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NATIONAL SYMPOSIUM ON RESEARCH AND DEVELOPMENT IN MARINE FISHERIES

MANDAPAM CAMP
16-18 September 1987

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CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
P. B. No. 2704, E. R. G. Road, Cochin-682 031, India

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Limited Circulation

DEVELOPMENT OF PRAWN CULTURE IN TUTICORIN AREA

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ABSTRACT

The coastal zone along Tuticorin in Chidambaranar District of Tamilnadu affords suitable environment for the occurrence, survival, growth and production of commercially valuable prawns. The prospects of prawn culture are discussed in relation to the available resources of land, water and wild seeds as well as the recent developments made in the area. Growth and production of *Penaeus indicus* cultured in the salt pan area near Tuticorin during 1985-87 are presented. The results of prawn culture experiments were highly influenced by the stocking density and also the hydrological features of the culture site Best result in growth (27 mm/4.2 g/month) and production (1347 kg/ha/crop) was recorded when the stocking was kept at 75 000-80,000/ha. The maximum production of 1,600-1,700 kg/ha/crop was attained in high stocking density, but the period of culture was more. A total production of 10, 407.5 Kg of *Penaeus indicus* was attained from 7 ponds of a total area of 4.2 ha by raising 2-3 crops in a period of 26 months and fetched a gross income of Rs. 3,90,161/-. The results of the experiments are highly encouraging for the fast development of semi-intensive farming in the area. Various problems encountered in the development of prawn farming and suggestions for better management practices are highlighted. Information covering the suitable areas for the development of coastal farm, economics of culture, culture operations, the sources of financial and technical aids available in this profitable venture are presented.

INTRODUCTION

The development of prawn farming in Tamilnadu is known only from recent years, although the state offers a rich potential. The production of prawns in these farms was found to vary from 200-400 kg/ha/crop, fetching an income of Rs. 3,000-10,500 (Srinivasan *et, al.* 1982). Inadequate facilities for extension, strict flow of finance and scarcity of seeds of desired species at desired time are some of the major constraints attributed to the poor progress in the field. There is vast scope for the development of shrimp culture even in slightly high saline sites in Tuticorin area. Published information support this view (Nair *et. al.*, 1974, Suseelan, 1975, Rao and Narasimham, 1978, Mohamed, *et, al.*, 1980, Marichamy and Rajapackiam, 1982 and Victor and Venkatesan, 1982).

Encouraging results with a maximum production of P. *indicus* at 1,604 kg/ha/crop with an average rate of production at 1,154 kg/ha/crop has been attained and reported by Marichamy and John Motha (1986) from new site developed at Veppalodai. Culture operations started in a few centres by private parties close to Vembar estuary, Vaipar, Palayakayal and Punnakayal in small scale, resulted in poor production. None of these centres can be said to be totally free of shortcomings such as insufficient experience, unscientific management of environmental factors etc. Many entrepreneurs have come into the field of prawn farming in Tuticorin area, since recent experiments by utilising the saline fallow coastal lands including salt pan areas for culture practices have proved to be profitable. Proposals are with the State Government for the development of 50 ha of brakishwater farms at Punnakayal (Dixitulu, 1986). In the present account, various techniques of prawn culture and the related problems are analysed to determine suitable management procedures for better production and profit so as to help the prawn culturists to progress in Tuticorin area.

MATERIAL AND METHODS

Semi-intensive culture system was followed. Construction aspects of prawn culture ponds

and farm management techniques suitable for the area have been described by Marichamy and John Motha (1986). Hydrological factors of most of the sites surveyed in Tuticorin area were found conducive for the growth of prawns The Productivity of the water was enriched by manuring with chicken or cow dung at 500 kg/ha. About one fifth of volume of water was drained from ponds daily in early hours and replenished with seawater pumped from the creek. Two separate 10 HP low head Kirlosker pumps were used to feed 4 ponds in an extent of 4.2 ha (Fig. 1 A). Construction of ponds in an elevated ground helps the culture practices in many respects. Provision of radiating canals around the bunds of the pond converged in the catching pit facilitates the cultured stock to assemble in this limited area and the crop easily lifted by a dip net laid in advance (Fig. 1 B & C). This improvised harvesting technique enables the field workers to take the valuable product in a healthy condition in less time (Fig. 1 D).

