CMFRI newsletter

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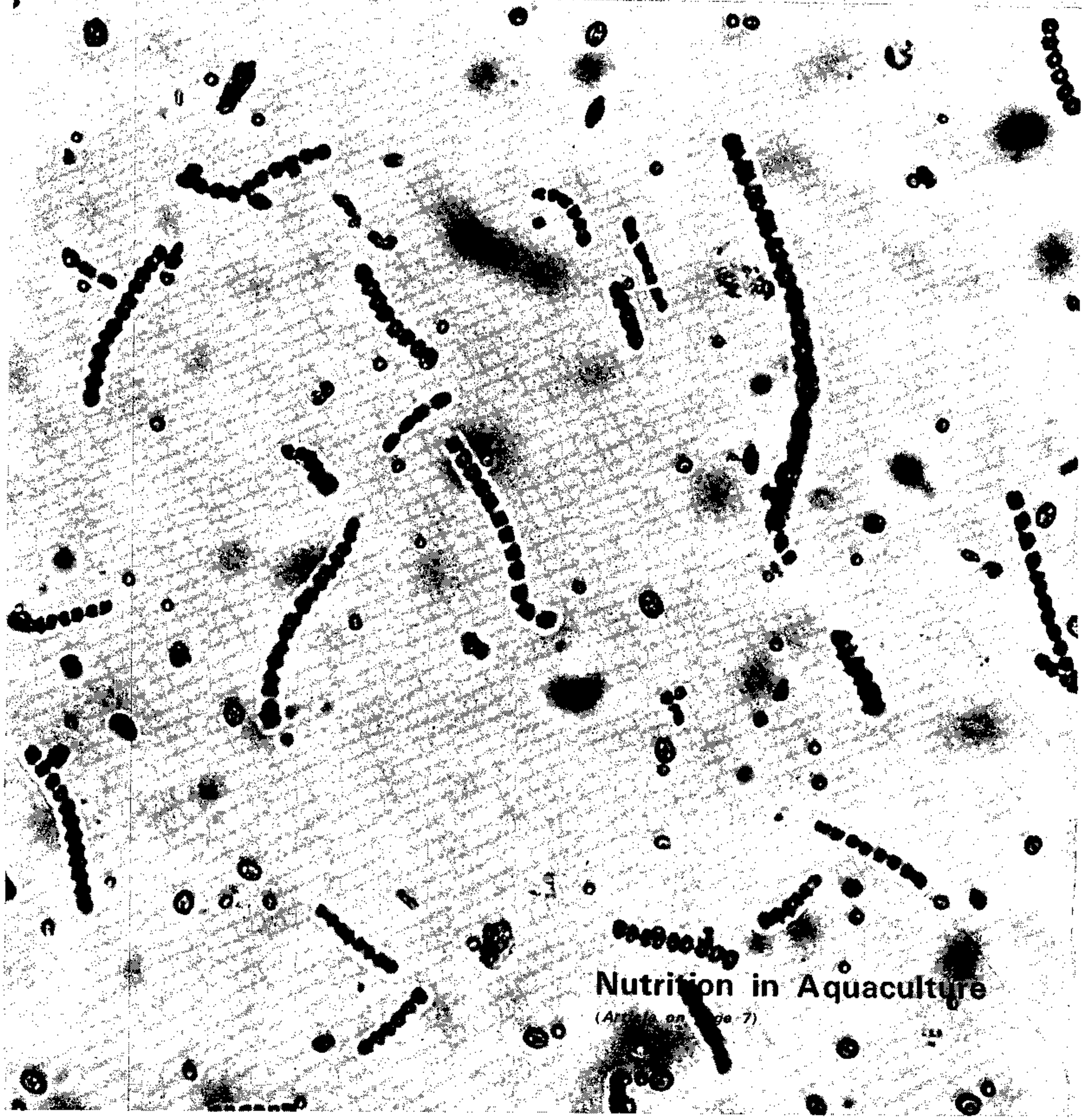


Nutrition in Aquaculture

(Article on page 7)

Dr James Takes over as Director

Dr P. S. B. R. James took over charge as Director of Central Marine Fisheries Research Institute on 2 September, 1985. Prior to taking up this assignment Dr James was holding the position of Assistant Director General (Fisheries) at ICAR headquarters, New Delhi.

Dr James has had long association with CMFRI, first as research scholar at Mandapam during 1958-61 and later in various capacities such as Research Assistant, Assistant Research Officer and as Joint Director at Mandapam Regional Centre. In between, for about nine years he served the College of Fisheries, Mangalore, under the University of Agricultural Sciences as Research Officer and Professor and Head of the Department of Fishery Biology.

Born at Bhimavaram, Andhra Pradesh in 1934, Dr James graduated in Zoology from Andhra University and worked for his masters degree in Zoology and doctorate in Fishery Biology at Banaras Hindu University. Research work for Ph.D. degree was done at CMFRI, Mandapam Camp. He has 27 years of rich experience in fisheries research, teaching and administration. During this period he has made very valuable contributions in systematics, osteology, biology and fishery of various commercially important groups of marine fishes especially the ribbon fishes and silver bellies with large number of publications. He was the receipient of Dr S. L. Hora Gold Medal and Cash Award of the Indian Society of Ichthyologists, Madras in 1983 for outstanding contributions in the field of fishery biology and development of fisheries in the country.

In an informal chat with the Newsletter, on his taking over, Dr James said, "Contributions of CMFRI in research and development of marine fisheries have been commendable. The Institute's efforts to find out ways and means of augmenting fish production have also resulted in the successful evolution and communication of low cost mariculture technologies."

Explaining the immediate objectives of the Institute, Dr James said that resource assessment would continue to receive high priority and the programmes would be extended to hitherto unexploited areas. With the improved vessel facilities like FORV Sagar Sampada, the Institute would launch programmes to study the resources' position in the EEZ. Commenting on the technology transfer programmes of the Institute, Dr James said that greater stress would be laid in the translation of the culture technologies for wider field applications. He also said that the educational programmes of CAS in Mariculture would help developing specialised manpower for further development of culture fisheries.

Dr James hopes that, with the cooperation of all related institutes, organisations and universities in the country, CMFRI will embark on the 21 century with a better understanding of potential, distribution and fluctuations in abundance of the marine fisheries resources for their rational exploitation, conservation and management.

Prime Minister Visits Minicoy

Prime Minister being received by the Scientists of CMFRI.

Prime Minister, Shri Rajiv Gandhi visited Minicoy on 24 November during his tour in Lakshadweep. An exhibition on the activities of the Research Centre was arranged in the premises of CPCRI where he was received by Dr P. P. Pillai, Dr G Gopakumar and Shri C. V. Mathew, Scientists of CMFRI. The Prime Minister showed keen interest on the tuna fishery of Lakshadweep. He also watched in detail the work on coral reef and baitfish and felt that preservation of the bait fish habitat was a matter which required urgent attention.

Prime Minister with his wife Smt Soniya Gandhi and son Shri Rahul at the exhibition organised by CMFRI.

