



वार्षिक प्रतिवेदन ANNUAL REPORT

1991-92



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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Cover Photos:

- Top Left: Backyard hatchery for *Penaeus monodon* at Muttukadu.
Top Right: Bacterial septicaemia disease in *P. monodon* in shrimp farm.
Bottom Left: Mud crab *Scylla tranquebarica*.
Bottom right: Pen culture of *Chanos chanos* in Muttukadu lagoon.

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INTRODUCTION

Brief historical background

Brackishwater aquaculture has been identified as one of the high potential areas for increasing prawn/fish 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 VII plan period (1985-90) 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 at Kakdwip (West Bengal), Puri (Orissa) and Narakkal (Kerala).

Mandate

The Institute has the following mandate:

- to conduct research leading to development of techno-economically viable and sustainable culture systems for finfish and shellfish in brackishwater;
- to carry out research, more specifically on nutrition and feed development, reproductive physiology, pathology, genetics, pond environment, aquaculture engineering, and operational

economics to provide technology support for optimising brackishwater productivity and production; and

- to undertake transfer of technology through training, education and extension programmes and to provide institutional consultancy services.

Thrust areas of research during VIII Five Year Plan

- Development of physical facilities of infrastructure and modern laboratories for research at the Headquarters and Research Centres of the Institute
- Development of semi-intensive and intensive culture technologies for different species of prawns for different agro-ecological regions of the country
- Improvement in production and productivity in traditional brackishwater aquaculture system
- Research in prawn seed production and nursery rearing technology for different scales of operation with innovations on hatchery feeds and water quality management
- Captive prawn broodstock development and management, controlled maturation and spawning and improvement in survival and quality of larvae
- Development of hatchery technology for finfish and establishment of brackishwater multispecies fish hatchery facility with land-based broodstock development

- Development of cost-effective fish production technology in ponds, pens and cages
- Development, testing and release of balanced/practical diet formulations for grow-out culture of prawns and fishes; micro-encapsulated larval and post-larval feeds; biotech products in feeds
- Development of *Artemia* cyst and biomass production technology; intensification of live feed mass production systems
- Establishment of prawn/fish disease diagnostic and treatment facilities and research on viral, protozoan and metazoan diseases and their prevention, prophylaxis and control; fish health management
- Basic research on ecophysiology, physiology of digestion, excretion, reproduction, physiological stress, pond bioenergetics
- Aquaculture stock improvement through genetic engineering, ploidy manipulation and selective breeding
- Biotechnological approaches in reproduction, nutrition, growth, disease control and pond health management
- Coastal zone management with reference to aquaculture
- Studies on aquaculture economics
- Aquaculture engineering research for systems, designs and materials for hatcheries and farms
- Transfer of technology through training, demonstration, information system, publications and institutional consultancy.

Infrastructure Development

During the year, the Government of Tamilnadu allotted 29.5 acres of land in Muttukadu for the establishment of an integrated prawn hatchery and land has been taken over. Construction of a farm laboratory at Muttukadu is nearing completion and an approach road to the hatchery site has been formed. Barbed wire fencing of the 10 acres site at Madras has been completed.

Some equipments for the various on-going projects have been imported and installed at the Institute's Headquarters at Madras, utilising the Institute's funds and grant from other organisations. Major equipments which have been imported are: Leitz Microscope with photoautomat set and other accessories for use in the Microbiology laboratory; Lyophiliser and Cyclotec Mill for the nutrition laboratory; UV-vis Spectrophotometer and electronic balances for general use.

Organisation

The research programmes of the Institute were organised under three divisions viz, Crustacean Culture Division, Finfish Culture Division and Resource and Technology Improvement Division. Prawn hatchery technology and seed production, culture of live food organisms and grow-out culture programmes were dealt with by the Crustacean Culture Division. Finfish Culture Division looked after captive broodstock development, breeding and culture of finfish. Nutritional aspects of fish/shrimps, feed technology, pathology, ecophysiology and reproductive physiology programmes were tackled by the Resource and Technology Improvement Division. A new division was created for Fish Farm Survey and Engineering Research to deal with programmes relating to brackishwater soils and their productivity, hatchery design, layout and systems, and machineries and structures for brackishwater aquaculture. During this year, an Extension Section was also established to look after technology transfer programmes. The

activities of Library and Technical Cell were looked after by a Principal scientist.

Budget

During the year 1991-92, an expenditure of Rs.49.26 lakhs under Plan and Rs.71.85 lakhs under Non-Plan was incurred by the Institute.

Major Research Accomplishments

The Institute made good progress in the research programmes in spite of the constraints of inadequate infrastructure facilities. For the first time in the country experimental culture of the red-tail prawn *Penaeus penicillatus* was launched at the Kakdwip Research Centre and initial results showed promise of using this good species in culture in West Bengal. In future, with hatchery production of seed, the species could be introduced in other states as well.

Controlled maturation of *P. monodon*, with an increase of polychaete component from 4% to 10% in the maturation diet, showed that the latency could be further reduced to 3 days.

The *Artemia* cyst project taken up in a pond of 0.4 ha in a private salt pan near Madras yielded satisfactory result with a production rate of 21.3 kg/ha in 199 day culture.

Experimental culture of *P. monodon* was initiated in confined ponds of the BFDA in the Chilka area for improving productivity and production.

The Institute successfully monitored the semi-intensive prawn culture programme of DBT/MPEDA/TASPARC in the farm at Puduparthi, Nellore which yielded very valuable results.

A captive broodstock of Asian Seabass *Lates calcarifer* was maintained successfully at Ennore, near Madras, and intramuscular implantation of hormone pellets

(LHRHa and HCG) was started to induce the females towards maturation.

Breeding of pearlspot *Etroplus suratensis* was intensified at Ennore, Kakdwip and Narakkal and satisfactory results have been obtained in fry production. Environmental parameters required for successful breeding have been enumerated.

Culture of seabass, pearlspot and grey mullet was largely on experimental stage with varying results of production due to vast changes in environmental conditions.

Several feed formulations were developed for prawn larval, juvenile and grow-out culture and for fish maturation and culture. The feeds were produced at the Institute's facility and were under laboratory and field trials. A microparticulate post-larval feed for *P. indicus* has been rigorously tested and found to give consistently satisfactory results. The feed will be further standardised for use in small-scale and backyard hatcheries for *P. indicus*.

Very good progress was recorded in investigations of diseases of prawns in farms and hatcheries. The studies included the bacterial septicaemia disease in *P. monodon* in culture ponds, EUS in fishes of Vembanad lake, soft shell syndrome of prawns, bacterial diseases in larval stages in several hatcheries and *Vibrio* problems in contaminated *Artemia* cysts. In all relevant cases, sensitivity tests were carried out with chemicals and antibiotics for suggesting curative measures.

Studies on reproductive physiology and endocrinology of *M. cephalus* and *P. indicus* made satisfactory progress and need further strengthening with infrastructure facilities and equipments.

A good range of coastal soils from existing prawn farms and potential areas for prawn culture from different agro-ecological regions were collected and analysed for their physico-chemical characteristics and productivity. This study included a survey of

the saline groundwater potential in Rajasthan for use in brackishwater aquaculture, and soils from certain sites in the coastal states of Andhra Pradesh, Tamilnadu, Goa and Gujarat.

The Institute implemented the DBT-funded project on 'Studies on quantitative requirements of essential amino acids and fatty acids for *P. monodon*' in collaboration with Central Institute of

Fisheries Technology. The CIBA/BOBP study on shrimp fry by-catch in West Bengal was completed during the year.

The Institute took up several programmes of extension education such as training programme in Backyard Hatchery Technology for *P. indicus*, training of technical managers in microbiological investigations in prawn hatchery and interaction with BFDA officials and farmers.

K. Alagarswami,
Director

GENERAL INFORMATION

Management Committee

The Second and Third meetings of the Management Committee of the Institute were held on 12.11.1991 and 23.3.1992 respectively.

Staff Research Council

The Staff Research Council of the Institute held its annual meetings on 11-12 April 1991 and also on 23-24 March 1992 to review the progress of various on-going research projects and to formulate new project proposals. The quarterly meetings of the Staff Research Council were held on 30.8.1991 and 13.11.1991 to review the progress made.

Assistance rendered

Follow-up action on the establishment of the Departmental prawn hatcheries at Chinnaveerampattinam in Pondichery and at Kumta in Karnataka, was further continued based on the designs provided by the Institute.

In collaboration with Central Institute of Coastal Engineering for Fishery, the Institute participated in the microlevel survey of Gundlakama estuary in Prakasam District in Andhra Pradesh for biological aspects.

Scientific monitoring of the semi-intensive culture of tiger prawn in the TASPARC prawn farm at Nellore was continued and disease problems studied in detail.

