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Evaluation of milkfish (*Chanos chanos* Forskal) and prawn (*Penaeus monodon* Fabricius) in polyculture systems

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The growth, survival and profitability of milkfish and prawns (averaging 3.1 g and 0.3 g respectively) grown in five different combinations for 100 days in 500 m^2 brackishwater ponds were assessed. The various treatments with three replicates each were: (I) 2,000 milkfish/ha; (II) 4,000 milkfish/ha; (III) 6,000 prawns/ha; (IV) 2,000 milkfish with 6,000 prawns/ha; and (V) 4,000 milkfish with 6,000 prawns/ha.

The percentage survival of both milkfish and prawn is presented in Table 1. The survival of prawns, 79.8%, 72.7% and 73.8% for treatments II, IV and V respectively, were not significantly different from each other. There was no significant difference in survival rates of milkfish grown in monoculture and polyculture systems at the same stocking density. Moreover, survival at 2,000/ha is significantly higher than those at 4,000/ha.

Figure I presents the growth curve of milkfish exposed to various treatments. Growth rates and average weight gains of milkfish (Table 1) were inversely related to the stocking rate. Those stocked at 2,000/ha (Treatments I and IV) grew significantly faster than those at 4,000/ha (Treatments II and V). Their growth rates when cultured singly was not significantly different than those in combination with prawn.

Growth curves of the prawns for the different treatments (Fig. 2) showed that the prawns in monoculture (III) attained the highest growth throughout the culture period. Its average weight gain (Table 1) was significantly higher than prawns in polyculture with milkfish (IV and V). Average weight gain of prawns cultured with 2,000 milkfish/ha were likewise significantly higher than those with 4,000 milkfish/ha.

Although milkfish production was not significantly affected by stocking rate and/or culture methods, monoculture treatments I (396.93 kg/ha) and II (442.08 kg/ha) provided slightly higher production than polyculture treatments IV (388.06 kg/ha) and V (374.0 kg/ha).

Production of prawn in the monoculture (144.3 kg/ha) was significantly higher than those

Table 1. Growth, survival and production of milkfish and prawn cultured singly or in combination for a period of 100 days.

Treatments	Replicate	MILKFISH Average Initial wt. (g)	MILKFISH Average Final wt. (g)	MILKFISH Average Wt. gain (g)	MILKFISH Survival rate (%)	MILKFISH Production kg/ha	PRAWN Average Initial wt. (g)	PRAWN Average Final wt. (g)	PRAWN Average Wt. gain (g)	PRAWN Survival rate (%)	PRAWN Production kg/ha	Total Production kg/ha
	1	3.25	201.10	197.85	98.00	394.17						394.17
I	2	3.05	215.32	212.27	94.00	409.12						409.12
	3	4.75	193.75	189.00	100.00	387.50						387.50
	Mean	3.68	203.39	199.71	97.3	396.93						396.93
	1	5.50	185.98	180.48	97.50	725.34						725.34
II	2	4.15	79.28	75.13	94.00	298.12						298.12
	3	3.70	87.01	83.31	87.00	302.08						302.08
	Mean	4.45	117.42	112.97	92.00	442.08						442.08
	1						0.36	31.99	31.63	70.00	134.36	134.36
III	2						0.50	28.02	27.52	95.00	159.74	159.74
	3						0.50	30.98	30.48	74.60	138.80	138.80
	Mean						0.45	30.33[a]	29.88	79.86	144.30	144.30
	1	3.75	186.38	182.63	88.00	382.04	0.40	14.98	14.58	95.60	86.03	414.07
IV	2	4.00	211.26	207.26	100.00	443.64	0.46	19.71	19.25	67.60	80.03	523.67
	3	5.95	196.25	190.3[illegible]	100.00	392.50	0.30	18.33	18.08	55.00	60.68	453.18
	Mean	4.56	197.96	193.40	96.00	388.06	0.38	17.69	17.31	72.73	75.58	463.64
	1	3.75	138.35	134.60	76.00	411.00	0.50	8.41	7.91	74.00	38.36	449.36
V	2	4.00	126.67	122.67	81.00	410.42	0.50	12.29	11.79	70.00	44.24	454.66
	3	3.62	96.34	92.72	78.00	300.58	0.41	14.36	13.95	77.60	66.91	367.49
	Mean	3.79	120.45	116.66	78.33	374.00	0.47	11.68	11.21	70.53	49.84	423.83