Hybrid Mullet Produced at Narakkal

Hybrid of mullet by crossing *Liza macrolepis* (Smith) female and *Liza parsia* male was produced for the first time in India at Narakkal Laboratory of CMFRI. Explaining the details of the achievement Dr L. Krishnan and Dr M. K. George, Scientists involved in the project, said that this hybrid was obtained by artificial stripping of the egg from a hormone-induced female and fertilising the same with the milt obtained from the male. Out of about 1.2 lakh larvae thus produced 12,000 were reared in a two-tonne tank using standard feeding procedures nearly 40% of the larvae survived all early critical stages and are about 3 months old now. The early larvae of hybrid were observed to differ in many details from pure *L. parsia* produced for comparison. The potential of this hybrid are presumably prospective since *L.macrolepis* is reported to grow up to 60 cm in the wild where as *L. parsia* is reported to grow only up to 21 cm.

Right. *Hybrid (L. macrolepis × L. parsia)*
Left. *Liza parsia larva*

Further Improvement in Artificial Insemination of Tiger Prawn

The artificial insemination technique which was evolved by CMFRI for breeding tiger prawn has been further perfected to give a hatching rate of 95% which is equal to that of normal spawning. The technique has also proved successful with white prawn *P. indicus*. This big leap forward in artificial insemination of the two most important species of prawn is a major achievement in crustacean breeding. This technique perfected by Shri M. S. Muthu and Dr Lakshmi Narayana at Narakkal is basic to all future research in the area of selective breeding and genetic manipulation of prawn stocks for aquaculture purposes.

Pearl Oyster Spat Presented to Tamil Nadu Fisheries Development Corporation

A consignment of pearl oyster produced in the experimental hatchery of CMFRI at Tuticorin was presented to M/s Tamil Nadu Fisheries Development Corporation who is a partner of the joint venture Tamil Nadu Pearls (Pvt) Ltd, as a part of CMFRI's technology transfer programme. The spat were handed over by the Director, CMFRI to the Managing Director of Tamil Nadu Pearls Ltd., at a function organized on 9 December at the shellfish hatchery laboratory at Tuticorin.

CMFRI achieved a breakthrough in 1981 in the development of technology for hatchery production of pearl oyster seed. Subsequently techniques for mass production of spat were also perfected and in one of the recent experiments about 2 million spat were produced in laboratory. Handing over the consignment Dr P. S. B. R. James, Director, CMFRI stated that this presentation was to create interest in the company to adopt the hatchery technology for pearl oyster production and had great significance in improving upon the viability of the technology for commercial production of pearl oyster spat. The joint sector will provide the necessary feed back to the Institute on the growth of spat in their farm.

Sea - ranching of Pearl Oyster in Gulf of Mannar

CMFRI has initiated a programme of sea-ranching of pearl oyster in the natural pearl banks of Gulf of Mannar in December 1985. The natural resources of Gulf of Mannar have not been productive over the last 25 years and there has been no pearl oyster fishery since 1961. This resource is well known for its wild fluctuations and failures of production for long periods of time. This programme was commenced with the objective of investigating the possibility of improving the situations by transplanting large numbers of pearl oyster spat on pearl banks. This programme will be strenghthened with follow-up monitoring and recovery.

Discussions on Ammoniacal Waste Disposal

The FACT, Cochin Division was facing problems regarding the dumping of ammoniacal waste from the storage tank in the Willingdon Island as there were reports doubting the safety of the storage tanks and the disaster that might strike the City in case there was a gas leak. Several residents also reported the presence of ammonia in the morning hours in and around Ernakulam. Hence the FACT called in their experts from West Germany to have an on-the-spot inspection of storage tanks and suggest remedial measures. A meeting of the representatives of various organisations dealing with marine resources was called by FACT at Cochin on 12 November. Explaining the process of waste disposal which the FACT is going to execute, Shri Thomas Abraham, Chief Engineer of FACT said that the operation was conceived in such a way that all ammonia that could possibly be removed would be used up for manufacture of fertilizers and the remaining waste in the tanks would be dumped in the sea at a distance of 60-80 km. As a sequel to this CMFRI conducted some in vitro studies to assess the impact of ammonia in the ecosystem as it is well known that ammonia above 5 ppm in the pH range of sea water is highly toxic to marine life, especially the pelagic fish. The mode of dumping suggested aimed not only at eliminating the hazard but also make it at a concentration where it would add up to the nutrient generation in the open sea.

Technical Assistance to Maldives under ITFC Programme

Dr M. J. George and Shri K. Nagappan Nayar, Senior Scientists of CMFRI were deputed by the Government of India/ ICAR to the Republic of Maldives to conduct a survey and give advisory services on the potential for prawn and pearl culture in the islands. The team visited Male and several other islands during 21-28 November. The team had detailed discussion with the Indian High Commissioner at Male and officials of the Ministry of Fisheries of Maldives. The team also carried out field collection of potential candidate species for culture and a survey of lagoon areas. While a detailed report of the programme is under preparation it is indicated that there is potential for prawn culture and pearl culture in some of the islands of Maldives.

Occurrence of Tar Balls in the Sea Reported From Veraval.

Large numbers of tar balls were observed along the seashore at Veraval which caused anxiety to the local fishermen and the scientists. This was reported by Shri V. D. Deshmukh and Shri S. G. Raje, Scientists at Veraval. The balls varied from 2-160 mm in diameter and the average weight of ten balls per square meter was 2.511 kg. The oil and its components in the tar balls were believed to be toxic to marine life, but surprisingly some goose barnacles were found attached to large-sized ones. The balls caused damage to the sea beach and the surface gillnets of some of the fishermen. The Scientists feel that the origin of the tar balls may be due to large-scale oil pollution caused by drilling operations and oil spill.

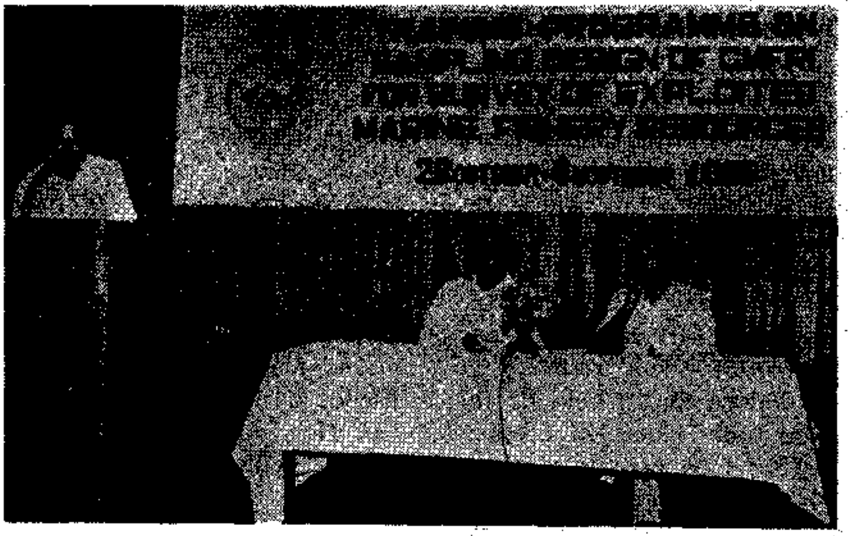
Milk Fish Harvested From Pen

Milk fish cultured in 0.5 ha pen in the Pillaimadam lagoon was harvested on 16 November. About 225 kg fish were obtained. The fish had attained a length of 260 mm and weight of 137 g in 6 months. The stocking rate was 8000/ha of 2 g fingerlings with no supplementary feeding. The recovery rate was about 51%.

Training Programme in Sampling Design

CMFRI's second training programme on sampling design for estimation of marine fish production was conducted from 28 October to 8 November. Fifteen Officers from the fisheries departments of maritime states and Union Territories were trained under this programme. This training was organised as a part of the Institute's technology transfer programme.

