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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the National Marine Living Resources Data Centre (NMLRDC) and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

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FIN FISH CULTURE

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Introduction

The potential inshore area in less than 18 m depth available for near sea farming along our coast is estimated to be of the order of 9 million hectares. But this zone is subject to the vagaries of the southwest and northeast monsoons. Sheltered bays with marine condition are restricted only to Andaman and Nicobar islands and Lakshadweep Archipelago. The paucity of such ideal bays for fish culture is compensated by extensive backwater areas at numerous river mouths, tidal creeks/inlets, mangrove swamps and lagoons. The total area under this complex ecosystem is estimated to be 2 million hectares. Out of this, the 'Pokkali' fields of Kerala, 'Bheris' of West Bengal, 'Gazani' farms of Karnataka and 'Khazan' lands of Goa accounting for 30,000 ha are known to be used for traditional and historical practice of fin fish culture raising the two major cultivable groups of fin fishes namely, mullets and milkfish with an annual yield known to vary from 35 - 750 kg/ha/year, depending on several factors. The pearl spot, bhukti, sand whiting and thread fins are also often grown. In other maritime states like Andhra, Tamil Nadu and Maharashtra hardly any cultivation in backwater is known except for a 100 ha area used in Gujarat.

The pioneering suggestion made eight decades ago to contemplate marine fish culture in India came from Hornell (1911). His later effort in 1915 to establish a fish farm in the Hare Island area at Tuticorin received a set back after initial experiments due to extreme difficulties in farm management during northeast monsoon season. Consequently the farm was abandoned. Fish farming work in Kerala started in 1940 at Narakkal, growing mullets and milkfish along with prawns in about 100 ha which gave encouraging production of nearly 1,000 kg/ha/year. The Madras Fisheries Department renewed fish farming experiments in 1944 by constructing a farm in a tide fed marshy swamp at Krusadai Island, near Pamban, for

growing milkfish and mullets. Recurring hardship and handicaps forced discontinuance of these experiments also. Such trials in farming efforts underlined the paramount need for accelerated involvement to evolve suitable farm management strategies for different ecological niche.

Awareness was also created to focus our attention on several areas such as knowledge of the influence of water temperature and salinity in the grow-out systems on the candidate species cultured, understanding of the interaction of several environmental parameters in the culture system, basic productivity of different habitats, availability of suitable sites based on soil types and microfauna production, seed stock availability in space and time and devising techniques of transporting the seeds from areas of availability to areas needing them. Evolving appropriate growing techniques and assessing the production capabilities of different methods were identified as priority areas for experimentation.

Fin fish culture in C. M. F. R. I.

In this context it will be of interest to mention here the significant advances made by the C.M.F.R. Institute in fin fish farming research. Pond culture experiments carried out by Tampi (1960) in saline mud flat at Mandapam emphasised the need for compensating the porous, leamy soil character of the area with low nutrient contents by improving pond designs and supplementing the food energy source. Other crucial problems to be solved were (a) overcoming disadvantages encountered during cyclonic months resulting in tidal erosion of bunds (b) avoiding silting of water supply channels at the water front due to tidal action and (c) solving the problem of low profile tidal amplitude during many months resulting in scanty water exchange in the ponds affecting the water quality. These adverse factors were considered common to other sectors of the east coast as well and called for improved



Fig. 1. A view of some ponds constructed with granite and cement (Photo: Courtesy of Shri P. Bensam).

