J. mar. biol. Ass. India, 1986, **28** (1 & 2) : 63 - 73

RESULTS OF EXPERIMENTAL MONOCULTURE OF MILKFISH IN MARINE FISHFARM AT MANDAPAM

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ABSTRACT

The results of the experiments conducted during 1980-82 on the monoculture of milkfish at Marine Fishfarm, Mandapam are presented. In a 0.25 ha earthen pond, each experiment was conducted for a period of 10 months. Fertilization with 1000 kg/ha of chicken manure and 400 kg/ha of N-P-K (12-24-12) was done in the first experiment. Supplementary feed at the rate of 5-10% body weight of the fish was given in the second experiment. The stocking density of 4000 fingerlings/ha yielded 216 kg/ha in the fertilized pond with a survival rate of 89.7% and 852 kg/ha in the unfertilized pond with 63% of survival.

INTRODUCTION

THE MILKFISH *Chanos chanos* (Forsskål) is one of the most important pond-raised finfish in terms of land area used and in quality of production. The milkfish is an algal feeder and a fast grower. It can be produced at a relatively low cost and also the milkfish production can be managed with reliable profit on saline lands unsuitable for agriculture and animal husbandry (Rabanal and Shang, 1976).

It is well known that commercial-farming of milkfish is practised in Philippines, Indonesia and Taiwan. In India, milkfish culture was initiated by the State Fisheries Department, Madras. From the available information on milkfish culture in India, it is evident that it has received attention mostly in Tamil Nadu. A brief account on the cultivation of milkfish in Krusadai Island has been given by Devanesan and Chacko (1944). Stray references have been made to the growth of *Chanos chanos* (Forskål) in brackishwater ponds by Menon *et al.* (1952). Culture of milkfish in and around Krusadai and Rameshwaram Islands has been mentioned by Chacko and Mahadevan (1956). Malupillai and Chacko (1956) have touched on the aspects of milkfish farming in Marine fishfarm. Tampi (1960) has indicated the potentialities of the milkfish culture in the biologically less productive saline lagoon at Mandapam. Evangeline (1967) has discussed in detail about the milkfish culture at the brackishwater fishfarm, Adyar. Sundararajan *et al.* (1979) have presented the results of the experiments conducted at Brackishwater fishfarm, Santhome, on the mixed culture of milkfish and prawn. Culture of *Chanos chanos* in the saltpans at Tuticorin has been mentioned by Nair *et al.* (1975) and Bensam and Marichamy (1981).

With an objective of standardising the management practice and finding out the possibilities of maximising production rate from the biologically less productive coastal area of Mandapam, a set of experiments were conducted during 1980-82. The results of the monoculture experiments form the basis of the paper.

MATERIALS AND METHODS

Preparation of the pond

One 0.25 ha earthen pond lined with black polyethylene sheet (0.16 mm gauge) on the

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inner slopes and strengthened over the berms by turfing was used for both the culture experiments. The nature of the pond bottom was mostly sandy with an admixture of clay. Before stocking, the pond was completely drained of the water and undesirable fishes and aquatic plants were eradicated. The pond was allowed to dry for a month, after which seawater was pumped in from Palk Bay, up to a depth of 10 cm initially and later raised to 45 cm for both the experiments. The same water level was maintained throughout, by periodic pumping.

Fertilization of the pond

For the first experiment, the pond was fertilized with 250 kg of organic manure (Dry chicken droppings) at the rate of 1000 kg/ha, which was broadcast over the pond bottom to stimulate and maintain the growth of phytoplankton, Microbenthic algae and filamentous green algae. This pond was initially filled with seawater upto a depth of 10 cm and was allowed to evaporate. Seawater was again pumped into this pond to the same level and allowed to remain. A dense mat of algae was formed within 10 days. The complex so formed was found to be constituted by green algae such as *Ulva* spp., *Enteromorpha* spp., *Chaetomorpha* spp., *Cladophora* spp., and members of Chlorococcales along with the bluegreen algae *Lyngbya* spp., etc. A number of species of diatoms and copepods were also observed. Then the water level was raised to 45 cm. Every fortnight, 5 kg (20 kg/ha) of inorganic fertillizer N. P. K. (12-24-12) was applied to the pond to promote and rejuvenate the growing benthic algae. The second experiment was carried out without such fertilization, in the same pond, during 1981-82.