Services in Committees

Dr. K. Alagarwami, Director served as

Member, Task Force in Aquaculture and Marine Biotechnology of Department of Biotechnology, Govt. of India

Member, Research Council of Centre

for Research on Sustainable Agricultural and Rural Development (CRSARD), Dr. M.S.Swaminathan Research Foundation

Member, Central Board of Fisheries, Ministry of Agriculture, Govt. of India

Member, Visiting Team for development and strengthening of Assam Agricultural University

Member, Research Council of CIFE, Bombay

Member, ICAR Regional Committee No. VIII

Member, Screening Committee for allotment of brackishwater lands, Govt. of Andhra Pradesh, Dept. of Fisheries

Member, Editorial Board for Indian Journal of Fisheries

Member, Agency for Development of Aquaculture in Kerala, Govt. of Kerala

Member, Committee on Introduction of Exotic Aquatic Species

Chairman - Expert Committee on Stake Net/Chinese Net fishery in Kerala and submitted a report to the Fisheries Division, Ministry of Agriculture, Govt. of India

Dr. K.V. Ramakrishna, Principal Scientist

represented the Director, CIBA in the Screening Committee for allotment of brackishwater lands of the Dept. of Fisheries, Govt. of Andhra Pradesh, at some of the meetings

Dr. A. Laxminarayana, Senior Scientist served as

Member, Text Book Committee

(Fisheries), Govt. of Kerala

Member, High Power Committee
(Fisheries) of the Kerala State Planning Board

Member, Expert Group to take up the
indepth study on the problems of fishermen in
Ashtamudi lake

Training

Two officers each from TASPARC
and OSPARC were imparted training for 10
days in the microbiological methods for
routine monitoring in the hatcheries at the
Institute during November, 1991.

The Institute organised a training
programme during February 1992 on backyard
hatchery technology at its Narakkal Research
Centre. 14 officers sponsored by Fisheries
Departments of maritime states and State
Agricultural Universities participated in the
training.

The following participants underwent
the training programme:

1. Shri Radheshyam Mishra -
Fisheries Extension Officer, BFDA,
Balikudan, Cuttak, Orissa

2. Shri A. Sitarama Raju - Asst.
Professor(Fisheries), APAU, Kakinada. A.P.

3. Shri Seshasayana Rao - Lecturer,
Fisheries Training Institute, Kakinada, A.P.

4. Shri S.Sampath-Sub- Inspector of
Fisheries, Pondichery

5. Shri V. Thirumulan Sub-Inspector of
Fisheries, Pondichery

6. Ms. Aney Kutty Joseph - Jr. Asst.
Professor, Fisheries College, Panagad, Kerala

7. Shri K.G. Suguna Prasad -
Sub-Inspector of Fisheries, Thrissur, Kerala

8. Shri Gangadhar V. Muddikeri -
Chief Executive officer, BFDA, Karwar,
Karnataka

9. Shri Dilip Baburao Phadtone - Asst.
Fisheries Development Officer, Ratnagiri,
Maharashtra

10. Shri Hingua Havagi
Naganathappa - Asst. Fisheries Development
Officer, Thane, Maharashtra

11. Shri B.M. Karjule - Licensing
Officer (Fisheries), Thane, Maharashtra

12. Shri Madhukant G. Makwana -
Fisheries Officer, Commissionerate of
Fisheries, Ahmedabad, Gujarat

13. Shri Kishore Kumar R. Sapna,
Fisheries Officer, Commissionerate of
Fisheries, Ahmedabad, Gujarat

14. Shri Prakash Chandra Mugerlal
Mehta - Survey Asst. BFDA, Valsad, Gujarat.

Manpower Development

Shri D. Rajababu, T-II-3 attended a
two week training programme in 'Management
of brackish water prawn/fish seed farms'
conducted by CIFE, Bombay at Kakinada
during 16-30 September, 1991.

Visits

Dr. K. Alagaswami, Director, visited
Assam Agricultural University as a Member of
the visiting team during 26 February to 1
March, 1992.

Shri M. S. Muthu, Principal Scientist
visited the Kumta prawn hatchery, Uttara
Kannada Dist., Karnataka and suggested
improvements in the water intake and filtration
systems.

Shri A.V.P. Rao, Principal Scientist
and Dr. B.P. Gupta, Senior Scientist,
undertook a study tour of brackishwater areas

of Valsad Dist., Gujarat, at the request of Govt. of Gujarat.

Shri A.V.P. Rao, Principal Scientist, visited Goa during 8-10 October 1991 to study the developments of brackishwater aquaculture in the state. He also visited Nellore, Andhra Pradesh during 28-30 January 1992 to discuss with BFDA officials regarding monitoring of BFDA ponds at Muthukur.

Dr. Smt. Munawar Sultana, Senior Scientist, visited Kolleru lake to study the fisheries of the lake with particular reference to pearlspot, *Etroplus suratensis* during March 1992.

Dr. S.M. Pillai and Shri R.K. Chakraborti visited several sites in the districts of Jodhpur, Sikar, Pali, Jalvar, Nagaur, Ajmer and saline lakes of Sambhar and Didwana in Rajasthan during 16-30 September, 1991 to ascertain the potential for brackishwater aquaculture using saline groundwater resource.

Seminar/Symposia/Workshops

The Director and Scientists of the Institute participated in the following Seminars/Symposia /Workshops held during the year :

- Workshop on “Promotion of Marine Pisciculture and Allied Activities among Fisherfolk - Integrated with Poverty Alleviation Programme” organised by Department of Rural Development, Ministry of Agriculture, Government of India, held at Tuticorin on 26.6.1991

Dr. K. Alagarswami

- Workshop on sustainable management of Coastal Ecosystems at Anna University, Madras on 7.10.1991

Dr. K. Alagarswami

- International Conference on Land Water Interactions held at

Jawaharlal Nehru University, New Delhi on 11.12.1991.

Dr. K. Alagarswami

- Seminar on Strategies for development of Fisheries in Andhra Pradesh - organised by Andhra Pradesh Agricultural University, Hyderabad at Kakinada on 30-31 January, 1992.

Dr. K. Alagarswami
and M.S. Muthu

- TC/DC programming exercise conducted by Department of Agriculture and Cooperation, Government of India, New Delhi on 7-11 October 1991.

Shri K.N. Krishnamurthy

- Workshop on Motivation, Management and Community participation in Research and Development - organised by NAARM, Hyderabad, 20-23 January 1992.

Dr. K. Gopinathan

- Workshop on reference book on Fish Culture for +2 and vocational teachers organised by NCERT and CIFE at Bombay, 22-27 January 1992.

Dr. K. V. Ramakrishna

- Workshop on utilization on shoreline change maps organised jointly by Space Application Centre, Ahmedabad and Institute of Remote Sensing, Anna University at Madras on 11.11.1991.

Dr. K. Alagarswami,
Shri M. S. Muthu
and Dr. B.P. Gupta

- Regional Seminar on Mud Crab Culture and Trade in the Bay of Bengal Region organised by FAO/BOBP held at Surat Thani, Thailand, 5-8 November, 1991.

S/Shri M. Kathirvel
and S. Srinivasagam

- Workshop on Industrial Development of Tuticorin region, organised by SIPCOT, Tamilnadu at Tuticorin on 26.10.1991.

Shri M.S. Muthu

- Seminar on Investment Opportunities in Shrimp/Prawn culture organised by Federation of Association of Small Industries, Southern Region and MPEDA at Madras on 28.10.1991.

Shri A.V.P. Rao

Meetings

Dr. K. Alagarwami, Director attended the following meetings:

- Fifth meeting of Committee on Introduction of exotic aquatic species at CICFRI, Barrackpore on 19.6.1991.
- Meeting at CIAE, Bhopal to discuss collaborative research programmes in the disciplines of Fisheries and Agricultural Engineering on 10-11 July, 1991.
- 16th meeting of Central Board of Fisheries, Government of India on 8.10.1991 at New Delhi.
- Brainstorming session at Department of Ocean Development, Government of India, New Delhi on 16.11.1991.
- Task Force (Aquaculture) meetings at Department of Biotechnology, New Delhi on 21.6.91, 24.10.91 and 13.12.91.
- Screening Committee meetings for brackishwater land allotment, Government of Andhra Pradesh at Hyderabad on 2.1.92 and 20-21 January 1992.
- Second AGM of CRSARD at Madras on 20.9.1991

- Meeting of Environmentally linked aquaculture projects organised by World Bank at New Delhi on 18.2.1992.

Deputation

Shri M.S. Muthu, Principal Scientist was on deputation for one month during May, 1991 to Bahrain Centre for Studies and Research (BCSR), Bahrain, to assist BCSR in developing the shrimp and fish farming industry in that country.

Honours and Awards

Dr. K. Alagarwami, Director was awarded the K.N. Bahl Memorial Medal of the Society of Biosciences for the year 1992.