Chairing the inaugural session Dr P.S.B.R. James, Director, CMFRI emphasised the need for following an uniform design and the relevance of multi-stage random sampling design developed by CMFRI on scientific lines in estimating exploited resources. He said that the training would go a long way in improving the system of collection of marine fish catch statistics and getting more precise catch estimates.



The inaugural session of the training programme. Seated are Dr P.S.B.S. James, Director, CMFRI and Shri T.K.A. Nair, Chairman, MPEDA. Dr K. Alagaraja, Scientist, CMFRI welcoming the gathering.

Delivering the inaugural address Shri T. K. A. Nair, Chairman, MPEDA pointed out the gaps in catch statistics especially in fishery forecast and emphasised the need for close contacts with the agencies involved in marine fisheries research and management.

The valedictory function was held on 8 November with Prof C. T. Samuel as the Chief Guest. He listed the areas where statistics on marine fishery resources were required and their usefulness for research and development programmes.

KVK

Innovative Courses

Since Vypeen has good scope for integrating paddy with fish/prawn culture, a 2-day course on paddy-cum-fish culture was specially arranged with the help of Kerala Agricultural University.

To help in combating the epidemic prevalent in the coastl areas during monsoon a one-day campus training course on environmental hygeine and communicable diseases was organised with the help of the Medical Officer, Primary Health Centre, Malipuram.

A one-day off campus training programme on Social Forestry was arranged and trainers were made to prepare beds for planting avenue trees on the sides of the western road of KVK campus. The trainees were also appraised of the benefits of such programmes and saplings of trees were distributed to them.

Farm women were trained in the preparation of fish wafers, fish soup powder and fish pickle as part of the post harvest technology training with the help of specialists from the Central Institute of Fisheries Technology, Cochin.

The KVK in association with the Departments of Food, Social Welfare and Forest celebrated World Food Day on 16 October. Special lectures, women's camp, exhibition and film show were arranged in this connection.

Role of Nutrition in Aquaculture

In India although significant advances have been made in the culture of a variety of fish and shellfish species, studies on the nutrition and its relevance to culture have been very few till 1980. However, during the past five years research has been intensified at CMFRI through mission-oriented projects and Ph.D and M.Sc. research programmes.

During the past two decades there has been tremendous growth in the farming of aquatic organisms, both in the developed and developing nations of the world. This has been possible through the development of intensive production technologies using operational inputs such as seed, feed and fertilizers. Studies have shown that production can be increased manifold through the supply of nutritionally adequate formulated feeds. Although fish farming is an ancient practice in India the production system has been mainly of the traditional extensive type as followed in West Bengal, Orissa and Kerala. In this aquaculturists stock the ponds with seed from the wild in which all sorts of organisms are let in without any selection and are harvested periodically. In the currently practised improved aquaculture, selective stocking is followed and farms are fertilized to increase production of food organisms present in the system. This manner of enhancing production of food organisms by inorganic and organic manuring has its own limitations as they are capable of affecting the water quality. Thus if we are to progress to semi-intensive and intensive aquaculture there is a need for supplementary feeding along with enhancement of natural food organisms in the former system and for intensive feeding in the latter. In this context, the study of feed requirement and formulation of feed for individual species of cultivable organisms to suit their physiology of digestion and feeding habits althrough their life cyclce, storage and supply of appropriate supplementary and complete feeds are essential.

In India although significant advances have been made in the culture of a variety of fish and shellfish species, studies on the nutrition and its relevance to culture have been very few till 1980. However, during the past five years research has been intensified at CMFRI through mission-oriented projects and Ph.D. and M.Sc research programmes. Studies are being undertaken to acquire information on (i) nutritional requirements of larvae, juveniles and adults of cultivable fish and shellfish (ii) suitability of feed ingredients both conventional and non-conventional for formulation of practical feeds (iii) diseases associated with deficiency or excess of nutrients as well as toxic components in feeds (iv) effect of salinity on nutritional requirements and (v) digestive physiology of finfish and shellfish. The nutrition laboratory of CMFRI has been equipped with major instruments like aminoacid analyser, gas-liquid chromotograph, refrigerated centrifuge, kjeltec, soxtec and fibretec systems through the UNDP/FAO/ICAR Project, Centre of Advanced Studies in Mariculture to carry out research on the above lines.

Based on feeding habits the cultivable species have been categorised into herbivores, omnivores and carnivores. Despite the differences in feeding habits all aquatic organisms require five groups of nutrients. Among these, lipid and carbohydrate form primary energy sources for metabolism and protein in general is utilised for growth. Carnivores efficienly utilise lipids and herbivores carbohydrates while omnivores use both carbohydrates and lipids as energy sources. Protein on deamination can also serve as an energy source. Besides these, aquatic animals also require vitamins and minerals as components in their diets.

Protein

Among the nutrients, protein assumes a major role as it enhances growth. But its quantity and quality supplied is determined by the cost. The quality of protein is solely dependent on its essential amino acid profile. The essential aminoacids are arginine, histidine, leucine, isoleucine, lysine, threonine, tryptophan, valine, phenylalanine and methionine which the cultivable animals are incapable of biosynthesising. In the case of crustaceans, amino acid tyrosine too is considered to be essential. However, if adequate levels of phenylalanine is available, tyrosine can be synthesised by crustaceans. Thus although qualitative requirement seems to be similar in all studied aquatic organisms, there are substantial differences in quantitative requirements for these amino acids. It is vital that essential amino acids should be available in balanced proportion as well as in adequate levels. Studies conducted in various species have shown that fish and shellfish species differ markedly in their protein requirements, ranging from 22% and to as high as 55% in diet. Most of the carnivorous fish such as a salmon, trout, red sea bream, channel catfish and sea bass (Lates sp.) tend to require relatively higher protein levels in diet. The protein requirement is influenced by endogenous factors such as maturity, age and moulting and exogenous factors like water temperature, salinity, water chemistry, water quality and amino acid profile in the diet. In general, juveniles being fast growing require comparatively more protein in diets than adults. Similarly, maturing organisms too need higher levels of protein for gametogenesis.

Lipids

Until 1930, lipids were considered purerly as energy nutrient for animals. However, the work of Burr and Burr in 1930 radically changed the concept. They reported that one of the fatty acids, linoleic was essential for animals and its deficiency resulted in poor growth and caused severe pathological syndromes. Subsequent researches have shown that aquatic organisms too need essential fatty acids. Unlike higher vertebrates which require linoleic acid ($18:2w6$), aquatic organisms such as fish and crustaceans require linolenic ($18:3w3$), eicosapentaenoic ($20:5w3$) and docosahexaenoic ($22:6w3$) in addition to linoleic ($18:2w6$) acid as essential fatty acids. There has also been significant difference between species in their essential fatty acid requirements as some require only linoleic and linolenic acids. Among the aquatic species studied, all fish and crustaceans of marine origin require highly unsaturated fatty acids such as eicosapentanoic and docosahexaenoic acids, whereas most of the freshwater species require linoleic and linolenic acids as primary essential fatty acids. Recent studies have shown that requirement for essential fatty acids increases as the level of lipids in the diet is increased. Deficiency of essential fatty acids in diets would result in poor growth, severe pathological syndromes and mortality. The fecundity, fertilization rate and hatchability of the eggs have also been found to be very much reduced. Salinity and water temperature are the two important factors which affect the requirement of essential fatty acids in fish. Cold water species require more of linolenic acid than warm water fish. Though both freshwater and salt water species require relatively more linolenic acid than linoleic acid, fresh water fish need higher levels of linoleic acid in their diets compared to marine species. Further, crustaceans, unlike finfish require cholesterol as an essential nutrient and deficiency of the same results in their ability to synthesise hormones essential for moulting and gonadial maturation.