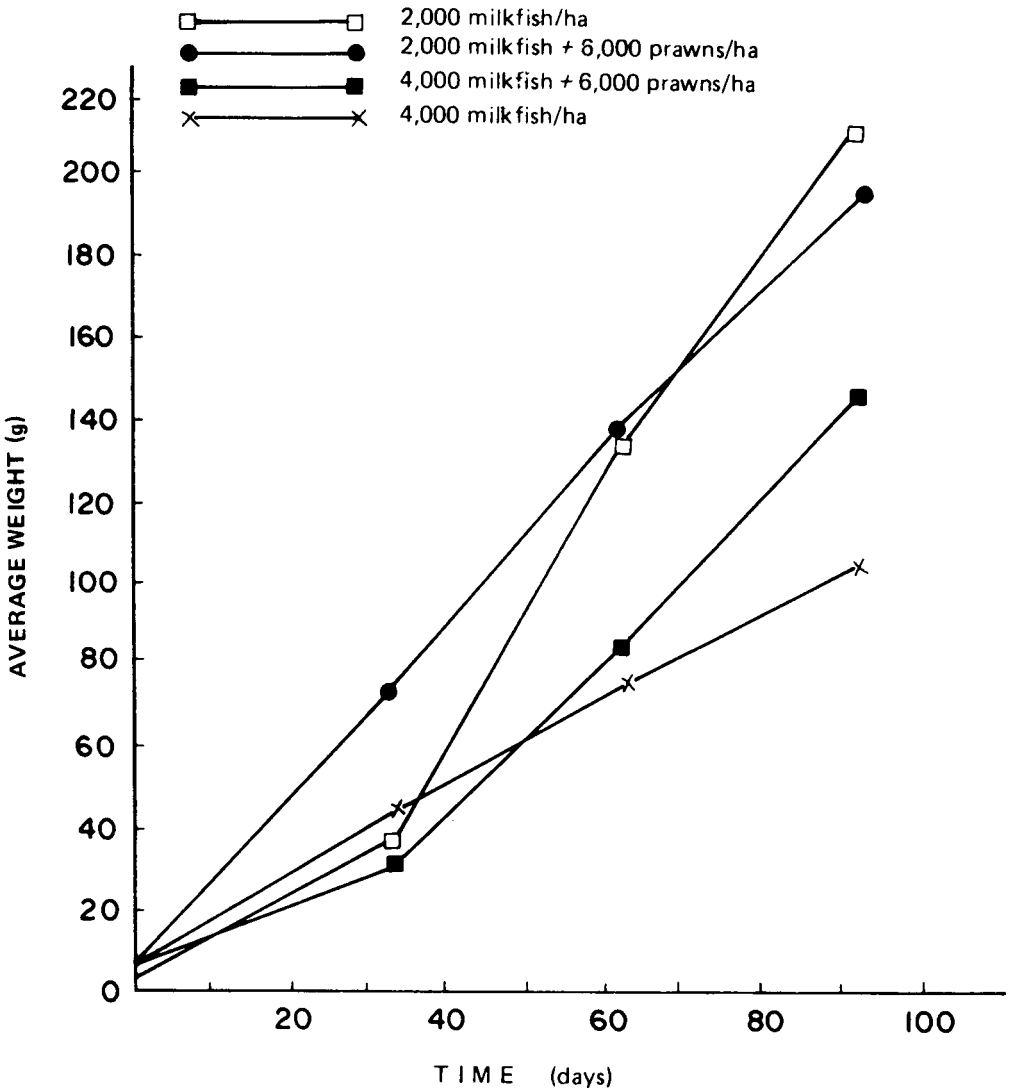

Figure 1. Growth curve of *C. chanos* stocked at 2,000 and 4,000/ha with and without 6,000 *P. monodon*/ha.

in the polyculture treatments. However, no significant differences were observed in the prawn production between the polyculture with 2,000 (75.6 kg/ha) and 4,000 (49.8 kg/ha) milkfish/ha.

