



वार्षिक प्रतिवेदन
ANNUAL REPORT
1995-96



केन्द्रीय खारापानी जलजन्तु पालन संस्थान
(भारतीय कृषि अनुसंधान परिषद)
नं.१४१, मार्शल्स रोड, एगमोर, मद्रास - ६०० ००८.

CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE
(Indian Council of Agricultural Research)
141, MARSHALLS ROAD, EGMORE, MADRAS 600 008



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(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
141, MARSHALLS ROAD, MADRAS-600 008

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Cover Photo
Experimental shrimp hatchery at Muttukadu

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INTRODUCTION

Brief Historical Background

Brackishwater aquaculture has been identified as one of the high potential areas for increasing fish and shellfish production and for deriving maximum economic and social benefits such as better utilisation of unproductive and marginally productive coastal lands, swamps and brackishwater bodies, augmenting production for export and foreign exchange earnings, support to food security system, establishment of ancillary industries, generation of employment and improving the socio-economic conditions of rural poor. As all these activities require adequate and continuous R & D support, the Indian Council of Agricultural Research sanctioned the establishment of the Central Institute of Brackishwater Aquaculture during the 7th Plan period with effect from 1.4.1985, by reorganisation of the then existing Fisheries Research Institutes of the Council. The Institute started functioning independently since April 1987. The Headquarters of the Institute is located in Madras City with field and farm facilities at Muttukadu, about 30 km south of Madras. The Institute has three Research Centres located at Kakdwip (West Bengal), Puri (Orissa) and Narakkal (Kerala).

Mandate

The Institute has the following mandate:

- To conduct research for development of techno-economically viable and sustainable culture systems for finfish and shellfish in brackishwater
- To act as a repository of information on brackishwater fishery resources with a systematic database
- To undertake transfer of technology through training, education and extension education programmes

- To provide consultancy service

Infrastructure development

The fish broodstock holding tanks at Muttukadu with a total seawater holding capacity of 500 t have been completed. The shrimp hatchery complex at Muttukadu is nearing completion. The fish hatchery and feed mill at Muttukadu are under construction. Reconstruction work relating to "A" series ponds at Muttukadu is also in progress.

Equipments imported during 1995-96 are: Fraction collector, micro-plate ELISA reader, thermocycler, histo-embedder and Kjeltac autosystem. Besides, Super AT-386 computer, dot matrix printers, cooling incubator, BOD incubator, quick seal V series for vacuum packing, deepfreezer, electronic typewriter, portable automatic levelling instrument and 2 KVA uninterrupted power supply system were also added to the laboratories.

Other facilities added to the Institute include a mini-bus acquired during the year for the transportation of Scientists/Staff to the Muttukadu field centre.

Organisation

The research programmes of the Institute were carried out under the following 5 divisions

1. Crustacean Culture Division (CCD)
2. Fish Culture Division (FCD)
3. Technology Improvement Division (TID)
4. Aquaculture Engineering and Environment Division (AE & ED)
5. Extension, Economics and Information Division (EE & ID)

Maintenance of broodstock, breeding and larval rearing of *Penaeus monodon* and *P. indicus*, grow-out culture of penaeid

shrimp in different ecosystems, culture of live food organisms and crab culture were taken up by the Crustacean Culture Division. Broodstock maintenance, breeding and culture of brackishwater fishes were dealt with by the Fish Culture Division. Research on nutritional aspects of fish and shrimp, feed technology, pathology, reproductive physiology and genetics programmes were taken up by the Technology Improvement Division. Aquaculture Engineering and Environment Division (unit) conducted studies on brackishwater environment, soil and water quality and productivity management for sustainable shrimp farming, hatchery design and layout systems, design and development of machinery and structures and use of non-conventional energy resources for aquaculture operations. The Extension, Economics and Information Division (unit) looked after the technology transfer programmes, aquaculture economics and development of database on brackishwater fishery resources. The Library and Technical Cell were under the responsibility of a Scientist each. An Engineering Cell attended to the construction works of the Institute.

A total number of 17 projects (14 departmental and 3 sponsored) were undertaken during the year.

Budget

During the year 1995-96 an expenditure of Rs 146.97 lakhs under Plan and Rs 99.01 lakhs under Non-Plan was incurred by the Institute.

Major research accomplishments

Extensive investigations have been conducted on the white spot disease which has been rampant since November 1994 affecting white as well as tiger shrimp of all sizes from larval stages to broodstock in the shrimp hatcheries and farms in the coastal districts of Tamil Nadu, Andhra Pradesh and Orissa irrespective of management practices. The causative agent was identified to be a

virus, the Systemic Ectodermal and Mesodermal Baculovirus (SEMBV). Survey of shrimp farms along the east coast revealed that apart from the white spot disease problem, Monodon Baculovirus (MBV) disease and luminescent bacterial disease were also prevalent. In view of the recurrent disease and mortality problems in shrimp farms during the last two years, the Institute has taken up disease diagnosis as one of its priority research areas. Diagnostic tests viz., Dot Immunoassay and ELISA (Enzyme-linked Immunosorbent Assay) have been standardised for the diagnosis of shrimp bacterial diseases caused by *Vibrio parahaemolyticus*, *Pseudomonas* sp. and *Aeromonas* sp. Advanced techniques of immunodiagnosics and gene probes are being developed for rapid diagnosis of shrimp diseases.

Studies on environmental impact assessment have shown that deterioration in water quality and unscientific management measures have been primarily responsible for the disease outbreaks. In this connection the Institute has built up a significant database on physical, chemical and biological parameters of shrimp culture systems and farm effluents based on which it has helped the Union Ministry of Agriculture and the Govts. of Andhra Pradesh and Tamil Nadu in formulating guidelines for aquaculture and standards for farm effluents.

Considerable progress has been made in the broodstock development programme of shrimp and finfishes. The grey mullet, *Mugil cephalus* (0.3 to 1.2 kg) and seabass, *Lates calcarifer* (0.75 to 10.0 kg) initially maintained in ponds at Muttukadu are now being held in RCC (Reinforced Cement Concrete) tanks with a total capacity of 500 t, provided with facility for seawater intake and drainage. A captive broodstock of tiger shrimp *P. monodon*, average size 200 mm/85 g, was also successfully developed under pond conditions at Muttukadu and induced maturation experiments were conducted with pond-reared broodstock.

Under the fish culture programmes, pen culture of milkfish *Chanos chanos* at Muttukadu gave encouraging results. Over a period of 6 months, at a stocking density of 5000 no./ha and with supplementary feeds, the fishes reached an average size of 296 mm/195 g from an initial average size of 120 mm/13 g. The growth of pearlspot *Etroplus suratensis* under integrated farming with poultry at Narakkal was also encouraging, recording an average growth of 170 mm/109 g from an initial average of 77 mm/10 g.

Significant advances have been made in the feed formulation programmes, with further improvements in the development of freeze-dried micro-particulate diets (50, 200 and 500 microns) for shrimp larvae and postlarvae. The milk protein casein was replaced by an equivalent amount of duck egg and total lipid was increased with the addition of fish oil. A combination of micro-particulate feeds along with diatoms was successfully tested on *P. monodon* larvae. Efforts are on for improvement in digestibility of feeds and enhancement of conversion efficiencies through biotechnological approach by bioconverting selected feed ingredients using solid-state fermentation and production and testing of probiotics in shrimp feeds.

Experiments on the use of binders for improving the water stability of feed pellets indicated that wheat gluten incorporated @

4 to 5 % in the pellets served as a good binder imparting a water stability beyond 6 hours. Gooseberry as a source of vitamin C, incorporated in standard shrimp diets at 3% level, gave better growth and survival in *P. monodon* compared to diets fortified with other sources of vitamin C.

Field testing of several grow-out shrimp feed formulations developed by the Institute has been initiated. A technology package has been developed for small-scale shrimp feed processing and production using a nutritionally balanced feed formulation with indigenous ingredients, to cater to the needs of small and medium shrimp farmers practising improved extensive and semi-intensive culture of tiger shrimp *P. monodon*.

The Institute has also developed layout and designs for backyard and small-scale shrimp hatchery viz., 2, 5 and 10 million capacities.

Survey and evaluation of different shrimp farming practices was continued in the states of Maharashtra, Goa and Tamil Nadu and in the Union Territory of Pondichery, covering a total of 48 farms with a water-spread area of 541.06 hectares. Development of database on brackishwater fishery resources is also in progress.

K. Alagarwami
Director

GENERAL INFORMATION

Institute's Management Committee*

The tenth and eleventh meetings of the Management Committee of the Institute were held on 7 September 1995 and 22 February 1996 respectively.

Staff Research Council*

The second and third meetings of the newly constituted Staff Research Council of the Institute were held on 5-6 September 1995 and 18-19 March 1996 respectively, to review the progress of work in the various on-going research projects and to formulate and finalise project proposals for the next year.

Research Advisory Committee of the Institute*

The second meeting of the Research Advisory Committee (RAC) of the Institute was held on 23-24 February 1996. The major recommendation/suggestions of the RAC are summarised as follows:

- Problem-oriented research related to shrimp industry should be taken up.
- The Institute should take further steps to get lands transferred from Govt. of Tamilnadu and complete infrastructure within a two-year time frame.
- The Institute should take an aggressive policy of dissemination of the results of investigations carried out through appropriate publications/literature/media immediately.
- Further precedence should be given to the programmes for which infrastructure facilities are presently available viz., environmental impact assessment, field-testing of economically profitable feed formulations in commercial farms in association with industry/farmer, networking pro-

gramme on disease diagnostics and related health management, shrimp/fish captive broodstock development.

- Totally integrated multi-disciplinary approach should be followed with team leader to ensure co-ordination and implementation of programme.
- Economic aspects should be built into production programmes right from planning stage.
- The Institute should plan proposals for obtaining funding support from ICAR Cess Fund / Dept. of Biotechnology / Dept of Ocean Development etc.
- Scientists working in prioritised areas of research should be sent abroad for training and experts to be got from outside wherever necessary.
- The Institute should prepare a project proposal for comprehensive study of impacts of shrimp farming.
- Proposal to be prepared for Workshop/Training on Environment Impact Assessment.

Special World Bank Review Committee meeting of NARP (Phase II)

The Special World Bank Review Committee Meeting of the NARP Phase II Sub-project on Aquaculture was held at the Institute during 14-15 December 1995, to review the progress of the project. The meeting was chaired by Dr. S. L. Mehta, DDG (Edn.), ICAR and reviewed by Dr. T. C. Jain, Agriculture Research Specialist, World Bank, New Delhi. The other experts present were Dr. Kuntala Jayaraman, Director, Centre of Biotechnology, Anna University, Madras, Dr. B. B. Jana, Professor and Head, Dept. of Zoology, Kalyani University, Dr. M. Y. Kamal, Assistant Director General (Fy),

* Refer annexure for composition of Committee

ICAR, Dr. K. N. Singh, Assistant Director General (NARP), Shri. M. Ranadhir, Director, Central Institute of Freshwater Aquaculture, Dr. K. Alagarwami, Director, Central Institute of Brackishwater Aquaculture, Dr. S. Ayyappan, Principal Scientist, Central Institute of Freshwater Aquaculture.

Institute Joint Staff Council *

The Institute's Joint Staff Council meetings were held at the Headquarters on 16 December 1995 and 15 March 1996.

ARS/SRF/NET Examination

ARS/SRF/NET Examination of ASRB for the year 1994 was conducted by the Institute at Madras from 5-7 October 1995.

Assistance rendered

The Institute assisted the Govt. of India, through Ministry of Agriculture, in a legal conflict on environmental consequences of shrimp farming heard by the Honourable Supreme Court of India.

A shrimp farmers contact programme was conducted from 25-31 March 1995 in the Godavari and Krishna districts of Andhra Pradesh with the objective of providing assistance to farmers in improving the nutritional quality and water stability of farm-made pelleted feeds used by them. A total of 67 farmers were contacted.

Dr. C. P. Rangaswamy and Dr. B. P. Gupta, Senior Scientists and Dr. S. S. Mishra, Scientist, visited shrimp farms in Balasore and Bhadrak districts of Orissa during 23-29 April 1995 to conduct investigations on the shrimp disease outbreaks in these districts and to suggest remedial measures for prevention of diseases.

Dr. K.K. Vijayan, Scientist, served as a resource person in the training programme on shrimp diseases, conducted by Prof. Donald Lightner (University of Arizona, U.S.A.) and organised by the MPEDA during 28-30

August 1995 at Visakhapatnam, Andhra Pradesh.

Dr. C.P. Rangaswamy, Senior Scientist, visited Keutakudi, Kusubenti and Haridas villages of Puri District of Orissa during December 1995 and January 1996 and rendered assistance in shrimp disease investigations.

Technical Assistance was rendered to 23 farmers from Andhra Pradesh and Tamil Nadu on shrimp culture technology.

The Institute rendered assistance on shrimp disease diagnosis and management to the following private entrepreneurs through B F D As: Navabharath and Varun hatchery at Nellore, PTI hatchery at Chingleput, Shri Ram Marine Harvests at Poompuhar and a farm at Palayam in Kerala.