The growth and yield directly depend upon a number of factors like the species selected, natural fertility of the culture site, efficiency of supplimentary feed, stocking intensity, size of seed etc. and it has to be determined emperically for each area. In view of this, experiments were designed to stock *P. indicus* at different stocking intensity varying from 44,000 to 275,000/ha. The best season for the collection of seeds of *P. indicus* was found to be February-May and August-September. Most of the culture operations were started with wild seeds measured in the range 11-46 mm and the last few experiments were purposely planned to stock with juvenile prawn in the size group of 65-90 mm with

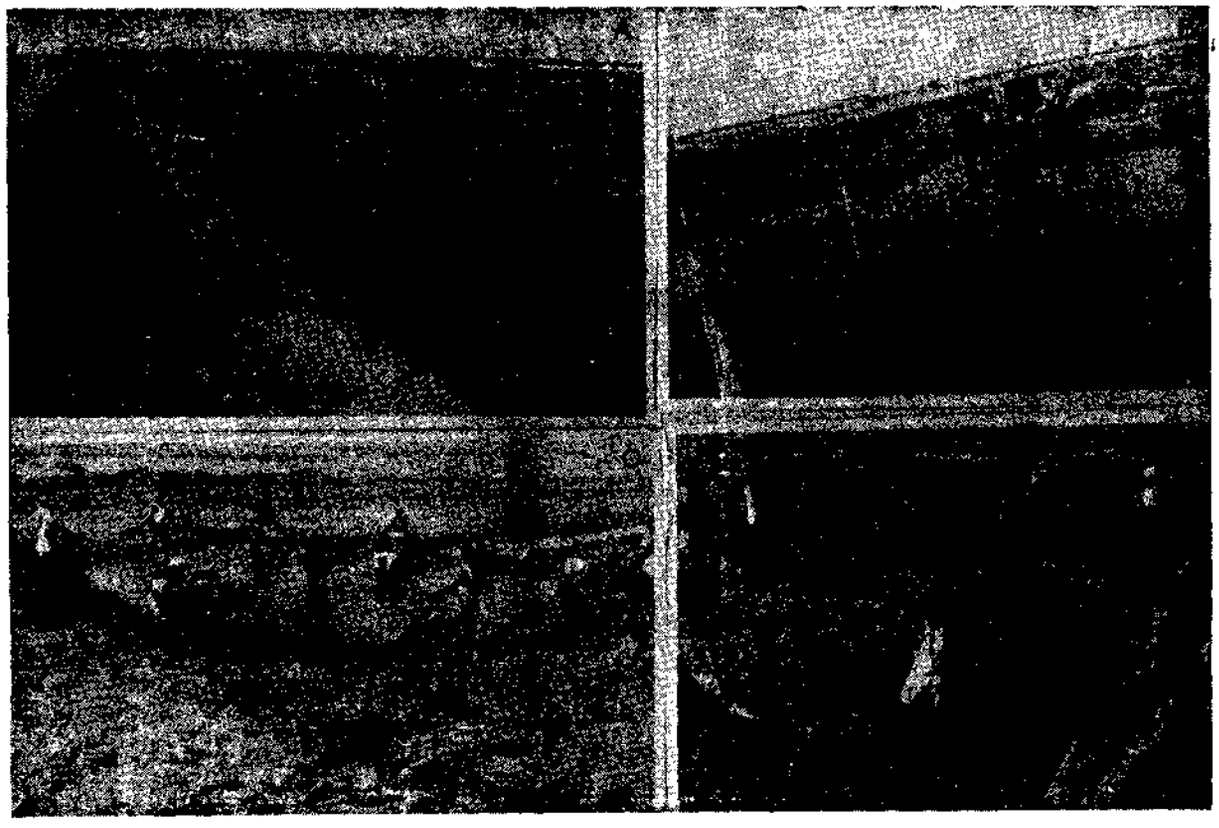

Fig. 1. A. view of prawn culture ponds. B. Pond showing the radiating canals and catching pits. C. Lifting the net from the catching. D. Harvesting of cultured prawn.