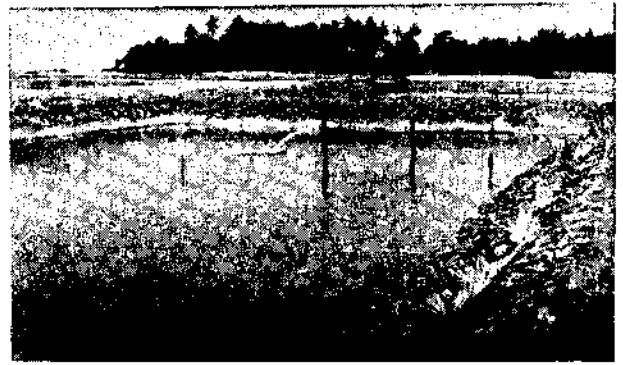


Fig. 4. Pumping of sea water into ponds. Sides of ponds protected by palmyrah rachis to prevent erosion on rainy days. (Photo: Courtesy of Shri P. Bensam).

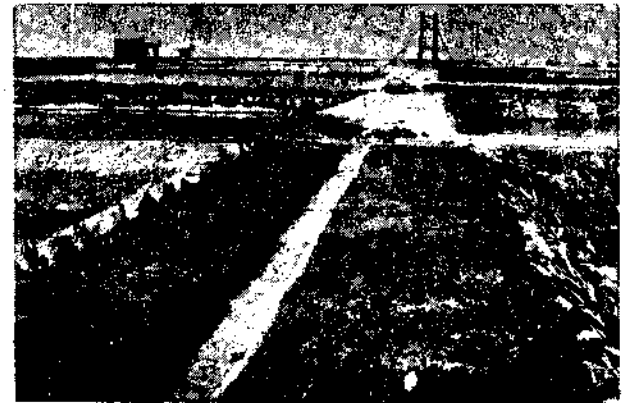
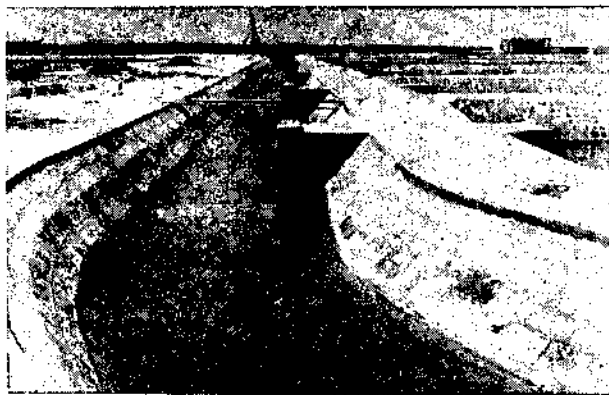


Fig. 5. Experimentation by lining pond slopes with palmyrah leaves, in order to make the dykes durable (Photo: Courtesy of Shri P. Bensam).



Fig. 2 & 3. Supply canal for flowing sea water into culture ponds. (Photo: Courtesy of Shri P. Bensam).



Fig. 6. Removing mangrove vegetation and constructing ponds at Tuticorin. (Photo: Courtesy of Shri R. Marichamy).

low cost designs in pond construction and water supply management plans.

Long after the farm at Mandapam was raged by the tidal bore during a cyclone which hit the Palk Bay coast, a set of 7 ponds were reconstructed in 1977 at

Mandapam (in a 1.0 ha area of the saline flat) providing granite stone revetment for pond bund slopes, strong sluice for automatic exchange of tidal water to and from each pond and a common, concrete supply channel leading from the sea controlled by shutter sluice to let in and let out water (Figs. 1, 2 and 3).

Subsequently another 2 ha plot was converted into 21 earth excavated ponds of different dimensions with arrangements for water supply through direct pumping. The bunds were effectively turfed with sea water resistant grass and bund slopes held compact by palmyrah leaf matting all over (Figs. 4 and 5). The above systems worked very satisfactorily facilitating farming experiments for the last five years.

Experiments to harness the mangrove vegetated areas for pond culture were tried at Tuticorin from 1977. A portion of mangrove fringed water expanse of 15 ha was initially compartmentalised into 6 ponds (each 0.25 ha) with strong bunds using the clay removed during excavation. Water exchange to all ponds was ensured by digging a tide fed supply channel, and the entry and exit of water were regulated by P.V.C. pipes connecting the channel to the ponds. Tufts of mangrove plants with the rhizophores were left intact unremoved, here and there, to serve as shaded shelter for the pond stock and for affording refuge to natural mangrove associated fauna to coexist (Figs. 6 and 7). The ponds have withstood monsoon seasons well.

