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POLYCULTURE OF GIANT FRESHWATER PRAWN, *MACROBRACHIUM ROSENBERGII*, WITH INDIAN MAJOR CARPS - A CASE STUDY

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ABSTRACT

A study conducted in a 450-m^2 earthen pond to evaluate the production potential of giant freshwater prawn (stocked at 20,000 juveniles/ha) and Indian major carps, catla and rohu (stocked at 5000 juveniles/ha in 2:1 proportion) revealed that in nine months' growing period, catla and rohu attained average sizes of 357 ang 746 g, respectively, while prawn weighed 48.32 g. The growth of rohu was much faster than catla as indicated by higher relative and absolute weight gains. The total fish production per hectare was estimated to be 2418 kg and prawn production stood at 780 kg with excellent survival of both the fish (>98%) and prawn (>80%).

Keywords : Polyculture, giant freshwater prawn, Indian major carps

INTRODUCTION

Polyculture of giant freshwater prawn along with Indian major carps is becoming popular compared to monoculture among fish farmers due to the high cost of management, low survival and differential growth of prawn under monoculture systems (Cohen *et al.,* 1983; Vasudevappa *et al.,* 1999). The polyculture of prawn with fish is commonly practiced in the northen parts of Karnataka, Andhara Pradesh, Orissa, West Bengal and Punjab. The presence of fish in a polyculture system serves as a biological control over development of zooplankton, phytoplankton and filamentous algae, which otherwise result in ecological instability of the pond ecosytem (Baissac, 1976; Barnes, 1980). It has been demonstrated that the presence of fish in low stocking densities improves the ecological maintenance of pond without affecting the prawn growth. Since the prawn under polyculture with fish derives its nutrition by utilizing the natural pond productivity and left-over fish feed, faecal matter of fish, etc., there is no need for a separte high-cost prawn feed. Ahemad (1998) while reviewing the progress of freshwater prawn farming in Orissa has indicated a stocking density of 10,000-200,000 prawn seed along with 5000 fish per hectare for getting good production of both fish and prawn. The experiments conducted at the Fisheries Research Station, Hesaraghata, have indicated that a stocking density of 20,000 prawn juveniles with 5000 fingerlings of catla and rohu in 2:1 ratio gives better growth and production of both fish and prawn in a polyculture

system. Utilizing the results of this experiment, a case study of polyculture of prawn with fish in a 450-m^2 earthen pond was carried out and the details regarding biomass growth, survival, size distribution, productin and economics have been worked out.

MATERIAL AND METHODS

An earthen pond of 450 m^2 area, the sides of which were covered with stone slabs (to control lateral seepage) with open earthen bottom, was utilized for the study. The pond was drained, dried and limed using agriculture lime at 250 kg/ha. The pond was manured using 200 kg cow dung, 1 kg urea and 2 kg super phosphate initially, and a monthly dosage of 100 kg cow dung, 0.5 kg urea and 1 kg super phosphate was applied. The pond was stocked with 150 catla and 75 fohu juveniles (86.7-105.0 g) along with 900 prawn juveniles (0.85-4.80 g). The fish and prawn stocking density worked out to be 5000 fish and 20,000 prawn juveniles, respectively, per hectare. Fish and prawn were fed on formulated pelleted feed prepared at the Fisheries Research Station using rice bran, groundnut cake, soybean cake, sunflower cake, coconut cake, fishmeal and wheat gluten meal along with fish and vegetable oils. The feed had a crude protein of 28.42% and fat 6.95%. Feeding was done at 6, 4 and 3% during the 1st, 2nd and 3rd months and it was maintained at 2% of body weight of fish and prawn during the remaining period. The water quality parameters, *viz.*, temperature, dissolved oxygen and pH, were monitored once in a fortnight.

RESULTS AND DISCUSSION

The water quality parameters, *viz,* temperature (24.50-27.10°C) pH (7.80-8.40) and dissolved oxygen (3.80-8.50 ppm), fluctuated within the desired levels. The details regarding monthly growth, growth rate, survival, biomass production and size frequency distribution of fish and prawn are presented in Tables 1-3. During the 9 months' growing period, catla juveniles of 105 g mean weight grew to a size of 357.10 g while rohu of initial weight of 86.70 g attained 745.90 g (Fig. 1&2), during the identical rearing period indicating faster growth of rohu as compared to catla. This is the result of low natural food production (zooplankton) in the pond due to continuous seepage of water from pond and greater density of catla as compared to rohu. Besides, the sinking pellets given as food probably would have been better utilized as food by rohu than catla. The prawn

Table 1 : Monthly weight gain (%) of fish and prawn in the polyculture system

Fish/ prawn	Initial mean wt	Relative weight gain in different months									Absolute wt gain (%)
		1	2	3	4	5	6	7	8	9	
Catla	105.0	53.00	21.69	23.07	12.39	9.17	5.05	4.84	3.32	6.31	240.10
Rohu	86.7	82.53	32.70	31.26	30.78	25.02	24.32	7.13	5.81	17.43	760.32
Prawn	2.34	192.74	132.85	62.26	34.65	17.30	6.65	2.75	2.46	5.27	1964.96