Dr.(Smt) Munawar Sultana, Scientist (SG) was awarded the Ph.D. degree of the Madras University, Madras for her thesis entitled 'Studies on zinc regulation in an estuarine crab, *Scylla serrata* (Forsk.)'.

Library, Information and Documentation

Library holdings

The CIBA library acquired 16 books during the period. Subscriptions to 13 foreign and 20 Indian journals were made. The library, in March, 1992, had a total holding of 680 books, 405 reprints and photocopies, 205 reports and 425 miscellaneous publications.

Exchange Services

The Library maintained exchange relationship with National and International organisations of mutual interest. The Library maintained free mailing of Institute's Annual Report and other publications to various Research Organisations, Universities and other agencies.

Information Services

The Library section provided the various reference needs of Institute's scientists and staff. It also 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. The section also provided reprography services to the scientists as and when needed.

Publications

- Annual Report for the year 1990-91.
- Highlights on the research and development in Brackishwater Aquaculture for the period 1987-1991.

Reports

- Report on the investigations on epizootic ulcerative syndrome in fishes of Kuttanad and Alleppey regions in Kerala
- Report on the investigations into the mortality of *Penaeus monodon* larvae in TASPAC hatchery at Visakhapatnam
- Investigations on a bacterial disease in tiger prawn *Penaeus monodon* in DBT/MPEDA /TASPAC farm near Nellore during June-July 1991
- Report on the microbiology of *Artemia* cyst samples from OSPAC
- Report on the pathological investigations on *Artemia*, seawater and larval samples of TASPAC hatchery at Visakhapatnam
- Report on a study of the confined-pond prawn farming in Chilka lake

- Report of ICAR Senior Scientists Dr. P.V. Dehadrai, Deputy Director General (Fy) ICAR and Dr. K. Alagarswami, Director, CIBA, Madras on deputation to Thailand and Philippines on study tour sponsored by FAO/BOBP
- Report on the survey of brackishwater resources of Rajasthan for development of aquaculture.

List of papers presented at Seminar/Symposia etc.

Alagarswami, K., 1991 Sustainable management and development of Coastal Aquaculture. Paper presented in the Workshop on 'Sustainable management of Coastal Ecosystem organised by CASAFA, Anna University, Madras, 7-9 Oct. 1991.

Alagarswami, K., 1992 'Brackishwater fish and prawn production in Andhra Pradesh - Constraints and prospects' - Paper presented in the Seminar on 'Strategies on development of Fisheries in Andhra Pradesh', organised by A.P. Agri. Univ., Kakinada, 30-31 Jan., 1992.

Ahamed Ali, S and . A. Laxminarayana, 1991 Compounded feeds for feeding post larvae of *Penaeus indicus* in the hatchery - paper presented at the National Seminar on prawn feeds, held at Fisheries College and Research Institute, Tuticorin, 25-26 Feb., 1992.

Joseph, K.O. and J.P. Srivastava, 1991 Anthropogenic influence on the mercury contamination in the Ennore estuary. Abstract submitted to the International Conference on land water interactions organised by UNESCO, SIL, NIE and ISTE at Jawaharlal Nehru University, New Delhi 8-14 Dec. 1991.

Kathirvel, M. and S Srinivasagam, 1991. Taxonomical studies of mud crab *Scylla serrata* (Forsk.) from India. Paper presented at the Regional Seminar on Mud Crab Culture and Trade in Bay of Bengal Region - organised

by FAO/BOBP at Surat Thani, Thailand, 5-8 Nov. 1991.

Kathirvel, M. and S. Srinivasagam, 1991 Resources and exploitation of Mud crab *Scylla serrata* (Forsk.) from India. *Ibid.*

Laxminarayana, A., 1992 Cost and construction of a Shrimp prawn hatchery - Paper presented at the Workshop for Banks organised by MPEDA held at Kochi, 12 March 1992.

Pillai, S.M., K.V. George, K.K. Surendran and N. Venugopal, 1992 On the characteristics of soil, water and benthic fauna of a perennial prawn culture pond in Vypeen Island. Paper presented at the National Workshop on impact of Coastal Aquaculture on Environment held at Fisheries College and Research Institute, Tuticorin, 25-26 Feb. 1992.

Srinivasagam, S. and M. Kathirvel, 1991 Experimental culture of mud crab *Scylla serrata* (Forsk.) in India. Paper presented at the Regional Seminar on Mud Crab Culture and Trade in the Bay of Bengal Region organised by FAO/BOBP at Surat Thani, Thailand, 5-8 Nov. 1991.

Survey of brackishwater prawn farms affected by flash floods in Andhra Pradesh

A cyclonic depression during the third week of November, 1991, resulted in heavy rainfall in Nellore District, Andhra Pradesh as a result of which almost all the irrigation tanks and reservoirs overflowed. Added to this, several tanks had breached resulting in flash floods. The irrigation department had opened the surplus sluices of Kalyani and Somashila reservoirs and let out excess water into the Swarnamukhi and Pennar rivers. A survey of the flood damage to the brackishwater farms in Nellore District was made by a team of scientists from CIBA.

Five Mandals and 8-10 farms in each Mandal which were severely affected were surveyed during the visit from 29.11.1991 to 8.12.1991. The farmers were personally

interviewed in many cases and details of damage assessed. Nellore District has a 163 km coastline with 13 Mandals under brackishwater farming. Though the potential is estimated at 10,766 ha, about 1000 ha is presently under prawn farming. The Fisheries Department of Andhra Pradesh has established 19 one-ha ponds at Krishnapatnam in Muttukur Mandal under the Scheduled Caste Employment Generation Scheme at an outlay of Rs. 19 lakhs. Another 24 one-ha ponds are to be brought under the scheme in future. The MPEDA has financed 52 units totalling an area of 400 ha under brackishwater aquaculture. Thus, presently 11 mandals are under brackishwater aquaculture viz., Venkatachalam, Manubolu, Chillakuru, Allur, Vidavalem, Muttukur, Indukurpet, Kavali, Vakadu, Kota and Totapalligudem. Most of the areas under brackishwater aquaculture are located in low lying areas and are prone to floods during heavy rainfall. On 14-15 November, 1991, heavy flooding as a result of breaching of nearly 202 irrigation tanks led to large scale inundation of the watershed area. Most of the farms with prawn stock either in growing phase (12-20 g) or harvestable phase (25- 35 g) were flooded and stocks were lost. The flood receded only after 4-5 days, when the farms could be reached to assess the damage. Ramulupalem in Indukurpet Mandal and Puduparthi in Venkatachalam Mandal were the worst affected. At the TASPARC farm in Puduparthi, the water level suddenly rose about 80 cm above the bund level damaging the machinery, equipment and feeds besides causing erosion of bunds. The total loss to the Fisheries sector alone due to flood havoc was estimated at Rs. 90 lakhs.

Visitors

Headquarters

Dr. Balram Jakhar, Honourable Union Minister for Agriculture, Government of India

Shri K.C. Lenka, Honourable Union Minister of State for Agricultural Research and Education, Animal Husbandry and Dairying, Govt. of India

Prof. V.L. Chopra, Director General, ICAR, New Delhi

Dr. P.V. Dehadrai, Dy. Director General (Fisheries), ICAR, New Delhi

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

Shri D.K. Srivastava, Director (Finance), ICAR, New Delhi

Shri Kishori Lal, Director (Personnel), ICAR, New Delhi

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

Dr. Kisan Singh, Asst. Director General (AN&P), ICAR, New Delhi

Shri K.L. Bokolia, Dy. Secretary, ICAR, New Delhi

Shri L. Chuaungo, I.A.S., Managing Director, GFDC, Ahmedabad

Dr. M. Sakthivel, Director, MPEDA, Kochi

Shri P. Palaniappan, Vice President (Products), Sakthi Sugars Ltd. Coimbatore

Dr. K. Gopakumar, Director, CIFT, Kochi

Dr. P.S.B.R. James, Director, CMFRI, Kochi

Dr. S.V. Giri, Spl. Secretary, Ministry of Agriculture, Govt. of India, New Delhi

Shri Sukumar Das, I.A.S., Director of Fisheries, Govt. of West Bengal, Calcutta

Dr. M.V. Rao, Vice-Chancellor, APAU, Hyderabad.