an aim to see the difference in the trend of growth in the process of fattening and production. Pelletized feed obtained from TOMCO at subsidised rates constituted the diet in early experiments but for later culture operations, pellets of better quality were prepared at Veppalodai and supplied to the stock at the rate of 7-10% of prawn biomass and the quantity was divided and broadcast 4 times a day, avoiding the peak noon hours. When the stock grow in size, instances of "animal stress" was noticed followed by oxygen depletion in rearing ponds in early hours, particularly in overstocked ponds as well as in ponds of excess "green water" or bloom. On such occasions adequate exchange of water from the ponds was arranged in addition to the use of floating poddle wheel for generating more oxygen in the culture site. When the values of dissolved oxygen content fell below 3 ml/l, organic manure at the rate of 100 kg/ha was added to maintain good primary production (above 700 mgC/m^3/day) and thereby oxygen generated by natural process. Based on the characteristics of water qualities the system of culture was broadly classified as monsoon crop extending from August to January and summer crop covering the period February–July. In summer season, occasional formation of H_2S was observed in corners of pond due to soil condition and poor exchange of water. However, treatment with lime powder in such spots improved the situation. Cessation of feeding on supplementary diet was noticed at times when water replenishment was interrupted, and quick action taken for adequate exchange of water in rearing ponds solved the problem. Baking of the muddy bottom before raising each crop and increasing the depth of water in ponds during summer were some other measures in the management of quality of water. Excess feeding also spoil the water and the determination of correct feeding dose for the prawn biomass at every stage formed the main part of monitoring the culture.

RESULTS

The difference in hydrological factors observed throughout the year exhibit clear influence on the progress of different experiments carried out during 1985-'87. Out of 18 experiments completed by August, 1987, eight experiments were covered during premonsoon/monsoon period, when the mean surface water temperature fluctuated in the range 25.2–27.4°C and the salinity varied from 36.74-42.90ppt. (Table 1). Summer crop faced slightly adverse environmental characteristics (Table 2) with increased mean temperature

TABLE 1. *Hydrology of prawn farm—monsoon crop*

Month	Water temp at 0830 hrs ° c		Salinity ppt		Dissolved Oxygen (ml/1)		pH		Productivity mgc/m^3/day	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Aug.	26.1-27.2	26.7	38.99-39.39	39.19	4.21-4.28	4.25	8.14-8.19	8.17	806-926	866
Sep.	25.0-27.7	25.9	40.97-44.53	42.90	4.14-4.35	4.25	8.15-8.35	8.27	669- 952	849
Oct.	26 7-27.2	26.7	40.42-44.09	41.86	3.24-5.17	4.38	7.90-8.08	8.02	725- 725	725
Nov.	27.2-27.7	27.4	30.26-40.60	35.80	3.05-4.50	3.68	7.90-8.02	7.98	825-1647	1041
Dec.	25.5-26.3	26.0	35.17-40.08	37.91	2.95-4.50	3.76	7.70-8.10	7.92	463-1458	961
Jan.	24.3-26.3	25.2	35.25-39.76	36.74	2.90-4.80	3.88	7.60-8.10	7.86	775-1916	875