Table 2 : Growth, survival and biomass production of fish and prawn in the polyculture system

Fish/prawn	Initial mean wt (g)	Size range at stocking (g)	Final mean wt (g)	Survival (%)	Total biomass (kg)	Net biomass (kg)	Production (kg/ha)
Catla	105.0	85-140	357.1	98.67	52.85	37.10	1174.44
Rohu	86.7	74-120	745.9	100.00	55.94	49.44	1243.10
Prawn	2.34	0.85-4.80	48.32	80.78	35.13	33.02	780.67

Table 3 : Frequency distribution of prawn, catla and rohu grown in the polyculture system

	Distribution (%)		
Size groups (g)	**Prawn**	**Catla**	**Rohu**
20-30	24.22		
31-40	23.80		
41-50	20.90		
51-60	11.20		
61-70	3.78		
71-80	6.30		
81-90	1.54		
91-100	2.86		
>100	5.40		
201-300		17.61	
301-400		59.17	
401-500		16.28	10.67
501-600		5.68	13.33
601-700		1.26	26.67
701-800			16.00
801-900			16.00
901-1000			5.33
1001-1100			2.67
1101-1200			4.00
1201-1300			5.33

juveniles of initial mean weight 2.34 g attained 48.32 g indicating better prawn growth in nine months. The size ranges of catla, rohu and prawn were 230-450 g, 400-1300 g and 25-220 g, respectively. In a polyculture system, whenever prawn was grown with channel catfish, the prawn and fish showed a size range of 30 to 72 g and 315 to 690 g, respectively (Miltner *et al.*, 1983; Pavel, 1985). The weight of catla, rohu, silver carp and grass carp varied between 187.22 and 267.55 g in a

Fig.1: Growth of Catla and Rohu in polyculture with prawn

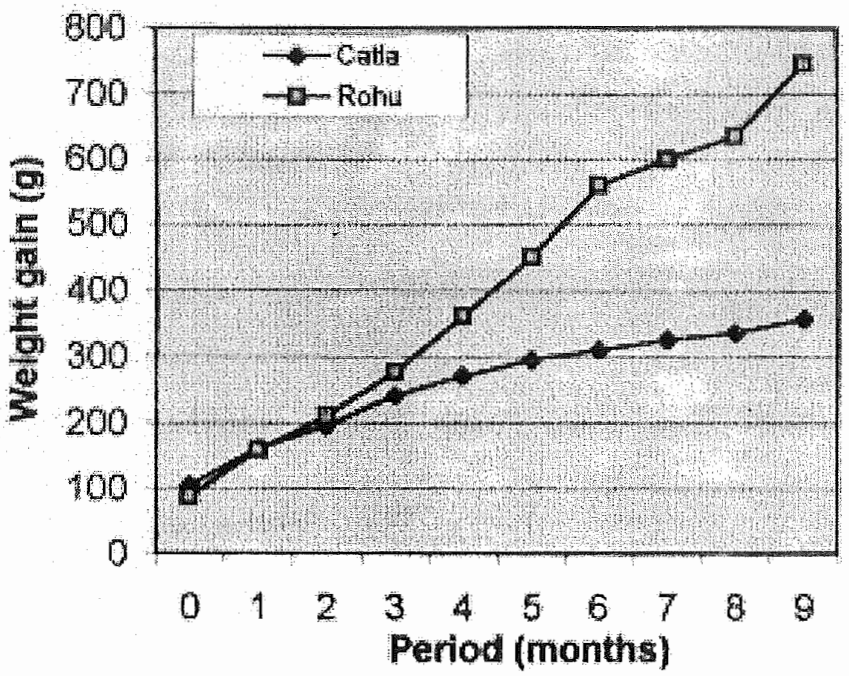
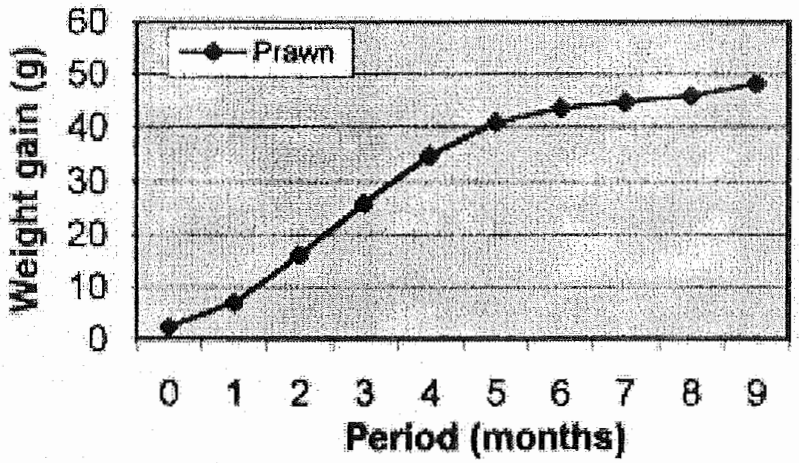


Fig.2: Growth of Prawn in Polyculture with Catla and Rohu



polyculture system during 5 months' rearing period (Ahmed and Varghese, 1992). However, the growth response of prawn was poor (3.70 g).