Minerals

Minerals are essential not only for the formation of hard tissues like bones, cuticles and appendages but also form cofactors in enzymes. Marine fish and shellfish are capable of meeting most of their requirements for minerals from the surrounding sea water. In the case of freshwater forms major minerals such as calcium, magnesium, phosphorus, potassium and sodium with trace minerals like iron, iodine, zinc, copper, cobalt, manganese and selenium have to be supplemented in the diets. Mineral deficiency though hard to be induced, when experimentally induced in finfish the symptoms were found to be nonspecific and resulted in lower growth, low haemocrit value, low bone ash and poor feed efficiency. Magnesium and zinc deficiency has been found to cause softening of muscle, renal calcinosis and visual problems in some species. Mineral deficiency syndromes in crustaceans and molluscs have not yet been thoroughly understood.

In aquaculture, feeding constitutes a major cost of production, often 40-70% of the operating cost. In the pond culture system, cost of production can be reduced by increasing the availability of natural food in the pond by adding fertilizers. In the flowing water and in cage culture systems the availability of natural food is very meagre and the fish have to rely on supplementary feeds.

Vitamins

Vitamins too are essential to aquatic animals. Deficiency of specific vitamins in higher animals manifests definite syndromes whereas in aquatic animals the symptoms are nonspecific. The water soluble vitamins, viz., thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, ascorbic acid, choline, folic acid, cyanocobalamin, biotin and inositol and fat soluble vitamins like vitamin A, D, E and K are also essential to fish and shellfish. The water soluble vitamins are useful directly and as coenzymes, whereas fat soluble vitamins do not function as coenzymes. Ascorbic acid and tocopherol (vitamin E) being antioxidant aids in the prevention of oxidation of polyunsaturated fatty acids. The oxidised products have been found to cause liver malfunctions and fatty liver in fish. Ascorbic acid deficiency also causes spinal deformities like lordosis and scoliosis. It is seen that requirement for vitamin E increases with the increase in polyunsaturated fatty acid level in the diet. Some of the vitamin deficiency symptoms observable in fish are anaemia, poor appetite, atrophy of gills and muscles, opaqueness of eye lens, deformation of skeletal tissue,erosion of stomach, liver fin and skin, fatty liver, haemorrhage in vital organs such as eye gill, kidney, liver and skin, lethargy and erratic swimming. In crustaceans, ascorbic acid deficiency induces malfunctioning of collagen metabolism leading to a disease called black death.

Types of feeds

In aquaculture, feeding constitutes a major cost of production, often 40-70% of the operating cost. In the pond culture system, cost of production can be reduced by increasing the availability of natural food in the pond by adding fertilizers. In the flowing water and in cage culture systems the availability of natural food is very meagre and the fish have to rely on supplementary feeds.

The important factors affecting the cost of feeding are the cost of components in the diet and the feed conversion rate. Based on their nutrient composition, feed ingredients are classified into protein concentrates, energy concentrates, roughages, minerals, vitamins and additives. Ingredients containing more than 20% protein are generally considered as protein suplements those containing more than 18% crude fibre as roughage and those containing less than 18% crude fibre and less than 20% protein as energy concentrates.

The most commonly available conventional protein concentrates are fishmeal, crustacean meal, slaughter house waste and oil cake meal. Recently non-conventional ingredients such as feather meal, clam meal and single cell protein are also considered as important protein concentrates which can be used for the formulation of practical diets. Herbivorous and omnivorous species can be grown on diets comprising mainly plant protein. While the carnivores require a high percentage of animal protein the omnivores can be grown using a mixture of both plant and animal proteins. The commonly available energy concentrates are rice bran, wheat bran, cereals and tapioca starch which can be used for dietary formulations. Cooked starch has enhanced digestibility compared to raw starch. Proteins of plant origin do not satisfy the essential aminoacids requirement for most of the aquatic species. The most limiting amino acids are methionine, lysine and tryptophan. Soyabean oil cake is found to contain a high quality protein, though it is deficient in the sulphur amino acid methionine. The lipids of marine origin are superior to those of plant origin for most species of aquatic organisms. Marine fish and shellfish oils are rich sources of highly unsaturated fatty acids such as linolenic, eicosapentaenoic and docosahexaenoic acids. However, freshwater and brackishwater species can be grown successfully on a diet containing a mixture of oils of plant and marine origin.

Micro - particulate Feed- NPCL - 17

A micro-particulate compounded feed, NPCL-17, having 35% protein is successfully developed at the Narakkal Prawn Culture Laboratory using low-cost ingredients such as prawn waste, mantis-shrimp *(Oratosquilla nepa)*, fishmeal, groundnut cake and tapioca for mass culture of prawn larvae. The feed with a particle size of 50 microns is used for rearing protozoea to post larvae PL1 in open culture system along with diatoms. The particle size of the feed is increased to 200 microns for rearing the post larvae PL1 to post larvae PL5. The rate of survival with this feed is found to be more than 60%. The same feed with a particle size of 500 microns is used for rearing the post larvae PL5 in nursery until they become stockable size with an average recovery of more than 50% at PL20 stage. This feed at present is successfully used in the mass production of the seed of *Penaeus indicus* at the Narakkal Laboratory. Development of this compounded feed has helped in completely eliminating the use of more expensive live feeds such as rotifers and *Artemia*. The cost of the feed works out at Rs. 5 per kg. The quantity of particulate feed required to rear and obtain one million post larvae PL5 is about 20 kg.

High-energy Pelletized Feed NPCL-235

A high-energy pelletized feed, NPCL235, has been developed for the culture of penaeid prawns in grow-out ponds. Carbohydrate and lipid in appropriate proportion are used to obtain the value of 4500 K Cal. and 250 g protein per kilogram of feed. Using this feed an average food conversion ratio of 3 is obtained in *P. indicus*. The water stability of the feed pellets is 6 hours. The feed costs Rs. 4 per kg.

Compounded feeds have the following advantages:

- The feeds are nutritionally balanced.
- Easy to prepare
- Cheaper in cost
- Can be prepared in large quantities, stored and used off-the-shelf as and when required.
- Easy to dispense.

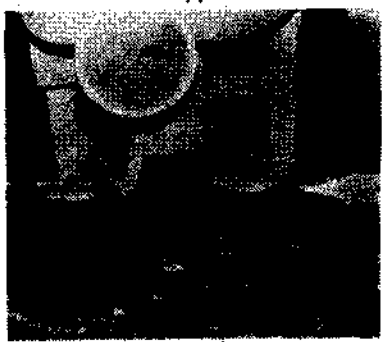
The water stability of the diet and its acceptability by the animals are dependent upon the form of diet. Various types of diet viz., hard pellets, soft pellets, floating pellets, flakes, crumbles, microcapsules, powdered diets, moist pellets and dough are used for feeding aquatic animals, depending upon the species and its size. Suitability of particle size of the feed offered is vital for filter feeders like larval crustaceans and molluscs. In most species the larvae are fed initially with live food organisms such as phytoplankters, rotifer, *Moina* and *Artemia* nauplii. Molluscan larvae are mostly reared with *Isochrysis galbana*. Of late microparticulate diets and microcapsules are used for feeding certain stages of larvae of prawn and fish fry on experimental scale. Advanced fry of certain species are also reared on flake and crumble diets. For the grow-out system the most successful diets are pellets. Finfish such as milkfish, mullets, carp and eel prefer soft dough for their diet. To prevent leaching of nutrients from diets various types of binders are used. Agar, alginates, chitosan, carrangeenan, guar gum, gelatinised starch, gelatin etc. are some of the most commonly used binders of feeds.