Services in committees

Dr. K. Alagarwami, Director, served as

- Member, Governing Council, Andaman and Nicobar Islands Shrimp Farming Development Agency, MPEDA, Kochi
- Member, Extension Council, CIFE, Mumbai
- Member, General Body, Orissa Shrimp Seed Development, Production and Research Centre, Berhampur
- Member, Patents Committee, ICAR
- Member, Working Group on Marine Living Resources, Dept. of Ocean Development, Govt. of India
- Member, Marine/Inland Fisheries Advisory Board, Govt. of Tamil Nadu, Dept. of Animal Husbandry & Fisheries
- Chairman, Expert Committee, to review the work of Fisheries College & Research Institute, TANVASU

* Refer annexure for composition of Committee

- Member, 9th Plan Working Group on Fisheries, Dept. of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India
- Member, MPEDA, Kochi
- Member, Standing Committee for Agriculture, Tamil Nadu State Planning Commission

Training under World Bank-Assisted Project

The Institute was given the responsibility of conducting a training course in Semi-intensive Shrimp Farming Technology, by the Department of Agriculture and Cooperation, Ministry of Agriculture, under the Shrimp and Fish Culture Project (World Bank-assisted) of Govt. of India. Under this project, the third batch of 7 Brackishwater Fish Farmers Development Agency officials from Andhra Pradesh *viz.*, Shri D.S. Sudhakar, Shri K. Pandu Ranga Rao, Shri K. Kanaka Raju, Shri K. Rama Rao, Shri K. Phani Prakash, Shri M. B. K. S. Ravi and Shri S. Janimaiya underwent training from 17 May to 15 June 1995. The 4th batch included two groups, the first group being 9 BFDA officials from Andhra Pradesh *viz.*, Shri P. Sreeramulu, Shri N. Srinivasa Rao, Shri V. Ventateswara Rao, Shri T. Gangadhara Rao, Shri P. Durga Prasad, Shri P. V. Satyanarayana, Shri K. S. V. N. Acharyulu, Shri P. Brahmaji Rao and Shri N. Peddiraju underwent training from 21 August to 19 September 1995. The second group of the same batch consisting of 18 BFDA officials from West Bengal *viz.*, Shri Amitava Bar, Shri Bani Kumar Misra, Shri Bhaskar Mukherjee, Shri Indranil Roy, Shri Jayanta Kumar Mondal, Shri Kishaloy Das, Shri Mrinal Kanti Naiya, Shri Prabal Kanti Bhunya, Shri Prabir Kumar Dasgupta, Shri Ramakrishna Sardar, Shri Ramgobinda Ganguli, Shri Santi Kumar Naskar, Shri Suboth Chandra Pramanik, Shri Subrata Sarkar, Shri Srikanta Bera, Shri Sujit Kumar Das, Shri Swadesh Kumar Bhattacharjee and Shri Swapan Kumar Bayen un-

derwent training from 28 August to 25 September 1995.

Other trainings

A short-term training course on shrimp disease monitoring was imparted to Smt. N. Lalitha, Shri A. Chellakumar and Shri R. Thangaraj, Research Assistants from Tamil Nadu State Fisheries, during 26 June to 1 July 1995.

Shri V. Thirumoolam and Shri R. Soundirapandian, Sub-Inspectors of Fisheries deputed by Fisheries Department, Govt. of Pondichery, were imparted training in shrimp backyard hatchery technology from 21 August to 3 December 1995.

Twenty young small farmers from Nellore (AP) were imparted training on water quality management during 18-19 October 1995.

Demonstrations and lectures on brackishwater aquaculture were also arranged for the following at the Headquarters and Research Centres of the Institute.

Madras

- A batch of 7 trainees of the 98th Refresher in-service training course of the Tamil Nadu State Fisheries Dept., on 14 June 1995
- A group of post-graduate students from Ethiraj College, Madras, on 21 September 1995
- 2 private corporate farmers from 'Sharing Aqualine' and 'Senthil Aquafarm', on 29 November 1995 and 17 December 1995
- 14 Students from Dept. of Marine Living Resources of Andhra University of Science and Technology, Visakhapatnam, on 10 January 1996
- 7 fish farmers accompanied by an Inspector of Fisheries, Andaman and Nicobar Islands, Port Blair, on 11 January 1996

- 31 trainees from Inland Fisheries Training Centre of CIFE, Barrackpore, on 19 January 1996
- 9 progressive farmers from Visakhapatnam sponsored by MPEDA on Inter-state Study Tour of Aquafarmers, on 11 March 1996

Puri

- 46 students of 1st and 2nd year B.Sc. Industrial Fish and Fisheries, Dept. of Zoology, Madras Christian College, Tambaram, on 20 January 1996

Kakdwip

- 3 batches of grass-root level trainees (60 no.) from Pathar Pratima Block, on 20 April 1995
- 6 batches of seed collection trainees (20 no.) from Namkhana Block, on 30 May 1995
- 15 trainees from R.K. Mission Lokasiksha Parisad, Narendrapur, on 1 June 1995

Narakkal

- Trainees sponsored by MPEDA
- Fishermen trainees from Andaman & Nicobar Islands
- Fishermen trainees from Lakshadweep
- B.F.Sc. students from College of Fisheries, Mangalore

Manpower development

Dr. L. H. Rao, Senior Scientist, attended the course on Agricultural Research Management, from 26 July to 5 August 1995, at NAARM, Hyderabad.

Shri S. V. Alavandi, Scientist (Senior Scale), underwent a deputation training under the World Bank-assisted National Agricultural Research Project (NARP) Phase II on Aquaculture: pond-bioenergetics, digestive enzymes and microflora in fish and

shrimp, at the University of Glasgow, U.K., from 8 August to 17 September 1995.

Dr. K. K. Vijayan, Dr. K. V. Rajendran and Dr. S. S. Mishra, Scientists, underwent a short-term training course on Fish Diseases: An appraisal of tools of research (light microscopy, immuno-electron microscopy and cytochemistry) organised by the Dept. of Zoology, University of Madras, under the sponsorship of the British Council Division, Madras, from 21-26 August 1995.

Dr. K. K. Krishnani, Scientist, underwent training on Biodegradation of Chlorinated Pesticides, sponsored by the Dept. of Biotechnology, at Industrial Toxicology Research Centre (CSIR), Lucknow, from 21 August to 8 September 1995.

Dr. M. Krishnan, Scientist (Senior Scale) underwent training at South East Asian Fisheries Development Centre, Aquaculture Dept., Tigbuan, Iloilo, the Philippines, under the JICA fellowship for Third Countries Training Programme, from 27 September to 25 November 1995.

Dr. S. M. Pillai, Senior Scientist, participated in the International Training Course for Fisheries Extension Officers in Fisheries Extension Methodology, at the training department of the South East Asian Fisheries Development Centre, Samut Prakan, Thailand, from 3 November to 8 December 1995.

Dr. K. K. Vijayan, Scientist, is undergoing a short-term training course for a period of three months on Basic Methodologies in Genetic Engineering, Cell Biology and Bioprocess Technology sponsored by Centre for Biotechnology, Anna University, Madras and Dept. of Biotechnology, Govt. of India, New Delhi, at Guindy, Madras, from 15 March 1996.

The following personnel underwent computer training at the National Informatics Centre, Madras.

- Kum. S. Nalini, Junior Stenographer, in Word Processing and Data Entry, from 22-25 May 1995
- Smt. V. Usharani, Junior Clerk, in Word Processing and Data Entry, from 5-8 June 1995
- Shri A. Manoharan, Junior Clerk, in Word Processing and Data Entry, from 19-22 June 1995
- Shri R. Kandamani, Senior Clerk, in RDBMS, from 29 May to 2 June 1995
- Shri T. Ravisankar, Scientist, in Unix Fundamentals, from 4-8 September 1995
- Shri R.G. Ramesh, Senior Clerk, in Word Processing and Data Entry, from 11-14 September 1995
- Shri S. Pari, Junior Clerk, in Word Processing and Data Entry, from 25-28 September 1995
- Shri R. Palaniswamy, Assistant, in Word Processing and Data Entry from 16-19 October 1995

Seminars / Symposia / Workshops

Dr. K. Alagarswami, Director, participated in the following Workshops/Seminars:

- Workshop on GIS as a Tool for Management of Coastal Aquaculture and Fishery organised by BOBP at M.S. Swaminathan Research Foundation, Madras, 3 May 1995
- Workshop on Water Quality and Effluent Management in Aquaculture, organised by Aquaculture Foundation of India, Madras, 10 May 1995
- National Workshop on Poultry, Fisheries and Food Processing in India, at NAARM, Hyderabad, 4-5 July 1995
- Seminar on Fisheries - A Multibillion Dollar Industry, Madras, 17 September 1995
- Seminar-cum-Exposition on Aquaculture organised by the Ma-

dras-Chinglepet Aquafarmers Association, Madras, 17 March 1996 and released a Souvenir.

The Scientists participated in the following Seminars/Symposia / Workshops held during the year :

- National Workshop on Poultry, Fisheries and Food Processing in India, at NAARM, Hyderabad, 4-5 July 1995

Dr. K.V. Ramakrishna

- National Symposium on Technological Advancements in Fisheries and its Impact on Rural Development, at Department of Industrial Fisheries, University of Science and Technology, Kochi, 5-7 December 1995

Dr. S. A. Ali, Dr. A. Laxminarayana and Dr. L. Krishnan

- Workshop on Impact of Climate Change on Food and Livelihood Security organised by M.S. Swaminathan Research Foundation and the Climate Institute, Washington, at MSSRF, Madras, 4-6 December 1995

Dr. A. R. Thirunavukkarasu and Dr. B.P. Gupta

- Workshop on Water Quality, Bottom Soil and Effluent Management for Aquaculture Ponds, organised by the Aquaculture Foundation of India, Madras, 10-11 May 1995

Dr. B.P. Gupta and Dr. K.O. Joseph

- Seminar-cum-Exposition on Aquaculture organised by the Madras-Chinglepet Aquafarmers Association, Madras, 17 March 1996

Dr. K. O. Joseph and Shri S.V. Alavandi

- National Conference on Sustainable Aquaculture at the Institute for Ocean Management, Centre for Water Resources, Anna University,

Madras, 5-6 April 1995 and presented a paper

Shri S.V. Alavandi

- Workshop on Selective Breeding of Rohu, *Labeo rohita*, under Indo-Norwegian Project at CIFA, Bhubaneswar, 21-22 March 1996

Dr. P. Kishore Chandra

- National Seminar on Aquatic Animal Health, at the Dept. of Aquatic Biology and Fisheries, University of Kerala, Thiruvananthapuram, 15-17 March 1995 and presented a paper

Dr. K.V. Rajendran

Seminars held in the Institute

- Dr. A.R. Thirunavukkarasu, Senior Scientist and Dr. C. Gopal, Scientist (Senior Scale), on their training at the International Training Centre for Fishery Extension Officers in Extension Methodology and Coastal Resource Management, at SEAFDEC, Bangkok, during 7 November to 9 December 1994, on 4 April 1995
- Dr. P. Ravichandran, Senior Scientist, on his training in Coastal Aquaculture under JICA Fellowship for Third Countries Training Programme at SEAFDEC Aquaculture Department, Iloilo, the Philippines, during 16 January to 15 March 1995, on 7 April 1995
- Shri N. Kalaimani, Scientist (Selection Grade), on his training in Aquaculture-Pond Bioenergetics, Digestive Enzymes and Microflora in Fish and Shrimp, under the World Bank-assisted National Agricultural Research Project (NARP) Phase II, held at Laboratoire de Biologie, College de France, Concarneau, Cedex, France, during 3 January to 20 February 1995, on 17 April 1995

- Shri S.V. Alavandi, Scientist (Senior Scale), on his training in Microbial Fermentation, at the University of Glasgow, under the World Bank-assisted National Agricultural Research Project (NARP) Phase II on Aquaculture, during 8 August to 17 September 1995, on 31 October 1995

- Dr. M. Krishnan, Scientist (Senior Scale), on his training at SEAFDEC, the Philippines, under JICA Fellowship for Third Countries Training Programme, during 27 September to 25 November 1995, on 16 December 1995

Lectures

The Scientists delivered the following lectures:

- On Fish Feeds (Bait and Meal) for Aquaculture, to the participants of UNIDO programme, at Central Leather Research Institute, Madras, 29 November 1995

Dr. S.A. Ali

- On Nutrition and Feeding of Penaeid Shrimp for their Sustainable Aquaculture, to the participants of UGC programme, Bharathidasan University, Thiruchirappalli, 21 March 1996

Dr. S.A. Ali

Lectures delivered to the students of VI Semester B.Tech-Industrial Biotechnology in Aquaculture and Marine Biotechnology at Centre for Biotechnology, Anna University, during February and March 1996.