TABLE 2. *Hydrology of prawn farm — summer crop*

Month	Water temp' at 8830 hrs°c Range	Mean	Salinity ppt Range	mean	Dissolved oxygen (ml/l) Range	Mean	pH Range	Mean	Productivity mgc/m^3/day Range	mean
Feb.	26.3-28.4	27.1	36.25-38.87	37.84	3.77-4.22	4.05	8.08-8.20	8.13	826- 926	880
Mar.	27.5-28.5	28.2	36.50-39.53	38.04	4.07-4.37	4.16	8.00-8.16	8.08	685-1055	922
Apr.	28.3-30.7	29.8	36.08-42.90	39.00	4.00-4.42	4.18	7.90-8.16	8.00	290- 835	636
May.	28.9-29.8	29 3	37.49-50.03	43.90	3.09-4.81	3.97	7.60-8.28	7.95	592- 876	705
June.	27.3-28.6	28.1	38.77-48.00	44.94	38.0-5.74	4.80	7.90-8.18	8.05	600-1003	975
July.	27.3-27.7	27.5	40.65-45 70	43.52	3.04-3.48	3.27	7.64-8.13	7.94	214-1062	500

TABLE 3. *The results of culture experiments of P. indicus and P. monodon*

Expt. No.	Seed size at stocking mm/g	No. of prawn stocked	Period of culture days	No. of prawn harvested/ kg	Size at harvest mm/g	Over all growth mm/g
1.	11.3/0.2	19000	166	16150/290.0	135.7/18.0	22.5/3.22
2.	28.0/0.3	22820	153	14833/277.0	138.3/19.8	21.6/3.82
3.	20.0/0.3	40000	174	37500/600.0	125.0/16.0	18.1/2.64
4.	22.0/0.3	66500	224	63460/835.0	123.4/13.2	13 5/1.73
5.	15.0/0.2	115000	232	106380/1169	116.0/11.0	13.0/1.40
6.	25.0/0.3	135000	172	100625/805.0	106.0/ 8.0	14.1/1.43
7.	25.0/0.3	45000	166	40260/330.0	108.0/ 8.2	15.3/1.49
8.	24.0/0.4	75000	128	56700/720.0	123.7/12.8	23.4/2.91
9.	46.0/1.0	28000	85	24000/300.0	124.8/13.0	27.5/4.24
10.	30.0/0.4	34000	126	27374/355.0	123.5/13.0	22.3/3.00
11.	30.0/0.4	91000	124	50050/550.0	118.1/11.0	21.6/2.60
12.	18.0/0.1	260000	143	213616/1027	93.0/ 4.5	15.7/1.00
13.	20.0/0.2	110000	130	96720/465.0	92.0/ 4.8	16.6/1.06
14.	65.0/1.3	55000	103	30887/349.0	120.0/11.3	16.0/2.91
15.	65.0/1.3	40000	99	39396/670.0	132.0/17.0	20.3/4.75
16.1	93.0/5.0	17375	67	16153/227.5	127.5/14.0	15.5/4.03
16.2*	70.0/2.5	160	67	158/ 10.5	210.0/83.0	62.7/36.0
17.	25.0/0.3	61000	168	58985/629.5	115.0/10.6	16.1/1.84
18.	60.0/2.5	59200	124	56700/810.0	128.0/14.2	16.5/2.83

* Expt. No. 16.2 *Penaeus monodon*

in the range 27.1-29.8°C and salinity between 37.84-44.94ppt. These variations resulted in the poor rate of growth in most of the experiments but not in mortality.

Wild seeds of *P. monodon* in the size, 70 mm released together with *P. indicus* in one experiment revealed good results in growth and survival. The tiger prawn attained the marketing size at 210 mm/83 g in a culture period of 67 days indicating an overall growth rate of 63 mm/36 g/m. Similarly, seeds of *P. indicus* of advanced size reached marketing size within a short culture period and found much tolerant even in high temperatures and salinity (Table 3). *P. indicus* grew to harvesting size at 127.5 mm/14 g in a short spell of 67 days (Expt. No. 16), and in earlier round of experiment also the seeds released at 65 mm progressed to 132 mm/17 g in 99 days showing an overall growth rate of 20.3 mm/4.75 g/m. Such fast growth was possible because of the well suited stocking intensity (43000-80,000/ha). This observation appeared to be an important consideration in the commercial development for realising quick profits. The growth was fast during early days of stocking, particularly in monsoon crops when campared to the summer crop. The trend of growth sharply declined with increase in stocking density.