Feed ingredients containing adventitious toxins such as gossypol in cotton seed, trypsin-inhibitor and haemagglutins in oil cakes, cyclopropenoic fatty acids, tannins and hydrocyanic acid require proper treatment before their inclusion in compounded feeds.

Handling and storage of feed assumes great importance in nutrition. In humid regions growth of mould produces aflatoxins and bacteria, which produce T2 toxins. Feeds containing the above toxins may induce diseases in the organisms. Proper care and storage are essential to prevent loss of feeds through these toxins.

Feed Preparation - Different Stages

A



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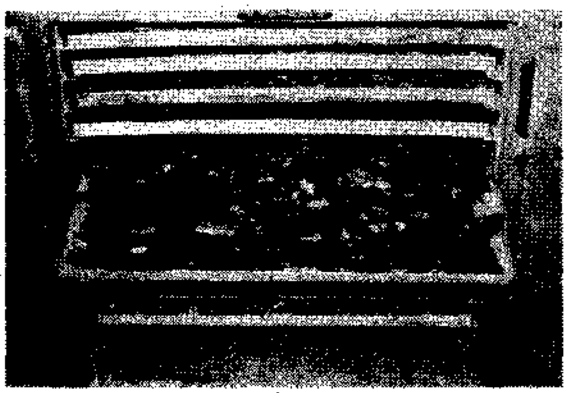

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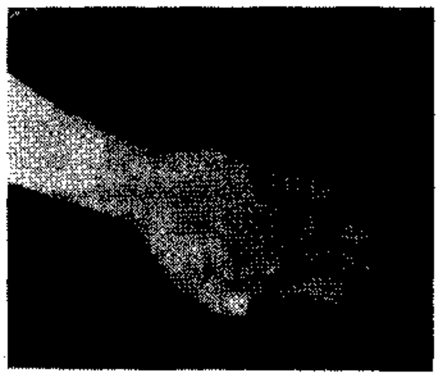

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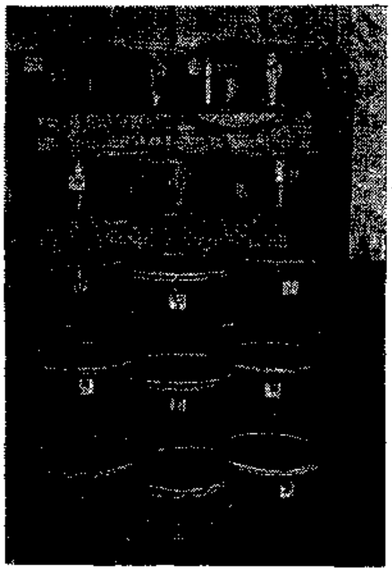

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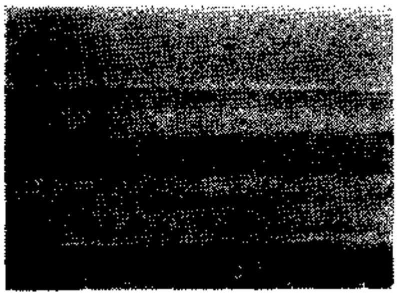

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A. Grinding of raw materials
B. Pelletization
C. Drying of pellets
D. Different feeds developed at Narakkal
E. Evaluation of feeds in the laboratory through statistically designed experiments.
F. Prawns feeding on pellets
G. Feeding finfish with dough form of diet.

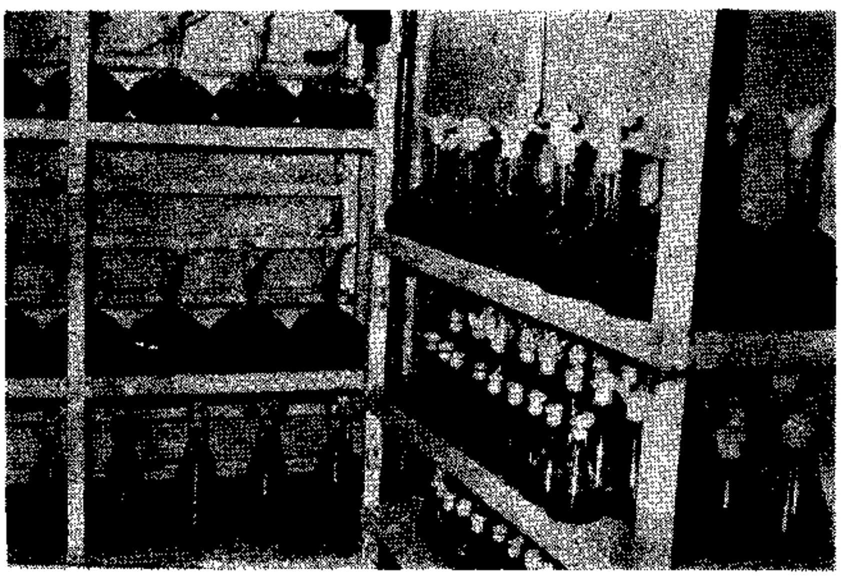
Algal Feed for Hatcheries

Realising the importance of the nannoplankton flagellates as the essential food of the larvae of both pearl and edible oysters, the isolation, identification, maintenance and mass culture of these flagellates are being carried out at the molluscan hatchery at the Tuticorin Research Centre of CMFRI.

About a quarter century ago, the large-scale culturing of unicellular algae was viewed with great enthusiasm as an alternative method for producing protein. But in the late 1960's this enthusiasm diminished when it was found that the process was uneconomical because of the technical problems involved especially in the recovery of the algal product and its subsequent conversion to a human food supplement. Recently there has been renewed interest in producing single cell protein by mass culturing the unincellular microalgae such as diatoms and nannoplankters for feeding the zooplankton and later the larvae of crustaceans, molluscs and fishes.

The success of any hatchery operation will depend mainly on the availability of the primary food, the phytoplankton. In the natural environment, the larval organisms feed on any minute plant, either ultraplankton or nannoplankton, which are readily available to them. But in a hatchery, the forms which will be acceptable to the larvae for their growth and further development have to be identified and isolated. The production and constant supply of the algal feed, especically selected species to the larval organisms is a pre-requisite in the hatchery systems throughout the world.

Researches related to the mass culture of live food organisms presently under way in many hatcheries are directed towards the solution of several key problems such as isolation of the required species and maintenance of the same under controlled conditions; large-scale culture of micro-algae using appropriate culture media and constant supply in different phases of growth; developing viable methods for the intensive culture, its maintenance, harvest and preservation during the optimum and peak densities and developing economical feeds which will meet the nutritional needs of the rearing organisms, either molluscs or crustaceans.



