

## FURTHER OBSERVATIONS ON THE SUITABILITY OF THE MARINE FISH FARM AT MANDAPAM FOR THE CULTURE OF MILKFISH AND GREY MULLET

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### ABSTRACT

The paper gives an account on the culture of milkfish *Chanos chanos* and the grey mullet *Valamugil seheli* under mono and polyculture systems in the saltwater ponds at Mandapam during the period 1982-1983. Ponds of 2,400 m<sup>2</sup> (two ponds), 450 m<sup>2</sup> (2 ponds) and 200m<sup>2</sup> (3 ponds) were used for conducting the culture experiments. The stocks were fed with a supplementary feed. The growth of fish was better in polyculture experiments. The rate of production of *Chanos chanos* was 354-443 kg/ha with a survival of 73.2-79.9% in monoculture and 422-872 kg/ha with 56.7-70.0% survival in polyculture experiments. *V. seheli* indicated a production of 200-290 kg/ha and 67-89 kg/ha with the survival rates of 22-91 % and 13.3-20.7% in mono and polyculture experiments respectively.

### INTRODUCTION

Earlier experiments on mono and polyculture of milkfish and grey mullets at Mandapam have given appreciable yields. Thus in monoculture of milkfish, Gandhi and Mohanraj (1986) obtained 216-852 kg/ha and in polyculture of milkfish and grey mullets (*Valamugil seheli*), James *et al.* (1984) obtained 1,205-1,405 and 64-333 kg/ha respectively. Similar attempts have been made in different areas with varying environmental conditions (Sundarajan *et al.*, 1979) on the culture of milkfish together with prawn *Penaeus indicus* at the brackishwater fish farm, Adyar and Bensam and Marichamy (1981) on the culture of *Chanos chanos* in the salt pans at Tuticorin).

The possibility of introducing Indian Major carps together with mullets and other commercially important species like milkfish and prawns in low saline waters has been

suggested by Jhingran *et al.* (1972). Experiments on *Mugil parsia* and *M. fide* under monoculture system conducted at the brackish water fish farm, Kakdwip have been reported (FAO, 1974; 1975). Pakrasi *et al.* (1975) have briefed about the role of grey mullets in polyculture in the coastal tanks of West Bengal.

The present set of experiments, confirmatory in nature to those carried out in previous years at Mandapam, will help in formulating future strategies for regular culture practice in areas similar to the Mandapam environment.

### *Seed collection and transportation*

The seed of *Chanos chanos* and *Valamugil seheli* were collected from the tidal pools, creeks and lagoon at Manoli Island and Pillaimadam. The seed was transported by means of oxygen filled polythene bags

and fibreglass tank with sufficient seawater. The transported seed were released first into a nursery pond where they were reared until stockable size.

#### *Preparation of culture ponds*

Two ponds (A, B) of 2,400 sq.m area each for monoculture of milkfish, three ponds (E, F, G) each of 200 sq.m in area for monoculture of grey mullets and two ponds (C, D) each of 450 sq.m area for polyculture experiments were selected for culture experiments. Prior to stocking, the ponds were drained thoroughly and extraneous fishes were removed. Seawater supply to the ponds was maintained by pumping from the sea daily. The water level was maintained between 50 and 70 cm.

#### *Stocking*

The total number of fish seed of each species stocked, the rate of stocking per ha and the average size at stocking are given in Table 1.

#### *Feeding*

A supplementary feed composed of groundnut oil cake and ricebran, mixed in equal proportion, was given (daily once) in the form of dough at the rate of 5-10% of the body weight of the fish.

#### *Sampling and harvesting*

Monthly sampling of fish was done and the measurements of length and body weight of about 10% of the total stock in each pond were recorded to ascertain the growth rate. Environmental parameters of salinity, temperature and dissolved oxygen were also monitored regularly. The details of harvest are given in Table 1.