Dr. Y. Rama Rao, Director, CICFRI, Barrackpore

Shri C.S. Sastry, World Bank Team

Kakdwip Research Centre

Dr. A. Ghosh, Editor, Times of India

Dr. Mark P. Hardin, Member, World Bank Team

Shri Apurba Ghosh, Director, CICFRI

Puri Research Centre

Dr. V.R.P. Sinha, Director, CIFE, Bombay

Dr. G.N. Mitra, Fisheries Advisor, Govt. of Orissa

Shri R.N. Mallick, Jt. Director of Fisheries, Govt. of Orissa

Shri S.K. Mohanty, Dy. Director of Fisheries, Govt. of Orissa

Shri B.N. Biswas, WBCA Corporation, Govt. of West Bengal, Calcutta

Narakkal Research Centre

Shri A.G. Varghese, MPEDA

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PROGRESS OF RESEARCH

CRUSTACEAN CULTURE DIVISION

Development of Hatchery Technology for Prawns (CCD/HT/1)

Madras: A.V.P. Rao (PL), L.H. Rao, K. Devarajan, S. Kulasekarapandian, S. Srinivasagam, K.O. Joseph and V. Sreekrishna

Narakkal: A. Laxminarayana, S.M. Pillai and K.V. George

Induced maturation of *Penaeus monodon*

During March-April 1991, ten females (220-270 mm/110-200 g) were unilaterally eye- ablated and held in 7-t capacity FRP tank along with 5 males (180-210 mm/70-95 g) in a closed and dark shed in Ennore facility. Daily water exchange was reduced to 75% from the previous level of 200%. Keeping the main diet consisting of mussel, crab and squid meats @ 15% and feed supplement of goat liver @ 2%, the polychaete component was raised to 4% (from 2% previously). The latency period for onset of maturation was 4 days as against 6 days reported during 1990-91. Fifteen spawnings were recorded during 45 days resulting in 3.94 million eggs from the above 10 female prawns. However, the eggs did not hatch in several cases and viable nauplii resulted only in two spawnings. This failure is due to poor quality of spermatophores in males as evidenced by the presence of melanophores. The males introduced into the tank had been in captive condition for more than 90 days since their collection from the wild and hence the deterioration in the spermatophore condition. In the second trial during May 1991, out of 8 ablated females, only one spawned, releasing an estimated 0.284 million eggs. During this period, the bar mouth at Ennore creek remained closed and the water used for larval rearing was highly turbid in spite of filtering it through fabric filters. This impaired the larval rearing and even though 0.22 million nauplii hatched out, their further development was affected due to failure of larvae to moult.

In the third trial with 10 females (100-150 g) procured from wild, and changing 90% of water daily, eight spawnings were recorded. By keeping the main diet constant and increasing the feed supplement of polychaetes to 10%, the latency period was further reduced to 3 days. A total of 1.997 million eggs were obtained; however they did not hatch due to low water temperature (24.0°C).

Due to problems of poor water quality at Ennore, the hatchery facility was shifted to Muttukadu in early 1992 and work initiated in March 1992 after establishing all systems. Seawater for hatchery was drawn from a borewell with a salinity of 31.5-32.0 ppt and pH of 7.7.

Larval rearing of *Penaeus monodon*

Five larval rearing trials of hatchery produced seed of *Penaeus monodon* were done using *Chaetoceros* sp., egg yolk suspension, *Artemia* nauplii (Mithapur strain) and egg custard as larval feeds. The survival from nauplii to PL-2 ranged from 28.0-55.0% with an average of 31.0% and from PL 2-6 upto PL 20-24 5.2-16.5% with an average of 11.0%. The low survival rates were mainly due to failure of yard cultures of *Chaetoceros* sp. during cloudy weather conditions on certain days during the initial critical stages of the larvae and also due to poor water quality consequent upon closure of bar mouth at Ennore and reuse of seawater.

Seed production of *Penaeus indicus* through backyard hatchery technology

Narakkal

Adopting backyard hatchery technology, 13 trials in seed production of *Penaeus indicus* were made at Narakkal. A survival rate of 17.5 to 71.7% from nauplii to

PL-1 was obtained. Further rearing of larvae was done using squilla powder of 200 micron particles size upto PL-5, 500 micron particles upto PL-15 and 1 mm particles upto PL-20; however, the survival of larvae was very poor as the larvae were from products of very small sized prawns. A total of 2,35,720 larvae (PL 21-42) were produced.

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

Madras : S. Kulasekarapandian(PL), S. Srinivasagam, K. Devarajan and K.O. Joseph

Axenic cultures of *Chaetoceros calcitrans* were maintained in UV filtered seawater under controlled temperature (20-26 °C) using Walne's medium at a light intensity of 2000-3000 lux. A maximum cell density of 4.8 million cells/ml was achieved.

In outdoor tanks mass culture of *Chaetoceros calcitrans* was done in filtered seawater of 30-33 ppt salinity enriched with modified 'F' medium. From the inoculum level of 0.1 million cells/ml a maximum cell density of 3 million cells/ml in 24 hrs were obtained.

With a starter culture of *Chlorella* sp. using modified Yashima medium, the rotifer, *Brachionus plicatilis* was cultured in filtered seawater of 30-32 ppt salinity. From an initial inoculum of 10 and 20 animals/ml, the population grew to 72 and 142 animals/ml in six days.

Artemia Culture

A 0.4 ha pond in a private salt pan was fertilized with urea and single super phosphate @ 30 kg/ha and water of 70 ppt was pumped into the pond. An indigenous parthenogenetic strain of *Artemia* was inoculated at 16 nauplii/l. As the phosphorus level in the pond did not improve, DAP was also added @ 25 kg/ha/application. Depending upon the development of phytoplankton blooms, refertilization of the ponds was done at 3-21 day intervals at half the basal dose of fertilizers.

The chemical parameters of the pond soil during culture were:

Available Phosphorus
2.82-7.2 mg/100g of soil
Organic Carbon 0.63-0.96%
pH 7.7-8.3
Primary productivity
3240-3600mg C/m³/day.

Oscillatoria terebreformis, *Spirulina subalsa* and *Aphanothecea pallida* were the common phytoplankters. When the salinity was below 160 ppt, the former two species were dominant, while the latter was predominant when salinity rose above 160 ppt.

In order to increase the *Artemia* population, the salinity of the pond was maintained at 70-110 ppt upto 60 culture days. At this level, the density of brine shrimp was 68 individuals/l. To induce oviparity, the salinity was gradually increased. By the 91st day the salinity increased to 165 ppt when the population reached oviparity leading to cyst production. The population density increased to 88 individuals/l, in which both oviparous and ovoviviparous adults formed half of the adult population. From day 91 cyst production was noticed and harvesting of cysts commenced between 98th and 140th culture days regularly. In 199 days of culture a total of 21.3 kg/ha of cyst production was achieved in addition to a total of 8.575 kg of wet biomass as partial harvest. The cysts were initially stored in brine, processed, sun dried and stored at a constant temperature of 30 °C in an incubator.

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

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Kakdwip: Hardial Singh, R.K. Chakraborti and Ashish Chowdhury
Narakkal: A. Laxminarayana, S.M. Pillai and K.V. George
Puri: R.D. Prasad, L. Krishnan and P.K. Ghosh

A non-drainable pond of 0.25 ha at Muttukadu was stocked with hatchery

produced *Penaeus japonicus* @ 20,000 nos/ha during last week of January 1991. A pelleted feed was provided to the stock and during a three month rearing period, the males and females had grown to 96.5 mm/7.5 g and 100.0 mm/8.6 g respectively from an initial size of 9.6 mm. Due to adverse summer conditions, the density of stock was very much reduced and only few individuals could be recovered.

In another trial a 0.2 ha pond was stocked with *Penaeus monodon* (26.5 mm/0.3 g) @ 12,000 PL/ha to raise them as broodstock. A growth rate of 25.3 mm/7.9 g per month was recorded upto November 1991,

when due to cyclonic storm and heavy rains, the pond was inundated vitiating the experiment.

At Kakdwip two tide-fed ponds of 0.275 ha and 0.375 ha each were stocked in March-April 1991 with nursery reared seed of *Penaeus monodon* @ 70,000/ha. Feed in dough ball form in pond I and in pellet form in pond II, were provided to the stocked prawns. Due to entry of sea bass, *Lates calcarifer* the survival and production were affected. In pond I the survival was 34.0% and in pond II 18.0%. The details of stocking, growth, production and survival are furnished in Table 1.

Table 1. *P. monodon* culture in tide-fed ponds at Kakdwip

Pond No.	Pond I	Pond II
Area (ha)	0.275	0.375
Source of Seed	OSPARC hatchery	CIBA hatchery
Stocking density (no./ha)	70,000	70,000
Date of stocking	18.03.1991	14.04.1991
Size at stocking	9.5 mm./118 gm.	33.0 mm/1.04 gm.
Period of rearing (days)	171	140
Date of harvesting	04.09.1991	31.08.1991
Avg. wt. of <i>P. monodon</i> at harvest	15.38 gm.	14.70 gm.
Qty harvested (kg.)		
<i>P. monodon</i>	100.650	69.850
Misc. fish	65.000	65.585
Misc. prawns	34.400	86.950
Projected production (kg./ha)		
<i>P. monodon</i>	366.000	186.130
Others	361.450	407.430
Total	727.450	593.560
% of retrieval of <i>P. monodon</i>	33.98	18.08
Form of feed	Dough balls	Pellets

The physico-chemical characteristics of the ponds were: Depth 63-120 cm, Turbidity (Formazin, ppm) 15-154, DO at 10.30 AM 4.8-9.7 ppm, pH 7.38-9.06 and Redox Value 34-213 mV.