The survival of both the species of fish was almost 100% and it was 80.78% for prawn, indicating excellent survival of fish and prawn in a polyculture system. Many workers have witnessed good survival of both fish and prawn in a polyculture system. Miltner *et al.* (1983) and Pavel (1985) recorded good survival of prawn juveniles (above 80%). Abramo *et al.* (1986) recorded mean survival rates of 89.40 and 93.30% for catfish and prawn, respectively during 4 months' growing period. The survival rates recorded by Ahmed and Varghese (1992) for fish and prawn were 75 and 58%, respectively. The observations made in this study corroborate the earlier observations.

In spite of the lower density of rohu as compared to catla, the total biomass contributed by rohu was highest (55.94 kg) followed by catla (52.85 kg). The prawn biomass was 35.13 kg accounting for about 24.40% of the total biomass (143.92 kg). The biomass of fish was 108.79 kg, which formed 75.60% of the total biomass. This indicates that prawn and fish form about 25 and 75%, respectively, of the total biomass in a polyculture system. Between catla and rohu, catla accounted for 36.70% and rohu 38.90% of the total biomass. The net biomass also showed a similar trend. Keeping in view the percentage contribution of catla, rohu and prawn to the total biomass, it was observed that the level of contribution of catla (31.03%) to the net biomass came down, while rohu (41.35%) and prawn (27.62%) showed an increase indicating better production and productivity of rohu compared to catla in this study. The total production per hectare works out to 3198.21 kg with fish contributing to 2417.54 kg (75.59%) and prawn 780.67 kg (24.41%). Indian major carps and common carp when grown with prawn gave a productions level of 1388-1695 kg in 5-8 months in Orissa (Ahemed, 1995). He obtained a prawn production of 250-268 kg/ha. The production of fish and prawn obtained in the present study are of much higher order as compared to the fish production observed in trials conducted in Orissa. However, much higher fish production (4982-8217 kg/ha) has been observed by D' Abramo *et al.* (1986) when catfish and prawn were cultured together, though the prawn production remained low (125-172 kg/ha). These results show a possibility of enhancing the fish production from 2418 kg/ha to a much higher level with proper species combination and management.

The details regarding growth given in Table 2 indicate higher monthly relative growth rate of rohu during the entire nine months' growing period, as compared to catla indicating faster growth of rohu. The overall absolute weight gain was 240.10% for catla and 760.32% in rohu indicating almost three-folds faster growth of rohu. The growth rate gradually came down with increasing growing period. The monthly relative weight gain remained quite high during the first four months, and it gradually came down and remained low towards the end of the growing period. The absolute weight gain for prawn was quite high (1964.96%).

The frequency distribution of prawn and fish in different size groups (Table 3) indicate that majority of catla (59.17%) were of size ranging from 301 to 400 g and greater proportion of rohu (58.67%) ranged from 601 to 900 g. Prawns of size 20-50 g dominated the catch accounting for 68.92% of the total. Prawn above 50 g formed 31.08%.

The economics of polyculture of prawn and fish given in Table 4 indicate a production worth Rs. 5730 and the total revenue realized was Rs. 10,289. The net profit was Rs. 4559 from 450 m^2 in nine months and when this is computed for one hectare it amounts to Rs. 101,313 in nine months, indicating the high profitability of polyculture of prawn and fish.

From the above results, it can be inferred that in a polyculture system involving catla, rohu and prawn, a fish production of about 2500 kg and prawn of about 800 kg/ha in 8-9 months' growing period are possible and profitable. There appears to be good scope for further enhancement of the fish production by suitably modifying the proportion of catla and rohu, and proper pond management.

Table 4 : Economics Rs. of polyculture of fish and prawn in 450-m^2 pond in 9 months

Expenditure:

Lime - 10 kg	3.00
Organic manure - 800 kg	400.00
Inorganic fertilizer - 10 kg	50.00
Fish seed (catla - 150 : rohu - 75)	450.00
Prawn seed - 900 no.	1800.00
Feed - 250 kg	2500.00
Micellaneous	500.00
Total	5730.00

Receipts

Sale of fish (108.79 kg) at Rs. 30/kg	3263.00
Prawn (35.13 kg) at Rs. 200/kg	7026.00
Total	**10,289.00**
Net profit	**4559.00**
Net profit/ha	**101,313.00**

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