Seed collection and transportation

There are two main seasons for milkfish seed collection at Mandapam; a major season in summer (April-August) and a subsidiary season during the Northeast monsoon (October-December). For the fertilized pond, in April 1980, shoaling fragile fry of 15 mm mean size were collected by using a rectangular piece of mosquito net in shallow tidal pools of Pamban. Polyethylene transportation bottles with oxygen were used to carry the seed to the farm site. These fry were reared initially in a 12' dia indoor pool, till they reached stockable size. In September 1981, for the unfertilized pond, fingerlings of 120 mm average size were collected from Pillaimadam Lagoon and transported in fibreglass tanks. These fingerlings were conditioned for two days, before they were released into the rearing pond.

Stocking

In both experiments, the pond was stocked with 1000 seeds, at a stocking rate of 4000/ha. The culture experiments in the fertilized and unfertilized ponds were initiated on 1st September '80 and 20th September '81 respectively. The average size and weight of the fish at the time of stocking were 59.2 mm and 1.9 g in the fertilized pond and 129 mm and 13 g in the unfertilized pond.

Feeding

During the experiments in the fertilized pond, the fish were not artificially fed. The stock was allowed to graze on the thick mat of benthic complex. The fish in the unfertilized pond was given supplementary feed composed of ricebran, groundnut oilcake, tapioca powder and fish meal mixed in equal proportion, once in a day, in a dough form, at a ration of 5-10% biomass of the fish.

Sampling

The fish were reared for a period of 10 months. Operating a drag net with scare line,

the growing fish were sampled once a month for recording the growth of the fish during different months. From each sample, 10% of the fish so caught were measured.

Hydrology

Environmental parameters such as water temperature, dissolved oxygen, salinity and pH of the pond water were determined at regular intervals during the culture experiments.

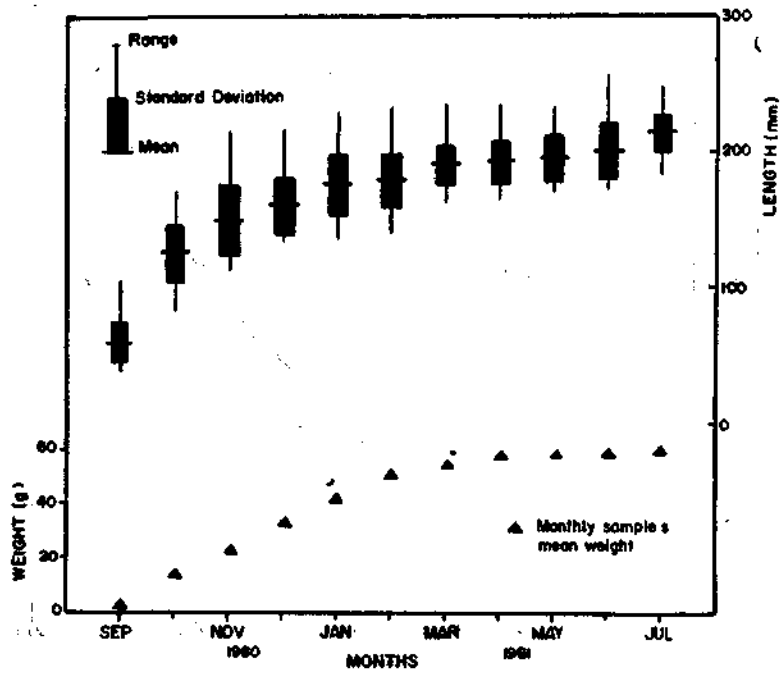

Fig. 1. Monthly sample's average length, mean weight and its standard deviation for the milkfish in the fertilized pond (1980-81).

Results

Fertilized pond

Growth and survival: The fish increased in size from the initial average size of 59.23 mm (1.9 g) to a mean size of 123.02 mm (14.36 g) in the first month. Thereafter a fairly rapid increase in the mean size to 146.01 mm (23.28 g) in the second, 159.12 mm (32.66 g) in the third and 174.65 mm (41.76 g) in the fourth months were recorded. In the fifth month, the fish reached a mean size of 177.90 mm (50.0 g) showing an increment in weight than the increase in length. A slow rate of growth in the average size to 188.51 mm (54.75 g) in the sixth month, 190.15 mm (57.73 g) in the seventh month, 194.08 mm (58.43 g) in the eighth month, 201.40 mm (59.10 g) in the ninth month and 211.95 mm (60.20 g) in the tenth month were observed. Average length, weight and size range recorded each month of the rearing period are presented in Fig. 1.