In another experimental trial, 18 ponds of identical size of 0.027 ha each were stocked with hatchery produced *Penaeus monodon* seed of 9.5 mm at three different stocking densities viz., 42,000, 48,000 and 60,000 no/ha in two replicates and two feeding schedules, one, where feed was scattered and in the other where feed was supplied in trays. The details of stocking and production are furnished in Table 2.

A 0.06 ha pond was stocked with *Penaeus penicillatus* @ 65,000 nos/ha during last week of May 1991. Feeding was done at 8% of the body weight of stock. By the end of June, the prawns had grown to a size of 102.5 mm/9.0 g and production of 484 kg/ha/88 days was obtained when the pond was harvested in June, 1992.

Seven skyfed ponds of 0.02 ha each of BFDA at Keutakudi near Puri were stocked with postlarvae of *Penaeus monodon* of 18 mm/13 mg at a density of 30,000/ha during January 1991. The prawns were fed with a pelleted feed prepared at the Institute. Using this feed a total production of 143.2 kg/ha/127 days was obtained. The retrieval ranged from

Table 2. *P. monodon* production at different stocking densities in tide-fed ponds at Kakdwip.

No of replicates	C(2)	PS(2)	PT(2)	C(2)	PS(2)	PT(2)	C(2)	PS(2)	PT(2)
S.D. / ha (3)	42000	42000	42000	48000	48000	48000	60000	60000	60000
Av. <i>P. monodon</i> production (kg/ha)	36.9	57.8	123.2	48.6	185.0	93.4	51.7	123.0	100.1
Av. miscl. (kg/ha)	289.3	202.5	119.5	163.8	194.2	352.3	157.2	346.1	400.9
Av. total production (kg/ha)	326.2	260.3	242.7	212.4	379.1	445.8	208.8	469.0	501.0
S. D. - Stocking Density C - Control P.S. - Pellets scattered P.T. - Pellets on tray									

Although the total production rate of 469 kg/ha and 501 kg/ha was obtained at 60,000/ha stocking, the experiments suffered badly due to large scale entry of *Lates calcarifer* in all the ponds, low water levels and poor bottom conditions. However, in spite of constraints, the production of *P. monodon* at a stocking density of 42,000/ha was higher in feeds provided as pellets in tray (123.2 kg/ha). At higher stocking densities of 48,000 and 60,000/ha, production rates at 185.0 kg/ha and 123.0 kg/ha were obtained with pellets scattered.

27.8-71.6% with an average of 41.8%. During the second crop, twelve ponds of 0.02 ha each were stocked on 24.12.91. Before stocking, application of lime @ 500 kg/ha was done in all ponds. After liming, a basal dose of cow dung @ 1,000 kg/ha was applied, later followed by urea and single super phosphate @ 75 kg/ha each. Stocking with *Penaeus monodon* seed of 30.2 mm/175 mg was done in all ponds with a density of 30,000 nos/ha in 6 ponds and 40,000 nos/ha in the other six ponds. Feeding was done with the pelleted feed and crushed *Pila* meat in replicates of 3 each @ 33% of body weight

initially and gradually reduced to 5% during the fourth month of culture. The prawns had grown to a size of 110.5 mm/11.8 g with pelleted feed and 103 mm/9.5 g with crushed *Pila* meat.

At Narakkal, a 0.06 ha perennial and undrainable pond was stocked with *Penaeus indicus* post larvae 16.5 mm/0.03 g in March 1991 at a density of 35,000/ha. After 58 days of rearing the prawns had grown to 111.3 mm/10.4 g and the projected production was 279.2 kg/ha/58 days. The survival was 76.6%.

During July 1991, the same pond was stocked with the grey mullet, *Mugil cephalus* 31.1 mm/0.3 g at a density of 20,000/ha. In January 1992, the same pond was again stocked with *Penaeus indicus* seed of 14.6 mm/0.14 g at a density of 28,300/ha. No supplementary feed was given to fish and prawns. The fishes registered a growth rate of 450 mm/900 g in 8 months, while the prawns 89.2 mm/3.6 g in 57 days. The physico-chemical characteristics of the pond water and soil were:

Water phase: Temperature 26.5-33.0°C, Salinity 3.8-19.7 ppt, Transparency nil-64.5 cm, pH 7.2-7.7 and P 0.18-0.58 mg/L.

Soil Phase: Organic Carbon 0.35-0.77%, Available P 177.12-439.85 kg/ha and Available N 30.5-391.0 kg/ha.

Monitoring of traditional brackishwater aquaculture systems for improving their productivity (CCD/TF/1)

Kakdwip: R.K. Chakraborti(PL),
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Narakkal: K.V. George

Two *bheries*, one at Darier jungle and another at Nazat which are under traditional brackishwater prawn farming systems were taken up for observations on the physico-chemical characteristics of soil and water. Water temperature ranged 28.4-29.4°C, salinity 3-19 ppt, DO 6.8-7.4 mg/L, turbidity 20-29 cm, dissolved reactive P 0.01-0.19 mg/L and soil pH ranged 7.12-7.39 and redox value -86 to -134 mv.

Stocking and production particulars of

a 16 ha *bheri* at Nazat was monitored. In addition to natural entry of seed, supplementary stocking of *Penaeus monodon* seed @ 87,500/ha was done. A total production of 4.5 t of *Penaeus monodon* and 9 t of other prawns and fish was obtained from this *bheri*. The production rate worked out to be 280 kg/ha of *P. monodon* and 560 kg/ha of other varieties.

Studies on the growth of the two commonly occurring aquatic macrophytes in the *bheries* viz. *Ruppia* sp. and *Najas* sp. under laboratory conditions indicated a growth of 16-25 cm in 30 days and flowering of the plants in 45 days. Of the two, the growth of *Najas* sp. was slow.

Two ponds of 0.196 ha and 0.162 ha at Kakdwip farm were selected for traditional system of culture. Initial liming @ 500 kg/ha was done. A make shift nursery with bamboo splits lined with nylon net was fabricated and erected inside the pond in which *P. monodon* post larvae were stocked during March 1991. After one month of nursery rearing, the juveniles ranging 38-55 mm/0.4-1.2 g were allowed entry into the pond when the make shift nursery was removed. Harvesting of prawns was done in October 1991. Although a projected production of 531 and 401 kg/ha from each pond was obtained, tiger prawn production was very poor.

At Narakkal, in a Pokkali field, a 0.6 ha pond was selected for monitoring of the traditional culture practices. There was no selective stocking in this case except for allowing entry of seed through tidal influx. Among the prawns *Metapenaeus dobsoni* accounted for 70% of the total catch followed by *M. monoceros* and *P. indicus*. From this pond, a total of 578 kg of *M. dobsoni*, 27 kg of *M. monoceros* and 16 kg of *P. indicus* were realised in December 1991. The water and soil characteristics of the pond were:

Water phase : Temperature 25-27.0°C, Salinity 6.2-11.0 ppt, D.O. 5.4-5.8 mg/L, pH 7.6-7.8 and Total Alkalinity 84-92 mg/L.

Soil phase : Organic Carbon 0.48-0.60%, Total N 0.024-0.031% and Available P 160.04-170.04 kg/ha.

Nereid worms and other polychaetes were the dominant groups among benthos.

FINFISH CULTURE DIVISION

Broodstock Development, Breeding and Seed Production of Brackishwater Finfishes (FCD/BS/1.1)

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Puri: R.D. Prasad, L. Krishnan and P.K. Ghosh

Narakkal: S.M. Pillai

Kakdwip: Hardial Singh and B.K. Banerjee

Lates calcarifer

After a detailed survey of the fish landing centres at Pulicat, Ennore, Muttukadu and Kovalam, a fishing ground for obtaining large sized Bhetki, *Lates calcarifer* in live condition was located near Ennore bar mouth. In addition to the thirteen fishes collected, stocked and maintained at Ennore from January-February 1991, three fishes of average size 260 mm/250 g were also collected and stocked during the year. Water exchange @ 50-70% was done on alternative days. Attempts to wean the fish to a diet of fresh chopped fish and formulated semi-moist maturation diet were in vain as the fish did not accept the feed. *Tilapia* which was available in large numbers nearby were collected and fed @ 10% of the body weight of broodfish daily. From October 1991, *Tilapia* formed the mainstay of feed for the broodfish. The water quality parameters of the broodstock pond was monitored regularly and the details of the physico-chemical parameters of the pond water during April 1991-March 1992 were: Temperature 24.8-34.0 ° C, Salinity 27.0-41.0 ppt, pH 8.1-8.4 and DO 3.4-8.2 mg/L .