Lab culture of phytoplankton

Realising the importance of the nannoplankton flagellates as the essential food of the larvae of both pearl and edible oysters, the isolation, identification, maintenance and mass culture of these flagellates are being carried out at the molluscan hatchery at the Tuticorin Research Centre of CMFRI. Oyster larvae can ingest nothing larger than 10 microns and appear to rely for food on minute phytoflagellates belonging to the algal classes, Haptophyceae, Chrysophyceae and Chlorophyceae. *Isochrysis Galbana*, a member of the Haptophyceae measuring 7 micron, has proved to be the ideal flagellate food for rearing the larvae of both pearl and edible oysters. It has been observed that apart from *Isochrysis*, species of *Pavlova, Chromulina* and *Dicrateria* could be used as feed for the oyster larvae during the rearing period.

For culturing the micro-algae, either diatoms or nanno-plankters, various chemical culture media have been used depending on the organisms, class and genera. Although most algae are photoautotrophic and can grow in purely inorganic media, many require organic compounds, the requirements of which may be either absolute or stimulatory. However, the technique of culturing different algae requires a clear understanding of their nutritional requirements, especially during the various phases of the growth. Selected glasswares such as glass culture tubes, conical flasks and Haufkin's culture flasks are used for the isolation of the required species as well as for maintaining them in the stock culture room. The algal stock culture room is provided with controlled conditions of temperature (23-25 deg. C) and light (500-2000 lux) arrangements. For the mass culture, 20 litre glass carbuoys, 10 litre polythene bags as well as 100 litre transparent persepex tanks are used with sterilized seawater, providing aeration.

The usual method of laboratory culture of the micro-algae is one in which a limited volume of medium containing the necessary organic and inorganic nutrients is inoculated with a relatively small number of cells and these are exposed to suitable conditions of light, temperature and aeration. Increase in cell numbers in such a culture follows a characteristic pattern in which different growth phases such as lag, exponential, declining, stationary and death phases can be recognised. The maximum growth of the culture will be determined by taking the cell concentration as well as by noting the colour. The culture will be harvested during the growing phase of the algae in the morning hours.

The isolation of the required organisms, either diatoms or any other nannoplankters, preparation of appropriate nutrient culture media, maintenance of stock culture, mass culture of the required species and supply of the same in sufficient quantities during the growing phase of the culture are the various aspects related to the successful culture of algal feed for utilization in rearing the larvae of cultivable organisms.

Interview

Dr Watanabe on Fish Nutrition

Dr Takeshi Watanabe, expert consultant on shrimp and fish nutrition, Tokyo University of Fisheries, Japan was at CMFRI during 28 November to 24 December. Dr Watanabe is a specialist in brood stock nutrition with major contribution in nutrition of brood stock of carp, trout and red sea bream. Shri Syed Ahamed Ali, Scientist S-2 was the counterpart to the consultant.

In an interview with the Newsletter Dr Watanabe said that brood stock nutrition was definitely an important area of research in aquaculture. The successful results obtained in Japan in this line were being followed and could be applied in many countries. In India too it could be taken up in cultivable species like mullet and milk fish. For undertaking such applied work, brood stock management was fundamental and facilities would be required for proper control of water quality and other environmental conditions. He said that he was impressed by the work on fish nutrition being carried out at CMFRI and the results obtained with such limited facilities were laudable.

Explaining some of his work Dr Watanabe said that his earliest research was on the muscular dystrophy induced by feeding dry silk worm pupae which was the biggest problem in carp culture twentyfive years ago. That was his doctorate thesis. He found out that muscular distrophy caused by oxidised lipid in the dried pupae was characterised by marked loss of flesh from the body, which could be effectively prevented by supplementing vitamin E. This led to his further specialization in the vitamin E requirement of various fish species. Later he worked with Dr R. G. Ackman in Canada on the lipid metabolism in the food chain between phyto plankton and oysters. Back in Japan, he worked on the essential fatty acid requirement, protein sparing effect and protein energy ratio. This work greatly helped to improve the quality of various commercial fish feeds and many other scientists all over the world also initiated research based on these findings. This also helped in solving some of the problems encountered in the mass propagation of various juvenile fish species. The high mortality of larval fish fed on yeast-fed rotifers was attributed to essential fatty acid deficiency. He has also developed methods to enrich the nutritional quality of rotifers and other live food such as *Artemia*. nauplii. These techniques have been adopted by many countries. Recently he had been working on the availability of minerals contained in fish meal to fish and found out that when fed on fish meal incorporated diet, zinc availability could not satisfy the requirements which resulted in dwarfism and lens cataract. Non-availability of zinc also affected the spawning and egg quality in rainbow trout and to manage this, supplements of zinc was essential.

Dr Watanabe said that his effort had been mainly in formulating low-cost and less polluting diet which could produce high quality aquacultural products in terms of taste, texture and pigment using locally available ingredients without reduction of growth and feed efficiency.

Visitors

Cochin

Dr K. Gopalakrishnan, Department of Natural Sciences, University of Hawaii.

Mr W. K. Syanyunya, Department of Fisheries, Chilang, Zambia.

Tuticorin

Miss G. Bernetin, Faith Academy, East Patel Nagar, New Delhi.

Smt Valliammai Subramanian President, SPIC Nagar Ladies Club, Tuticorin.

Shri P. V. Prabhu and Shri M. K. Kandoran, Scientists, CIFT, Cochin.

Smt Uma Kumar, Department of Zoology, S. R. College, Trichy.

Dr N. S. Murthy, Medical Superintendent, Railway Hospital Madurai.

Shri R. S. Raman, Executive Director, Tuticorin Alkali Chemicals, Tuticorin.

Shri K. M. Veeranna, Anna University, Madras.

Dr T. Swaminathan, Assistant Professor, Civil Engineering Anna University, Madras.

Students from the following Institutions also visited CMFRI Headquarters / Research Centres during the period.

P. S. G. College, Coimbatore
St Joseph's College, Alleppey
Christ College, Irinjalakuda
Department of Marine Biology, Karwar.

Birla College, Kalyan
C. M. S. College, Kottayam
N. S. S. College, Pandalam
New Science College, Hyderabad.

Department of Zoology, University of Mysore

Government College, Kasargod.

Staff News

Engagements

Dr A. V. S. Murty, Officiating Director attended the following meetings :

Meeting of the ICAR Director's Co-ordination Committee at CIFE, Bombay, 1 July.

Thirteenth meeting of the ICAR Scientific Panel for Fisheries at New Delhi, 6 August.

Second meeting of the ICAR Co-ordination Committee for Sagar Sampada at New Delhi, 7 August.

Dr P. S. B. R. James, Director attended the following meetings :

Meeting of the ICAR Regional Committee No. VIII at Trivandrum, 6-7 September.

Second meeting of the Tamil Nadu Fisheries Research Council at Madras, 16 September.

ICAR Directors' Conference at New Delhi, 24-25 October.

Tripartite Meeting of the FAO/UNDP Project on Intensification of Freshwater Aquaculture Research and Training at FARTC, Dhauli, 7 November.

Meeting of the Reorganisation Committee for CIFRI, Barrackpore, 8 November.

National Conference on Fisheries at New Delhi, 23 November.

Twelth meeting of the ICAR Scientific Panel for Fisheries.

Dr M. M. Thomas, Officer-in-charge attended the V Annual Workshop on KVK/TTC at (UPASI), Coonoor from 6 to 8 November. Dr Thomas also attended the Workshop in connection with the finalisation of script of lessons for integrated farming for Farm School on Air at Kasaragod, 3 December.