- Hatchery technology for shrimp

Dr. P. Ravichandran

- Hatchery technology for fishes

Dr. A.R. Thirunavukkarasu

- Hormones for controlled spawning in fishes

Dr. A.R. Thirunavukkarasu

- Micro-encapsulated diet Biocapsulation Composite feed

Dr. S.A. Ali

- Bioenergetics and feed selection
- Live feed organisms - mass culture technique (*Artemia* and rotifers)
- Bacterial and fungal diseases of shrimp and fish - diagnosis, prevention and control

Dr. M. Natarajan
Dr. S. Kulasekarapandian
Shri S.V. Alavandi

Meetings/Conferences

The Director attended/participated in the following meetings/conferences:

- National Conference on Sustainable Aquaculture at Anna University, Madras, 5 April 1995
- Conference on Informatics for Sustainable Agriculture Development, New Delhi, 24-25 May 1995
- First meeting of the Technical Committee for Reviewing Incidence and Causes of Shrimp Diseases, at the Dept. of Agriculture and Cooperation, Ministry of Agriculture, New Delhi, 5-7 July 1995
- Mid-year ICAR Director's Conference, ICAR, New Delhi, 10-14 July 1995
- 9th meeting of Extension Council, CIFE, Mumbai, 21 July 1995
- Governing Council meeting of OSSPARC, Madras, 25 July 1995
- Meeting on Coastal Fisheries Management Project, BOBP, Madras, 28-29 July 1995
- Second meeting of the Technical Committee on Shrimp Diseases, Ministry of Agriculture, Govt. of India, Madras, 14 September 1995

- Interaction Meeting on Development of Aquaculture Feed, at Dept. of Biotechnology, New Delhi, 12 October 1995

- 1st meeting on Marine/Inland Fisheries Advisory Board, Govt. of Tamil Nadu, Madras, 1 November 1995
- 20th meeting of Central Board of Fisheries, Calcutta, 3-4 November 1995
- Patents Committee meeting, Calcutta, 4 November 1995
- Meeting with World Bank Team on Aquaculture, M.S. Swaminathan Research Foundation, Madras, 15 November 1995

- Meeting with World Bank Review Mission for Shrimp Culture, FAO office, New Delhi, 28 November 1995

- Expert Committee meeting to review the work of Fisheries College and Research Institute, TANVASU, Tuticorin, 9-10 February 1996

- 9th Plan Working Group on Fisheries, Dept. of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India, New Delhi, 19 February 1996

- ICAR Director's Conference, New Delhi, 26-29 February 1996

- 77th meeting of MPEDA, Kochi, 21 March 1996

- Governing Council meeting of Andaman and Nicobar Islands Shrimp Farming Development Agency, MPEDA, Kochi, 22 March 1996

The Scientists attended/participated in the following meetings:

- Second meeting of Expert Committee on Fishermen Welfare, Fisheries Development and Fisheries Management Policy, Directorate of Fisheries, Madras, 26 February 1996

Dr. R.D. Prasadam

- Interaction meeting on Aquaculture Feed Development organised by Dept. of Biotechnology, Govt. of India, New Delhi, 12-13 October 1995

Dr. S. Ahamad Ali and
Shri D. Narayanaswamy

- Meeting on project ARIS(Agricultural Research and Information Service), Indian Institute of Horticultural Research, Bangalore, 4 May 1995

Dr. M. Krishnan

- Brain Storming Session sponsored by the Dept. of Biotechnology on Microbial Pollution of Coastal Environment and Shrimp Diseases held at Indian Institute of Technology, Madras, 30 January 1996

Shri S.V. Alavandi

Honours and Awards

Dr. S. S. Mishra, Scientist, has been selected as the recipient for the Jawaharlal Nehru Award for the year 1995 for his work on 'Molecular characterisation of fowlpox virus: Analysis of protein and genomic profile of vaccine strain and field isolates' at Indian Veterinary Research Institute, Izatnagar, U.P.

Dr. P. Kishore Chandra, Scientist, was awarded the doctoral degree in Animal Genetics and Breeding in the Faculty of Veterinary Science by the Andhra Pradesh Agricultural University for his thesis entitled 'Studies on some aspects of progeny testing of buffalo bulls', in March 1996.

Library, Information and Documentation

Library holdings

The Institute's library acquired 82 books during the period. To meet the reference needs and for updating the current knowledge of the scientists, subscriptions to 14 foreign and 18 Indian journals were also made. The library, in March 1996, had a total

holding of 902 books, 435 reprints and photocopies, 250 reports and 500 miscellaneous publications.

Exchange services

The library maintained exchange programmes with national and international organisations of mutual interest. The library maintained the free mailing of Institute's Annual Report and other publications to various research organisations, universities and other agencies.

Information services

The library section extended its information service to the scientific personnel of research organisations, universities, research scholars, students and individuals, through reference of books and journals in the library.

Publications

- Annual Report for the year 1993-94
- Annual Report for the year 1994-95
- Proceedings of the National Workshop on Transfer of Technology for Sustainable Shrimp Farming, held at Madras, on 9-10 January 1995, March 1996
- CIBA Extension Series No.1, Shrimp Culture: Pond Preparation, March 1996
- CIBA Extension Series No. 2, Shrimp Culture: Water Quality Management, March 1996
- CIBA Extension Series No. 3, Shrimp Culture: Feeds and Feed Management, March 1996
- CIBA Extension Series No. 4, Shrimp Culture: Diseases and Health management, March 1996
- CIBA Extension Series No. 5, Chlorination in Brackishwater Aquaculture, March 1996

- CIBA Extension Series No. 6, Lime and its Application in Brackishwater Aquaculture, March 1996
- CIBA Extension Series No. 7, Training Programmes in CIBA, March 1996
- CIBA Brochure, March 1996

Visitors

Headquarters

Dr. R. S. Paroda, Secretary to Govt. of India, Dept. of Agricultural Research & Education (DARE) and Director General, ICAR

Dr. P. V. Dehadrai, Deputy Director General (Fy), ICAR

Dr. K. Radhakrishna, Asst. Director General (M.Fy), ICAR

Shri N. Parthasarathy, Joint Secretary, Govt. of India and Financial Advisor, DARE

Shri T. S. Krishnamurthy, Additional Secretary (Expenditure), Ministry of Finance, Govt. of India

Dr. Herman Van Wersch, Principal Operations Officer, Mid-Term Review Team on Shrimp and Fish Culture Project under World Bank

Dr. Ronald Zweig, Aquaculturist, Mid-Term Review Team on Shrimp and Fish Culture Project under World Bank

Dr. S. P. Agarwal, Senior Finance Officer, Mid-Term Review Team on Shrimp and Fish Culture Project under World Bank

Shri T. C. Jain, Agriculture Research Specialist, World Bank, New Delhi

Shri G. Mohankumar, Director (A & I), MPEDA, Kochi

Dr. S. L. Mehta, Deputy Director General (Edn.), ICAR

Dr. M. Y. Kamal, Asst. Director General (Fy.I), ICAR

Dr. K. N. Singh, Asst. Director General, NARP (II)

Shri M. Ranadhir, Director, CIFA, Bhubaneswar

Dr. S. Ayyappan, Principal Scientist, CIFA, Bhubaneswar

Dr. B. B. Jana, Professor & Head of Dept., Kalyani University, Burdwan, West Bengal

Dr. T. J. Varghese, Emeritus Professor, College of Fisheries, UAS, Mangalore (External Member, SRC)

Shri M. S. Muthu, Retired Principal Scientist, CIBA (External Member, SRC)

Dr. George John, Director, Dept. of Biotechnology, New Delhi (External Member, SRC)

Dr. (Mrs) Kuntala Jayaraman, Director, Centre of Biotechnology, Anna University

Dr. T. V. R. Pillay, Former Programme Director, Aquaculture Development and Co-ordination Programme, FAO (Chairman, RAC)

Prof. R. Natarajan, M. S. Swaminathan Research Foundation, Madras (Member, RAC)

Dr. H. P. C. Shetty, Retired Director of Instruction (Fy), UAS, Mangalore (Member, RAC)

Shri A. Rajeswara Rao, Satyasudha, Bhadrachalam, Khammam, Andhra Pradesh (Member, RAC)

Kakdwip Research Centre

Shri M. V. Samurajan, Technical Officer, CMFRI, Visakhapatnam

Prof. R. G. Maity, Department of Horticulture, B. C. K. Viswavidyalaya, Mohonpur, Nadia district, West Bengal

Shri S. K. R. Haque, Journalist (Agro-Horti-Fisheries), Nadia district, West Bengal

Farmers from Pathar Pratima Block, Joynagar, Calcutta

Puri Research Centre

Prof. P. Sita Rama Reddy, Professor of Zoology, Madras Christian College, Madras

PROGRESS OF RESEARCH

CRUSTACEAN CULTURE DIVISION

Development of hatchery technology for penaeid shrimp (CCD/HT/1)

Madras : L. H. Rao (PL), K. Devarajan, P. Ravichandran, M. Kathirvel, K. O. Joseph, P. S. Sudeesh, C. P. Balasubramanyam, Imelda Joseph, R. Rangeshwaran, S. S. Mishra and P. S. P. Gupta.

Narakkal : A. Laxminarayana and S.M. Pillai

Puri : C. P. Rangaswamy and S. Srinivasagam

Development of captive broodstock

A captive broodstock of tiger shrimp *Penaeus monodon* was successfully developed under pond conditions at Muttukadu. Adult *P. monodon* of average size 160 mm / 33 g were stocked in a 0.075 ha non-drainable pond at a density of 0.8 no./m² and fed with CIBA pelleted feed initially @ 3% of total biomass gradually reduced to 1.5%, supplemented with cooked clam meat given @ 3% of total biomass and also gradually reduced to 1%. An average size of 200 mm / 85 g (females of average size 204 mm / 93 g and males 195 mm / 77 g) was attained in 6 months period. The pond water salinity was maintained between 26 to 31 ppt by regular exchange (10-15%) of seawater drawn from an intertidal borewell.

Induced maturation

The pond-reared broodstock were used for conducting induced breeding experiments. Initial experiments with unilaterally ablated females maintained in FRP tanks, with 100% water exchange daily and fed on clam and squid meat @ 15% of total biomass supplemented with polychaetes @ 10% of total biomass, have yielded encouraging results. Viable eggs and nauplii were produced and the larvae were successfully reared using

Chaetoceros affinis and *Artemia* nauplii as larval feeds. The rate of survival from nauplii to PL2 and from PL3 to PL20 was 41.6% and 50% respectively.

Backyard hatchery technology

Adopting backyard hatchery technology, breeding and larval rearing trials for the seed production of *P. monodon* were initiated at Muttukadu using *C. affinis* and *Artemia* nauplii as larval feeds. At Narakkal, trials were continued on the improvement of backyard hatchery technology for the seed production of *P. indicus*.

Quality control tests for penaeid post-larvae

To evaluate the quality of seed produced in the commercial shrimp hatcheries, post-larvae were collected from different hatcheries and subjected to several quality control tests which included visual observations *viz.*, behaviour, colour and activity; microscopic tests *viz.*, muscle-gut ratio, condition of gut, incomplete moulting, muscle deformity, broken appendages, number of rostral spines, bacterial and fungal infection, *Vorticella* / *Zoothamnium*, MBV occlusion bodies etc. and stress tests *viz.*, exposure to 100 ppm concentration of formalin and sudden salinity decrease (50%). Active post-larvae with full gut, no muscle deformity or broken appendages, with muscle gut ratio more than 4:1, without bacterial/fungal/MBV infection and with the ability to withstand stress tests were considered as grade I larvae suitable for stocking.

Studies on long-distance transportation of broodstock

Preliminary experiments were conducted on the transportation of broodstock of *P. monodon* / *P. indicus* using anaesthetics

viz., MS-222 (Tricane Methane Sulphate) and by lowering water temperatures to 26, 22, 20, 17 and 15°C. In the first instance, it was observed that sedation of shrimp could not be induced by MS-222 at 100 or 200 ppm. Low temperatures ranging from 20-22°C were found to be suitable for the transportation of broodstock. *P. monodon* (average size 200 g) acclimatised to these low temperatures, could be transported successfully for periods ranging from 24 to 48 hrs.

Evaluation of sperm quality in captive broodstock

Studies on the effect of unilateral eye-stalk ablation on sperm quality in captive *P. monodon* broodstock (175 - 195 mm / 55-75 g) revealed that the percentage of live sperms / abnormal sperms and number of sperms in the spermatophores of ablated males were not significantly different ($P < 0.05$) from those of unablated males. Artificial insemination of *P. monodon* was also carried out using freshly moulted ablated females. Spawning was observed 4 days after introduction of spermatophores and the eggs were found to be fertilised.

Survey of broodstock / spawners of penaeid shrimp availability along Orissa coast

The survey on the availability of broodstock / spawners of penaeid shrimp along Orissa coast was continued. Though adults of the 3 species viz., *P. monodon*, *P. indicus* and *P. merguensis* were available throughout the year in the commercial catches of marine fish landing centres viz., Paradeep, Astarang, Pentakota and Gopalapur, mature females of all the three species were available during the period September 1995 to March 1996 at two centres viz., Pentakota and Gopalpur. Mature females/spawners of *P. indicus* were not recorded at Paradeep and Astarang. At Balugon, on Chilka Lake, only the adults of *P. indicus* and *P. monodon* were recorded

throughout the year, while *P. merguensis* was not available at this centre.

Culture of penaeid shrimp in different ecosystems (CCD/CP/1)

Madras : P. Ravichandran (PL), M. Kathirvel, B. P. Gupta and R. Rangeshwaran

Narakkal : S. M. Pillai and A. Laxminarayana

Puri : S. Srinivasagam and C. P. Rangaswamy

Kakdwip : S. R. Das and R. K. Chakraborti

Experimental grow-out culture of penaeid shrimp under tide-fed, pump-fed, rain-fed and perennial systems was continued at Kakdwip, Madras, Puri and Narakkal respectively, using feeds developed by the Institute. At Kakdwip, at a stocking density of 40,000 no./ha (initial size 18-30 mm), multiple stocking and harvesting of *P. monodon* of size 25 g and above was followed. At similar stocking densities and initial size, *P. monodon* of average size of 22 and 30 g were harvested at the end of 4 months culture period, at Puri and Narakkal respectively.

However, the growth of *P. indicus* under pump-fed system at Madras, at a higher stocking density of 90,000 no./ha was affected due to affliction with soft-shell syndrome.

Monoculture of *Macrobrachium rosenbergii* at Kakdwip under low saline conditions

Monoculture of *M. rosenbergii* under low-saline conditions at Kakdwip, at a stocking density of 40,000 no./ha, has shown that from an initial size range of 4-5 g, the growth attained by the shrimp in one year ranged from 27-37 g.