Due to rains in November 1991 the salinity of water declined and remained low between 8 and 15 ppt. During May-June 1991,

the Ennore bar mouth remained closed due to mechanical troubles in the dredger of the Tamilnadu Electricity Board resulting in stagnant water conditions in the creek. The hydrographic parameters of the Ennore creek during June 1991 were: Salinity 33.0-35.0 ppt, DO 3.2-4.0 mg/L , pH 8.0-8.1, Transparency 8.7-9.2 cm, Total alkalinity 124.0-130.0 mg/L , Total hardness 6250.0-6480.0 ppm, Ammonia N 0.12-0.14 mg/L , Nitrite N 0.04-0.05 mg/L , COD 12.4-14.6 mg/L , and Mercury 0.0003 µg/ml. During July 1991, TNEB renewed the dredging operations and kept the bar mouth open. The water quality in the backwaters improved due to regular flushing of tidal water from the sea. Periodical sampling of the broodfish was done to assess the growth of fish and development of gonads. Two females of 700-800 mm were treated with a combination of LHRHa and HCG @ 125 mg and 500 IU/kg body weight respectively in September 1991 in order to induce them to maturity. However, subsequent sampling did not reveal any signs of gonadal improvement in the treated fish.

No work could be taken up at Puri during the year due to non-availability of suitable size seabass in Chilka lake.

Mugil cephalus

In order to develop a captive broodstock of the grey mullet, *Mugil cephalus*, an earthen pond of 250 m² was excavated at Ennore with provision of water supply and drainage. Attempts to get large sized fish from Pulicat failed as all the fish which were transported, died within two days. Hence, efforts were made to procure the fish locally at Ennore. During July 1991, 17 adults and 42 juveniles could be procured in live condition and stocked in the pond. The size of the stocked fish ranged 200.0-485.0 mm/100.0-1400.0 g. The average size was 305.6 mm/377.8 g.

A feed with groundnut oil cake 40%, fish meal 20% with vitamins and mineral mix @ 5 g/kg was developed and fed to the fish @

7% of the body weight of fish. The feed was given in semi-moist dough form and found to be acceptable to the fish. In addition to the above feed, the pond had developed good growth of algae which also formed the feed of the fish. Excessive growth of algae was removed periodically to avoid oxygen depletion.

Water was exchanged at 70% two to three times a week and an average of 1.2 m level of water was always maintained in the pond. The physico-chemical characteristics of the pond water were: Salinity 6-35 ppt, Temperature 26.0-33.4 ° C, pH 7.8-8.4.

During December 1991 and January 1992 sampling was done to examine the fish for gonad development. It was observed that few males were already mature and in oozing condition. However, females had not attained maturity.

In order to take up breeding work on mullets, mature fishes of *Mugil cephalus* were procured from Pulicat. Three females and two males in advanced stage of maturity were collected and transported to Ennore without mortality. Two females of 485 mm/1000 g and 430 mm/600 g were treated with carp pituitary @ 30 mg/kg in combination with Pimozide on 5 February 1992 and released in a tank along with two oozing males. However, all the fish died the following morning.

A breeding camp was set up at Arkakuda near Chilka lake mouth between 25.11.1991 and 6.1.1992. A total of six ripe females of *M. cephalus* were available and three females were treated with a combination of mullet pituitary gland and Pimozide. One fish spawned and the eggs were fertilized by stripping a male collected from the lake. The fertilization was 77% and hatching was observed after 45 hours. The hatching was very poor with only 1.6% survival. The larvae were few in numbers and they were fed with *Chlorella* and *Brachionus* and could be reared for 11 days in field conditions.

Etroplus suratensis

Development of a broodstock and controlled breeding of the pearlspot, *Etroplus suratensis* was taken up at Ennore, Narakkal and Kakdwip. The broodstock pond at Ennore (0.01 ha) was deepened and prepared with a basal application of cattle dung @ 1,000 kg/ha and stocked with 68 fishes of 140 mm/74.5 g (average) during July 1991. During September 1991, an additional stock of 25 nos. of 148 mm/70.4 g (average) was introduced into the pond. 50-70% of water exchange was done daily in the pond and the broodfish were fed the same diet as for *Mugil cephalus* @ 7% of their body weight. Nesting materials were provided to facilitate natural breeding and deposition of fertilized eggs. Three spells of breeding were noticed during August, December 1991 and February 1992 and a total of 2966 no. of fry ranging 23-39 mm were collected out of which 950 were supplied to the Fisheries Department, Govt. of Tamilnadu and the rest were used for further rearing, using a formulated feed consisting of soyabean oil cake (40%), rice bran (40%) and fish meal (20%) with a control feed of ground nut oil cake and rice bran @ 1:1 ratio. The experiments were conducted in plastic pools. However, the experiment was vitiated due to heavy mortality of fish.

At Narakkal an undrainable pond of 0.02 ha was used for pearlspot seed production and two experiments were conducted. After initial dewatering by pumping and application of *Croton tiglium* @ 2 ppm to eradicate the undesirable fishes, lime was applied @ 200 kg/ha.

In the first experiment during April-September 1991, 40 fish were stocked during April and July, 1991. The size of fish ranged 113.2-176.6 mm/33.8-127.2 g. Feeding of the fish was done with a combination of ground nut oil cake and rice bran @ 1:1 ratio and @ 3% of the body weight of fish. During June-July 1991, due to monsoon rains, the pond was inundated and a number of fishes, especially *Tilapia* gained entry into the pond. The pond was dewatered during September

1991 and 228 fry of pearlspot were recovered. The water quality parameters were temperature 27.5-29.5 °C, Salinity 3.4-4.4 ppt, pH 7.5-7.9, and DO 5.9-8.3 mg/L. The same pond was restocked with 20 fish (152-165 mm/81-115 g) during last week of September 1991. Feeding schedule remained as before and during March 1992, the pond was dewatered and 812 pearlspot fry (50-70 mm) were recovered. The water quality parameters were: Temperature 29.0-31.0 °C, Salinity 5-15 ppt, pH 7.5-7.8 and DO 4.6-5.1 mg/L.

Two tide-fed ponds of 0.02 ha were stocked with 50 nos. of pearlspot (165-265 mm/150-550 g) after thorough netting and application of lime @ 250 kg/ha and poultry manure @ 1,000/kg/ha. Urea and single superphosphate @ 20 kg/ha each were applied at regular monthly intervals to ensure a sustained production of natural food for fish. Water exchange was done during spring tides. Natural breeding of fish was observed from April to November 1991 and a total of 11,547 fry of 15-42 mm were recovered. Water quality parameters were: Salinity 4.5-16.5 ppt, DO 6.1-9.8 mg/L, pH 7.4-8.2. The details of experiments on seed production of pearl spot are furnished in Table 3.

Culture of Finfishes(FCD/FC/1)

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Kakdwip: Hardial Singh, S.R. Das,
B.K. Banerjee and H.S. Majumdar

Narakkal: S.M. Pillai

Culture of Seabass, *Lates calcarifer*

Kakdwip

Nursery phase: Two nursery ponds of 600 m² each were stocked during June, with wild caught fry of *Lates calcarifer* of average size 18 mm/68 mg. Before stocking, lime was applied @ 300 kg/ha and manuring was done with poultry droppings @ 700 kg/ha. At fortnightly intervals, the ponds were flushed

with tidal water. The ponds were stocked with 900 and 700 fry respectively. Miscellaneous prawns and fish were collected by operating a shooting net in the nearby river and about 250 g of this were fed to the stock four times a fortnight. After 88 days of rearing, the ponds were harvested. The survival of stocked fish was very poor in both the ponds. A total of 26 large sized *Lates* (299-311.8 mm/301-413 g) were recovered from both the ponds perhaps due to lateral entry.

Growout phase: One pond of 0.12 ha was prepared by pumping out the water and removal of unwanted fishes. Lime was applied @ 300 kg/ha. Sea bass fingerlings obtained from nature of size 140 mm/33.5 g (range 127-153 mm/25.0-42.0 g) were stocked on 19.9.91 in the pond @ 3,500/ha. Freshly cut and chopped pieces of Bombay duck and Ribbon fish were fed to *Lates* @ 10% of the body weight. The pond was flushed with the tidal water, once during every spring tide. After 130 days of rearing, partial harvesting was done on 28.1.1992 and 85 fish 301 mm/406 g size (total wt. 34.5 kg) were harvested representing 23.4% of the stock and 278 fishes of 165.5 mm/78.4 g were released again in the pond for further rearing.