## RESULTS

### 1. Hydrological conditions

#### *Milkfish monoculture ponds*

Fig. 1 represents the important hydrological parameters studied such as water temperature, salinity and dissolved oxygen in

the culture ponds (A to G). In monoculture ponds of milkfish (A & B), the temperature of water fluctuated between 25.8 and 32.6°C. In both the ponds, highest salinity around 48 ppt was observed in August, '82 and lowest around 22 ppt in December, '82. A minimum dissolved O<sub>2</sub> level of 0.89 and 1.79 ml/l was noticed in pond A and B respectively during February, '83. The maximum level was found in January, '83 in both the ponds, the respective values being 5.12 ml/l in pond A and 5.20 ml/l in pond B.

#### *Polyculture ponds*

In the polyculture ponds (C & D), higher temperature of 31 and 29.8°C in January, '83 and lower of 24.7 and 25.6°C in December, '82 were observed in pond C and D respectively. The salinity was maximum in August, '82 (43.48 ppt in pond C and 45.14 ppt in D) and minimum (21.01 and 17.22 ppt in respect of C and D) during December, '82. Highest level of 5.24 and lowest of 0.67 ml/l of dissolved O<sub>2</sub> in pond C were noticed during January and February, '83. On the other hand, 3.76 ml/l (November, '82) and 0.74 ml/l (March, '83) were the highest and lowest values in pond D.

#### *Mullet monoculture ponds*

In ponds E, F and G, highest water temperature (31.2°C) was recorded in January, '83 and lowest in October, '82 (around 29°C). During December, '82, the salinity ranged between 15.75 and 18.69 ppt and increased to 39 ppt in July, '83. The dissolved O<sub>a</sub> level was found to be in the ranges of 1.58-4.70, 1.14-5.34 and 2.07-5.02 ml/l in ponds E, F and G respectively.