It may be seen that the monthly mean growth recorded for the first three months of the

rearing period was 33.29 mm in length and 10.25 g in weight. For the next three months, the average monthly increment observed was 9.79 mm (4.33 g). The monthly average increase in length and increment in weight for the last four months worked out to 5.86 mm and 1.36 g. On the whole, faster growth was observed during the first quarter of the rearing period. The monthly growth increment during the whole period ranged from 1.64 to 63.8 mm in length and 0.7 to 12.5 g in weight, with an average of 15.27 mm in length and 5.83 g in weight.

The fish gained a net increase of 152.7 mm in length and 58.3 g in weight during the ten months rearing period. It may be concluded that a better growth was observed during first four months of rearing. At harvest, the survival rate was 89.7%.

A sample of 200 harvested fish was plotted for length - weight relationship in Fig. 2 and

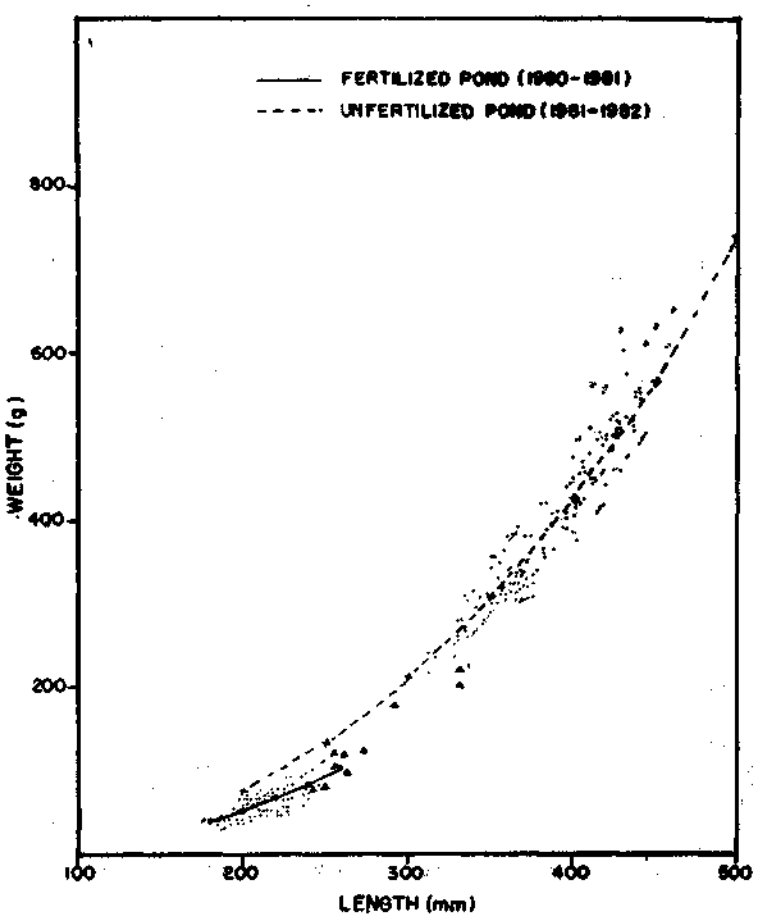

Fig. 2. Length-weight relationship of the milkfish at harvest.

the relationship was found to be Log W= 2.5524 Log L - 4.1743. The correlation coefficient (r) value was 0.4648 and standard error of estimate ($b\pm$) was 0.3456. The 't' value was found to be 1.2953. It was seen that the regression coefficient was not significant from 3 at 1% level. During the rearing period, the high values of condition factor 'K' were found to be 0.914 during September '80 and 0.888 in February '81 (Fig. 3).

Yield

The fish were harvested on first July, 1981, yielding 54 kg, denoting a calculated production rate of 216 kg/ha. The fish at harvest ranged from 184 mm (34 g) to 248 mm (108 g). The different size groups both in length and weight are shown in Fig. 4.41% of the harvested fish were found to have grown above the average size and the dominant modal size group (200 - 209 mm) formed 32% of the catch at harvest.

Environmental conditions

The lowest (27.7°C) and the highest (35.0°C) water temperature values were recorded in the months of November '80 and March '81 respectively. It ranged from 28.1 to 34.5°C during the other months of the culture period.