The crops raised during monsoon season, generally revealed a better growth as seen in experiments 1, 2 and 8-11 indicating an overall growth of 22-27 mm and 2.60-4.24 g/m. But at the same time poor growth at 16 mm/1 g/m was well noticed in experiments 12 and 13 which was exactly due to high stocking at 2.75 lakhs/ha (Table 3). The crops raised during summer season exhibited a poor growth at 13-16 mm / 1.4-2.8 g/m, although the stocking intensity was kept at 62,500/ha as in the case of experiment No. 18. The trend of growth observed in these two different seasons are plotted in Fig. 2 and 3. The growth curves for *P. indicus* indicated a clear inverse relationship between stocking density and growth.

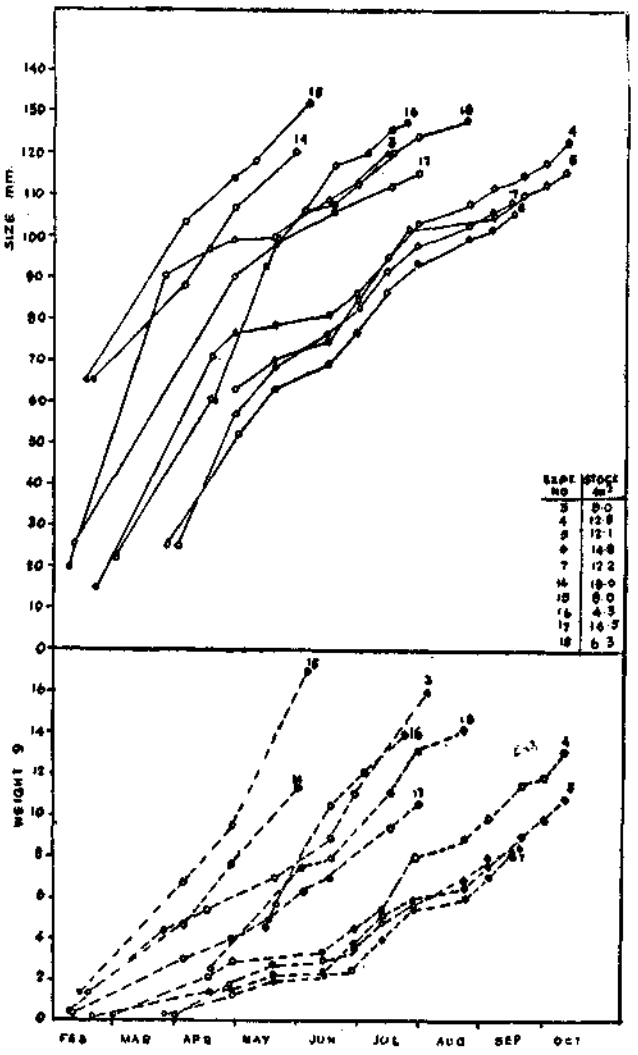

Fig. 2. Trend in the growth rate of *P. indicus* cultured in summer season.

The changing pattern of growth rate in different stages or size group of *P. indicus* are depicted in Fig. 4. Seeds of *P. indicus* released during monsoon at 11 mm and 24 mm have grown fast at the rate of 38 mm and 43.6 mm/m respectively as seen in experiments 1 and 8. Significantly, the seed released in summer at 15mm (Expt. No. 5) have indicated a poor growth rate at 25.3 mm/m even during early stages. The rate of growth declined suddenly after 80 mm size, invariably in all experiments. Weight increase was not steady in the growth of prawn. Two prominant modes were seen in the histogram drawn for the rate of increase of weight in the cultured prawn. Maximum weight input was noticed when the prawns reached the size at 110 mm