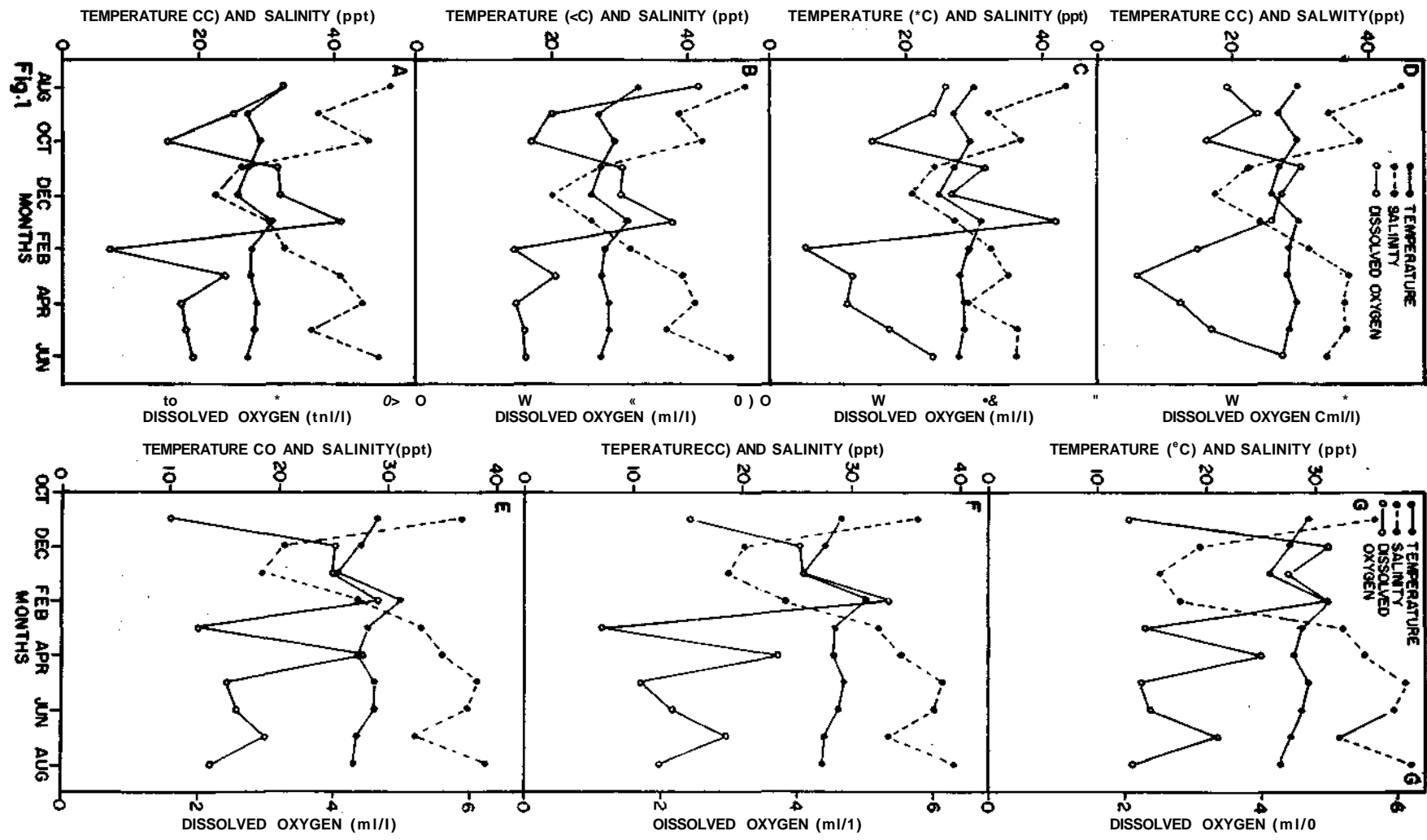
### 2. Growth, survival and production

The monthly growth increments in length and weight for milk fish and mullet under mono and polyculture in each pond are presented in Table 2.

#### *Chanos chanos in monoculture system* (Ponds A and B)

Better growth was observed during first three months in both the ponds. Again

Legend to Fig. 1. Hydrological conditions in Milkfish monoculture ponds (A & B), polyculture ponds (C & D) and Mullet monoculture ponds (E, F & G).



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the same was noticed in the sixth and eighth month in A and seventh and ninth in pondB.

At harvest, the length of fish ranged from 223 mm to 321 mm in pond A and 234 mm to 378 mm in pond B. 47% of the total harvested fish in pond A had grown above the average size and the modal size group

was found between 260 and 280 mm (Fig.2A). In pond B, the same was observed between 280 and 300 mm(Fig.2B) and constituted 45 % of fish grown above the average size at harvest. The rate of production was 354 kg/ha with a survival of 73.2% in pond A and 443 kg/ha with 79.9% survival in pond B.

TABLE 1. Details of culture experiments in saltwater ponds at Mandapam during 1982-'83

(a) *Chanos chanos*

Particulars	Monoculture		Polyculture		
	Pond A	PondB	Pond C	Pond E	
Size of the pond (sq. m)	2,400	2,400	450	450	
Total No. of seed stocked	840	720	150	300	
Rate of stocknig (No./ha)	3,500	3,000	3,300	6,700	
Month of stocking	August '82		August '82		
Average length at stocking (mm)	74.6	74.6	67.9	67.9	
Average weight at stocking (g)	2.7	2.7	2.5	2.5	
Month of harvest	June '83		June '83		
Duration of culture (months)	10	10	10	10	
Average length at harvest (mm)	278.4	295.2	325.7	302.9	
Average weight at harvest (g)	136.6	185.0	227.7	187.4	
Average growth rate/month	Length (mm)	20.4	22.1	25.8	23.5
	Weight (g)	13.4	18.2	22.5	18.5
Survival rate (%)	73.3	79.9	56.7	70.0	
Production (kg/ha)	354	443	422	872	