Culture of live food organisms (CCD/LFC/1)

Madras : S. Kulasekarapandian (PL), P. Ravichandran, K. Devarajan, N. Kalai-

mani, K. O. Joseph, P. S. Sudeesh and Imelda Joseph

Algal culture

Axenic cultures of *Chaetoceros calcitrans* and *Skeletonema costatum* were maintained in UV filtered seawater under temperature controlled conditions (20-24°C) at a light intensity of 1,000-1,500 lux. A maximum cell density of 4.5 million cells/ml of *C. calcitrans* was obtained in 5-7 days with Walne's medium. *S. costatum* reached a density of 50,000 cells/ml in 4-6 days with TMRL medium. Mass culture of *C. affinis* was carried out in outdoor tanks using TMRL medium and a density of 1 to 1.5 million cells/ml was obtained in 48 hours.

Rotifer culture

Continuous culture of rotifer *Brachionus plicatilis* was maintained in outdoor tanks (1.5 ton capacity) with *Chlorella* as feed. An average density of 160 no./ml was obtained after 4 days from an initial density of 5-8 no./ml.

Brine shrimp culture

The natural population of the brine shrimp *Artemia* sp. in the Kelambakkam salt-pan area was observed to be dominated by the San Francisco Bay strain. Culture of this species was taken up during August 1995 in a 0.4 ha pond at Kelambakkam, at an increased stocking density of 200 nauplii/litre, with a view to restrict the culture period to 3 months. A maximum density of 252 no./l with

48% ovoviviparous females was attained at the end of 41 days when the salinity gradually increased from 70 to 120 ppt. A shift to oviparous stage (42%) with production of cysts was observed when the salinity was lowered from 120 to 100 ppt from day 41 to day 53. However, the experiment was vitiated in October 1995 due to incessant rains.

Attempts were made to enrich second instar San Francisco Bay strain *Artemia* sp. nauplii with cod liver oil emulsion over a period of 24 hours. The quality of enriched nauplii in respect of their fatty acid composition is being analysed.

Culture of mud crab (*Scylla* sp.) (CCD/CF/1)

Madras : M. Kathirvel and C. P. Balasubramanyam

Kakdwip : P.K.Ghosh

The growth of the mud crab *Scylla tranquebarica* under pond conditions at Muttukadu, on a diet of trash fish @ 10% of body weight, was encouraging. At a stocking density of 2/m², the smaller size group 66 mm / 44 g has shown a monthly growth rate of 12 mm / 14 g while the larger size group 87 mm / 90 g has recorded a monthly growth rate of 16 mm / 71 g, the average growth recorded at the end of 2 months being 89 mm / 71 g and 119 mm / 233 g respectively. When the adult crabs (126 mm / 325 g) were stocked @ 1/m² the monthly growth rate recorded was 13 mm / 153 g with an average growth of 146 mm / 550 g at the end of 45 days.

FISH CULTURE DIVISION

Broodstock development, breeding and seed production of brackishwater finfishes (FCD/BS/1)

Madras : R. D. Prasadam (PL), Mathew Abraham, A. R. Thirunavukkarasu, Munawar Sultana, P. Kishore Chandra, M. Kailasam and Shiranee Pereira.

Narakkal : L. Krishnan

Considerable progress has been made under the finfish broodstock development programme. A captive broodstock of grey mullet *Mugil cephalus* (140 fishes of size range 0.3 to 1.2 kg) procured from the commercial catches at Muttukadu/Kovalam were maintained in a non-drainable earthen pond (0.075 ha) at Muttukadu on a diet of formulated maturation feeds (proximate composition: crude protein 35.5%, crude lipid 5.24%, crude fibre 3.16% and carbohydrate 26.54%) @ 5% of body weight daily. Subsequently, during December 1995, the stock was transferred to two newly constructed RCC (Reinforced Cement Concrete) tanks (each 100 ton capacity) provided with seawater connection and drainage facility. However, it was observed that the fishes did not attain maturity and were only in the early stages of maturation.

Induced breeding of fishes collected from the wild was conducted during the period November 1995 to January 1996. Oozing males were available in plenty but mature females were scarce in the commercial catches at Kovalam/Muttukadu. A mature female fish (1.2 kg) with average ova diameter of 520 microns was subjected to hormone treatment consisting of a priming dose of carp pituitary hormone (CPH) @ 20 mg/kg body weight along with pimozone @ 2 mg/kg body weight and a resolving dose of LHRHa @ 200 µg/kg body weight, administered after 6 hours. However, no ovulation was observed. Further induced breeding experiments could not be taken up due to non-

availability of mature females in the commercial catches at the above centres during the period. At Narakkal, 4 fishes in the size range 500 mm/1.6 kg to 560 mm/2.5 kg were subjected to a combination of hormones viz., CPH with pimozone, ovaprim and LHRH in various doses. However, mortality of spawners occurred due to infection after hormone treatment.

Continued efforts were made to build up a captive broodstock of seabass *Lates calcarifer* (112 fishes in the size range 410 mm/0.75 kg to 860 mm/10.0 kg), procured from the commercial catches at Muttukadu/Kovalam, in ponds and cages at Muttukadu. The fishes were maintained on a diet of live *Tilapia* @ 5% of body weight daily. The major problem encountered during broodstock maintenance, was infestation by parasites viz., protozoan *Trichodina* sp., monogenic trematode *Diplectanum latesi*, copepod *Caligus* sp., *Lernanthropus* sp., *Lernea* sp., isopod *Cynathora* sp. and *Acanthocephalus* sp. The fishes were effectively treated with 1 ppm Dichlorovos or 3 ppm malachite green. They were subsequently transferred during December 1995 to three newly constructed RCC tanks (100 ton capacity each) as mentioned above, and were weaned to a diet of frozen fishes viz., sardines, anchovies and *Nematolosa* sp.

Culture of brackishwater finfishes (FCD/FC/1)

Madras : K. V. Ramakrishna (PL), A. R. Thirunavukkarasu, Munawar Sultana, P. Kishore Chandra and M. Kailasam

Kakdwip : S. R. Das, P. K. Ghosh, R. K. Chakraborti and B. K. Banerjee

Narakkal : L. Krishnan

Culture of milkfish *Chanos chanos*

Milkfish fry of average size 25 mm/0.3 g collected from Muttukadu lagoon during

May-June 1995 were nursery reared in hapas and ponds. The fry were reared in a pond (150 m² area) fertilised prior to stocking, with raw cowdung @ 1,200 kg/ha and urea @ 300 kg/ha for production of lab-lab. At a stocking density of 1,06,667 no./ha and maintained on a diet of lab-lab (the natural food of milkfish) and supplementary feeds (groundnut oil cake and rice bran in the ratio of 1:1) @ 3% of body weight, the fry attained an average size of 120 mm/13 g in 60 days with a recovery rate of 62.5%. The lab-lab growth was sustained by fertilisation with raw cow-dung and urea @ 600 kg/ha and 150 kg/ha respectively, at fortnightly intervals. In hapas, @ 125 no./m² stocking density and maintained on supplementary feeds as mentioned above given @ 10% of body weight, the fry attained an average size of 86 mm/5 g in 45 days with a survival rate 57.2%.

Grow-out rearing of milkfish under pen culture (0.4 ha pen) at Muttukadu @ 5,000 no./ha stocking density and with supplementary feeds viz., groundnut oil cake and rice bran (1:1), gave encouraging results. The average size of fish attained over a rearing period of 6 months was 296 mm / 191 g from an initial average of 120 mm / 13 g. Under pond culture (polyculture with *P. indicus*) over a period of 6 months, at a low stocking density of 2,000 no./ha and with supplementary feeds, the average size of fish attained was 340 g from an initial average size of 50 mm / 1 g with a total production of 821 kg/ha/6 months. In monoculture, with seed of average size 49 mm/1 g, stocked @ 2,667 no./ha, the fishes attained an average size of 310 mm/175 g in 5 months. Similarly at Kakdwip, under monoculture over a culture period of one year, at a stocking density 2,830 no./ha the fishes attained an average size of 320 mm / 240 g from an initial average of 130 mm / 18 g.

Culture of grey mullet *Mugil cephalus*

Grey mullet seed of average size 98 mm/10 g collected from Muttukadu/Kovalam backwaters, were reared in a nursery pond

for a period of one month on pelleted feed @ 5% of body weight. The fishes on reaching an average size of 105 mm / 15 g were stocked in two grow-out ponds (0.15 ha each) at Muttukadu @ 2,000 no./ha and fed on a diet of groundnut oil cake and rice bran (1:1) @ 2% of body weight. The average growth attained over a period of 6 months was 354 mm/518 g.

Culture of seabass *Lates calcarifer*

Nursery rearing and grow-out culture of seabass *L. calcarifer* was successfully carried out at Kakdwip. Seabass seed, of average size 20 mm / 120 mg, nursery reared @ 14,000 no./ha, attained an average size of 142 mm / 37 g at the end of 94 days. With subsequent grow-out rearing, for a period of one year, the fishes attained an average size of 306 mm / 312 g.

Culture of pearlspot *Etroplus suratensis*

Pearlspot seed of average size 80 mm / 8 g stocked in 0.062 ha pond at Kakdwip @ 10,000 no./ha during November 1994 and fed on a diet of fish meal, groundnut oil cake and rice bran (1:1:1) @ 2-3% of body weight twice daily, attained an average size of 153 mm / 73 g in December 1995.

Integrated fish cum poultry farming

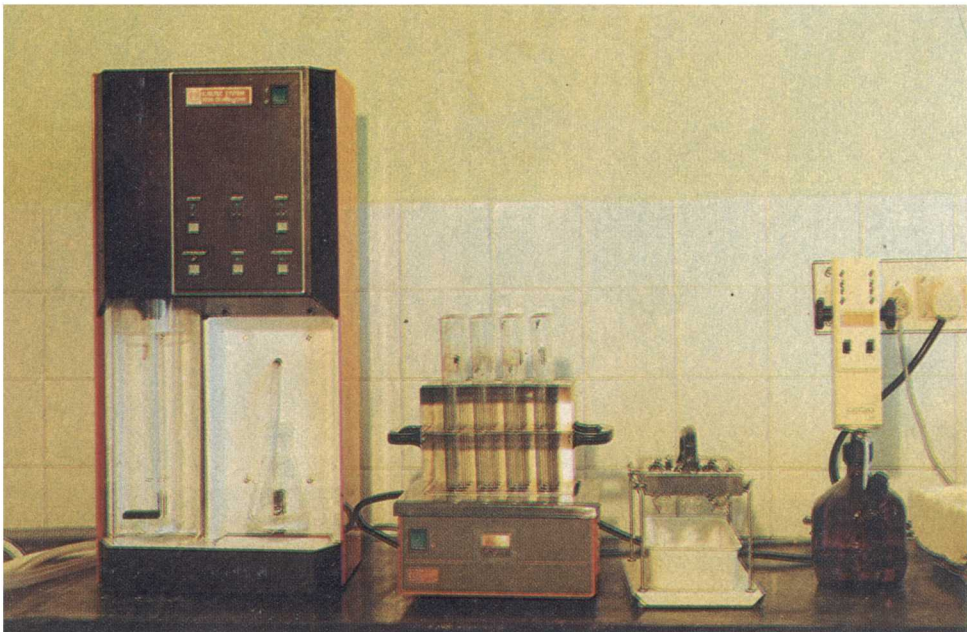
In order to develop low-input sustainable production technologies, mixed culture of compatible finfish species integrated with poultry farming was taken up at Madras (Muttukadu), Kakdwip and Narakkal. At low stocking densities ranging from 10,500 no./ha at Narakkal (with only pearlspot) to 20,000 no./ha at Madras and Kakdwip (with both shrimp and fish) and with less input, relying solely on natural production of food organisms generated by the decomposition of poultry manure, the growth of fishes and shrimp under integrated farming conditions was encouraging. The poultry consisting of layer birds were housed in a shed/cages (at a stocking density of 500 no./ha), constructed over one of the ponds. The fishes in the

control pond were maintained only on supplementary feed (groundnut cake and rice bran 1:1). At Madras, mixed culture of tiger shrimp *P. monodon* with *M. cephalus* and *E. suratensis* was carried out in two ponds, each 0.05 ha area. In the experimental pond with poultry, *P. monodon* grew to an average size of 18 g in 3 months of rearing, from an initial average size of 1 g, while pearlspot and *M. cephalus* reached an average size of 38 and 43 g respectively in 4 months of rearing, from an

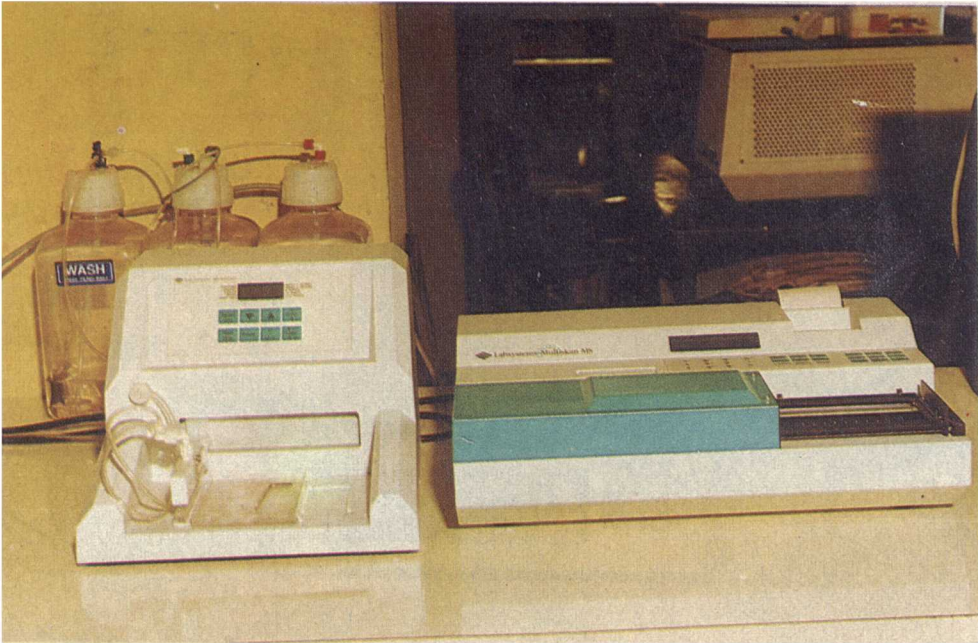
initial average of 11.5 and 3.1 g respectively. At Narakkal, pearlspot attained an average size 169 mm / 109 g over one year culture period in the poultry integrated pond compared to 153 mm/74 g in the control. Average size at stocking was 77 mm / 10. g. At Kakdwip, *P. monodon* and grey mullet *Liza parsia* of initial average size 12 mm and 30 mm respectively, attained an average size of 110 mm and 40 mm respectively in 3 months culture period in the poultry integrated pond.



