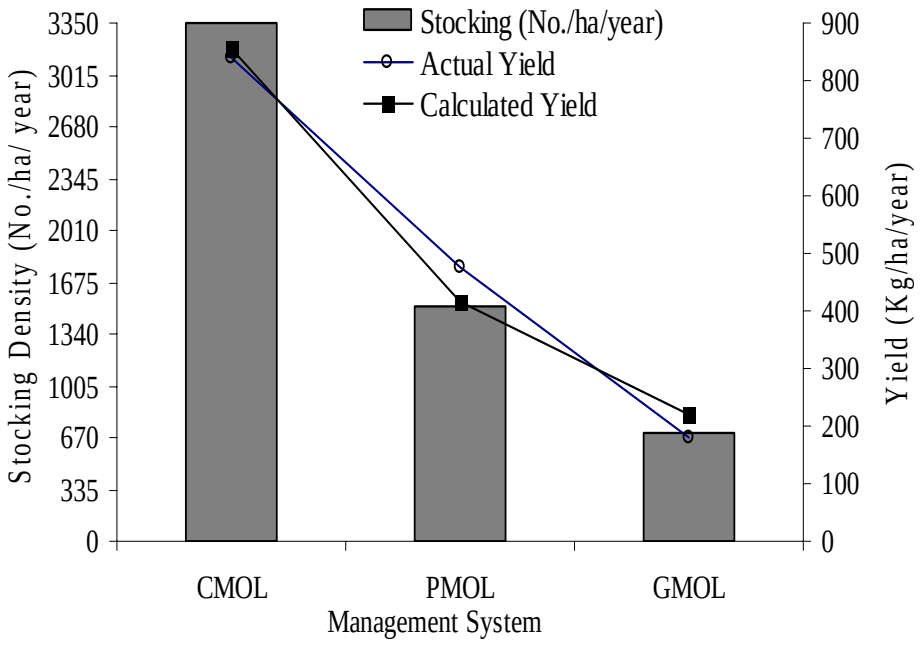

Figure 1. Variation in the yield resulting from stocking density

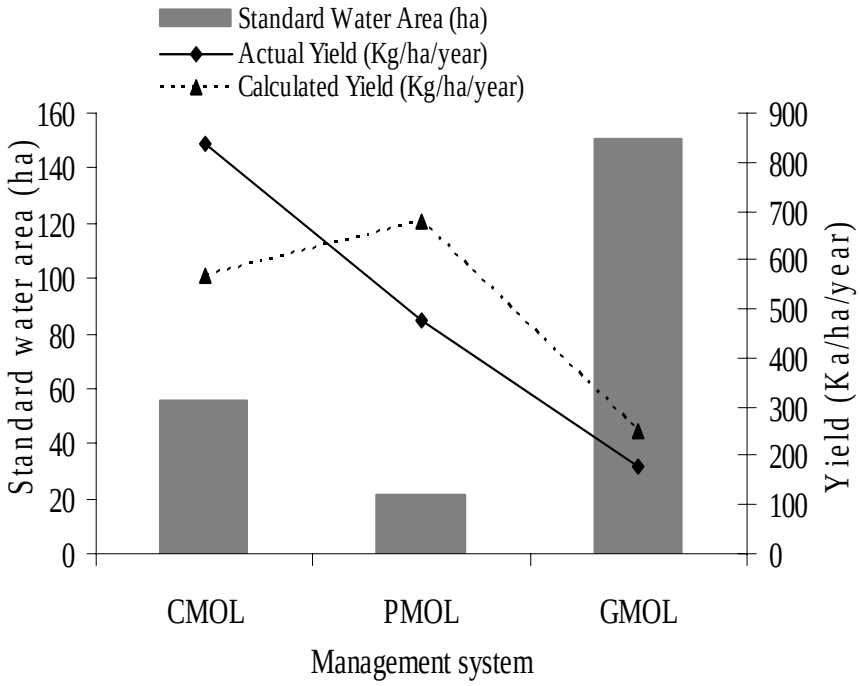

Figure 2. Variation in the yield resulting from standard

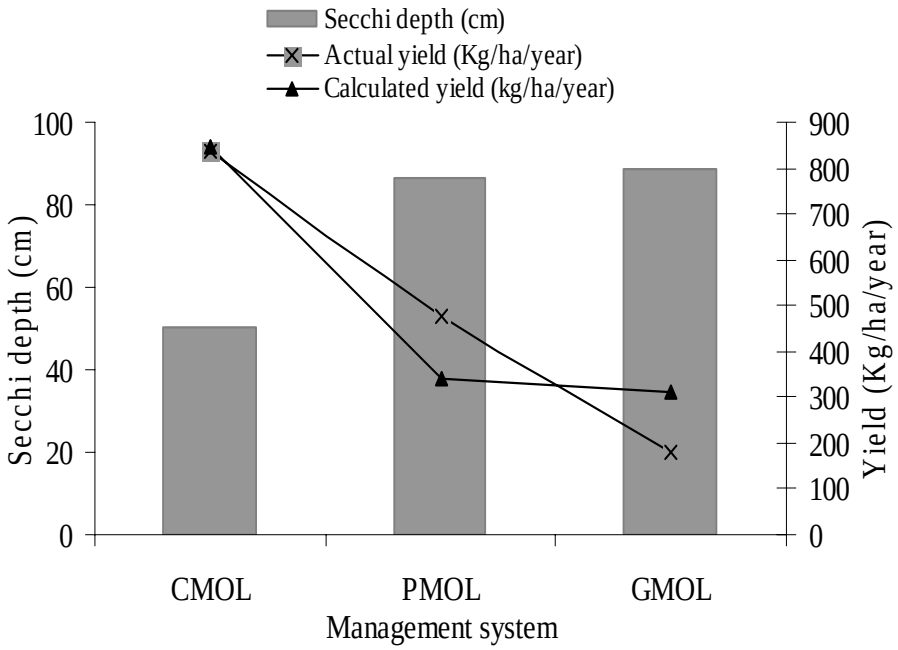

Figure 3. Variation in the yield resulting from secchi depth

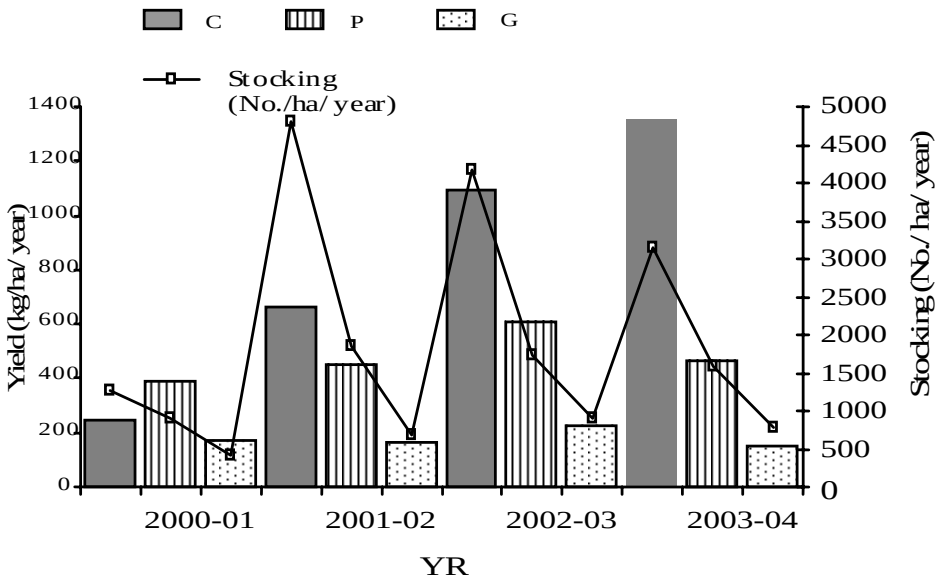

Figure 4. Relationship between yield and stocking density in different LWBs

Interaction between Three Major Carps and Three Exotic Carps

Catches of the stocked fish species per unit area (Kg/ha) in CMLWB (Purakhali LWB) over the year 2000-2001 to 2003-2004 are analyzed in Table 2. Correlation matrix showed that significant positive correlation ($P< 0.01$; $n = 12$) existed between silver carp and mrigal; mrigal and grass carp; catla and grass carp and, rohu and common carp. Highly negative correlation found between the species of catla and common carp (Table2).