(b) *Valamugil seheli*

	PondE	Pond F	PondG	PondC	Pond D	
Size of the pond (sq. m)	200	200	200	450	450	
Total No. of seed stocked	100	150	200	300	150	
Rate of stocking (No./ha)	5,000	7,500	10,000	6,700	3,300	
Month of stocking	September '82			August '82		
Average length at stocking (mm)	48.1	48.1	48.1	50.5	50.5	
Average weight at stocking (g)	1.3	1.3	1.3	1.5	1.5	
Month of harvest	July'83			June'83		
Duration of culture (months)	10	10	10	10	10	
Average length at harvest (mm)	155.9	246.4	138.3	241.9	249.1	
Average weight at harvest (g)	40.1	175.6	31.3	103.2	96.0	
Average growth rate/month	Length (mm)	10.8	19.8	9.0	19.1	19.9
	Weight (g)	3.9	17.4	3.0	10.8	9.4
Survival rate (%)	91	22	74	13.3	20.7	
Production (kg/ha)	200	290	230	89	67	

TABLE 2. Growth increments offish in saltwater ponds at Mandapam during 1982—83

(a) <i>Chanos chanos</i>									
Duration (month)	Monoculture				Polyculture				
	Pond A		PondB		PondC		PondD		
	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)	
First	60.7	17.9	55.9	19.0	81.0	22.9	63.4	15.8	
Second	43.1	23.6	64.5	36.4	48.6	36.6	57.1	34.5	
Third	41.1	25.5	36.4	27.5	23.2	8.0	18.8	16.4	
Fourth	11.5	29.4	9.7	25.6	7.4	14.3	8.8	10.4	
Fifth	1.7	7.6	3.0	5.1	20.0	26.0	10.2	10.5	
Sixth	10.9	2.4	4.5	8.7	3.0	144	10.9	23.6	
Seventh	10.4	10.6	28.7	50.4	14.4	9.6	20.6	10.1	
Eighth	13.0	6.3	5.4	4.4	40.1	74.3	29.3	51.2	
Ninth	1.3	5.5	12.3	1.7	7.0	6.7	11.6	6.0	
Tenth	10.0	5.1	0.2	3.5	13.1	12.4	4.3	6.4	

(b) <i>Valamugil seheli</i>										
Duration (month)	PondE		PondF		PondG		PondC		PondD	
	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
First	23.2	2.3	22.2	2.9	17.9	2.4	25.6	4.4	26.8	5.0
Second	27.0	8.4	31.7	9.2	14.3	5.6	14.7	4.8	18.5	3.5
Third	27.1	8.0	22.5	6.6	15.2	4.4	12.1	4.3	10.6	5.3
Fourth	1.2	2.0	15.3	10.5	14.2	1.8	5.1	0.8	10.2	0.4
Fifth	5.2	3.0	1.7	4.1	4.5	3.5	6.8	1.7	13.1	7.3
Sixth	8.4	5.5	25.4	23.0	8.5	3.0	6.0	4.9	2.9	3.1
Seventh	4.9	0.5	26.7	25.7	4.9	3.0	—	—	—	—
Eighth	3.3	1.5	14.9	51.7	1.8	1.8	—	—	—	—
Ninth	3.6	1.5	18.8	5.0	4.5	3.2	—	—	—	—
Tenth	3.9	6.1	19.2	35.6	4.4	1.3	—	—	—	—

Growth increments of fish could not be determined from seventh to tenth month since sampling was not obtained for *V. seheli* in polyculture ponds C and D.

#### *Chanos chanos* in polyculture system (Ponds C and D)

In both the ponds, the growth was good in the first two months and also in the eighth month of the culture period. A sudden increase in body weight rather than length was observed in the eighth month.

