Polyculture - A Viable Alternative for Less Productive Tide-fed Brackishwater Ponds

Imelda Joseph
KVK of CMFRI
Narakkal
Cochin - 682 505

Mathew Abraham and S.M. Pillai
Central Institute of Brackishwater Aquaculture
101/B Mahalingapuram
Chennai - 600 034, India

Polyculture of brackishwater fishes and shrimps was experimented upon in a tide-fed pond of 500 m² at Narakkal and it was found to be viable. Brackishwater fishes, ***Mugil cephalus, Liza parsia*** *and* ***Etroplus suratensis*** *along with shrimps,* ***Penaeus monodon*** *and* ***Penaeus indicus*** *were stocked at different stocking rates ranging from 3,800 to 12,000 nos/ha. A wet dough made out of mixture of varying ingredient compositions was given as feed @ 3.5 to 5% standing crop in feeding trays to the stocked animals. After a total culture duration of about 250 days, two crops of shrimp with a yield of 98.5 kg/ha were obtained. Fish production was 1571.3 kg/ha. Water quality parameters were also monitored and maintained regularly with application of lime, cattle dung and other inorganic fertilizers.*

The feeding habits, easy adaptation to varying salinities and availability of seed makes *M. cephalus, L. parsia* and *E. suratensis* suitable for polyculture in traditional tide-fed ponds along with *P. monodon* and/or *P. indicus*. Polyculture of mullets and shrimps are experimented upon in different culture conditions in India and abroad (James *et al.* 1984; Gonzales 1987; Pillai *et al* 1987; El Gobassy *et al.* 1993). Thampy *et al.* (1987) has reported *E. suratensis* as a suitable species for polyculture. In the present study, the authors have aimed at higher production from traditional ponds with comparatively higher rate of stocking. Survival and production of selected brackishwater fishes and shrimps in a short-term polyculture experiment were also determined.

Materials and Methods

The culture was carried out from July 1999 to March 2000 in a 500 m² tide- fed pond with a water depth of @ 0.65 to 1.1 m at Narakkal. For pond preparation, after dewatering, the pond bottom was treated with lime along with ammonium sulphate (4:1) which helped in the eradication of unwanted fishes and other organisms and also in the maintenance of soil pH. After keeping the sluice closed for five days, free entry of tidal water was allowed through fine mesh (1 mm) sluice screen. When algal bloom had developed to the extent needed, brackishwater fishes, *Mugil cephalus* (12,000 nos./ha), *L. parsia* (4,000 nos./ha) and *E. suratensis* (3,800 nos./ha) were collected from local seed sources and stocked. Post larvae of *P. monodon* (12,000 nos./ha) and *P. indicus* (12,000 nos./ha) produced at the hatcheries of CIBA at Chennai and Narakkal respectively were used for stocking. The stocking details are given in Table 1.

Table 1 : Stocking details of fishes and shrimps

Species	*M.cephalus*	*L.parsia*	*E.suratensis*	*P.monodon*	*P.indicus*
Date of Stocking	29-7-99	29-7-99	30-8-99	27-8-99 & 25-9-99	7-1-2000
Mean size at Stocking L/W; mm/g	25/0.16	25/0.16	58/8	23.3/0.3	15/0.3
Stocking Density (No/ha)	12,000	4,000	3,800	12,000	12,000

The pond was fertilized at regular intervals (once in a fortnight) with cattle dung and inorganic fertilizers (Urea, Factumphos and Ammonium Sulphate @ 1 : 1: 1) alternatively to induce algal bloom. Wet dough of feed mixture, consisting of ground nut cake (35%), rice bran (12%), coconut cake (10%), wheat bran (10%), fish meal (10%), Tapioca powder/ *maida* (10%) and vitamin mix (1%) was supplied to the stock once in a day @ 3 to 5% feeding trays. Physico-chemical parameters like temperature, pH, salinity, dissolved oxygen, water depth and total alkalinity were recorded at weekly intervals. Standard methods were followed for estimations. Fishes and shrimps were sampled once in a month, so that their

Table 2 : Sampling details showing growth measurements (length (mm)/weight (g)) of fishes and shrimps