In terms of total production of milkfish and prawn, Treatments IV was observed to give the highest production (463.6 kg/ha). Treatment V resulted in lowest production (423.8 kg/ha).

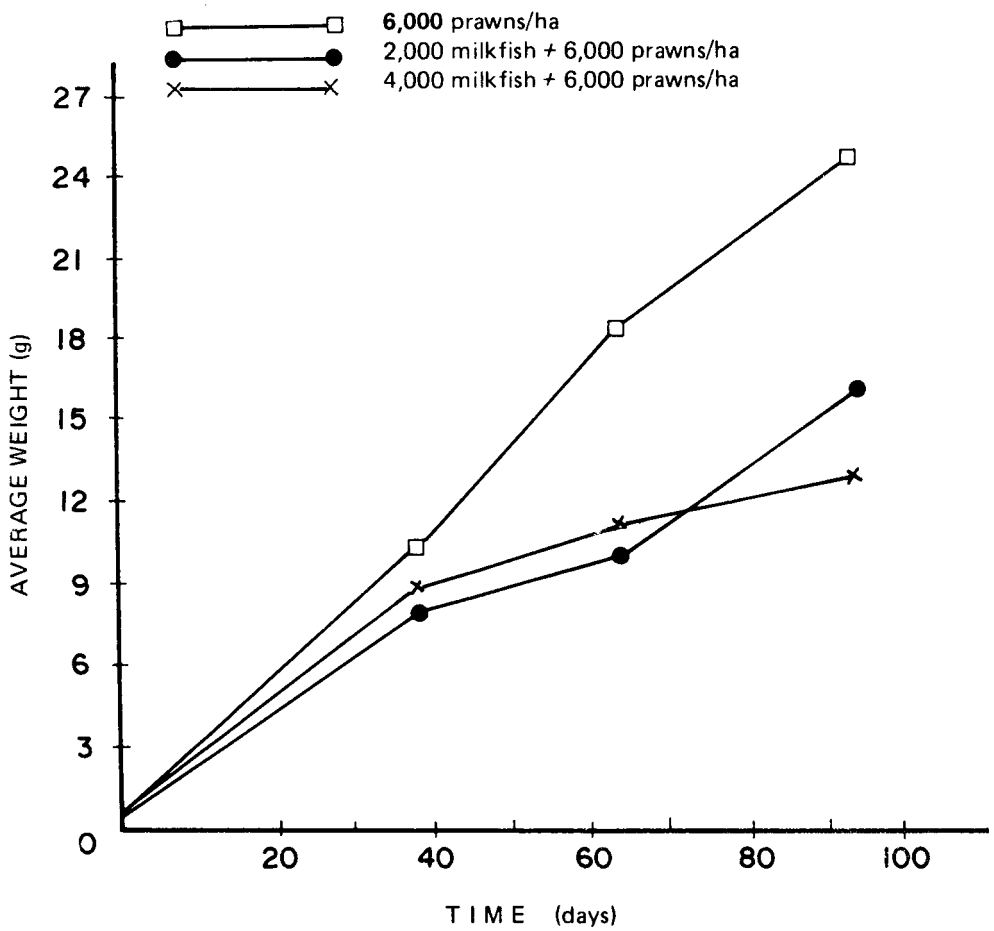

Figure 2. Growth curve of *P. monodon* stocked at 6,000/ha with and without 2,000 or 4,000 *C. chanos*/ha.