Dr P. Parameswaran Pillai, Scientist S-3 attended the meeting of the Indo-Pacific Tuna Programme and Indian Ocean Fishery Commission (VIII session) at Colombo, Sri Lanka on FAO's invitation, 3-7 December.

Dr V. Chandrika, Scientist S-2 attended the XXVI Annual Conference of Association of Microbiologists of India at Madras and presented a paper on distribution of phototrophic thiomic bacteria in anaerobic and micro aerophitic strata of mangrove ecosystems of Cochin, 19-12 October.

Shri K. A. Unithan and Dr P. K. Martin Thampson participated as resource persons in the Functional Literacy Training Programme organised by the Vypeen Block. Shri Unithan gave a talk on Mariculture for Rural Development.

Shri A. N. Mohanan, Training Assistant, attended the short-term training on Management of brackishwater fish/prawn farming organised by CIFE at Bombay, 10-26 September.

Dr P. S. B. R. James to serve as :

ICAR Representative in MPEDA.

Member of the Committee on Productivity from Aquatic Resources constituted by the Department of Agriculture and Co-operation.

ICAR Representative in the Co-ordination Committee for Development and Conservation of Pelagic Resources constituted by the Department of Agriculture and Co-operation.

Member of Expert Committee to study and report on cropping pattern for Kuttanad area and Kole areas of Trichur and Ponnani.

The Andhra University has recognised Dr V. Sriramachandra Murty, Scientist S-2 as a guide for candidates working for Ph.D. degree of the University.

Five Yearly Assessment

The following S-3 Scientists have been granted the scale of pay of Rs. 1800-2250 with effect from 1 January 1984

Shri T. Jacob

Dr P. V. Ramachandran Nair

Dr K Alagarswamy

Shri K. Nagappan Nayar

Dr S. V. Bapat

With effect from 1 July 1984

Dr P. Vedavyasa Rao

The following Scientists have been granted merit promotion.

S-2 - S-3 (with effect from 1 January 1984)

Shri K. N. Kartha

Shri V. Balan

Shri D. Sadananda Rao

Dr V. S. Krishnamoorthy Chennubhotla

Dr C. S. Gopinatha Pillai

Shri G. Subbaraju

Shri P. T. Meenakshisundaram

Dr P. Vijayaraghavan

S-1 - S-2 (with effect from 1 January 1984)

Shri K. N. Rajan

Dr V. Chandrika

Dr M. K. George
Shri Daniel Selvaraj
Shri K. V. Somasekharan Nair
Shri K. Prabhakaran Nair
Dr. P. N. Radhakrishnan Nair
Shri M. E. Rajapandian
Shri Pon Siraimeetan
Shri S. Dharmaraj
Shri M. Kathirvel
Shri R. Thiagarajan
Shri K. Ramdoss
Shri Alexander Kurian
Dr N. Gopinatha Menon
Shri K. K. Sukumaran
Shri Y. Appanna Sastry
Shri K. S. Scariah

(With effect from 1 July 1984)

Dr A. Geethanand Ponnaiah
Dr N .Gopalakrishna Pillai
Dr M. Mohamed Kasim
Dr M. Rajamani
Shri K. G. Girijavallabhan
Shri V. Gandhi
Shri A. Raju
Shri K. M. Ameer Hamsa
Shri Madan Mohan
Dr Lalitha Devi
Shri A. P. Lipton
Shri G. Gopakumar
Shri M. Srinath
Shri R. Sathiadhas
Shri K. K. P. Panikkar

The following Scientists have been granted advance increments:

S-3

Dr S. Ramamurthy

S-2

Shri V. N. Bande
Shri P. Bensam
Shri G. G. Annigiri

S-1

Shri G. P. K. Achari
Shri P. V. Srinivasan
Dr V. S. Kakati
Dr R. Padmini
Smt Grace Mathew
Shri S. Shanmughan
Smt Geetha Bharathan
Shri V. Thangaraj Subramanian
Shri P. Livingston
Shri S. Krishna Pillai
Shri P. E. Sampson Manikkam
Shri K. S. Sundaram
Shri S. K. Chakraborty
Shri N. Surendranatha Kurup
Dr N. Ramachandran
Shri K. Y. Telang
Shri V. D. Deshmukh
Shri D. Kandasami
Smt Krishna Srinath
Shri K. Balan
Shri S. Muthusamy
Shri K. R. Manmadan Nair

Appointments :

Dr P. S. B. R. James as Director, 2 September.

Dr P. Parameswaran Pillai as Scientist S-3 at Cochin, 18 October.

Dr K. J. Eapen as Scientist S-3 at Cochin on transfer from IVRI, Izatnagar.

Dr V. Narayana Pillai as Scientist S-3 at Cochin, 30 December.

Smt P. Geetha, as Junior Library Assistant (T-2) at Cochin, 7 December.

Promotions

Technical Assistants T-I-3 - T-II-3

Shri A. Ganapathi
Shri C. Kasinathan
Shri Joseph Xavier Radrigo
Shri K. Ramasomayajulu
Dr C. Thankappan Pillai
Shri Joseph Andrews
Shri K. Chittibabu
Shri K. Muthuramalingam

Reversion

Shri G. K. Rajan, Deckhand on ad hoc basis to SS Grade I (Pump Driver) on request.

Shri U. Sethuraman, Deckhand on ad hoc basis to SS Grade I (Fieldman) on request.

Transfers

Shri Balan N. Kathkar, Field Assistant (T-1) from Dahanu to Ratnagiri

Shri S. Mani, SS Grade II (Watchman) from Vizhinjam to Tuticorin.

Shri V. Kochunarayanan Nair SS Grade I (Watchman) from Cochin to Vizhinjam.

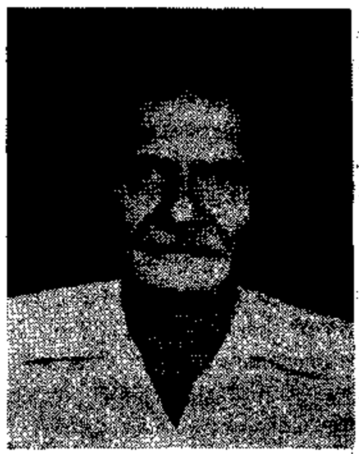
Shri S. Palanichamy, Technical Assistant (T-1-3) from Kovalam to Madras.

Shri K. U. Gopi, SS Grade II (Safaiwala) from Cochin to Narakkal.

Retirements

Shri M. Mydeen Kunju, Scientist S-2, 31 July.

Shri P. Krishnan Nair, SS Grade III (Lab Attendant), 30 July.



Shri P. Krishnan Nair

Shri A. Sreedhara Menon, SS Grade III (Lab Attendant), 30 September.

Shri N. Nagalingam, SS Grade III (Lab Attendant), 31 December.

Reliefs

Shri V. K. Sridhar, Administrative Officer to take over as Senior Administrative Officer at Central Research Institute for Dryland Agriculture, Hyderabad, 6 September.

Shri R. Padmasekhara, Field Assistant on resignation, 28 August.

Shri G. Rajappan, SS Grade II (Watchman) on resignation, 4 July.

Weddings

Shri A. D. Sawant at Bombay married Kumari Nanda V. Torne, 26 May.

Shri Kamalkumar Datta, Scientist S-1 at Cochin married Kumari Madhu Mohini at Karnal, 24 November.