Higher salinity value (39.80 ppt) was recorded during the month of July '81. Lower salinity (34.48 ppt) was observed during the month of November '80. Salinity values fluctuated between 34.69 ppt. and 38.91 ppt. in the rest of the months. The salinity values were less during November '80 and December '80, due to the Northeast monsoon.

The dissolved oxygen level was found to be high (5.88 ml/l in the month of February '81 and low (3.00 ml/l) in the month of April '81. It ranged from 3.30 to 5.68 ml/l during the other months of the rearing period.

The record of pH level varied between 8.2 and 8.5 throughout the culture period.

The observations regarding enviromental parameters have been graphically depicted in Fig. 5.

Unfertilized pond

Growth and survival: The fish quickly increased from 129.00 mm (13.0 g) to 172.43 mm (38.08 g) in the first month. After a slow rate of growth seen during the second month (mean size 177.65 mm), a sudden spurt of the growth to 250.00 mm mean size (133.88 g) was observed in the third month. A gradual increase in the average size to 251.58 mm (136.52 g) in the fourth month, to 269.38 mm (165.52 g) in the fifth month and to 293.74 mm (195.30 g) in the sixth month was noticed. Again, steep rise in growth to 348.10 mm mean size (279.80 g) was registered during the seventh month. After a period of slow growth, during the eighth month, an increase in length was observed in the ninth month from 350.04 mm to 365 mm. A very slow growth of 368.70 mm (325.39 g) mean size was recorded in the tenth month. Average length, weight and size range recorded each month of the rearing period are presented in Fig. 6.

The monthly mean growth noted for the first three months of the rearing period was 40.33 mm and 40.29 g. For the next three months, the average monthly increment was 14.58 mm (19.59 g). The monthly average increase in length and weight for the last four months was 5.15 mm and 11.39 g. During the whole period of culture, faster growth was observed in the first quarter only.

The monthly increment in length varied between 1.58 mm and 72.35 mm and the weight between 0.39 g and 88.64 g, with a mean of 23.97 mm in length 31.24 g in weight. A length increase of 239.7 mm and weight increment

of 312.39 g were recorded during the ten months rearing period. Better growth was observed during the first, third and seventh months. At harvest, the survival rate was 63%.

A sample of 200 harvested fish plotted (Fig. 2) for length - weight relationship showed it to be Log W = 2.4742 Log L - 3.8077. The length - weight relationship was better correlated. The values of correlation coefficient (r) and standard error of estimate ($b\pm$) were 0.9277 ranged from 240 mm (80 g) to 494 mm (780 g). The different size groups both in length and weight are shown in Fig. 4. 53.5% of the total harvested fish had grown above the average size and the dominant modal size group (400-439 mm) constituted 36.5% of the catch. A total quantity of 1990 kg of artificial feed was given to the fish to gain a net weight increase of 200 kg, working out a gross conversion ratio of 9.95:1.

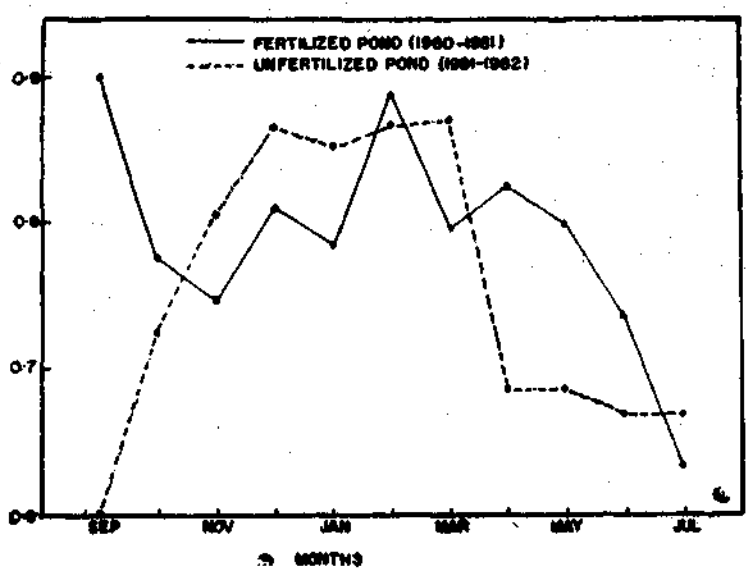

Fig. 3. Condition factor 'K' of the milkfish during the different months of the rearing period.

and 0.0707 respectively. The 't' value 7.4371 was found to be significant at 1% level. From December '81 to March '82, the condition factor 'K' varied between 0.864 to 0.871 showing the robust condition of the fish than the other months of the rearing period (Fig. 3).

