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PRELIMINARY EXPERIMENTS ON MONOCULTURE OF *CHANOS CHANOS* (FORSKAL) AND ITS POLYCULTURE WITH *PENAEUS MONODON* FABRICIUS

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ABSTRACT

Preliminary experiments on monoculture of milk fish, *Chanos chanos* and its polyculture with tiger prawn, *Penaeus monodon* were carried out in the grow-out pond system at Mariculture farm, Muttukadu near Madras. During the six-month rearing, *C. chanos* attained an average size of 234.6 mm (76.9 g) in the monoculture trial and 159.8 to 231.8 mm (39.0 to 90.9 g) in the polyculture experiments. In the case of tiger prawn, the growth was poor and the sizes recorded at harvest were 119.4 to 135.1 mm (12.8 to 17.8 g). The rate of recovery ranged from 8.4 to 87.0% for fish and 20.6 to 35.3 % for prawn. The reasons for poor growth and survival of fish and prawn in relation to environmental and other factors are discussed.

INTRODUCTION

In recent years, the utilisation of coastal areas for aquaculture has been felt very much in India. Among the cultivable marine finfishes and prawns of the Indian region, the milk fish *Chanos chanos* (Forskal) and the tiger prawn *Penaeus monodon* (Fabricius) are known to grow fast in coastal ponds and attain harvestable size in 6-12 months and 4-5 months respectively. Good amount of information are available on milk fish and tiger prawn culture in coastal areas (Chacko and Mahadevan, 1956; Tampi, 1960; Evangeline, 1967; Marichamy *et al.*, 1979 and 1980; Sundararajan *et al*, 1979; Dwivedi *et al.*, 1980; Bensam and Marichamy, 1981; Shanmugam and Bensam, 1982; Mohan and Nandakumaran, 1982; Marichamy and Rajapackiam, 1982; Mohan, 1983; Mohanraj *etal.,1983* and Venkataraman *et al.*, 1985). In the present paper a pioneering attempt has been made to study the constraints involved in the culture of fi?h and prawn in the Mariculture farm of CMFRI at Muttukadu near Madras.

MATERIAL AND METHODS

Three experiments (one monoculture and two polyculture) were conducted during June-December, 1983 in the ponds of the Mariculture farm located at Muttukadu, 36 km south of Madras. The location and general lay out are indicated in Fig. 1. The pond B-2, where monoculture was carried out for milk fish was 1.2 ha in area and was provided with a wooden sluice (2.5 X 1.0 X 1.5 m) to have water connection with the open farm. Polyculture trials I and II were carried out in pond No. A-l (0.15 ha, with a wooden sluice of 2.5 X 0.4 X 0.4 m) and pond No. A-5 (0.4 ha without a sluice) respectively. All the three ponds have sandy bottom with a little amount of silt. As the nearby bar mouth of Kovalam backwaters remained closed during February-August, 1983, there was no exchange of water between the farm and the outside backwaters. However, exchange of water with the ponds B-2 and A-l took place from September onwards when the bar mouth was opened on 1-9-1983.

TABLE 1. *Hydrological conditions of the culture ponds during June - December*, 1983

Months	Ponds	Temperature (°C)	Salinity (Ppt)	Dissolved oxygen (ml/1)	PH	Water transparency (cm)
June	A-1	29.6	51.89	5.40	8.00	22.0
	A-5	29.2	33.57	4.69	8.29	28.0
	B-2	29.5	56.10	5.17	8.54	44.0
July	A-1	30.3	47.23	4.54	8.28	45.0
	A-5	32.4	31.09	3.84	8.11	24.0
	B-2	31.9	59.77	461	8.27	49.0
August	A-1	31.5	50.58	4.05	8.20	35.0
	A-5	30.9	25.11	4.64	8.26	33.0
	B-2	30.2	49.40	4.43	8.69	48.40
September	A-1	31.5	37.54	4 32	8.31	30.0
	A-5	31.8	22.45	4.50	8.36	28.0
	B-2	31.5	44.16	4.73	8.51	38.0
October	A-1	29.8	25.37	5.41	8.02	47.0
	A-5	30.1	18.21	4.74	8.20	54.0
	B-2	30.0	30.17	5.26	8.40	33.0
November	A-1	28.0	22.79	4.82	8.46	57.0
	A-5	27.4	14.33	4.52	8.40	52.0
	B-2	27.4	21.21	4.66	8.59	32.0
December	A-1	26.8	26.93	5.21	8.00	47.0
	A-5	26.8	14.91	4.87	8.21	48.0
	B-2	26.1	21.91	5.11	8.50	52.0

Hydrological parameters such as surface temperature, salinity, dissolved oxygen, pH and water transparency of the culture ponds under study were recorded weekly and are given in Table 1.