Mohan K. Zachariah, Scientist S-1 at Cochin married Kumari Sophy Joseph at Tiruvankulam, 30 June.

Deputations under FAO/ UNDP Fellowship

Shri M. S. Rajagopalan, Scientist S-3 for training in Applied Ecology of mangroves at the Australian Institute of Marine Sciences, Townswille, Australia for 6 months from August.

Shri T. S. Velayudhan, Scientist S-1 for training in molluscan genetics at the Department of Biology, Dalhousie University, Halifax, Novascotia, Canada for four months from August.

Shri P. Muthiah, Scientist S-2 in oyster hatchery at the Institute Franitair de Research, Pour I exploitation de la mer Seige Social Paris for four months from 9 September.

Shri S. Dharmaraj, Scientist S-2 for training in Invertebrate tissue culture in the National Institute of Fisheries Agency Tokyo, Japan for two months from 24 October.

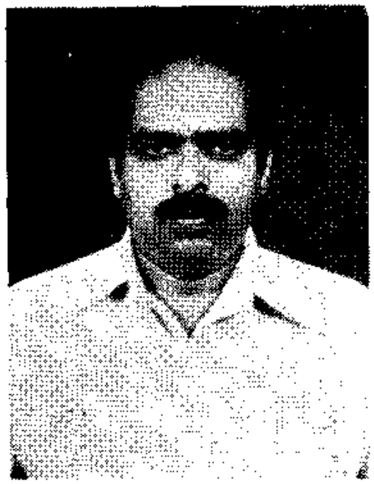
Dr P. S. Kuriakose, Scientist S-2 for training in mussel culture at the Institute de Investigations Pesquares, Spain for 4 months from October.

Staff Recreation Club celebrates Independence day

The Independence Day this year was celebrated at the Institute by hoisting of flag by the Director and film show for children of staff and distribution of sweets. The CMFRI Staff Recreation Club was revived and declared open at this occasion by the Director with following office bearers.

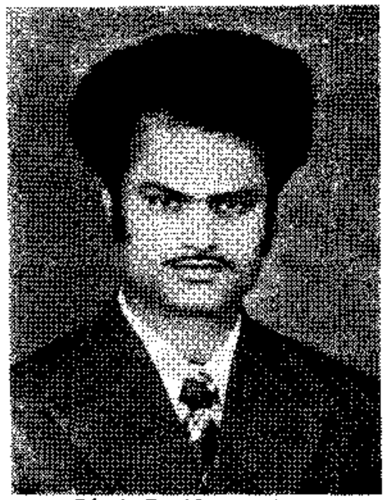
Director (Ex-officio) — Patron
Joint Director (Ex-officio) — President
Shri P. C. Jacob — Vice Presiden
Shri T. N. P. Kurup — Secretary
Shri K. Sadanandan — Treasurer
Smt P. K. Sreedevi
Smt A. Renjini
Shri D. B. S. Sehara
Shri V. A. N. Kutty
Shri K. Raju
Shri N. Govindan — Members

Degree Awarded



Shri Scariah

Shri K. S. Scariah, Scientist S-1 at Cochin, has been awarded Ph D in Statistics by Indian Institute of Technology, Delhi. His thesis was on Ranking and Selection in the Method of Paired Comparison. Shri Scariah worked under the supervision of Dr G. Sadasivan, IASRI, Delhi and Dr B. R. Handa, IIT, Delhi.



Shri S. Natarajan

Shri S. Natarajan, Technical Officer, has been awarded MBA by the University of Cochin.

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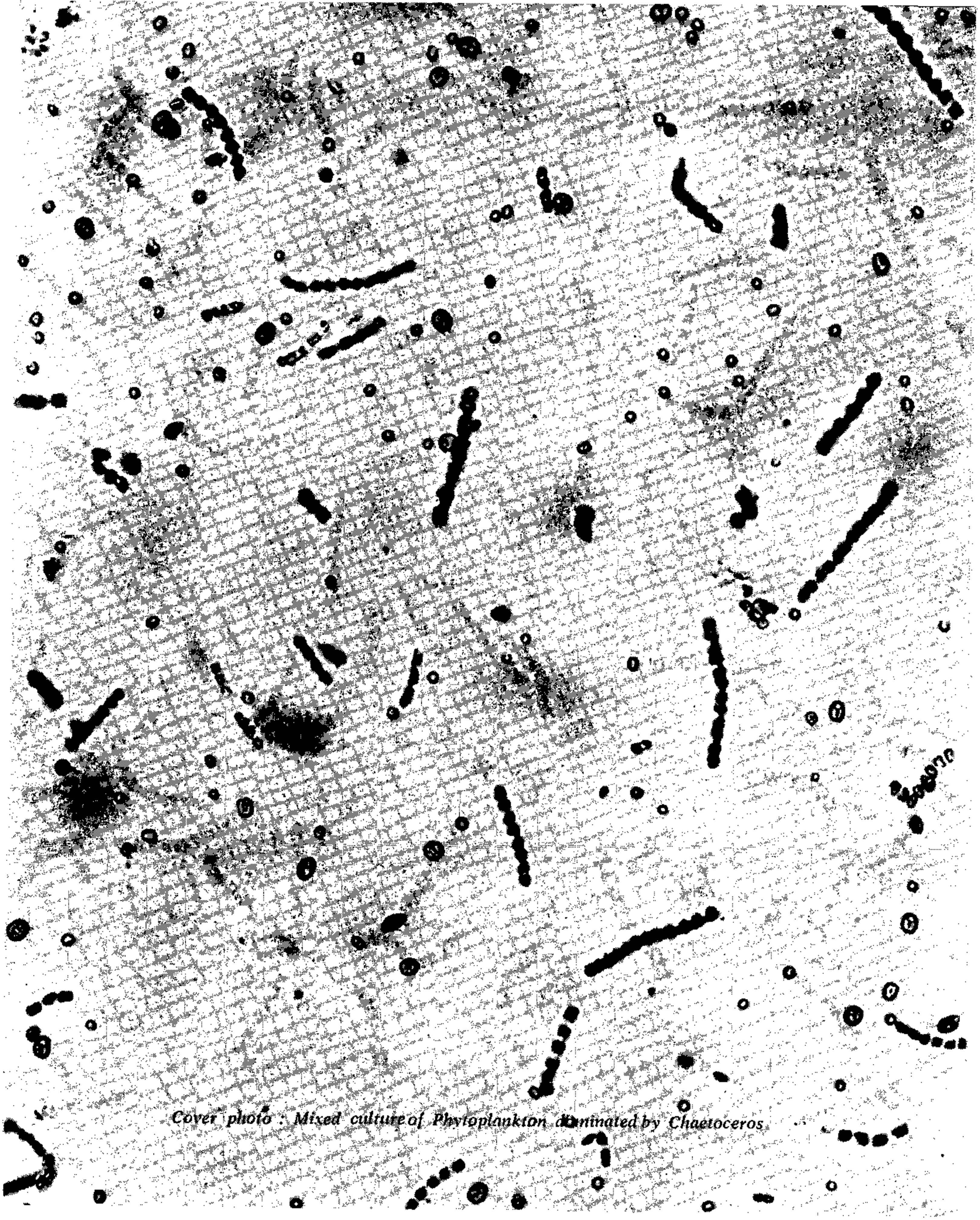

Cover photo : Mixed culture of Phytoplankton dominated by Chaetoceros