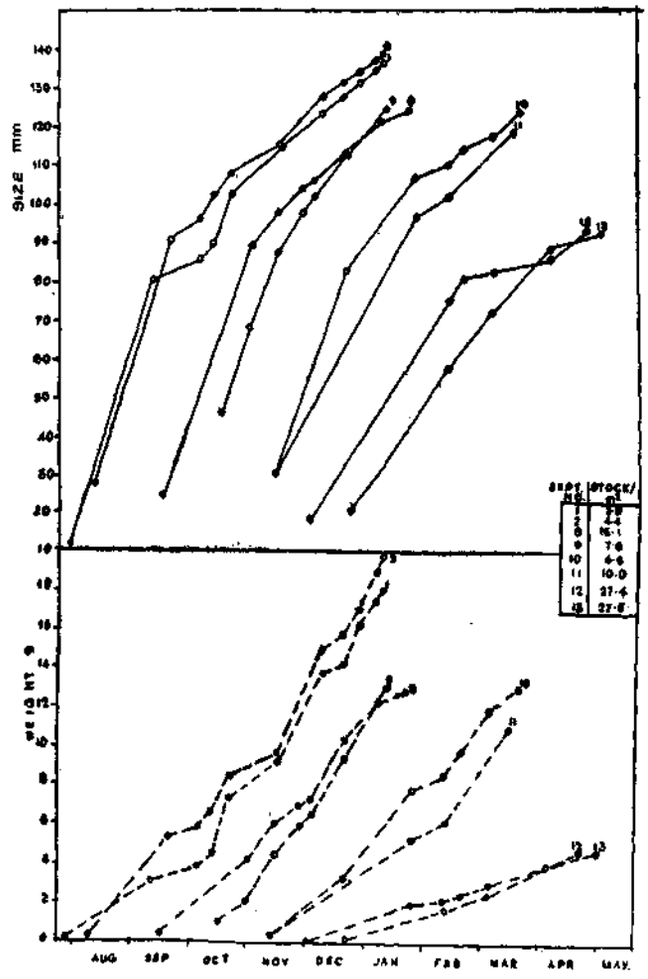

Fig. 3 Trend in the growth rate of *P. indicus* cultured in monsoon season

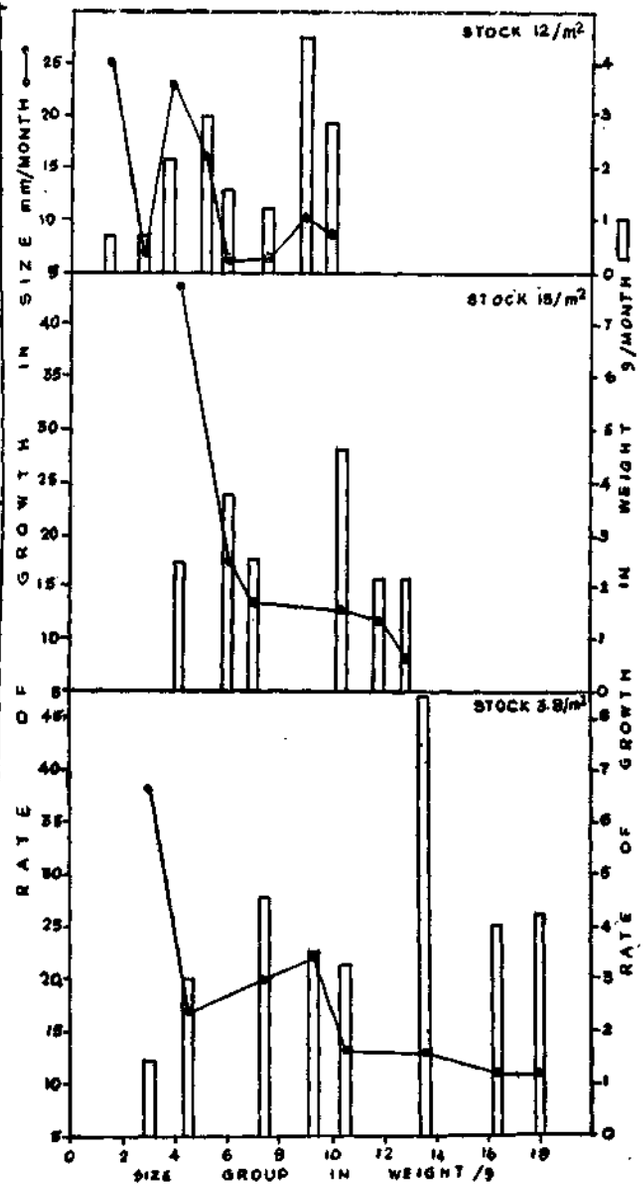

Fig. 4. The growth rate of *P. indicus* at different steges.