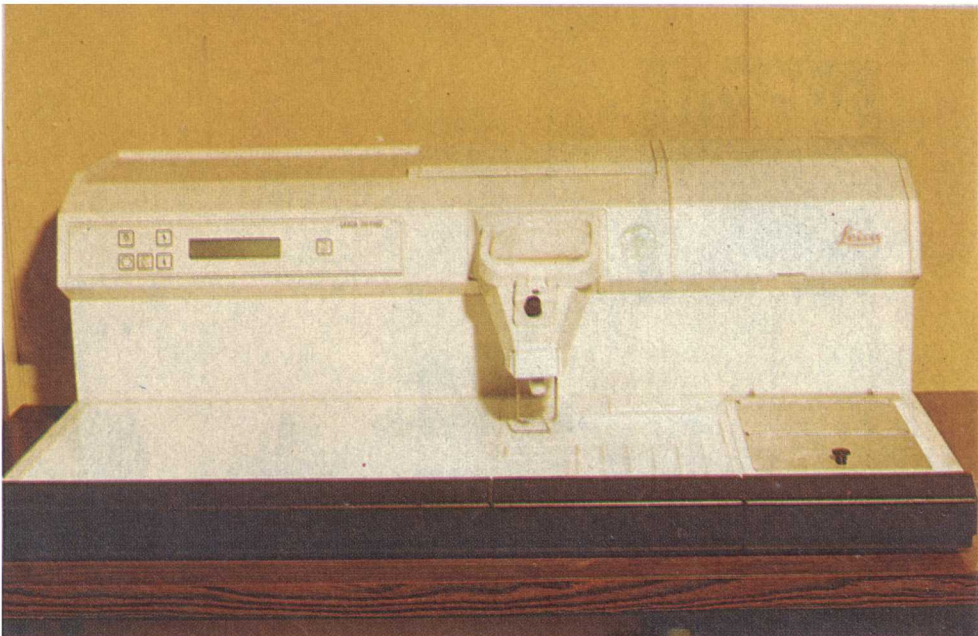
Fraction Collector



Kjeltec Auto System



ELISA Reader



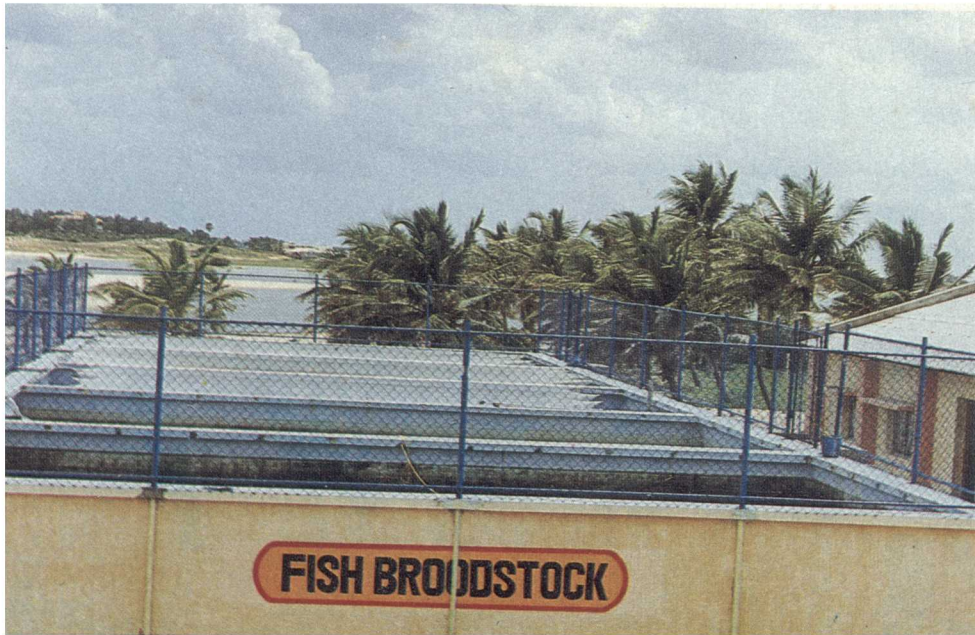
Histo-embedder



Poultry cum fish/shrimp farming at Kakdwip Centre



3 months old Rhode Island Red Variety layer birds



Broodstock holding facility for seabass and mullet at Muttukadu



A mini-bus for the transportation of staff to the field centre

TECHNOLOGY IMPROVEMENT DIVISION

Development of feeds for aquaculture of brackishwater shrimp and finfishes (TID/NT/1)

Madras : S. A. Ali (PL), M. Natarajan, D. N. Swamy, N. Kalaimani, C. Gopal, J.V. Ramana, K. K. Krishnani and M. Shashi Shekhar

Puri : C. P. Rangaswamy

Micro-particulate feeds for shrimp larvae/post-larvae

Micro-particulate feeds developed by the Institute for shrimp larvae and post-larvae were further improved by replacement of the milk protein, casein, with an equivalent amount of duck egg and by increase of total lipid content with the addition of fish oil. The proximate composition of the feed prepared by freeze-drying is as follows: protein 46.3%, fat 15.0%, carbohydrate 17.0%, ash 10.93% crude fibre 0.42% and moisture 10.45%. This feed was successfully tested on *P. monodon* larvae (Nauplius VI) stocked in FRP tanks (each 500 litre capacity) @ 10 no./l. The survival rate of larvae upto PL1 at the end of 8-9 days, when fed on a mixed diet of micro-particulate feed (2.5 g/tank) and diatoms (20,000 cells/ml), was much higher (90%) than those fed exclusively on diatoms (40,000 cells/ml), or micro-diets (5.0 g/tank) (73% and 40.6% respectively). In the case of post-larvae (PL1 to PL20), stocked in similar tanks @ 4 no./l, though the survival rate recorded at the end of 20 days was higher with micro-diet (2.5 mg/post-larvae) alone, being 57%, than with *Artemia* nauplii (20 nauplii/post-larvae), being 42%, the growth of post-larvae was better when fed with live feed (16.6 mm at PL20) than with micro-diet (14.4 mm at PL20).

Formulation and testing of feeds for broodstock shrimp/fish

Feeds were formulated for the broodstock of tiger shrimp *P. monodon* using fresh

clam meat, squid meal, polychaete worms and gingly cake. One of the feeds, containing 40% protein and incorporating free amino acids as attractants, was found to be readily accepted by the shrimp. The feeds were analysed for their essential amino acid composition (EAA) (Table 1). Based on this, the formulations were further refined to match the EAA profile of shrimp muscle. Feeding trials with ablated animals are underway.

A feed was also formulated for the broodstock of grey mullet, *M. cephalus*, using indigenous ingredients viz., fish meal (16%), soya flour (18%), groundnut cake (20%), cotton seed cake (5%), wheat bran (15%), wheat flour (10.0%), maida (2.3%), alfalfa (4.8%), vegetable oil (6%), yeast (0.5%), Spirulina (0.2%) and vitamins, minerals and antioxidants (2.2%). The feed prepared as dry pellets was found to be readily accepted by the fish.

Gooseberry as a source of vitamin C in shrimp feeds

Gooseberry as a source of Vitamin C was tested in the diet of tiger shrimp *P. monodon*. Feeding trials with juveniles for a period of 30 days indicated better growth and survival of shrimp when gooseberry was incorporated in a standard diet at 3% level (dry weight) compared to diets fortified with plain and protected vitamin C (Phosphate derivative).

Improvement of farm-made shrimp feeds in selected areas through Farmers Contact Programme

A comprehensive survey was conducted on the use and improvements in farm-made shrimp feeds in the districts of Godavari, Krishna, Prakasam and Nellore in Andhra Pradesh. The survey revealed that commercial shrimp feeds, both indigenous and imported have largely replaced hitherto

Table 1 : Essential amino acid profile of maturation feeds

	Formula I		Formula II		Formula III		Formula IV	
	% feed	% TP	% feed	% TP	% feed	% TP	% feed	% TP
Threonine	1.23	4.39	1.03	3.65	0.94	2.95	1.44	4.17
Valine	1.97	7.05	1.56	5.50	1.52	4.74	2.34	6.79
Methionine	0.42	1.49	0.32	1.15	0.35	1.11	0.55	1.59
Isoleucine	0.82	2.93	1.55	5.50	1.41	4.43	2.18	6.32
Leucine	1.14	4.07	0.97	3.44	0.85	2.66	1.34	3.88
Tyrosine	0.89	3.17	0.68	2.42	0.67	2.11	1.02	2.97
Phenylalanine	1.61	5.75	1.30	4.58	1.16	3.64	1.76	5.12
Histidine	0.69	2.48	0.63	2.24	0.57	1.79	0.84	2.44
Lysine	0.43	1.53	0.27	0.96	0.39	1.23	0.67	1.95
Arginine	1.63	5.83	1.55	5.47	1.22	3.83	2.28	6.61
EAAI (on muscle profile)	0.95	-	0.92	-	0.96	-	0.96	-
EAAI (on requirement studies)	0.99	-	0.96	-	1.00	-	1.00	-

TP-Total protein; EAAI - Essential amino acid index

used farm-made feeds. An interesting development in this region was the establishment of small-scale shrimp feed mills operating on hire basis and catering to the needs of individual farmers. Some of these farmers were given advisory service in feed formulation, use of binders and feed processing techniques.

Farm-scale shrimp feed processing and production technology

A technology package was developed for small-scale shrimp feed processing and production using a nutritionally balanced feed, formulated with indigenous ingredients such as squid meal, fish meal, shrimp head meal, soybean meal etc., to cater to the needs of small and medium shrimp farmers practising improved extensive and semi-intensive culture of tiger shrimp *P. monodon*. Based on this technology package, a proposal has

been prepared for the establishment of a farm-scale feed production unit for the Andhra Pradesh State Fisheries Department at Pallithumalapalem near Machilipatnam. Several requests have also been received from different organisations for setting up captive farm-scale shrimp feed production units.

Production and testing of formulated grow-out shrimp feeds developed by the Institute in selected farmers ponds

A grow-out shrimp feed formulation developed by the Institute was successfully tested under field conditions in a private farmer's pond at Ongole, in Andhra Pradesh. The feed, formulated using indigenous ingredients viz., fish meal, squid meal, soybean meal, shrimp head meal, squilla meal, wheat flour, vitamins, minerals and additives (proximate composition: crude protein

41.56%, fat 8.13%, carbohydrate 21.97%, moisture 5.35%, crude fibre 4.45% and ash 18.54%) was supplied in 4 grades namely Pre-starter (0.5 mm), Starter (1.0 mm), Grower and Finisher (3 mm). At a stocking density of 70,000 no./ha, *P. monodon* (PL20) attained an average size of 22 g in 112 days, the growth being comparable to that achieved with imported commercial feeds.

Production and testing of shrimp feeds in interaction with industry

In order to promote interaction with the shrimp industry for on-farm research, steps have been initiated to collaborate with the commercial feed manufacturers for large-scale production of feeds using the feed formulations developed by the Institute. Testing of these feeds under field conditions in association with the industry will be subsequently taken up.

Development of standards for quality control of shrimp feeds.

To develop quality standards for shrimp feeds, fifteen commercial feeds (both indigenous and imported) were analysed for their proximate composition. Indigenous feeds generally showed higher percentage of acid insoluble ash compared to imported feeds. Moisture content of some of the feeds analysed was high (17%). Water stability of pellets determined at different time intervals indicated that loss in weight of pellets occurred in the first half-hour and almost remained constant upto seven hours. Studies are in progress using standard AOAC methods to estimate the total volatile nitrogen which determines the rancidity of fat for stored feed samples.

Diagnosis, prophylaxis and control of diseases of commercially important brackish water shrimp/fish (TID/DIS/1)

Madras : S. V. Alavandi (PL), T.C. Santiago, K. K. Vijayan, S. S. Mishra, K. V.

Rajendran, M. Shashi Shekhar and K.O. Joseph.