Fry of rnilk fijh were collected from the tidal pools at Kovalam, a nearby fishing village. Seed of tiger prawn were obtained from the prawn hatchery of the CMFRI Field Laboratory at Kovalam. The details of stocking of fish and prawn are given in Table 2.

Monthly sampling of stocked fish and prawn was carried out by drag net to study the growth and general well-being of the cultured organisms. All the three experiments were carried out for a period of six months, without offering any supplementary feed and the final harvest was done on 14-12-1983 for polyculture experiments and 16-12-1983 for monoculture trial. Drag netting, cast netting and hand picking were resorted to for harvesting.

HYDROGRAPHY OF THE CULTURE PONDS

Monthly average values of hydrographical features of the ponds are given in Table 2.

Temperature: In all the three ponds under study, the value rose from 29.2°C in June to 32.4°C in July and afterwards, it gradually decreased and reached the lowest of 26.1°C in December, coinciding with the prevailing monsoon season.

TABLE 2. *Stocking details of mono and polyculture experiments*

Species	Date of stocking	Pond size (ha)	Rate of stocking per ha	Size range (mm)	Average length (mm)	Weight (g)
			Monoculture			
C. chanos	20-6-'83	1.2	2,500	20-60	36.4	0.4
			Polyculture -1			
C. chanos	18-6-'83	0.4	5,000	12-35	25.0	0.1
P. monodon	-do-		5,000	11-23	17.8	0.02
			Polyculture - II			
C. chanos	-do-	0.15	5,000	12-35	25.0	0.1
P. monodon	-do-		5,000	11-23	17.8	0.02

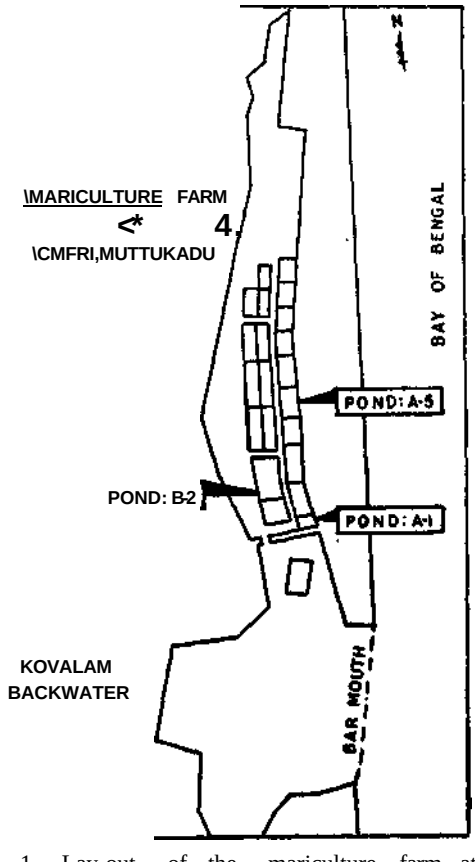

Fig. 1. Lay-out of the mariculture farm at Mattukadu showing the location of culture ponds under study.

Salinity: In ponds A-1 and B-2, the value recorded during the second half of June was 51.89 and 56.10 ppt respectively, which was slightly reduced to 40.58 and 49.40 ppt in August. The heavy rains occurred in the following months decreased the value to 26.93 ppt in A-1 and 21.91 ppt in B-2 during the first half of December. The initial salinity in pond A-5 during the second half of June was 33.57 ppt, which went down to 14.91 ppt in December.

Dissolved oxygen: In all the three ponds, the dissolved oxygen levels varied from 3.84 to 5.40 ml/1.

pH: The pH values ranged from 8.00 to 8.59 in ponds A-1 and A-5. In pond B-2, the values varied from 8.29 to 8.69.

Water transparency: The secchi-disc was used as a measure of transparency of the water. The transparency of the water in pond B-2 was 44 cm in July as the pond water remained clear. When the pond was flooded in September, the water transparency depth was 38 cm. It decreased to 32 cm in November, as the algal bloom consisting of *Oscillatoria* sp. increased. However, the depth of water transparency was 52 cm in December, as the bloom faded away. In the case of ponds A-1 and A-5, the water transparency was erractic, as a succession of algal bloom was noticed.