Month	*M.cephalus*	*L.parsia*	*E.suratensis*	*P.monodon*	*P.indicus*
Aug'99	67.5/2.55	2.5/1.0	65/15	23.3/0.3	-
Sep	106.5/20	59.5/10	71/20	*	-
Oct	142.8/31	*	*	76-146/2.5-2.4	-
Nov	157/50	*	120/45	88-148/4-27	-
Dec	177/63	*	*	*	-
Jan '00	200/110	100/30	144/60	159/47	(Stocking)
Feb	226.5/128.5	*	*	*	*
Mar	250/154.5	161.6/35.6	178/134	152/28.8	100.7/5

* Samples could not be secured

Table 3 : Harvest details of fishes and shrimps

Species	M.cephalus	L.parsia	E. suratensis	P.monodon	P.indicus
Culture Duration (d)	250	250	215	130 & 190	84
Prodn (kg)	55.75	2.0	15.94	4.1	0.425
Yield (kg/ha)	1115	40	318.8	82	8.5
No. stocked	530	196	190	620	620
No recovered	367	52	133	194	84
Recovery rate (%)	69.24	26.54	70	32.33	14

growth rate could be observed and feeding quantity could be increased depending upon the standing crop biomass. For periphyton growth, polyethylene pieces tied to nylon wires were tied across the pond at regular intervals.

Results and Discussions

The monthly sampling details are given in Table 2. The pond was partially harvested for *P. monodon* after 130 days of stocking. After that *P. indicus* was stocked to have a second crop of shrimp. Total harvesting was done after 250 days of first stocking. A small percentage of *P. monodon* above 30 g size were observed to be soft due to the combined effect of low salinity, low pH, low dissolved oxygen and other undetermined abiotic or biotic factors in the ambient water. *P. indicus* did not have such a problem. In the light of this experience, it is recommended to stock the native species of the area for better culture results. The harvest details are given in Table 3. A total production of 1534 kg/ha was obtained. A production of 674 to 1321 kg/ha in 6 to 7 months of culture duration was reported by Mathew *et al* (1988) in polyculture trials. It is seen that from the weight of 0.16 g, each, *M. cephalus* reached @ 155 g, *L. parsia* @ 36 g and *E. suratensis* from 8 g to @ 134 g in 250 days with regular supplementary feeding. The initial size of *M. cephalus* influenced its harvest size as reported in an earlier work (Sarig 1975). As reported by him, the stocking size was 100 to 120 g. During the 250 days of culture period they could have attained 1000 g at least, a size which gives much higher profit to the farmer. For this to be achieved, however, the stocking rate has to be reduced considerably compared to the present rate. The size distribution of *M. cephalus, L. parsia* and *E. suratensis* were 220-278 mm/ 110-175 g, 140-187 mm/ 20-50 g and 163-187 mm/ 80-160 g respectively. In a 374 day polyculture experiment, Pillai *et al* (1987) had reported a yield of 141.54 kg/ha and a survival of 64.36% for *M. cephalus*. In the present study, a yield of 1115 kg/ha (69.24% recovery) was obtained. There was not much variation in size distribution for individual species in most of the fishes of the crop. In Mugilidae, it is a well-known fact that, in nature, *M. cephalus* grows faster than *L. parsia*, a smaller species. The stocking size of both species were the same, while only the growth rate of *L. parsia* was only about one fourth of that of *M. cephalus*. The highest recovery rate (70%) was obtained for *E. suratensis* and lowest for *P. indicus*. Lower recovery of *P. indicus* could be due to its later stocking which resulted in loss of small post-larvae in tidal exchange and in generating cannibalistic nature in them in the absence of suitable zooplankton organisms. These factors are to be taken care of when such trials are conducted in a similar way.