Culture of pearlspot, *Etroplus suratensis*

Kakdwip

Nursery: Three ponds of 0.06 ha area each were stocked with pearlspot fry @ 50,000 nos./ha. The average size of fry at stocking was 24 mm/0.3 g (range 15-40 mm). The prestocking pond preparation schedule included eradication of unwanted fishes, application of lime @ 250 kg/ha and a basal dose of organic manure (poultry droppings) @ 1,000 kg/ha. Stocking of the ponds was done on 25 May 1991. Phased application of poultry manure at 300 kg/ha and inorganic fertilisers, urea and single superphosphate @ 30 kg/ha at monthly intervals alternatively was done. Feeding of the stocked fry was done daily with a mixture of fish meal, groundnut oil cake and rice bran @ 1:1:4 at 5% of the body weight. Regular flushing of the ponds was done during

Table 3. Details of breeding and seed production of Pearlsip, *Etroplus suratensis*

	Ennore	Narakkal	Kakdwip	
Pond Size and No.	0.01 ha (one)	0.02 ha (one)	0.02 ha (two)	
Water Management	Pump fed - 50-70% exchange	Perennial - undrainable pond	Tide-fed; water exchange during spring tides	
Pond preparation	Dewatering and removal of unwanted fish	Application of Croton tiglium @ 2ppm. for removal of unwanted fish	Thorough netting and removal of unwanted fish	
Liming	Nil	@ 200 kg/ha	@ 250 kg/ha	
Manuring - Organic	Basal application of cattle dung @1000kg/ha	Nil	Poultry manure @ 1000kg/ha as basal dose	
Fertr. - Inorganic	Nil	Nil	Urea + single super Phosphate @ 20kg/ha at monthly intervals	
Details of stocking of broodfish				
No./size	68 + 25 (148mm./74.5g)	40 + 13 + 7 (113.2-176.6mm/ 33.8-127.2 g))	50 (165-265mm/150-550g)	
Dates of stocking	03.07.1991 - 16.08.1991	01.04.1991, 26.07.1991, 06.11.1991	April, 1991	
Feeding schedule	Daily @ 7% of body weight of stock. GNOC + RB + FM @4 :4: 2 and vit. and min. mix @ 5 g./kg.	Daily @ 3% of body weight RB + GNOC @ 1:1	Daily @ 3% of body weight RB + FM @ 1:1	
Water quality parameters				
Tempreture (°C)	25.6 - 34.0	27.5 - 29.5		
pH	7.9 - 8.4	7.5 - 7.9	7.4 - 8.2	
Salinity (ppt)	25.0 - 36.0 (15.0 in Nov.'91)	3.4 - 4.4	4.5 - 16.5	
D.O. mg/l		5.9 - 8.3	6.1 - 9.8	
Seed production	Month No. Size (mm)	Month No. Size (mm)	Month No. Size (mm)	
	Aug'91 966 39mm	Sept'91 228 41-63	Apr'91 11547 15-42	
	Dec'91 500 23	Mar'92 812 50-70	Nov'91	
	Feb'92 1500 25			
	Total 2966	Total 1040	Total 11547	

spring tides. After 120 days of rearing the ponds were harvested. The survival of the pearlspot was low mainly due to the entry of *Lates calcarifer* despite provision of screens. A total number of 60 *Lates* of 150-300 g were recovered from the three ponds. The details of harvest of pearlspot are furnished in Table 4.

Though the experiments were vitiated by inundation of the ponds during monsoon months and entry of *Tilapia*, *Megalops* and milk fish, in two experiments better survival, growth and production were noted. The hydrographic parameters of the water, plankton and bottom biota of the ponds were studied.

Table 4: Nursery rearing of Pearlspot *Etroplus suratensis* at Kakdwip

	No. harvested	% survival	Size at harvest length/weight	Total weight (kg.)
Pond I	1305	43.5	55-95 mm/4.4-17.6g (72.2 mm/8.2g)	10.7
Pond II	1970	65.6	60-105 mm/ 4.7-25.2 g (78.5mm/9.0g)	17.7
Pond III	1230	41.0	52-100 mm/ 3.4-23.9g (74.0mm/8.5g)	10.4

Growout culture: The juveniles resulting from the nursery phase were stocked in a freshly prepared pond of 0.184 ha @ 10,000 nos/ha on 18 September 1991. By middle of March 1992, the growth recorded was 118 mm/38 g (average) with a range of 77-153 mm/11-82.5 g. The water quality parameters of the pond were: Salinity 4-17 ppt, DO 8.5 mg/L and pH 7.5-8.4.

Narakkal

Monoculture of pearlspot *Etroplus suratensis* in two ponds of 0.02 ha each was done and four experiments were conducted. Before stocking, dewatering of the ponds was done and *Croton tiglium* @ 2 ppm was applied to eradicate the unwanted fishes. Water was pumped into the ponds and the inlets were provided with wire mesh screens to prevent entry of undesirable fishes.

The details of stocking and production are furnished in Table 5.

Pen and cage culture of milkfish *Chanos chanos*

Muttukadu

Collection and Transport

Wild fry of milkfish from Adyar estuary were collected during May-June, 1991 and transported to Muttukadu. The size of fry collected was 28.6 mm/0.37 g during May 1991 and 49.4 mm/1.0 g during June 1991.

Nursery Rearing

Two net cages of 50 m² each were stocked with the above *Chanos* fry. The stocking was done in two different densities @ 15 fry/m in cage I and @ 20 fry/m² in cage II. The fry were fed with rice bran and groundnut oil cake @ 1:1 ratio daily @ 20% of the body weight of stock. After 70 days of rearing, the fry were collected from cage I and the average size was 109.3 mm/8.8 g with a survival of 76.6%. In cage II the average size of fry was 96.8 mm/6.2g

Table 5: Monoculture of Pearls spot *Etroplus suratensis* at Narakkal

Pond No. & Size	2 0.02ha	2 0.02ha	3 0.02ha	3 0.02ha
Experiment No.	I	II	III	IV
Stocking density (No./ha)	5000	7500	5000	5000
Duration of culture (days)	162 Apr-Sept '91	170 Sept'91-Mar'92	162 Apr-Sept'91	170 Sept'91-Mar'92
Size at stocking (mm/g)	113.2/33.8	63.7/6.4	113.2/34.0	a) 41.1/2.3 b) 96.8/21.2
Size at harvest (mm/g)	169.7/124.5	123.0/44.0	144.1/60.5	a) 122.5/44.3 b) 156.3/93.3
Survival (%)	85	42	94	10
Actual production (kg)	9.75	2.42	5.5	0.59
Projected production (kg/ha)	487.5/162 days	121.0/170 days	275/162 days	29.5/170 days
Production of by-catch (kg)	7.0 (Tilapia, Megalops and others)	8.0 (Tilapia and others)	20.0 (Tilapia and others)	7.0 (Tilapia)
Remarks	Pond inundated during SW monsoon	Pond inundated during NE monsoon	Pond inundated during SW monsoon	Pond inundated during NE monsoon

with a survival of 64.3% after 80 days.

Growout Culture in Pens

Two pens of 0.1 ha each were installed at Muttukadu lagoon during July 1991 and stocked with the above cage-reared fingerlings of *Chanos* during August 1991. The stocking density was 7,500 nos/ha in both the pens. Pen I was stocked with fingerlings of 109.3 mm/8.8 g while in Pen II size of fingerlings at stocking was 96.8 mm/6.2 g. Initially the fingerlings were fed with a mixture of ground nut oil cake and rice bran @ 1:1 ratio and later with a formulated feed with following combinations: Fish meal 15%, soya cake 20%, GN oil cake 25%, rice bran 27%, starch 11%, vitamins and

mineral mix 2%. Feeding was done once every morning initially @ 5% of the body weight of stock and later reduced to 3%. In Pen I the fish had grown to an average 204 mm/86.3 g in 205 days and in Pen II 203.5 mm/88.3 g in 195 days. The experiment is in progress.

Pond culture

A 0.4 ha confined pond was stocked with milkfish seed of 49.4 mm/1 g @ 7,500 fry/ha during the first week of July 1991. Feeding was done with the same formulated feed as above @ 5% of body weight initially and later @ 3%. During October 1991, after 95 days of rearing, the fish had shown an average growth of 160.6 mm/52.2 g. The experiment was vitiated due to inundation of the pond caused by heavy rains.

RESOURCE AND TECHNOLOGY IMPROVEMENT DIVISION

Development of feeds for aquaculture of brackishwater prawns and finfish (RTID/NT/1)

Narakkal: S.A.Ali (PL)

Madras: M.S. Muthu, C.P. Rangaswamy, D.N. Swamy, C. Gopal and V. Sreekrishna

Narakkal

Feed development for prawns

Based on the amino acid composition of the body tissue of the white prawn, *Penaeus indicus*, an essential amino acid mixture was formulated and prepared consisting of the three basic ingredients, viz., arginine, histidine and lysine. It was incorporated in the formula feed CIBA-WFG-2 at different levels ranging 1-5%. The feeds were tested on *P. indicus* post larvae (PL-20) in a 30 day rearing trial. The results indicated a marginal improvement in growth and FCR in prawns fed with 1% EAA mixture over the control feed. Higher levels of AA mixture had no beneficial effect.