and above. Maximum gain in weight (8.5 g) was noticed in the first experiment in prawn belonging to 120 mm size group and it may be due to conducive environmental conditions and low stocking. In another experiment (No. 8) although it was carried during monsoon, the maximum gain in weight (4. 6 g) was noticed with 110 mm sized prawn and this low rate may be attributed to high stocking density. This observation confirmed that environmental factor alone was not the criteria for promoting the growth but the stocking intensity constituted the primary concern. This trend was also noticed in the fifth experiment and in confirmity with the observations made by Muthu *et. al*, (1981).

The production and marketing details are presented in Table 4. A total production of of more than 10 tonnes of *P. indicus* was attained from 7 ponds in a total area of 4.2 ha by raising 2-3 crops in a period of 25 months and fetched a gross income of Rs. 3,90,161/-. Best result in growth and production was recorded when the stocking

TABLE 4. *Results of production, marketing and income of the experiments*

Expt No.	Culture period	Pond size m^2	Percentage of survival	Production Kg	Rate of production kg/ha/crop	Value realised Rs. Ps.
1.	26.7.85-8.1.86	4973	85.0	290.0	583.0	9,976.00
2.	8 8.85-8 1.86	5205	65.0	277.0	532.0	10,664.50
3.	8.2 86-2.8.86	4973	93.8	600 0	1206.5	33,000.00
4.	1.3 86-10.10.86	5205	95.4	835 0	1604.0	38,410.00
5.	20.2.86-10.10.86	9472	92.5	1169.0	1234.0	43,253.00
6.	25.3.86-13 9.86	9139	74.5	805.0	880.8	17,710.00
7.	1.4.86-13 9.86	3677	73 2	330.0	897.5	7,260.00
8.	15.9.86-21.1.87	4973	75.6	720.0	1448.0	43,200.00
9.	15 10.86-10.1.87	3677	85.7	300.0	815.9	18,000.00
10.	12.11.86-18 3.87	5205	80.5	355.5	683.6	16,708.00
11.	12.11.86-16.3.87	9139	55.0	550.0	601.8	20,350.00
12.	1.12.86-22.4.87	9472	82.2	1027.0	1084.3	15,405.00
13.	21.12 86-30.4 87	4000	87.9	465.0	1162.5	6,975.00
14.	19.2.87-28.5.87	5500	56.2	349.0	635.0	12,215.00
15.	15.2.87-4.6.87	4973	98.5	670.0	1347.3	24,790.00
16.	15.5.87-21.7.87	4000	93.0	227.5	569.0	9,782.50
17.	10.2.87-28.7.87	3677	96.7	627.5	1706.5	21,962.50
18.	18.4.87-20.8.87	9472	95.8	810.0	855.0	40,500.00
	Average	5930	82 6	578.2	991 5	21,676.00

TABLE 5. *Production and conversion efficiency*

Expt. No.	Prawn Production kg.	Food supplied kg.	Conversion quotients
1.	290.0	1740.0	1: 6.0
2.	277 0	1608.0	1: 5.8
3.	600.0	3179.0	1: 5.9
4.	835.0	4833.0	1: 5.8
5.	1169.0	6288.0	1: 5.4
6.	805.0	3243.0	1: 4.0
7.	330.0	1972.0	1: 6.0
8.	720.0	2906.0	1: 4.0
9.	300.0	859.0	1: 2.9
10.	355.5	2490.0	1: 7.0
11.	550.0	3714.0	1: 6.8
12.	1027.0	5404.0	1: 5.3
13.	465.0	3037.0	1: 6.5
14.	349.0	1960.0	1: 5.6
15.	670.0	4154.0	1: 6.2
16.	227.5	954.0	1: 4.2
17.	627.5	2860.0	1: 4.6
18.	810.0	4000.0	1: 4.9
Average	578.2	3067.0	1: 5.4