TABLE 3. *Growth ofmnkfish in monoculture and polyculture trails in different culture systems of India*

Type of pond	Stocking rate/ha	Culture period (month)	Rate of growth (mm) Per month	Per day	Production rate/ha (kg)	Authors
I. Monoculture (without supplementary feeding)						
Marine	6,250	12	18.7	0.6	212.0	Tampi (1960)
Brackishwater	1,000	7	36.4	1.2	—	Evangeline (1967)
Marine	10,000	5	51.4	1.7	—	Marichamy *etal.* (1979)
Brackishwater/ hypersaline	5,000	10	22.8	0.7	—	Dwivediefa/. (1980)
M arine/hypersaline	4,000	1	54.0	1.8	—	Mohan (1983)
Marine	9,875	6	49.3	1.6	—	Venkataraman *et al.* (1985)
Brackishwater/ marine/hypersaline	2,500	6	33.0	1.1	—	Present observation
n. Polyculture (without supplementary feeding)						
Brackishwater	3,500	6	43.2	1.4	877.0	Sundararajan *et al.* (1979)
M arine/hypersaline	3,000	12	28.1	0.9	323.8	Marichamy *et al.* (1980)
Marine/hypersaline	7,815	11	6.3	0.2	318.0	Bensam and Marichamy (1981)
Marine/hypersaline	5,000	7	39.4	1.3	133.5	Marichamy and Rajapackiam (1982)
Brackishwater	4,444	3	35.9	1.1	—	Ramakrishna *et al.* (1982)
M arine/hypersaline	4,000	10	24.0	0.8	1,289.0	Mohanraj *et al* (1983)
Brackishwater/ marine/hypersaline	5,000	6	16.9—19.5	0.6—0.7	—	Present observation

CULTURE RESULTS

Monoculture experiment of milk fish

The stocked fry exhibited fast growth during the first three months of rearing and thereafter, the growth rate decreased. During the first three months, fish grew from an average length of 36.4 to 229.4 mm, the increase being 193.0 mm in 90 days (64.3 mm/month; 2.14 mm/day). The growth rate was 6 to 7 mm/month during the fourth and fifth months of rearing. At the final harvest, after 180 days, the average size stood at 234.6 mm, which was lesser than that of fifth month's record (243.3 mm in November, Fig. 2). The decrease in size could have been due to the escape of unknown number of the stock when the earthern bund of the pond breached at the time severe flooding in the farm by the end of November. The growth in 180 days was 198.2 mm, the rate of growth being 33.0 mm/month and 1.1 mm/day. The gain in weight was 76.5 g in 6 months (12.7 g/month; 0.4 g/day). Out of 3,000 stocked, 761 number of fiih weighing 54 kg were harvested, the rate of recovery being 25.3 %. The lesser recovery was due to the escape of some fishes in November as mentioned above. The average size and weight at the final harvest were 234.6 mm and 76.9g respectively, while the size ranged from 223 to 264 mm and 60 to 96 g in weight.

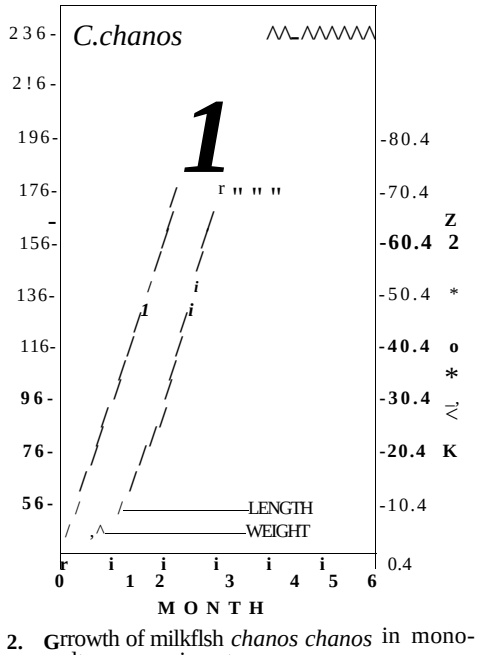

Fig. 2. Growth of milkfish *chanos chanos* in monoculture experiment.