Database on shrimp diseases

Shrimp farms in the coastal districts of Orissa viz., Bhadrak and Balasore and Andhra Pradesh viz., East Godavari, West Godavari, Krishna and Prakasam were surveyed to investigate the shrimp disease outbreaks in those areas. Detailed microbiological and histopathological investigations revealed that the white spot disease was the major cause of mortality of shrimp *P. monodon* and *P. indicus* in most of the farms. Analysis of *P. monodon* samples from shrimp farms near Kannur (Kerala) revealed that the disease had also struck the coastal districts along the west coast. Further, the incidence of white spot disease was also observed in the brood-stock of *P. monodon* in shrimp hatcheries at Madras and Nellore. The causative agent of this disease was identified to be a virus, the Systemic Ectodermal and Mesodermal Baculovirus (SEMBV). The major clinical symptoms included circumscribed white spots on the carapace and other parts of the cuticle, broken antennae and discolouration of the body. Experimental induction of the disease to study the host range of the virus revealed that in addition to shrimp, crabs of the genus *Scylla* were also affected by the disease. Studies on the mode of transmission of the virus to the host indicated that SEMBV infection can be elicited in healthy animals by feeding on the carcass of infected animals as well as by intra-muscular injection with extracts of gills from the same.

Apart from the white spot disease, Monodon Baculovirus (MBV) was also prevalent in the farms in Andhra Pradesh and Tamil Nadu. The shrimp larvae were affected by this disease in some of the hatcheries in Nellore and Ongole (A.P) and Kovalam and Chinglepet areas (T.N.). In addition to these two major diseases, Vibriosis and protozoan infection caused by *Zoothamnium* sp. were also common in both hatcheries and farms.

Parasitic infections in commercially important brackishwater finfishes

A detailed study was conducted on the parasitic infection of seabass broodstock, *Lates calcarifer*, held in ponds at Muttukadu. The fish were found infested with leech, *Lernanthropus* sp., *Caligus* sp., *Diplectanum* sp. and *Acanthocephala* sp. The affected fish were treated with formalin (100 ppm) and Dichlorovos (1 ppm).

Development of diagnostic tests

Diagnostic tests *viz.*, Dot immunoassay and Enzyme-linked immunosorbent assay (ELISA) were used for the rapid diagnosis of shrimp bacterial diseases caused by *Vibrio* sp. and *Aeromonas* sp. 160 isolates of bacteria were tested and 65 were found to be positive for the former and 12 for the latter.

Molecular characterisation of bacteria was initiated by isolation of plasmid DNA from a pathogenic *Vibrio anguillarum* with subsequent restriction enzyme digestion.

Efforts were made to isolate the DNA from the spores of a microsporidian parasite which caused cotton shrimp disease in *P. indicus*, in order to produce a DNA probe for the early diagnosis of the disease and to screen the intermediate hosts.

Studies on the shrimp defence system

Preliminary studies were carried out on the basic immune system of the shrimp, *P. monodon*. Two types of haemocytes, granulocytes and agranulocytes were identified and total haemocyte count (THC) of normal shrimp of different moult stages was standardized. Studies on the variation of THC in experimentally disease-induced shrimp are underway to understand the diagnostic value of THC in viral diseases. Interactions between haemocytes and *Vibrio* bacteria were studied *in vitro* to identify their role in defence functions *viz.*, phagocytosis and degranulation.

Challenging shrimp / fish with specific pathogens and development of disease control measures

Use of bleaching powder and other chemicals/drugs:

Studies were conducted on the use of bleaching powder (chlorination) in the control of viral diseases caused by SEMBV and MBV. Homogenised tissue samples from SEMBV and MBV-infected shrimp were treated with various concentrations of bleaching powder ranging from 50 to 4000 ppm at 4°C for different periods of time. Healthy *P. monodon* (5 g) were injected with SEMBV-infected tissue homogenate filtrate or fed with MBV-infected tissue samples. Observations indicated that treatment with high concentrations of bleaching powder *i.e.*, 1000 ppm and above, for more than 5 hours, seemed to inactivate SEMBV / MBV.

Different brands of commercially available bleaching powder were tested at various concentrations ranging from 50 to 4000 ppm (10 to 1000 ppm chlorine) for their antibacterial activity. Tests with water from various sources with variable organic load and peptone water indicated that the presence of proteins and organic matter reduced the antibacterial activity of bleaching powder.

Various chemicals and drugs *viz.*, copper sulphate, formalin, malachite green, furazolidone, potassium permanganate, benzalkonium chloride, bromosept, tetracycline, sulphadizine, choramphenicol etc. were tested for their inhibitory effect on bacterial growth *in vitro*. The minimum inhibitory concentration (MIC) for *Vibrio* sp. was estimated to be 100, 25, 6, 25, 50, 1.5, 1.5, 50, 12 and 3 ppm respectively.

Reproductive physiology of brackishwater fish and shrimp (TID/RP/1)

Madras : T. C. Santiago (PL), K. K. Vijayan, P. Kishore Chandra, M. Shashi Shekhar, P. S. P. Gupta, K. K. Krishnani and K. V. Rajendran.

A selective breeding experiment was conducted with three size groups of *P. monodon* from three different mothers, to identify strains with disease resistance and faster growth. In order to rule out variations due to environmental factors all the animals were grown in identical conditions and the RNA/DNA ratio was periodically estimated from the three groups. Larger animals from 3 mothers were shown to possess greater RNA/DNA ratio compared to smaller animals. Preliminary experiments conducted on disease resistance, indicated that larger animals exhibited better disease resistance compared to smaller animals.

Studies on genetic manipulation for molecular sexing were initiated in the

seabass *Lates calcarifer*. As a first step, the technique of preparing metaphase chromosomes was standardised. The chemical colchicine was injected into the fish (1 mg/ml/100 g body weight) and blood samples were collected and processed to obtain metaphase chromosomes. Work is in progress to separate nuclei and prepare blocks for pulse field electrophoresis.

Cryopreservation of milt was carried out using the milt of grey mullet *M. cephalus* diluted in the extender Fish Ringer and cryoprotectant 5% dimethyl sulphoxide (DMSO). The cryopreserved milt was tested periodically for motility estimation. The samples showed a post-thaw motility around 50%.

AQUACULTURE ENGINEERING AND ENVIRONMENT DIVISION

Soil and water quality and productivity management for sustainable shrimp farming (AEED/PM/1)

Madras : B. P. Gupta (PL), K.O. Joseph, K. K. Krishnani, M. Muralidhar and P.S. Sudeesh

Kakdwip : R. K. Chakraborti

Natural productivity and its enhancement by application of different manures and fertilizers

To understand the natural productivity and its enhancement in culture systems, a series of yard experiments were conducted using different organic and inorganic manures viz., cattle dung @ 1%, poultry manure @ 0.3%, urea @ 50 kg/ha and single superphosphate @ 30 kg/ha, added singly or in combination to filtered seawater held in 1 ton capacity cement tanks with a 10 cm layer of saline soil at the bottom and the effect on plankton and benthos production was assessed before and after rearing postlarvae of *P. monodon* (average weight 0.3g) @ 8 no./m². The water and soil quality in the tanks was analysed at weekly intervals for a period of 29 days prior to stocking the shrimp. The ammonia (0.009 - 0.018 ppm), nitrite (0.005 - 0.01 ppm), COD (5.0 - 17.6 ppm), BOD (2.8 - 6.0 ppm) and H₂S (BDL) were found to be within acceptable levels with different types of manure and fertilizer treatments. However the soil phase registered a reducing condition (Eh -70 to -120 mV) on treatment with manures. Higher productivity was noticed with combined treatments (114.5 - 277.0 mgC/m³/hr). At the end of the period the shrimp were introduced for rearing with and without supplementary feed for a period of 120 days. The experiment is in progress.

Soil and water quality and biological productivity in relation to culture practices

The soil and water quality and biological productivity was studied in relation to culture practices in a commercial farm at Venkannapalem, Nellore (A.P.). The data recorded during the culture phase in both semi-intensive and extensive types of culture systems is presented in Table 2. Soil conditions were also noted during pond preparation and after harvest. There was a significant increase in organic carbon in both systems from culture to harvest period (Table 2). Mud reducing conditions were comparatively higher in semi-intensive culture (Eh -180 mV) than extensive culture (Eh-120 mV).

Changes in soil-water interface due to accumulated organic matter

In order to study the changes in soil-water interface due to accumulation of organic matter, a yard experiment was initiated using cement tanks (1 ton capacity) holding filtered seawater with a 10 cm layer of saline soil at the bottom. Different size groups of shrimp viz., 0.3 g, 7.0 g and 16 g were stocked in the tanks @ 8 no./m² and fed with suitable feed provided in starter, grower and finisher grades @ 8%, 5% and 3% of body weight respectively. At the end of a period of 28 days, the values of Eh and organic carbon were found to be higher with finisher feed (Eh -130 mV, organic carbon 0.19%) though within acceptable limits, than with starter (Eh - 106 mV, organic carbon 0.16%) or grower feeds (Eh -115mV, organic carbon 0.16%). The concentration of ammonia (0.005 ppm) and nitrite (0.019 ppm) were also higher with finisher feed compared to starter and grower feeds (0.002 and 0.005 ppm respectively for starter feed and 0.003 and 0.007 ppm respectively for grower feed).

Table 2: Soil and water quality in relation to culture practices-study in a commercial farm (45 ha, at Venkannapalem, Nellore)

A. Water Quality						
Parameters	Extensive		Semi-intensive			
Transparency, NTU	100.0		120.0			
Alkalinity, ppm	120.0		158.0			
Dissolved Oxygen, ppm	6.2		7.4			
Total Suspended Solids, ppm	106.0		112.0			
Nitrate, ppm	0.08		0.09			
Orthophosphate, ppm	0.008		0.009			
B. Soil condition						
Parameters	Culture period (Sept.'95)		After harvest (Oct.'95)		During pond preparation (Jan.'96)	
	EX	SI	EX	SI	EX	SI
pH	8.4	8.7	8.2	8.3	8.1	8.1
EC (mmhos/cm)	5.4	4.6	9.5	9.2	18.8	17.6
Eh (mV)	-120	-180	+20	+17	ND	+50
Organic Carbon (%)	0.21	0.27	0.60	0.77	0.18	0.27

EX - Extensive; SI - Semi-intensive

Evaluation of effects of bioaugmentors and other chemicals used in shrimp farms

The effect of 2 bioaugmentors *viz.*, bio-clean and super oxygen @ 3 ppm each and 4 chemicals *viz.*, sodium nitrate @ 10 ppm, calcite and dolomite @ 25, 50 and 100 ppm for both and $KMNO_4$ @ 2.5, 5.0 and 7.5 ppm, was evaluated on the mud redox potential of brackishwater soils under laboratory conditions. Preliminary studies indicated that the dose of chemicals used should be increased to obtain desired results.

Design and development of machinery and structures for aquaculture (AEED/AE/1)

Madras : P. Lakdhanadoss (PL) and M. Jayanthi

With the objective of utilising non-conventional energy resources *viz.*, wind energy for pumping ground water to the

brackishwater culture ponds at Muttukadu, a geared windmill was installed and its performance was evaluated. The discharge rate was measured and found to vary from 300 to 1200 litres / hour depending on wind speed. The economic feasibility of windmill was worked out in comparison with diesel and electrically-operated pumps. The internal rate of returns (IRR) was 56.6% for windmill with subsidy and 25.7% for windmill without subsidy. On the other hand, the IRR for the diesel and electric pumps was 79.3% and 52.6% respectively.

The prototype of the automatic feed dispenser unit developed by the Institute was tested for satisfactory performance and handed over for use in the Institute's hatchery at Muttukadu.

With a view to develop cost-effective seepage control measures, studies have been initiated to estimate seepage loss in brackishwater farms in different areas.

Layout, systems and design of small-scale shrimp hatchery

Madras : K. Alagarwami (PL), L. H. Rao and P. Lakshmanadoss

Designs for backyard and small-scale shrimp hatchery viz., 2, 5 and 10 million capacities for *P. indicus* / *P. monodon*, have been prepared incorporating the necessary information on infrastructure required for construction.

EXTENSION, ECONOMICS AND INFORMATION DIVISION

Investigations on the brackishwater aquaculture practices adopted by different categories of farmers - an integrated approach (EEID/EXTN/1)

Madras : K. Gopinathan (PL), M. Krishnan, T. Ravisankar, D. D. Vimala and V. Chellapandian

Survey of shrimp farms in the coastal districts of various maritime states was continued during the period April 1995 to March 1996. A total of 48 farms with a waterspread area of about 541.06 ha were surveyed in the states of Maharashtra, Goa and Tamil Nadu and in the Union Territory of Pondichery.

In Maharashtra, the production of tiger shrimp *P. monodon* ranged from 1500 to 2500 kg/ha/crop under semi-intensive culture, 600-900 kg/ha/crop under extensive culture and 800-900 kg/ha/crop under modified extensive using both Indian and imported feeds. In Goa, *P. merguensis* was cultured under extensive and modified extensive systems.

Killai, Agaram and Parangipettai areas in South Arcot district of Tamil Nadu practised semi-intensive culture of *P. monodon* with productions ranging from 2000 - 3000 kg/ha/crop. Kattur, Poompuhar and Vanagiri areas in Nagai Quadi-i-milleth district practised semi-intensive culture of both

P. monodon and *P. indicus* with productions ranging from 1800 to 3000 kg/ha/crop, depending mainly on hatchery-reared seed. Disease problems were encountered in some farms in the Thanjavur area in Tamil Nadu. In Pondichery area both *P. monodon* and *P. indicus* crops were affected with white spot disease. Socio-economic conditions and extension needs of the farmers were also noted.

Development of database for brackish water fishery resources (EEID/EXTN/2)

Madras : M. Krishnan (PL), K. Gopinathan, T. Ravisankar, D. D. Vimala and V. Chellapandian

Data on various aspects of brackish-water fishery resources was collected from journals and other published sources; National Institutes viz., National Institute of Oceanography, Goa, Indian National Oceanographic Data Centre (INODC), M. S. Swaminathan Research Foundation, Madras; state fisheries departments and other sources. The data from the state departments was computerised and is made available on MS DOS 5.0 based software developed under the project. The data obtained from other sources is yet to be classified. With the development of FISHNET network, changes in data entry will be made.