Table 4 : Mean water parameters in the polyculture pond

Month	Temp (oC)	Salinity (ppt)	pH	DO (mg/l)	Tot. alkalinity (ppm)	Water depth (cm)
Jul'99	31.5	8	8.5	6	107.5	57.5
Aug	32	8	8	5.45	107	57.5
Sep	32.5	10	7.25	1.6	97.5	62.5
Oct	31.5	7.5	7.05	2.45	55	82.5
Nov	31.5	9.5	7	3.15	60	87.5
Dec	31	16	6.7	1.7	55	95
Jan'00	31.5	17	7	1.85	65	95
Feb	32	21	6.65	2	72.5	87.5
Mar	32	22	6.6	1.85	72.5	87.5

The size distribution of *P. monodon* and *P. indicus* were 135 to 170 mm and 20 to 25 g and 94 to 108 mm and 5 to 6.5 g respectively. Nammalwar and Kathirvel (1988) reported 119.4 to 135.1 mm and 12.8 to 17.8 g for *P. monodon* in polyculture experiment. Rate of recovery was 20.6% to 35.3%. Pillai *et al*. (1987) got 34.6% survival for *P. monodon* in polyculture conducted in Sunderbans. In the present trial, 34.6% survival was noticed. It should be emphasized that no feed was supplied specifically for shrimps. Poor bloom conditions often prevailed in the culture pond due to black clam, *Villorita* sp. infestation.

Mean water quality parameters are given in Table 4. The values were normal except for dissolved oxygen and pH, which were less than normal on many occasions. James *et al* (1984) reported that mullets sharply reacted to low oxygen levels in polyculture ponds. But in the present study, no negative reaction due to low oxygen levels noticed.

The study has demonstrated that polyculture is a viable practice for extensive and semi-intensive traditional brackishwater culture systems, where monoculture of fish or shrimp is comparatively less yielding. Also it is observed that with proper stocking, feeding and fertilization, polyculture is a profitable alternative in tide fed ponds.

Acknowledgements

The authors are grateful to Dr. G.R.M. Rao, Director and Dr. L.H. Rao, Head of Division, Crustacean Culture Division, CIBA, Chennai, for their continuous support throughout the study. Also, the authors are thankful to Messers C.S. Sasidharan, K.K. Surendran and M.G. Sivadasan for the excellent technical assistance rendered during the period of study.

References

EL GOBASHI, A., E. OMAR, A.E.A. NOUR., 1993. Effect of supplementary feeding on survival rate, growing performance and yield of four marine fish species, sea bass, *Dicentrachus labrax* (L), gilthead sea bream, *Sparus aurata* (L) and mullet *Mugil capito* and *Mugil cephalus*, reared in polyculture in ponds. Proceedings of the First International Symposium on Aquaculture Technology and Investment Opportunities, Ministry of Agriculture and Water, Riyadh, Saudi Arabia, pp.537-549.

GONZALES, G.K. and CORRE, 1987. Polyculture of tiger shrimp (*P. monodon*) with Nile Tilapia (*Oreochromis niloticus*) in brackishwater fishponds. Second International Symposium on Tilapia in Aquaculture, Bangkok, Thailand, 15p.

JAMES, P.S.B.R., A. RAJU and V.S. RANGASWAMY, 1984. Further observations on polyculture of finfishes and prawns in saltwater ponds and in a net-pen at Mandapam. *Indian J.Fish.*, 31(**1**):31-46.

MATHEW, P.M., S. JOSE, M.M. JOSE and P.S. MRITHUJAYAN, 1988. Proceedings First Indian Fisheries Forum, Mangalore (Joseph, M.M., ed.) pp.131-134.

NAMMALWAR, P and M. KATHIRVEL, 1988. Preliminary experiments on monoculture of *Chanos chanos* (Forskal) and polyculture with *P. monodon* Fabricius. *Indian J. Fish.*, 35(**3**) 197-204.

PILLAI, S.M., P.K. GHOSH, T. RAJYALAKSHMI, D.D. HALDER, A.K. ROY and R.K. CHAKRABORTHY, 1987. Production potential of rain fed ponds in coastal aquaculture in Sunderbans. *J. Indian Soc. Coastal Agric. Res.*, 5(**1**), 313-318.

SARIG, S., 1975. Fisheries and fish culture in Israel in 1974. Bamidgeh 27(2), 25-39.

THAMPY, K.S., C.G. RAJENDRAN, P.S. MRITHUJAYAN and M.M. JOSE, 1988. Proceedings First Indian Fisheries Forum, Mangalore, 1987 (Joseph, M.M. ed.) pp.131-134.

Culture Shrimp Production in A.P

The harvesting activities of culture shrimp in the coastal districts of AP now in its final phase are expected to be over by end June. Reports speak of encouraging harvest of healthy shrimp in several parts, while shrimp with white spot is noted in some areas.