Polyculture experiment No. I

In this experiment, fry of milk fish showed a gradual growth of 65.0 mm by the first month, 88.2 mm by the second month, 151.0 mm by the third month, 175.0 mm by the fourth month, 210.0 mm by the fifth month and 231.8 mm by the sixth month. The corresponding weight recorded from 1st to 6th month was 2.5, 5.0, 25.0, 44.6, 66.0 and 90.9 g respectively (Fig. 3). The increase in length and weight from stocking to harvest was 206.8 mm and 90.8 g respectively. The length increment was 34.4 mm/month or 1.1 mm/day and weight 15.1 g/month or 0.5 g/day. In the case of *P. monodon*, the growth was slow. The stocked prawns grew to an average size of 51.3 mm in the first 30 days, 99.2 mm in 60 days, 125.2 mm in 90 days, 126.7 mm in 120 days, 128.1 mm in 150 days and 135.1 mm in 180 days. The corresponding weight increases were 1.0, 8.0,14.0,15.0,16.1 and I7.8g during 1st, 2nd, 3rd, 4th, 5th and 6th months respectively. The increase in length during 6 months culture period was only 117.3 mm, the rate of growth being 19.5 mm/month or 0.65 mm/day. The gain in weight was 17.78 g (2.96 g/month or 0.09 g/day).

At the final harvest in December, the recovered fish and prawn amounted to 63 number (5.7 kg) and 265 number (4.7 kg) respectively. The harvested milk fish had a size range of 202 to 277 mm and tiger prawns had a range of 123 to 164 mm. The lower survival rate for *C. chanos* (8.4%) and *P. monodon* (35.3%) was due to the unauthorised fishing by local fishermen in August.

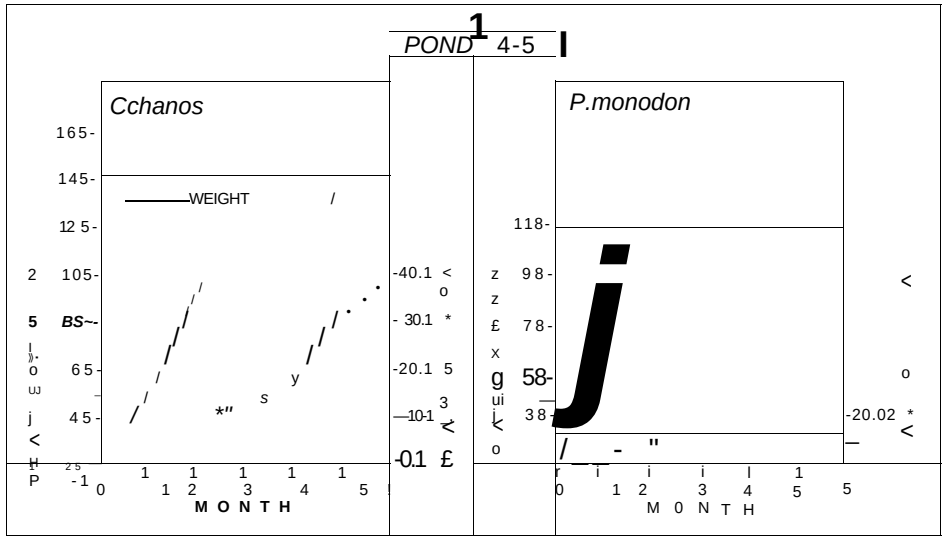

Fig. 3. Growth of milkfish *chanos chanos* and tiger prawns *Penaeus monodon* in polyculture experiment-1.