EXTERNALLY FUNDED PROJECTS

Project funded by Dept. of Biotechnology

Development of feed technology for semi-intensive/intensive shrimp farming (duration : 4 years from 19.12.1992)

Coordinator : Dr. K. Alagarswami

Personnel : S. Ahamad Ali (Principal Investigator) C. Gopal and J. V. Ramana

Feeds formulated using indigenous feed ingredients viz., fish meal, squid meal, squilla meal, soybean meal, wheat flour, fish oil etc. were tested under yard and field conditions in *P. indicus* and *P. monodon* along with three commercial imported feeds. The growth performance of shrimp with the formulated feeds was comparable to that obtained with imported feeds. FCR values in *P. monodon* for both starter and grower feeds were 1.76, 1.64, 1.52 and 1.39 for DBT, Lux (Waterbase), CP and Hanaqua brands respectively. FCR values obtained in *P. indicus* were 1.95 and 1.93 for DBT and CP feeds respectively. Feed production trials were carried out and standardized using the formulated feeds.

Based on the dietary requirements of both *P. monodon* and *P. indicus*, vitamin mixtures were formulated and incorporated at 0 to 2.5% level in shrimp feeds. Results obtained showed that the growth of the shrimp was enhanced when the feeds were fortified with vitamin mixtures at 0.5 to 1.0% level.

Natural and synthetic feed materials were tested for their attractant and growth promoting properties in *P. monodon*. Among the natural materials, greater attractant property was exhibited by fish paste while squid meat exhibited greater growth promoting property. Synthetic materials such as DMS showed both greater attractant and growth promoting properties.

Studies on the effect of particle size on pelletability and digestibility of feeds indi-

cated that when feed materials viz., fish meal, shrimp head and squilla were micro-pulverized using a 0.5 mm screen and passed through six different sieves of 10, 18, 38, 52, 60 and 72 standard mesh, the digestibility of pellets ranged from 55.6 to 61.4% with 10 to 18 mesh sieve and 65.1 to 71.3% with 38 to 72 mesh sieve. The pelletability was also good when the particle size was 350 microns (38 mesh sieve).

Project funded from A. P. Cess Fund

Impact of brackishwater aquaculture on the environment (duration from 12.11.1992 to 11.11.1995)

Coordinator : Dr. K. Alagarswami

Personnel: K. O. Joseph (Principal Investigator), B. P. Gupta, S. V. Alavandi, S.S.Mishra, K. K. Krishnani and M. Muralidhar

Study of Kandaleru Creek area

The study on the environmental impact of shrimp farming in the Kandaleru Creek area was completed during the year. The study revealed that the Kandaleru Creek ecosystem was subjected to excessive organic pollution resulting in a serious negative feedback to the shrimp farming activity of this area. Environmental degradation and deterioration in the water quality of the creek and adjoining shrimp farms triggered the outbreak of viral and bacterial diseases during 1994-95 leading to large-scale mortality of shrimp. Consequently, shrimp farming activity was suspended in the area till July/August 1995. Thereafter, a low level of activity was observed which was estimated to occupy about 10% of the existing farm area.

Survey of the creek during 12-13 January and 18-19 October 1995, showed a perceptible improvement in water quality as given below: total suspended solids (TSS) 20-42 ppm, turbidity 15-36 NTU; COD 3.0 -

11 ppm; BOD 1.2 - 4.2 ppm; nitrate 0.04 - 0.08 ppm; orthophosphate 0.002 to 0.01 ppm; total nitrogen 0.16 - 0.32 ppm; total phosphorus 0.03 - 0.09 ppm; free ammonia 0.001 - 0.003 ppm; nitrite 0.01 - 0.03 ppm; hydrogen sulphide BDL.

Survey of shrimp farms in the coastal districts of Tamil Nadu

A survey of the disease affected shrimp farms in the V. O. Chidambaranar (VOC) and Ramanathapuram districts of Tamil Nadu during July 1995 revealed that disease outbreaks were restricted to farms practising intensive and semi-intensive culture.

Salinisation of coastal soils around shrimp farms

A study was conducted on the salinisation of coastal soils adjacent to brackishwater aquaculture farms in the Nellore district of Andhra Pradesh. The study has shown low level salt accumulation near the farms, the levels decreasing with increasing distance from the farms.

Treatment of waste water from shrimp farms

Laboratory experiments were conducted to find out suitable lime materials for the treatment of acidic farm effluents. Different commercially available lime materials viz., calcite (CaCO_3), dolomite (CaCO_3 , MgCO_3) and calcium hydroxide [$\text{Ca}(\text{OH})_2$] were used in different concentrations viz., 25, 50 and 100 ppm each for treating the effluents. Results indicated that calcium hydroxide is superior to calcite and dolomite in ameliorating the acidic condition of effluents. It can be effectively and economically used @ 25 ppm for treating acidic farm effluents. Hourly pH readings indicated that the pH level of effluents (7.35) increased 2 hours after treatment with calcium hydroxide (7.50) and thereafter remained constant.

Toxicological studies with heavy metals and pesticides

The permissible safe levels of heavy metals and pesticides in brackishwater medium for the culture of tiger shrimp *P. monodon* were estimated by conducting static bio-assay tests. The 96 h median lethal concentrations (LC 50) calculated for Cr, Cu, Zn, Cd and Hg were 4.20, 1.20, 1.50, 0.15 and 0.03 mg/l respectively in *P. monodon* of size range 33-47 mm. Similarly, the 96 h LC 50 values for DDT, BHC, heptachlor and endosulfan were 2.08, 4.10, 16.25 and 2.90 $\mu\text{g/l}$ respectively.

Based on the extensive database generated under this project on environmental impact assessment, the Institute has helped the Union Ministry of Agriculture and the Govts. of Andhra Pradesh and Tamil Nadu in formulating guidelines for aquaculture and standards for farm effluents. The results of this project are also of great benefit to the various State Governments in planning and development of brackishwater aquaculture zones and to the respective State Pollution Control Boards in their regulatory activity.

Project funded by ICAR/National Agricultural Research Project (NARPI/IBRD) Aquaculture : Basic research on pond bioenergetics, digestive enzymes and microflora in fish and shrimp under aquaculture (duration 30.9.1992 to 30.6.1996)

Sub-activity:

Identification and characterisation of digestive and gut microbial enzymes in brackishwater fish and shrimp and enzyme mediated bioconversion of feed ingredients.

Principal Investigator : Dr. K. Alagarswami

Personnel : M. Natarajan (Project-in-charge), N. Kalaimani, T. C. Santiago, K. K. Vijayan, S. A. Ali, D. N.

Swamy, S. V. Alavandi and S. S. Mishra

Studies on the changes in activity levels of digestive enzymes *viz.*, protease in relation to moult stage in *P. monodon* (size range 50-70 mm/0.5-1.5 g), showed that total protease activity was minimum in shrimp at late premoult and postmoult stages (617 and 2189 μM tyrosine/min/g of hepatopancreas tissue respectively) and maximum at intermoult and early premoult stages (2310 and 4046 μM tyrosine/min/g hepatopancreas tissue respectively). Changes in activity levels of lipase were recorded in relation to size of animals. Mean lipase activity was 19.32 ml 0.05 N NaOH/g tissue in 6 hours, in smaller animals (*P. monodon* 2-5 g), while in larger animals it decreased to 14.37 ml 0.05 N NaOH/g tissue in 6 hours.

Ammonia excretion was studied in *P. monodon* fed with diets prepared using different protein sources. Smaller animals of size group <1g and between 3-5 g exhibited higher levels of ammonia excretion in 24 hours when fed with a diet incorporating sunflower cake followed by diets with squilla meal, fish meal, shrimp head meal, soybean meal and squid in descending order. In larger animals 10-12 g size, higher levels of ammonia were excreted when fed on squilla meal diet and *vice versa* with soybean meal diet. The excretion of ammonia by different size groups of shrimp seems to be related to the feed ingredient and may not be size specific.

The effect of papain, an exogenous protease enzyme, on protein digestibility was tested in postlarvae, juveniles and adults of *P. monodon*. The enzyme incorporated at 0.1, 0.2, 0.3 and 0.5% in a feed formulation, showed only marginal positive effect on protein digestibility upto 0.3% level which was not significantly different from control diet devoid of papain.

Other studies on digestibility of different dietary constituents indicated that juvenile *P. monodon* exhibited excellent

digestibility of carbohydrate in the diet, ranging from 87.1 to 96.2%, whereas that of lipid ranged from 70.8 to 90.1%.

Use of probiotics in shrimp feed

Preliminary experiments on the use of probiotics in shrimp feed indicated that the digestibility of feed and growth of shrimp (juvenile *P. monodon*) were considerably enhanced when probiotics *viz.*, shrimp gut microflora, *Spirulina*, yeast and *Lactobacillus* were incorporated in shrimp feeds, the digestibility levels being 91, 89, 88 and 85% respectively, with 69% in control.

Bioconversion of feed ingredients

A total of 64 gut bacterial isolates from *P. monodon* were screened for proteolytic, amylolytic, lipolytic, cellulolytic and chitinolytic activity and bioconversion experiments were carried out by solid-state fermentation method using selected bacteria.

Bioconversion of soyabean meal, fish meal and squid using proteolytic microbes *viz.*, *Lucibacterium* sp., showed that a fermentation period of 5 days was optimal for maximum release of monomeric units (amino acids) from the raw materials. Bioconversion of fish oil by lipolytic bacteria *Lucibacterium* sp. resulted in liberation of fatty acids after 24 hours of fermentation with a maximum on 4th day. The bioconversion of chitinous materials *viz.*, shrimp head waste and squilla meal with and without heat treatment using chitinolytic *Cytophaga* sp., *Aeromonas* sp., and *Alkaligenes* sp., indicated that natural microbial fermentation of shrimp facilitates the release of N-acetyl glucosamine with peaks on 2nd and 3rd day. The results also indicated that bioconversion is efficient when pure cultures are used in higher inoculum rates. The bioconversion of cellulose-rich plant residues *viz.*, sugarcane bagasse and soybean meal by a cellulolytic bacterium *Pseudomonas* sp., resulted in the liberation of glucose after 24 hours reaching a maximum on 4th and 6th day. However in this case,

studies indicated that pre-treatment of soybean was essential for improving fermentation and facilitating attack by the cellulolytic enzymes.

The bioconversion of formulated feed mixtures consisting of 5% shrimp head waste, 5% bagasse, 25% soybean meal, 40% fish meal, 5% squid meal, 10% wheat flour and 4% fish oil, using a mixed culture of bacteria (*Lucibacterium* sp., *Pseudomonas* sp. and *Al-*

kaligens sp.), facilitates the release of free amino acids, glucose and N-acetyl glucosamine with a peak on 6th day of fermentation. Further studies on the use of bioconverted materials in shrimp feeds indicated that the digestibility of feeds was appreciably increased to 86% compared to 69% with unfermented feeds and 71% with feeds fermented under natural condition without inoculation of microbes.

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* Also includes publications of Scientists of the Institute based on their work in previous Institutes.

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PERSONNEL
(Not a Gradation List)

DIRECTOR
Dr. K. ALAGARSWAMI

SCIENTISTS

Principal Scientist

Dr. K.V. Ramakrishna
Dr. R.D. Prasadam

Senior Scientist

Dr. L. Hanumantha Rao
Dr. Mathew Abraham
Dr. P. Ravichandran
Dr. A. Laxminarayana
Dr. S. Kulasekarapandian
Dr. S.M. Pillai
Dr. L. Krishnan
Dr. A.R. Thirunavukkarasu
Dr. Syed Ahamad Ali
Dr. K. Gopinathan
Dr. C.P. Rangaswamy
Dr. B.P. Gupta
Dr. M. Natarajan
Dr. P.K. Ghosh

Scientist (Selection Grade)

Shri K. Devarajan
Shri Hardial Singh
(Rejoined on 18.3.1996 after deputation
from Punjab Agro Industries Corpora-
tion from 1.3.1994 to 1.3.1996)
Shri S.R. Das
Shri M. Kathirvel
Dr. T.C. Santiago
Shri R.K. Chakraborti
Shri S. Srinivasagam
Shri D. Narayanaswamy
Shri N. Kalaimani
Dr.(Smt.) Munawar Sultana

Scientist (Senior Scale)

Shri B.K. Banerjee
Dr. M. Krishnan
Dr.K.O. Joseph
Dr.C. Gopal
Shri S.V. Alavandi

Scientist

Dr. K.K. Vijayan
Shri T. Ravisankar
Smt. D. Deboral Vimala
Dr. (Kum.) Shiranee Periera
Dr. S.S. Mishra
Dr. J.V. Ramana
Dr. P.S.P. Gupta
Dr. P. Kishore Chandra
Shri. V. Chellapandian
Shri P.S. Sudheesh
Dr. K.V. Rajendran
Smt. Imelda Joseph
Dr. K. K. Krishnani
Dr. M. Muralidhar
Smt. M. Jayanthi
Shri M. Shashi Shekhar
Shri R. Rangeswaran
Shri M. Kailasam
Shri C.P. Balasubramanyam

Technical

Shri P. Lakshmanadoss, T-7(Engineer)
Shri P.M.A. Kadir, T-5
Shri N. Venugopal, T-5
Shri R. Elangovan, T-4
Shri S. Krishnan, T-4
Shri S. Sivagnanam, T-II-3
Shri R. Puthiavan, T-II-3