Yield and feed conversion: The stock was harvested in the month of July '82. The yield obtained was 213 kg, showing an estimated production of 852 kg/ha. The fish at harvest

Environmental conditions: The highest (30.2°C) and the lowest (24.0°C) water temperature were recorded during the months of April '82 and December '81 respectively. During the other months, water temperature fluctuated between 25.4 and 29.0°C.

The lowest (23.91 ppt.) and the highest (67.16 ppt.) salinity values were observed in the months of January '82 and July '82 respectively. The lower salinity values of 31.29 ppt. in November and 27.91 ppt. in December '81

and 23.91 ppt. in January '82, were due to the effect of Northeast monsoon. The salinity of the other months ranged from 34.04 to 50.96 ppt.

Highest (5.05 ml/l) and lowest (2.55 ml/l) dissolved oxygen levels were recorded during the months of November '81 and February '82 respectively. During other months, the dissolved oxygen level ranged from 2.75 to 4.64 ml/l.

The pH values ranged from 8.2-8.6 throughout the culture period. Monthly mean values of the environmental parameters have been presented in Fig. 5.

Discussion

In milkfish culture, the application of organic fertilizer has been recommended by several authors for increasing the production rate of fish. In Taiwan, organic fertilizer, *viz.* 400-1000 kg of ricebran per hectare is being applied. The use of N-P-K fertilizers (8-9-0) at 400-500 kg/ha, in addition to ricebran, has been recommended at Taiwan (Chen, 1973). Fertilization at the rate of 450-900 kg/ha with green manure or copra slime is done in the traditional method at Philippines (Bardach *et al.*, 1972). In the present experiment, chicken manure and N-P-K- (12-24-12) fertilizers were applied to the pond at the

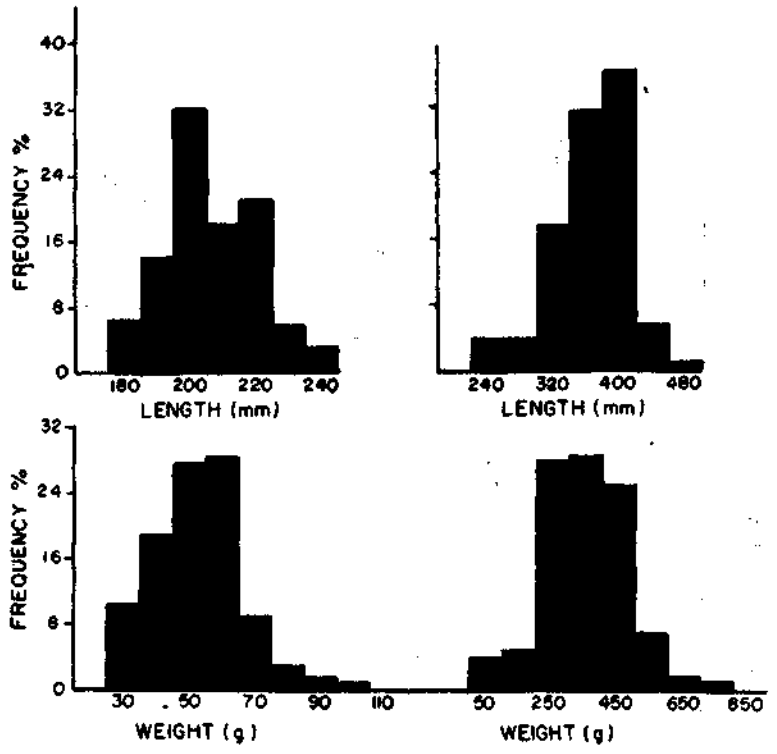

Fig. 4. Size groups of milkfish at harvest.

rate of 1000 kg/ha and 400/ha respectively. The application of inorganic fertilizer, even though it produced the benthic complex, did not help to sustain the fish food by promoting the growth of bluegreen and green algae, which were depleted by the fast grazing of the stock. As observed by Tampi (1960), the poor and porous soil is perhaps responsible for inhibiting the fertility of the ponds. We agree with Atkinson (1977) who observed that the application of superphosphate or N-P-K- fertilizers has little effect, if any, on increasing the production of the milkfish.