At Madras, also a portion of saline water spread of about 50 ha at Muttukad was converted into a fish farm during the last two years (Figs. 8 and 9). It is too early to assess the performance.

Pond culture: Experiments conducted so far in Tuticorin and Mandapam using ponds were mostly for milkfish and mullets although the Indian sand whiting was also stocked at Mandapam occasionally. Monoculture and mixed culture were attempted. Interesting results have been obtained as evidenced by the reports of James (1983), James, *et al.* (1980b, 1983), Silas *et al.* (1983), Mohanraj *et al.* (1983) and Marichamy and Rajapackiam (1982). Polyculture of *Chanos*, *Velamugil seheli*, *Liza macrolepis* and *Penaeus indicus* has been shown to be very productive (1,364.4–1,864.5 kg/ha) while mixed culture of *V. seheli* and *Chanos* also yielded 1,422.2–1,600 kg/ha in 1980–82 experiments at Mandapam. Monoculture of *V. seheli* and *Chanos* did not yield production rate in excess of 358.2 kg/ha except in one year (81–82) when the production of *Chanos* grew to 852 kg/ha. During 1977–1979 Polyculture experiments at Tuticorin, an estimated production value of 499 kg to 731 kg/ha/yr of milkfish, mullet and prawn was obtained by Marichamy and Rajapackiam (1982).

In the Polyculture experiments with *Chanos chanos*, *L. macrolepis* and *Scylla serrata* at Tuticorin a production of 1,644 kg/ha/yr has also been reported. The

striking aspect of the experiments was that the yield was encouraging enough to attempt further experiments to perfect and standardise the farming techniques.

Salt pan fish culture: This was yet another trial to find out whether vast areas of salt pans in the east coast could be profitably utilised for farming milkfish and mullets. During 1973–75 experiments in the salt pans at Veppalodai near Tuticorin (Fig. 10) Bensam and Marichamy (1982) reported about the possibility of harvesting 857.47 kg/ha of milkfish in 14 months. It was observed that the survival range of 44–85% could be further improved with predator control.

Pen culture: In view of the operational and experimental success of pen enclosures for growing fishes in countries like Malaysia, Singapore, Thailand and Philippines experiments were undertaken in India also to identify suitable areas and show the production capabilities. The initial experiments at Tuticorin 1973 using bamboo screen pens to grow *Chanos* and mullets in a selected area with shallow muddy bottom flopped due to technical defects in pen construction and site selection (Shanmugam and Bensam, 1982).

During 1976–78, bamboo screen pen enclosures (81 m² area) were put up in the Gulf of Mannar at Mandapam for growing milkfish and mullets (Venkataraman *et al.* 1980). Except for the details of growth of *Chanos* from 60 mm to 217 mm in 4 months (average growth 51 mm per month) production data are wanting for these experiments.

A more positive contribution in pen culture was the utilisation of hypersaline, lagoon area of Mandapam for growing *Chanos* in pen enclosures. The work was initiated in 1982 and an area of 2.25 ha in an expanse of 230 hectares of Pillaimadam lagoon acquired by CMFRI was converted as pen enclosures by erecting net screens (using 20 mm mesh nylon webbing) dividing the area into 5 compartments ranging from 0.25–1.00 ha (Fig. 11). Stocking the pens with 80–100 mm fingerlings of milkfish a growth rate of 450 mm in 180 days has been reported (Lal Mohan, 1983). Attempts to lower the hypersaline conditions (60–180‰) during certain months (due to evaporation) by keeping the bar mouth open not only helped to increase the standing water column inside the lagoon but also to bring down the salinity considerably. The production capability is estimated to be around 2,000 kg/ha (Lal Mohan, personal communication). This remains to be substantiated in the coming years.