The competition of prawns to milkfish as expressed by the competition index (CI) was 0.03 and 0.15 compared to the competition exerted by milkfish to prawn, 0.48 and 0.67.

The cost and return of milkfish and prawn production is shown in Table 2. Cost of production/kg at the monoculture and polyculture systems ranged from P7.45/kg to P29.52/kg and P10.26/kg to P12.41/kg, respectively. Net gain was P20.48/kg for III, P19.89/kg for IV, P2.55/kg for I and P1.18/kg for II.

Differences in the growth and production of prawns cultured singly or in combination with milkfish at increasing stocking density (2,000 and 4,000/ha) strongly suggests that the presence

of milkfish exerts some negative effect on prawns. This is supported by the high and increasing competition index (CI = 0.48 and 0.67) due to the increasing numbers of milkfish. However, data on growth, production and competition index (CI= 0.03 and 0.15) suggest that the presence of prawn do not significantly affect milkfish. The presence of prawn as beneficial for milkfish could be due to the reason that prawn control competitors of milkfish for food, without being

Table 2. Comparison of production, total production cost, total and net income per hectare, and percentage of return for different treatments.

Items	TREATMENTS				
	I	II	III	IV	V
A. Production					
1. Milkfish	396.93	442.08		388.06	374.00
2. Prawn			144.30	75.58	49.84
B. Total production cost/ha (P) *	2,960.00	3,460.00	4,260.00	4,760.00	5,260.00
C. Total income/ha (P) **	3,969.30	3,978.72	7,215.00	6,903.80	4,861.20
D. Net income/ha (P)	1,009.30	518.72	2,955.00	2,143.80	−398.80
E. Production cost/kg (P)	7.45	7.82	29.52	10.26	12.41
F. Net income/kg (P)	2.55	1.18	20.48	14.89	− 0.94
G. Percentage of return***	34.09	14.99	69.36	45.03	− 7.58

* Include the cost of experimental animals, supplies and materials, pump fuel and maintenance (Iloilo market, September to December, 1979) and labor cost.

**Sale price of the produce were the following:

- Milkfish sale price of P9.00/kg for those less than 150 g and P10.00/kg for those more than 150 g.
- Prawn sale price of P50.00 for those 30 g and above; P40.00 for those less than 15 g.

*** % return = $\frac{\text{Total net income}}{\text{Total prod. costs}} \times 100$

competitive itself. Thus, in a polyculture system, growth and production would largely be dependent on the effectiveness of different stocking combinations. According to Prowse, (1968) the total crop is dependent on the primary productivity level, and increasing number of fish will not increase the total crop but merely give a large number of smaller fishes in the absence of supplementary feeding. Tang (1972) attributes this phenomenon to the dependence of fish growth on population size.

The observed differences in weight gains of milkfish was primarily due to the differences in stocking density. Intraspecific competition showed that the increase in milkfish stocking rate by 100 % (from 2,000 to 4,000/ha) decreased the final weight by 45%. These results were consistent with the observation of Reich (1975) that an increase in fish number of the same species depressed the individual growth more than the addition of fish of a different species.

The monoculture of prawn (III) was the most profitable of the treatments. It gave the highest net income (P2,955.00/ha/100 days) compared to the culture of milkfish alone (P1,009.30 and P518.72/ha/100 days for treatments I and II, respectively) and its combination (P2,143.80 and P398.80/ha/100 days for treatments IV and V, respectively). These differences were mainly due to the price of prawn which was about five times higher than that of milkfish. The smaller size of milkfish and prawns produced also commanded lower market price/kg.

While the maximum production of prawn can be attained with the monoculture system its polyculture with 2,000 milkfish/ha is also economically feasible. Due to greater food competition, prawn production decreased as milkfish stocking density increased. In order to lessen the interspecific competition exerted by milkfish, it is recommended that the stocking density of prawns (6,000/ha) be further increased while that of milkfish (2,000/ha) be decreased. However, the extent of stocking combination that will give an efficient polyculture of milkfish and prawn under the various culture systems needs to be further studied.

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