rate was kept at 70,000-80,000/ha. The rate of production/ha/crop varied from 532 to 1706 with an average production of 991.5 kg. Annual production in a ha fluctuated in the range 1064-4344 with an average at 2434 kg. Survival was high and the average income per crop of 144 days worked out to be Rs. 21,676/-. The cost of expenditure on various accounts roughly came to 50-60% of the income.

The conversion quotients of the experiments were calculated in the range 2.9-7.0 : 1, with an average of 5.4 : 1 (Table 5).

DISCUSSION

Considerable efforts were made to improve the growth, survival, production and profit with the existing developed grow-out facilities. High production of quality prawn was realised by designing short term culture operation to facilitate to raise 3 crops in a year. The occurrence of seeds of high quality, desirable

species like *P. indicus* without the mixing of poor growing species was another added advantage for the progress of culture in this area. Periodical stocking and harvesting in different ponds, leaving sufficient days of gap, promotes the collection efforts easier, besides creating prospects for regular flow of income for smooth management of farm.

The results on the production were compared with earlier works to realise the value and feasibility of present experiments. Andhra Pradesh is leading in the development of prawn culture in vast coastal belt, but still the rate of production is low. Srivastava (1984) analysed the production results and reported the average production of prawn under monoculture experiments as 264 kg/ha only. Srinivasan *et. al.* (1982) reported in brackishwater prawn farm of Tamilnadu to vary from 200 to 400 kg/ha/crop. Polyculture of milkfish and *P. indicus* at Kakdwip have shown a total production of 2196 kg/ha/6 months (Rao, 1978). Suseelan (1976) recorded a maximum production of 1134 kg/ha/year. Nandakumar (1982) observed in *P. indicus* a production of 231 5 kg/ha/5 months with supplementary feeding practice. Venkatesan and Victor (1982) recorded a maximum production of *P. monodon* at 521 kg/ha/ 3 months in brackishwater in Madras, although it is a fast growing species. Varghese *et. al.* (1982) obtained a maximum production of *P. indicus* at 511 kg/ha/3 months in converted filtration fields in Kerala. In Tuticorin area, some of the private farmers have produced 300-400 kg / ha / 4 - 5 months without any scientific management. The production figures (991kg/ ha/crop) from Veppalodai farm are several times more than the results published for *P. monodon* and *P. indicus* from different areas.

CONCLUSION

The productive areas are Pinnakayal estuary and Palayakayal which consist of low deltaic land intersected by winding creeks. The lands adjacent to Korampallam creek, Arasalodai creek, Kallar estuary, Vaipar and Vembar estuaries are the other identified sites for the development of prawn culture in this zone.

Extention and research are the major immediate needs for the development of prawn farming in a new area. Present extension service has aimed to improve the level of production in existing conditions, increasing area of operation by monitoring progress of fish farmers. Environmental and resource evaluation are in progress and the investigation will provide adequate information for new entrepreneurs in this zone. Improved management and greater operational efficiency executed at Veppalodai prawn farm have set examples for the development potential and for follow up action. A perfect technology has been developed for a guaranteed production of one or two tonnes per hectare. The involvement of different organisations are essential for the development of the sector. The action plan of Marine Products Export Development Authority has already evoked interest among entrepreneurs for enjoying the incentive schemes in the form of subsidy for development of new farms, establishment of seed bank and hatchery and subsidy on prawn feed. Central Institute like CMFRI also extends technical guidance to promote this industry as at present. A well planned area development programme with integrated approach as exemplified in the field of agriculture, could accelerate the progress of aquafarming in near future as there is considerable scope for further development in production techniques and high income.

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