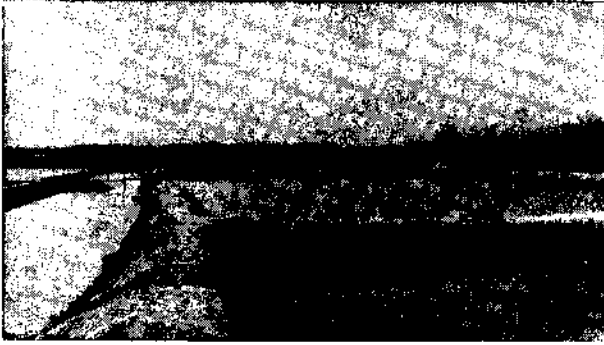


Fig. 7. View of coastal ponds developed along Tuticorin Bay (Karapad). (Photo: Courtesy of Shri R. Marichamy).



Fig. 8. General view of earthen ponds at Mariculture Centre of CMFRI, Muttukad. (Photo: Courtesy of S/Shri. P. R. S. Tampi and M. Kathirvel).

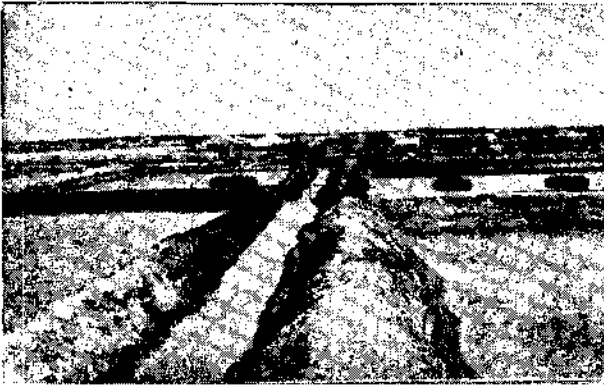


Fig. 9. Close-up view of earthen ponds. (Photo: Courtesy of S/Shri. P.R.S. Tampi and M. Kathirvel).

Recently a few net pens have been erected (Fig. 12) in the Muttukad farm, (near Madras), by the Institute for studying the growth of *Chanos chanos*. Results are awaited.

Cage culture: Cage culture is a new experience in India. But considering the great potential it holds,



Fig. 10. View of fish ponds in salt pan area at Veppalodai. (Photo: Courtesy of Shri. R. Marichamy).

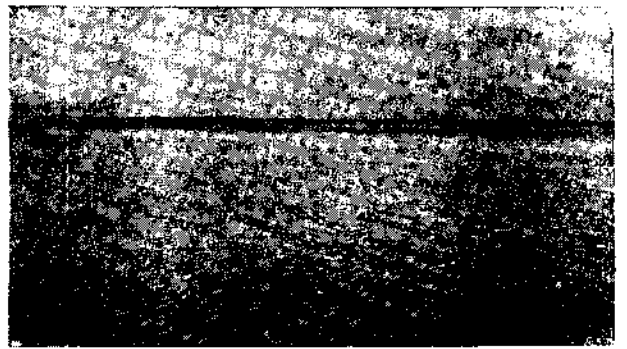


Fig. 11. Pen enclosure at Pillaimadam lagoon, Mandapam. (Photo: Courtesy of Dr. R. S. Lal Mohan).