Shri V.R. Senthil Kumar, T-II-3
 Shri D. Rajababu, T-II-3
 Shri Vasanthakumar Charles, T-II-3
 (joined on 20.11.1995)
 Shri S. Rajukumar, T-II-3
 (joined on 28.11.1995)
 Shri Rajeswar Singh, T-II-3
 (joined on 1.12.1995)
 Shri Joseph Sahayarajan, T-II-3
 (joined on 8.12.1995)
 Shri Marella Ravi, T-II-3(joined on
 11.12.1995)
 Shri K.K. Surendran, T-I-3
 Shri C.S. Sasidharan, T-I-3
 Shri M.G. Sivadasan, T-I-3
 Shri M.G. Subramani, T-I-3(Driver)
 Shri M. Gopinathan Nair, T-I-3 (Driver)
 Shri B.B. Roy, T-I-3(Driver)
 Shri N. Ramesh, T-1
 Shri S. Saminathan, T-1
 Shri C. Ananthanarayanan, T-1
 (joined on 6.10.1995)
 Shri P. Manickyam, T-1
 (w.e.f. 10.11.1995)
 Shri S.S. Maity, T-1
 (w.e.f. 18.11.1995)
 Shri P.S. Samantha, T-1
 (w.e.f. 21.11.1995)
 Kum. Chanda Mazumdar, T-1
 (joined on 28.11.1995)
 Shri N. JaganMohan Raj, T-1
 (joined on 15.2.1996)
 Shri M. Chinnakuppan, T-1
 (joined on 26.2.1996)

ADMINISTRATIVE PERSONNEL

Shri S. Veeraswamy, Administrative
 Officer (Relieved on 11.12.1995)
 Shri S. Sasidharan, Administrative
 Officer (from 11.12.1995)
 Shri S. Krishnaswamy, Asst. Finance &
 Accounts Officer
 Shri P.K. Sabapathi, Superintendent
 (on deputation from SBI, Coimbatore)
 Shri N. Raghavan, Senior Stenographer
 Smt. S. Bhagirathi, Assistant

Shri R. Palaniswamy, Assistant
 (on deputation from CICR ,Coimbatore)
 Shri A.B. Mondal, Assistant
 (w.e.f. 6.6.1995)
 Shri R. Kandamani, Senior Clerk
 Shri R.G. Ramesh, Senior Clerk
 Smt. V. Usharani, Senior Clerk
 (w.e.f. 24.5.1995)
 Shri P.N. Rajasekharan Nair, Senior
 Clerk (w.e.f. 25.5.1995)
 Shri P.K. Roy, Senior Clerk
 (w.e.f. 19.6.1995)
 Shri S.K. Haldar, Stenographer
 (w.e.f. 7.3.1996)
 Kum. S. Nalini, Junior Stenographer
 Smt. K. Hemalatha, Junior Stenographer
 Kum. K. Subhashini, Junior Stenogra-
 pher (joined on 23.8.1995)
 Shri K. Mani, Junior Clerk
 Shri S.K. Bindu, Junior Clerk
 Smt K. Nandini, Junior Clerk
 Shri S. Pari, Junior Clerk
 Smt. E. Amuthavalli, Junior Clerk
 Shri A. Manoharan, Junior Clerk
 Shri R. Suresh, Junior Clerk
 (joined on 1.6.1995)
 Shri A. Sekar, Junior Clerk
 (joined on 26.9.1995)
 Smt. E. Mary Desouza, Junior Clerk
 (joined on 6.10.1995)
 Shri P. Srikanth, Junior Clerk
 (joined on 23.2.1996)

AUXILIARY PERSONNEL

Shri P.C. Mohanty, Driver
 Shri K. Paranthaman, Driver
 Shri N. Mani, Gestetner Operator
 (w.e.f. 24.5.1995)

SUPPORTING STAFF

(Strength of supporting staff grades
 I,II,III and IV in the ratio of 8:4:2:1 has been
 fixed with effect from 7.3.1996)

S.S.Gr. IV

Shri A.K. Mondal

Shri D.N. Sahoo (w.e.f. 20.3.1996)
Shri N.C. Jena (w.e.f. 20.3.1996)
Shri Sita Ram Das (w.e.f. 20.3.1996)
Shri S.C. Mondal (w.e.f. 20.3.1996)
Shri Gunadar Das (w.e.f. 20.3.1996)

S.S.Gr. III

Shri L.C. Manna
Shri Prakash Chandra Saha
Shri Badlu Dhanuk(w.e.f. 20.3.1996)
Shri K.K. Raman (w.e.f. 20.3.1996)
Shri Dhaneswar Das(w.e.f. 20.3.1996)
Shri R.K. Behera(w.e.f. 20.3.1996)
Shri Shyam Bhoi(w.e.f. 20.3.1996)
Shri Sita Ram Bahadur(w.e.f. 20.3.1996)
Shri A.E. Raju(w.e.f. 20.3.1996)
Shri M.N. Biswas(w.e.f. 20.3.1996)
Shri Shyamlal Dhanuk(w.e.f. 20.3.1996)
Shri A.K. Biswas(w.e.f. 20.3.1996)

S.S. grade II

Shri Biswanath Mondal
Shri K.M. Das
Shri B.K. Jena
Shri M.N. Mondal
Shri Amulya Bijali
Shri N.C. Samanta
Shri N.K. Shanmugham
Shri P. Arumugam
Shri Baman Jally
Shri R. Subramani
Shri Sasadar Betal
Shri R.B. Das
Shri Gaur Hari Jena
Shri Kalipada Mondal
Shri M.C. Behera
Shri K.C. Samal (w.e.f. 20.3.1996)
Shri Pani Gharami (w.e.f. 20.3.1996)
Shri Sudarshan Naik (w.e.f. 20.3.1996)
Shri Bijay Bhoi (w.e.f. 20.3.1996)
Shri Balram Das (w.e.f. 20.3.1996)

Shri K.U. Gopi (w.e.f. 20.3.1996)
Shri Nitai Chandra Som
(w.e.f. 20.3.1996)

S.S. Grade I

Shri B.C. Paik
Shri Pranesh Chandra Saha
Shri Patit Paban Halder
Shri Abhimanyu Naskar
Shri R.K. Roy
Shri T.V. Shaji
Shri K. Kunjuraman
Shri K. Thankappan
Shri N.C. Mondal
Shri N.K. Jena
Shri M.D. Suresh
Shri M. Santhosham
Shri N. Harinathan
Shri V. Jeevanandam
Shri Amar Gharami
Shri K. Mariappan
Shri Maharaja Majhi
Shri Narendra Nath Jena
Shri Krishna Pada Naskar
Smt. S. Santhi
Shri Premanda Bisoi
Shri V.M. Dhanapal
Shri K. Nityanandam
Shri M. Subramani
Smt. Lakshmi Rani Bhuiya
Shri M.P. Devadasan
Shri V. Kumar
Shri E. Manoharan
Shri K.V. Delli Rao
Shri C. Saravanan
Shri S. Kuppan
Shri Uttam Kumar Santra
Shri M. Pichandi(joined on 3.8.1995)
Shri R. Balakumaran(joined on
20.9.1995)
Shri R. Kumaresan(joined on 27.3.1996)

ANNEXURE

Composition of Institute Management Committee (IMC), Staff Research Council (SRC)
Research Advisory Committee (RAC) and Institute Joint Staff Council (IJSC):

INSTITUTE MANAGEMENT COMMITTEE

(constituted by ICAR for a period of 3 years vide Office Order No.6-35/89-IA-VI
dated 3.8.93, 23.5.94 and 21.7.94.)

- | | |
|--|--------------------------|
| 1. Director, CIBA | Chairman |
| 2. Commissioner of Fisheries,
Govt. of Tamil Nadu | Member |
| 3. Director of Fisheries,
Govt. of Orissa | Member |
| 4. Director of Research and Extension (Fy),
Tamil Nadu Veterinary & Animal Sciences
University, Madras | Member |
| 5. Shri Subba Somu,
Tiruchiurapalli (T.N.) | Member
(Non-official) |
| 6. Shri A. Rajeswar Rao,
Khammam (A.P.) | Member
(Non-official) |
| 7. The Finance and Accounts Officer,
Sugarcane Breeding Institute, Coimbatore | Member |
| 8. Dr. K. Radhakrishna,
Assistant Director General (M.Fy),
ICAR | Member |
| 9. Dr. K. V. Ramakrishna,
Principal Scientist, CIBA | Member |
| 10. Dr. B. P. Gupta,
Senior Scientist, CIBA | Member |
| 11. Dr. Munawar Sultana,
Senior Scientist, CIBA | Member |
| 12. Dr. M. Natarajan,
Senior Scientist, CIBA | Member |
| 13. Administrative Officer,
CIBA, Madras | Member Secretary |

STAFF RESEARCH COUNCIL

(constituted by ICAR for a period of 3 years with effect from 8th February, 1995, vide
Office Order No.18(2)/94-ASR-I dated 8.2.95)

- | | |
|---|----------------------|
| 1. Director, CIBA | Chairman |
| 2. Assistant Director General (M.Fy), ICAR | Member |
| 3. Shri M. S. Muthu,
Retired Principal Scientist, CIBA | Member
(External) |
| 4. Dr. George John, Director,
Dept. of Biotechnology, Govt. of India | Member
(External) |

- | | | |
|--|--|----------------------|
| 5. | Dr. T. J. Varghese, Emeritus Professor
College of Fisheries, UAS, Mangalore | Member
(External) |
| 6. | Dr. K. V. Ramakrishna, Principal Scientist,
Head of Fish Culture Division & Aquaculture
Engineering and Environment Division | Member |
| 7. | Dr. R. D. Prasadam, Principal Scientist,
Head of Technology Improvement Division &
Extension, Economics and Information Division | Member |
| 8. | Dr. L. H. Rao, Senior Scientist,
Head of Crustacean Culture Division | Member |
| Principal Investigators for on-going projects | | |
| 9. | Dr. P. Ravichandran, Senior Scientist | Member |
| 10. | Dr. S. K. Pandian, Senior Scientist | Member |
| 11. | Shri M. Kathirvel, Senior Scientist | Member |
| 12. | Dr. S. A. Ali, Senior Scientist | Member |
| 13. | Dr. T. C. Santiago, Senior Scientist | Member |
| 14. | Shri S. V. Alavandi, Scientist (Senior Scale) | Member |
| 15. | Dr. B. P. Gupta, Senior Scientist | Member |
| 16. | Dr. K. Gopinathan, Senior Scientist | Member |
| 17. | Dr. M. Krishnan, Scientist (Senior Scale) | Member |
| 18. | Dr. Munawar Sultana, Senior Scientist and
Officer-in-charge, Technical Cell | Member |
| 19. | Shri P. Lakshmanadoss, Technical Officer(T7) | Member |
| 20. | Shri N. Kalaimani, Senior Scientist | Member Secretary |

RESEARCH ADVISORY COMMITTEE

(constituted by ICAR for a period of 3 years with effect from 8th February, 1995, vide Office Order No.18(2)/94- ASR-I, dated 8.2.95)

- | | | |
|----|--|----------|
| 1. | Dr. T. V. R. Pillay,
Former Programme Director
Aquaculture Development and Coordination
Programme, FAO | Chairman |
| 2. | Prof. R. Natarajan
M. S. Swaminathan Research Foundation
Madras | Member |
| 3. | Dr. M. Sakthivel
Aquaculture Foundation of India
Madras | Member |
| 4. | Dr. H. P. C. Shetty
Retd. Director of Instructions (Fisheries)
University of Agricultural Sciences,
Mangalore | Member |

- | | | |
|-----|--|--|
| 5. | Dr. K. Venkataramanujam
Dean, College of Fisheries
Tamil Nadu University of Veterinary and
Animal Sciences, Tuticorin | Member |
| 6. | Director, CIBA | Member |
| 7. | Assistant Director General (M.Fy)
ICAR, Krishi Bhawan | Member |
| 8. | Shri Subba Somu
Tiruchirapalli (T.N.) | Member
(IMC member
representing Agriculture
& Rural Interest) |
| 9. | Shri A. Rajeswara Rao
Khammam (A.P.) | Member
(IMC member
representing Agriculture
& Rural Interest) |
| 10. | Dr. K. V. Ramakrishna
Principal Scientist, CIBA | Member Secretary |

INSTITUTE JOINT STAFF COUNCIL

(constituted by CIBA for a period of 3 years with effect from 1.11.95 vide Office Order No.F.No.13-1/90-Admn. dated 2.11.95)

- | | | |
|-----|--|-----------|
| 1. | Director, CIBA | Chairman |
| | Official side | |
| 2. | Dr. K. V. Ramakrishna
Principal Scientist | Member |
| 3. | Dr. R. D. Prasadam
Principal Scientist | Member |
| 4. | Dr. L. H. Rao
Senior Scientist | Member |
| 5. | Dr.(Smt.) Munawar Sultana
Senior Scientist | Member |
| 6. | Shri S. Krishnaswamy
Assistant Finance and Accounts Officer | Member |
| 7. | Administrative Officer, CIBA | Secretary |
| | Staff side | |
| 8. | Shri S. Krishnan, T-4 | Secretary |
| 9. | Shri C. S. Sasidharan, T-1-3 | Member |
| 10. | Shri R. Kandamani, Senior Clerk | Member |
| 11. | Shri K. Mani, Junior Clerk | Member |
| 12. | Shri N. Mani, S.S.Gr.III | Member |
| 13. | Shri P. Arumugam, SS Gr-II | Member |