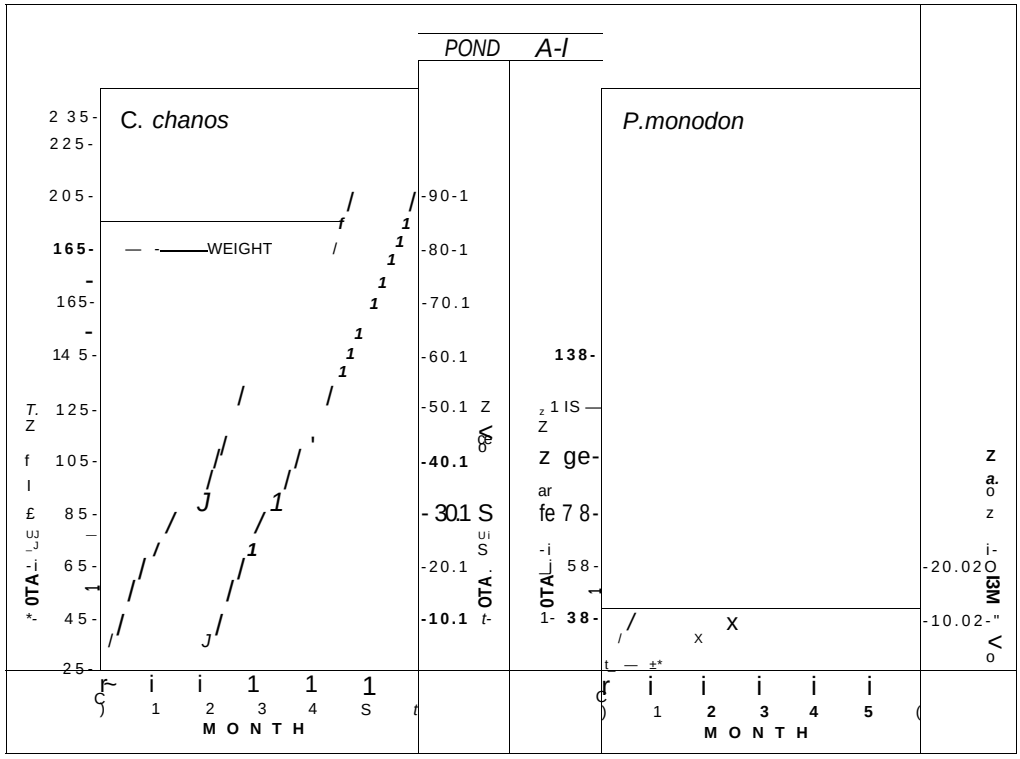

Fig. 4. Growth of milkfish *chanos chanos* and tiger prawn *Penaeus monodon* in polyculture experiment-II.

Polyculture experiment No. II

In this experiment, the fry of milk fish recorded a lower growth rate of 56.2 mm by first month, 97.0 mm by second month, 146.8 mm by fifth month and 159.8 mm by sixth month (Fig. 4). The rate of giowth was 22.4 mm/month or 0.74 mm/day (6.35 g/ month; 0.21 g/day). The reared tiger prawn also recorded a lower growth rate. The stocked prawns grew from an initial average size of 17.8 mm (0.02 g) to 119.4 mm (12.8 g) in 180 days. The actual increase in length and weight was 101.6 mm and 12.78 g respectively. The rate of growth was 16.9 mm/month or 0.56 mm/day in length and 2.1 g/month or 0.07 g/day in weight.

Out of 2,000 each of *C. chanos* and *P. monodon* stocked, 1,760 (weight: 67.76 kg) milk fish and 412 (wt: 5.27 kg) tiger prawn were harvested. The recovery rate for fish and prawn was 87.0 and 20.6 % respectively. The size range for harvested milk fish was between 141 and 218 mm, while it was from 110 mm to 130 mm for the tiger prawn. Most of the harvested prawns were not in good condition as their exoskeleton was soft, indicating the possible mortality of prawns in the course of culture.

DISCUSSION

To compare the present record of growth of *C. chanos* in the monoculture and polycylture trials, the results of experiments conducted in different ecosystems with various stocking densities by many earlier Indian workers have been summarised in Table 3. During the present studies, it has been observed that irrespective of saline and less productive conditionsof the culture pond, the milk fish has grown fast (up to 1 mm and above per day) in a stocking density of 2,500/ha without supplementary feeding. Mohan (1983) reported a growth of 1.7 to 2.0 mm/day with a stocking density of 4,000 to 8.000 per ha in hypersaline ponds. Though, the higher rate of growth was observed in the present monoculture and polyculture-I for *C. chanos* (34.4 to 35.5 mm/month; 1.14 to 1.16 mm/day), the rate of recovery was 8.4 to 25.3% which was due to the escape of reared milk fish during flood in November in the monoculture pond and due to poaching in the second month of rearing in polyculture-I pond. In the case of polyculture-II, though the survival rate was high (87.0%) for milk fi;h, the growth exhibited was poor (22.4 mm/month; 0.7 mm/day) on account of low productivity in the newly constructed pond.

In the case of *P. monodon*, the growth (16.9 to 19.5 mm/month; 0.56 to 0.65 mm/ day) and survival (20.6 to 35.3 %) were poor. Such unfavourable results in the polyculture experiments of milk fi?h and tiger prawn in Philippines were reported in regard to growth (Santiago and Santiago, 1978) and survival (Delmando andRabanal, 1956; Caces-Borja and Rasalan, 1968). However, higher rate of survival for tiger prawn in polyculture operations was achieved with supplementary feeding and improved pond management (Caces-Borja and Rasalan, 1968; Eldani and Primavera, 1981). Though, salinity of the water remained high (51-56 ppt) in ponds B-2 and A-1 during the first three months, the growth rate of milk fish and tiger prawn was in steady state.With supplementary feeding and effective pond management, it may be possible to achieve better results in the future polyculture trials of milk fish and tiger prawn.

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