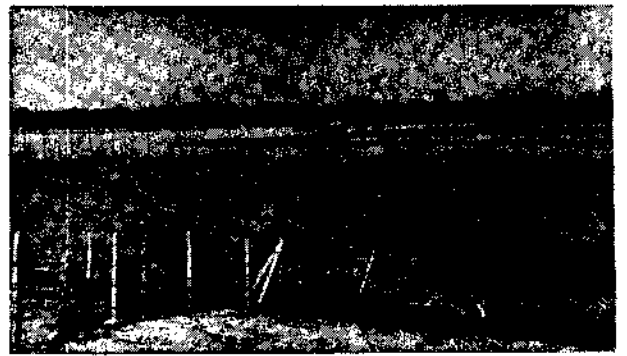


Fig. 12. Pen enclosure at Muttukadu, Madras. (Photo: Courtesy of S/Shri. P.R.S. Tampi and M. Kathirvel).

it was decided to attempt this method for growing groupers and rabbit fishes at Mandapam. James *et al.* (1980a) tried the possibility of culturing *Siganus*, *Sillago* and *Epinephelus* using fixed cages made up of nylon nettings and palmyrah leaf stilts in the coastal areas of Palk Bay near Mandapam. The experiments did not last long enough to give any quantitative

assessment. Recently cage culture work at Mandapam has been restarted using new cage designs for growing *E. tauvina* and *Siganus*, in a total area of 250 m². The work has just commenced and the results will be closely watched.

Apart from the above, Lal Mohan and Nandakumar (1981) attempted rearing milkfish and pearl spot in ponds excavated in the sandy shore of Calicut. Polythene sheets were used to cover the entire pond bottom and sides for water retention. It has been reported that it is possible to achieve a production of 920 kg/ha in 7 months in the case of *Chanos* and 380 kg/ha in 15 months for pearl spot.

Tank culture of eel: Experimental culture of the eel *Anguilla bicolor* was conducted at Mandapam during 1974-76 in running water in fibreglass tanks. It was seen that they could grow to 27.8 cm (43 g), 38.9 cm (115 g) and 41.9 cm (177 g) in the first, second and third years respectively.

The production in outdoor tanks using recycled water was still greater (rate 2.15 kg/m²) in 5 months. The eels were fed with silver belly and prawn flesh which gave better conversion ratio (7:1) than when fed with sardine and clam meat (MFIS, 23, 1980).

Remarks

It is difficult to review here all efforts in fin fish culture that might have been made by different states and Governmental agencies. After the initial experiments at Mandapam during 60's it is less than a decade since the C.M.F.R.I., formulated projects and experiments on fin fish culture. From these experiments varying results regarding the production capability have been obtained for different locations and for different methods of culture. But when compared with the low yield of the traditional coastal culture (35.5 kg in Gujarat, 258 kg in Karnataka, 700 kg in Kerala and 300 kg/ha/yr in West Bengal) the results obtained in controlled culture is rather impressive. In most of the experiments in the ponds, natural food availability has been supplemented with the addition of artificial feed in the form of oil cakes and rice bran at 10% of the body weight of fishes. While this imposes a burden on the cost of production it has enhanced production rate/ha.

Although other allied investigations engaging the attention of the Institute with regard to problems

connected with the fish culture have not been elaborated in this review it may be mentioned here that commendable progress has been made by the scientists of the Institute in assessing the productivity of the coastal areas and documenting data on the seed stock availability of culturable species along the Indian coast. The Fishery Environment Management Division of CMFRI, has been conducting special survey using the mobile laboratory along the Tamil Nadu coast on a phased programme since 1983 to study the ecosystem along the coast to find suitable areas for sea farming. Five estuarine regions and one large swamp in the area between Devipatnam near Mandapam and Nagoor at Karaikal have already been completed. Dry organic carbon in %, dry wt fishing varying from 0.061 to 2.859 has been reported. This is considered as a fairly high value of productivity for the regions studied. Investigations during 1976-81 in 3 centres each in Kerala and Tamil Nadu have enabled identifying areas of abundance of seeds of *Mugil cephalus*, *Liza macrolepis*, *Velamugil seheli*, *Sillago sihama*, *Siganus javus*, *Etroplus suratensis*, *Chanos chanos*, *Lates calcarifer* and *Anguilla bicolor*. Safe methods for transporting the fry/fingerlings/elvers by using oxygen filled seed bottles have been successfully experimented upon.

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