The fish at harvest ranged between 240 and 395 mm and 54% offish reached beyond the average size in pond C. The dominant size group was found in 320-340 mm. (Fig. 2C). In pond D, the same was found between 300 and 320 mm in which the harvested size ranged from 225 to 357 mm and constituted 51 % grown above the mean size (Fig. 2D).

The rate of production and survival were 422 kg/ha and 56.7% respectively whereas in D, they were 872 kg/ha and 70%.

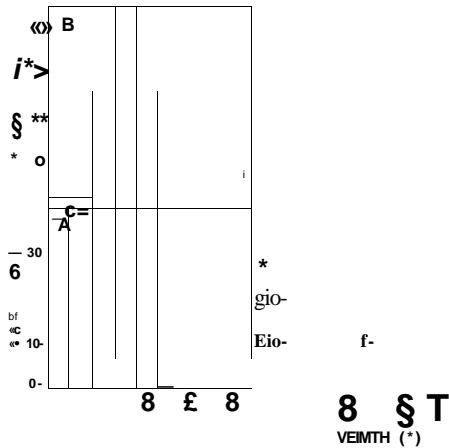


Fig. 2. Size groups of harvested *Chanos chanos* in monoculture ponds (A & B) and polyculture ponds (C & D).

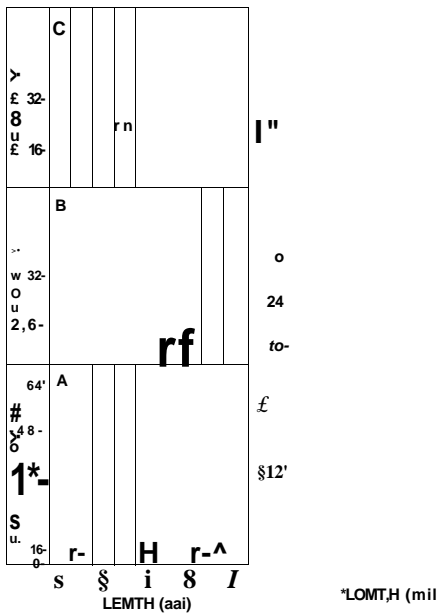


Fig. 3. Size groups of harvested *Valamugil seheli* in monoculture ponds (A, B & C) and polyculture ponds (D & E).

*Valamugil seheli* in monoculture system

The growth of fish was better during the first two months in pond E and F and thereafter in the sixth and seventh months in F only. But in G, encouraging growth was noticed during first and third months and stunted growth in other periods.

In pond E, the length of fish at harvest ranged from 132-235 mm with a dominant mode at 140 mm and formed 33% above average size (Fig. 5A). It shifted to 240 mm (Fig. 3B) in pond F with size ranging between 210 and 271 mm in which 48% of fish had reached above the mean size. The size range of fish in pond G was 113-175 mm and constituted 37% above average size and modal size group at 120 mm (Fig. 3C). The respective production and survival rates were 200 kg/ha and 91%, 290 kg/ha and 22% and 230 kg/ha and 74% in ponds E, F and G respectively.

*Valamugil seheli* in polyculture system (Ponds C and D)

In the whole period of culture, the monthly mean growth increment observed was 19.1 mm (10.8 g) in pond C and 19.9 mm (9.4 g) in D. In both the ponds, the growth was fairly good in first two months.

At harvest, the size of fish ranged from 195 mm to 310 mm and 165 mm to 302 mm in ponds C and D respectively. The maximum size mode was found at 200 mm in C (Fig. 3D) and 260 mm in pond D (Fig. 3E). About 43% in C and 65% of harvested fish in pond D had grown above the average size. The rates of production and survival were 89 kg/ha and 13.3% in pond C and 67 kg/ha and 20.7% in D.

REMARKS

The rate of stocking reported by Sribh-bhadh (1972) was 1,000-4,000/ha for milk fish in Taiwan. The stocking densities adopted in saltwater ponds at Mandapam for *Chanos* was 4,000/ha under monoculture (Gandhi and Mohanraj, 1986) and 8,300-22,000/ha

under polyculture system (James *et al.*, 1984). In the present experiments, the stocking rates were 3,000-3,500/ha in monoculture and 3,300-6,700/ha in polyculture.