Stocking rate appears to be an important factor in milkfish culture. We stocked at the rate of 4000/ha for the present experiments, although various stocking rates are being followed in different countries depending upon the method of culture. The stocking rate of 1500 - 6500 /ha is adopted at Philippines (Rabanal and Shang, 1976). The Fisheries

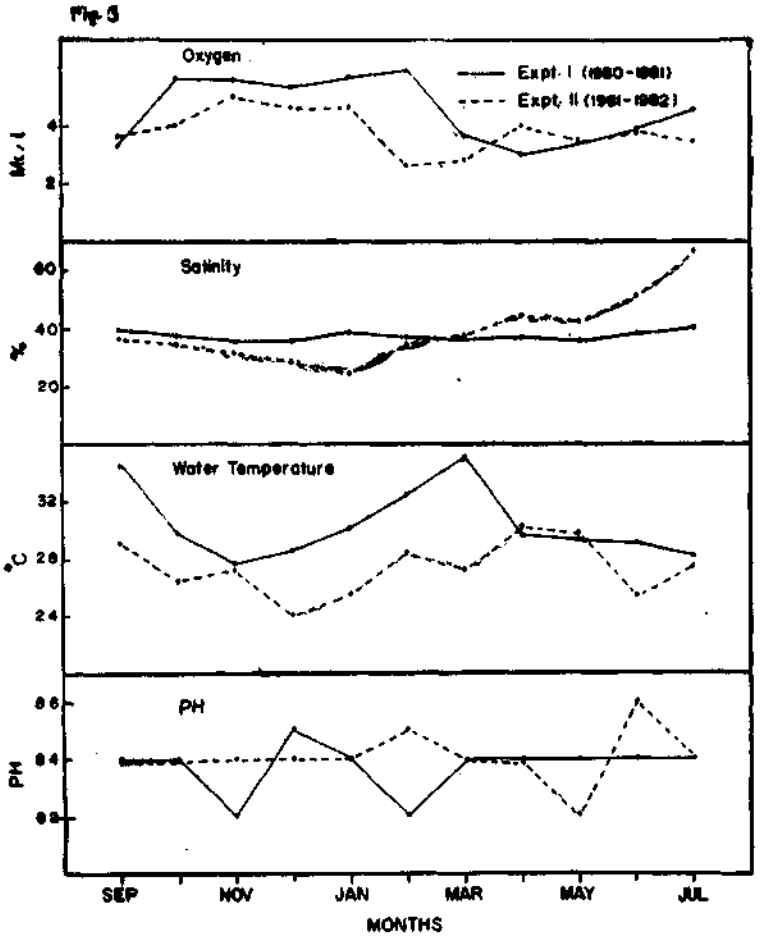

Fig. 5. Monthly mean values of environmental parameters in the fertilized pond (1980-81) and unfertilized pond (1981-82).

Division in Malaysia (1973) has mentioned a stocking rate of 5000/ha. In Indonesia, the production ponds (Monoculture) are stocked at the rate of 4000-6000/ha (Rabanal and Shang, 1976). In Thailand, the fingerlings to 235-240 mm in one year at the Krusadai fishfarm. The average monthly growth of 15.27 mm recorded in the fertilized pond compares well with the above observation. The mean monthly growth of 24.97 mm observed in