Table 2. Correlation matrix between interactions of different species

Species	Silver carp	Catla	Rohu	Common carp	Mrigal	Grass carp
Silver carp	1	-	-	-	-	-
Catla	0.878	1	-	-	-	-
Rohu	0.369	0.018	1	-	-	-
Common carp	0.406	-0.005	0.979	1	-	-
Mrigal	0.813	0.453	0.512	0.639	1	
Grass carp	0.866	0.536	0.733	0.793	0.927	1

Cost-effectiveness of the intervention

Fishermen in CMLWB targeted sales volume (kg) before stocking into the LWB. Annual budgets were prepared including all fixed and variable costs. Besides shadow net income & balance sheet were thereby prepared which were later followed up through strong audit & monitoring in each production cycle. In Table 3 Cost Volume Profit scenario of CMLWB in different years in CMLWB was prepared.

Table 3. Cost Volume Profit scenario of CMLWB in different years

CVP Scenario	Cost activities	Per Unit	Percentage of sales
2000-01	Selling price	38.37	100
	Variable cost of each item	30.34	79.09
	Selling price less variable cost (C.M)	8.02	20.90
	Yearly fixed expenses		
	Lease fee	24805	
	Other fixed expenses	24000	
	Total fixed expenses per year	48805	
2001-02	Selling price	37.82	100
	Variable cost of each item	28.10	74.29
	Selling price less variable cost (C.M)	9.72	25.70
	Yearly fixed expenses		
	Lease fee	27285	
	Other fixed expenses	24000	
	Total fixed expenses per year	51285	
2002-03	Selling price	33.45	100
	Variable cost of each item	31.63	94.56
	Selling price less variable cost (C.M)	1.81	5.43
	Yearly fixed expenses		
	Lease fee	31377	
	Other fixed expenses	10800	
	Total fixed expenses per year	42177	
2003-04	Selling price	35.03	100
	Variable cost of each item	30.99	88.46
	Selling price less variable cost (C.M)	4.04	11.53
	Yearly fixed expenses		
	Lease fee	31377	
	Other fixed expenses	5400	
	Total fixed expenses per year	36777	

CONCLUSION

Fishermen's access into the LWBs will be significantly ensured in terms of their involvement into the decisional processes e.g. stocking, harvesting and cost decisions; investment into as well as enjoyment of profit there from. In CMLWB fruitful results were found from the same endeavors except some problems as financing. If soft and seasonal credit can be provided them the situation will be improved. AqDP (Aquaculture Development Project), 2001. Besides sometimes lease fees are so high due to bureaucratic "red tape" that fishermen can't afford that.

REFERENCE

AqDP (Aquaculture Development Project), 2001. Baor Babosthapona Bidhimala (Lake Management Constitution), Implemented by Padakkhep Manobik Unnayan Kendra – a national NGO.

Hasan, M.R. and Middendorp, H.A.J., 1997a. Optimizing stocking density of carp fingerlings through modelling of the carp yield in relation to average water transparency in enhanced fisheries in semi-closed water in western Bangladesh. Paper presented at FAO/ODA *International Expert Consultation on Inland Fishery Enhancement*, Dhaka, Bangladesh, 7-11.

Kaplan, S.R., Atkinson, A.A., 2003 Advanced Management Accounting. *Prentice- Hall of India Private Limited*, New Delhi, India, 28 -114 pp.