In monoculture of mullets, Chen (1976) reported a stocking density which ranged from 4,000 to 10,000/ha in Taiwan. In monoculture experiments at the brackishwater fish farm, Kakdwip, a stocking density of 6,000/ha was employed for *Mugil tade* (FAO, 1975). James *et al.* (1984, 1985) tried a stocking rate of 22,000-40,000/ha and 2,200-17,000/ha for *V. seheli* under mono and polyculture systems respectively at the saltwater-ponds, Mandapam. In the present experiments the stocking density for *V. seheli* varied between 5,000 and 10,000/ha in monoculture and 3,300 and 6,700/ha in polyculture.

A growth rate of 28 mm per month was reported for *Chanos* in the marine fish ponds of Krusadai Island (Devenesan and Chacko, 1944). In the present investigation, the monthly growth rate of *Chanos* was 20.4 mm (13.4 g) - 22.1 mm (18.2 g) under mono and 23.5 mm (18.5 g)-25.8 mm (22.5 g) under polyculture system. Tampi (1960) reported that the growth of *Chanos* was rapid in the first 3-4 months. The present results broadly agree with that of Tampi.

Liao (1981) reported that in mixed culture of milkfish, mullet and grass prawn in a milkfish pond at Taiwan, the growth of mullet was better than that of milkfish. Agreeably in the present investigation, *V. seheli* when cultured with milkfish, has grown to the size of 241.9 mm (103 g) and 249.1mm (96 g) in polyculture and 138.3 mm (31.3 g), 155.9 mm (40.1 g) and 246.5 mm (175.6 g) in monoculture after a rearing period of ten months.

Ling (1972) reported that in Philippines, the annual average milkfish production was 1,000 kg/ha by improved methods and in Taiwan, 1,600-1,800 kg/ha where ponds are heavily manured in addition to supplementary feed. In India, the production of milkfish recorded was 1,088 kg/ha with feed and

fertilizer and 705 kg/ha without both (Sundarajan *et al.*, 1979) and 318-857 kg/ha (Bensam and Marichamy, 1981). The present observation indicates a production of only 354-443 kg/ha under monoculture and 422-872 kg/ha under polyculture in ten months.

Polyculture experiments with mullets in brackishwater ponds in Lagos, indicated a production of 220 kg/ha with fertilizer and feed (Sivalingam, 1975). A production of 480 kg/ha and 750 kg/ha was obtained without and with feed respectively in monoculture of *M. parsia* (Ghosh *et al.*, 1975). Pakrasi *et al.*, (1975) have reported a production of 199.6 kg/ha/10 months and 139.84 kg/ha/8 months in polyculture. The production of 200-290 kg/ha/10 months in monoculture in the present study is higher than that reported by Pakrasi *et al.*, (Op. cit.) and in agreement to some extent with that of Sivalingam (Op.cit.) under polyculture system.

Sundarajan *et al.* (1979) found that the survival of *Chanos* was 89.2-99.04% at the brackishwater fish farm, Adyar. A survival rate of 44.04% in higher stocking and 85.53% in lower stocking rate was recorded in the salt pan areas of Tuticorin (Bensam and Marichamy, 1981). In the present case, the survival rates between 56.7 and 79.9% for *Chanos* has been noticed in both mono and polyculture systems.

On the otherhand, the survival of *V. seheli* was found to be in the monoculture pond E and G. The lower rates of survival (22%, 13.3% and 20.7%) in the ponds, F, C and D respectively might be due to mortality of fish as a result of oxygen depletion (0.67 & 0.74 ml/l) during the sixth and seventh month in polyculture ponds C and D and (1.14 ml/l) in the fifth month in the monoculture pond F of the culture period.