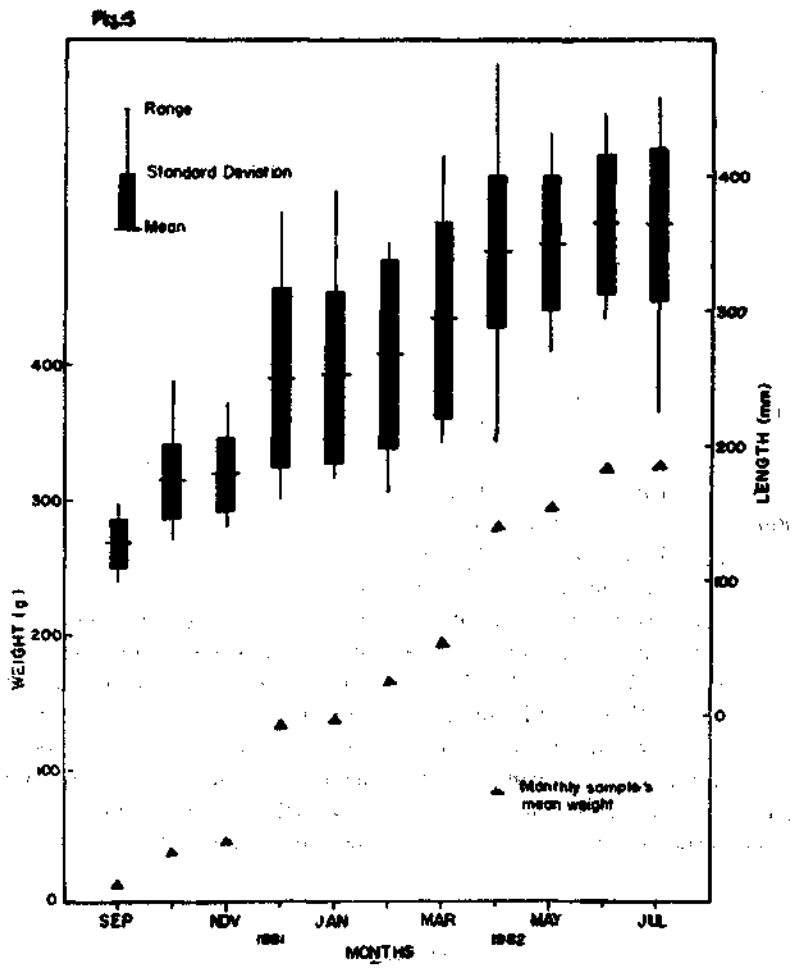

Fig. 6. Monthly sample's mean length, average weight and its standard deviation for the milkfish in the unfertillized pond (1981-82).

are stocked at the rate of 1000-4000/ha (Sribhibhadh, 1973).

According to Chacko and Mahadevan (1956), the fish had grown from the initial 50-85 mm the unfertilized pond is higher than the growth of 18.33 mm/month obtained in the saltwater ponds at Mandapam by Tampi (1960). Liang and Huang (1973) reported the growth between 0.98 g and 1.35 g/day for the cultured fish.

Sundarajan *et al.* (1979) reported the growth from 1.26 g to 1.74 g/day. The growth recroded in the fertilized and unfertilized ponds is 0.19 g and 1.04 g/day respectively.

Sundararajan *et al.* (1979) have stated the survival rate for the fish at the brackishwater fishfarm, Adyar from 89.2 to 99.04%. Bensam and Marichamy (1981) have noticed a survival rate of 44.04 to 85.53% for the Veppalodai saltpan area. The survival rate recorded now was 89.7% in the fertilized pond and 63% in the unfertilized pond.

Tampi (1960) reported a yield of 212-455 kg/ha/yr. Rabanal and Shang (1976) stated that the production was 500-3000 kg/ha in Philippines. A production rate of 318-857.47 kg/ha/11-14 months was stated by Bensam and Marichamy (1981). The production recorded in the present experiments (216-852 kg/ha) compared well with that of Indonesia where 300-1000 kg/ha has been reported (Rabanal and Shang, 1976). The production obtained in the unfertilized pond (852 kg/ha) was found to be much better than that of reported from Thailand, where an average 560 kg/ha/yr was reported (Sribhibhadh, 1973). The results of the unfertilized pond are comparable to that of reported from Ceylon, where selective harvesting followed by replenishment gave a production of 799-1159 kg/ha/annum (Samarakoon, 1973).

Kinne (1969) found that salinity above 55 ppt. adversely affected the growth of *Chanos* Lal Mohan (1983) has also confirmed the above observation. In the present experiments, similar observation has been made in the unfertilized pond.

It may be seen from the results of the foregoing experiments that a satisfactory yield can be expected from even a biologically less productive pond like the one existing in the Palk Bay farm area by efforts to compensate prevailing deficiency of natural fish - food in the pond through artificial feed supplied. This is borne out by the production value of 852 kg/ha obtained in the unfertilized pond.

On the other hand the value of 216 kg/ha of fish production obtained from the fertilized pond appears rather poor. It is quite probable that the application of inexpensive organic fertilizer in the form of chicken droppings is not upto the desired quantitative level to stimulate and sustain the growth of vegetation adequate to cope-up with the intensity of grazing by the fish stocked in the pond. Notwithstanding the poor cohesive quality of the sand loam soil with low percentage of clay in the pond bottom better results can be expected if the initial dosage of organic fertilizer is increased. Fertilizing the pond using orther organic manures in combination might also help. Experiments on the above lines are being pursued.

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