Results of the present study also indicate that *Chanos* can tolerate and survive even low oxygen level when compared to mullets. The salinity in the experimental ponds decreased during the monsoon months (Oct.-Dec.)

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and the growth of fish was also rapid during those periods. Therefore, it may also be concluded that faster growth was observed during the monsoon when the salinity was less.

### REFERENCES

- BENSAM, P. AND R. MARICHAMY 1981. An experiment on the culture of milkfish *Chanos chanos* (Forsk.) in the salt pans at Veppalodai, Tuticorin. *Indian J. Fish.*, 28 (1 & 2): 265-269.
- CHEN, T.P. 1976. Culture of grey mullet. *Aquaculture practices in Taiwan*, pp. 43-55, Page Bros. (Norwich) Ltd.
- DEVENESAN, D.W. AND P.I. CHACKO 1944. Cultivation of milkfish in Krusadai Island. *Proc. 31st Ind. Sci. Cong.*, p. 108.
- FAO 1975. *Aquaculture-Bulletin*, 7 (3-4): 4.
- GANDHI, V. AND G. MOHANRAJ 1986. Results of experimental monoculture of milkfish in marine fish farm at Mandapam. *J. mar. biol. Ass. India.*, 28(1 & 2): 63-73.
- GHOSH, A.N., M.K. MUKHOPADHYAY AND G.N. CHATTERJEE 1975. Supplementary feeding as a tool for enhanced production in mullet culture, *Mugilparsi* (HAM). *J. Inland Fish. Soc. India*, 7: 209-211.
- JAMES, P.S.B.R., A. RAJU AND V.S. RENGASWAMY 1984. Further observations on polyculture of finfishes and prawns in saltwater ponds and a net pen at Mandapam. *Indian J. Fish.*, 11 (1): 31-46.
- JAMES, P.S.B.R., V. GANDHI, G. MOHANRAJ, A. RAJU AND V.S. RENGASWAMY 1985. Monoculture of grey mullets in coastal saltwater ponds at Mandapam. *Indian J. Fish.*, 32 (2): 174-184.
- JHINGRAN, V.G., B.B. PAKRASI, R.K. BANERJEE AND A. MOITRA 1972. Operations in a Pilot Fish Farm in lower Sunderbans. In: *Coastal Aquaculture in the Indo-Pacific Region*, pp. 472-485. Fishing News (Books) Ltd., London.
- LIAO, I. C. 1981. Cultivation methods. *Aquaculture of grey mullets*. O. H. Oren (Ed.), 361-389 pp. Cambridge University press, Cambridge, London.
- LING, S.W. 1972. Review of the status and problems of coastal aquaculture in the Indo-Pacific region. In: *Coastal Aquaculture in the Indo-Pacific Region*, 2-24 pp.
- PAKRASI, B.B., N.C. BASU, AND K.K. BANERJEE 1975. Role of grey mullets in polyculture in coastal tanks of West Bengal. *Bull. Dep. Mar. Sci. Univ. Cochin*, 7 (1): 31-40.
- SIVALINGAM, S. 1975. On the grey mullets of the Nigerian coast, prospects of their culture and results of trials. *Aquaculture*, 5 (4): 345-357.
- SRIBHIBHADH, A. 1972. Status and problems of coastal aquaculture in Taiwan. In *Coastal Aquaculture in the Indo-Pacific Region*, 74-83 pp. Fishing News (Books) Ltd., London.
- SUNDARAJAN, D., S.V. CHANDRA BOSE AND V. VENKATESAN 1979. Brackishwater fish and prawn culture at Santhome brackishwater fish farm, Madras. *J. Inland Fish. Soc. India*, 11 (1): 109-116.
- TAMPI, P.R.S. 1960. Utilization on saline and mud flats for fish culture: an experiment in marine fish farming. *Indian J. Fish.*, 17 (1): 137-146.