Experiments were also conducted incorporating duck weed and whole cuttle fish waste substituting them for tapioca and squid waste at 5% and 16%. The feeds were tried separately on *P. indicus* post larvae (PL-20) in 30 day feeding trials. The feeds with the above ingredients were found to be acceptable by the prawn post larvae and the growth and FCR values were similar to that of control feed indicating their usefulness as potential ingredients. A microparticulate feed incorporating squilla protein, squid powder, soyabean cake, etc., was formulated and prepared and it is being tested on prawn post larvae for their acceptability and efficiency.

Nutrition of pearlspot

To evaluate the lipid requirements of pearlspot, a lipid mixture was prepared consisting of sardine oil and coconut oil at 1:1 ratio and, using this, six diets were formulated and experimental feeding trials were conducted on juveniles of 5 g size (av.) for 35 days. Based on the growth performance of fish fed on diets with different lipid levels, it was observed that the lipid requirement of pearlspot is 8.3%.

A mineral mixture was formulated based on the requirements of finfish for use in feeding trials to improve the quality of the formulated diets. The mineral mixture was added @ 1-10 g per 100 g of diet and pearl spot young ones were fed in single and group feeding trials with diets fortified with mineral mixture. The addition of mineral mixture at 4% was found to improve the growth by 31% and FCR by 18% over the diet without mineral mixture. A microparticulate diet consisting of wheat flour, fish oil, soya bean oil, milk protein, whole eggs, vitamins and minerals was prepared and fed to six day old pearl spot larvae in a 25 day feed trial. The control diet consisted of live rotifers and copepods. The results indicated that the diet prepared sustained the growth and survival of larvae. However, the growth of larvae fed on control diet was found to be superior, even though the survival was better with prepared diet.

Madras

Feed formulations and preparation for *P. monodon* culture

The feed mill unit of the Institute was equipped with a mixer, pulveriser, pelletiser, plate mill and a tray drier and installed at Ennore. Using these equipments, a grow-out feed for the tiger prawn, *Penaeus monodon*

was formulated and prepared for trials at the Institute's Kakdwip farm, at the BFDA ponds in Puri district and also at Muttukadu farm. The feed had the following ingredients: fish, prawn head, squilla and squid meal, soyabean cake, starch, fish oil, lecithin, alfalfa meal, vitamin and mineral mixture and had a crude protein level of 35.7%. Based on the requirements for the prawns, vitamins and mineral mixtures were formulated and prepared for evaluating their role in enhancing the growth and survival of prawn. Three trial preparations of prawn feed pellets by extrusion cooking process were conducted with courtesy of M/S. Vorion Chemicals and Distilleries Ltd.

Formulation, preparation and feed testing for finfish

For the milkfish, a growout feed was formulated and prepared. The feed had the following ingredients - fish meal, soya cake, ground nut oil cake, rice bran, wheat flour and vitamins and minerals. The feed was found to be acceptable to *Chanos*.

Formulation and preparation of a maturation feed for the sea bass, *Lates calcarifer* broodstock being maintained at Ennore, was done using trash fish, soya cake, ground nut oil cake, wheat flour, rice bran, and vitamins and mineral mixture. The feed was given in semi-moist dough form and was being tested for its acceptance.

Water stability testing of commercial feed pellets

Three commercial prawn feed samples were tested for their water stability, for different time periods. The stability of the feed pellets was determined by measuring the turbidity of water and loss in weight of pellets. The results indicated that both the imported feeds were more water stable than the indigenous feed. The loss in weight of pellets was 22-23% in 3 hours time in the case of the imported feeds whereas it was 41.2% in the indigenous feed during the same period.

Diagnosis and control of finfish and shellfish diseases(RTID/DIS/1)

Madras: M.S. Muthu (PL), S.V. Alavandi and K.K. Vijayan

Kakdwip: R.K. Chakraborti

Narakkal: K.V. George

Disease investigations in prawn hatcheries

Investigations on diseases leading to mortality of prawn larvae were conducted in the TASPARC hatchery at Visakhapatnam, TNFDC hatchery at Neelankarai and in a private hatchery near Madras.

At Neelankarai, the prawn larvae were found to be infested with a non-septate coenocytic fungus, *Sirrolpidium* sp. and the disease was diagnosed as larval mycosis. Within two days of its detection, it was found that nearly 70-80% of larvae had died. Control measures suggested were treatment with Malachite green @ 6-10 ppm or Treflan @ 10-100 ppm.

At TASPARC hatchery near Visakhapatnam, heavy mortality of *Penaeus monodon* larvae was reported and investigations of the moribund and dead larvae indicated that mysis and postlarvae were infected with pathogenic bacteria, such as *Vibrio alginolyticus* and *V. harveyi* and the disease was diagnosed as luminescent bacterial disease. Several antibiotics and chemicals were tested for their antibacterial activity against these pathogens. *In vitro* sensitivity tests indicated that polymyxin B and Methylene blue @ 1-3 ppm are effective for the control of the disease.

In a private hatchery near Madras, it was reported that despite proper husbandry practices followed in the hatchery, the mysis stage was prolonged and further development was impaired. In two weeks, about 35% mortality was reported. On examination, the larvae were found to be lethargic, pale in colour and the abdominal musculature was

opaque. The problem was traced to larval mycosis caused by the fungus *Sirolopidium* spp. affecting about 20% of the larvae. Experimental trials with Malachite green at different doses for control of the problem were inconclusive.

Disease investigations in grow-out ponds

Monitoring of ponds under semi-intensive culture of prawns under TASPARC / MPEDA / DBT project at Nellore in Andhra Pradesh was carried out regularly. Microbiological investigations on the soil and water samples from the ponds and prawns under culture were carried out in detail at monthly intervals during the entire period of culture from March to July 1991. The bacterial flora in the pond ecosystem and those epibiotic on the prawns belonged mainly to the group of Pseudomonadales. *Flavobacterium* sp., *Micrococcus* sp., *Acinetobacter* sp., *Aeromonas* sp., *Pseudomonas* sp. and *Bacillus* sp. were commonly found in the pond ecosystem in addition to the prawn pathogenic bacteria viz., *V. alginolyticus*, *V. parahaemolyticus* and *V. anguillarum*.

Bacterial septicaemia in *Penaeus monodon*

During June 1991, an outbreak of disease was noticed in the prawn culture pond (No. 2) leading to mortality of prawns. The affected prawns were found to be lethargic, swimming near the surface along the margin of the pond. The prawns which were more severely affected, were found to be lying along the marginal areas of the pond without any movement. On examination, the affected prawns were found to have distinct black blisters on the branchiostegites, abdomen and uropods. The branchiostegites were extended and had melanised blisters bilaterally. In general, the prawns had a fuzzy appearance. Moulting was affected in the diseased prawns. In certain instances, the melanised blisters were found on the abdominal segments also. Microscopic examination of the scrapings from the exoskeleton of dead and moribund prawns revealed heavy infestation of the prawns with *Zoothamnium* sp. a ciliate

protozoan. From the melanised blisters and haemolymph, a gram negative bacterium, *Vibrio alginolyticus* was isolated, and the disease was diagnosed as bacterial septicaemia. Details of occurrence of disease manifestation are furnished in Table 6 and 7.

In vitro sensitivity tests for antibiotics indicated that the disease causing pathogen was sensitive to Oxytetracycline, Chloramphenicol and Polymyxin -B. Health of the affected prawns improved with the application of KMnO₄, Iodine and imported bacterial formulation BN-10 in the pond and greater exchange of water.

Detailed histopathological examination of exoskeleton, hepatopancreas and gills of the diseased prawns were carried out. The cuticle covering the blister was found to be abnormally thickened and around the blister the cuticle was irregular. Heavy infiltration of haemocytes was observed in the endocuticle area resulting in melanisation of the cuticle. Hypertrophy was noticed in the epidermal cells situated in the affected cuticular regions. The epicuticle was ruptured exposing the exocuticle. In the diseased gills the hepatopancreas tissues, haemocytic nests were found to be infected with the pathogenic bacterium, *Vibrio alginolyticus*. Sections of gill tissues revealed the presence of *Zoothamnium* sp.

Soft-shell syndrome in penaeid prawns

Investigations were carried out on the incidence of soft shell syndrome in penaeid prawns under culture in brackishwater ponds at the Kakdwip Research Centre of CIBA, in MATSYAFED prawn farm in Kerala and in CIBA farm at Muttukadu. During July 1991, cultured prawns were found to be affected and samples from Kakdwip were collected. Based on the degree of softness, grading of the prawns was done and the percentage of prawns in different grades of softness was noted.

The soft prawns were found to harbour a bacterium *Vibrio anguillarum* in the haemolymph as well as in the exoskeleton. In addition to this, several other bacteria viz.,

Table 6: Bacterial flora of selected ponds of TASPARC shirmp farm

Pond No.	Bacterial Load in			Bacterial flora																
	Date of sampling	Water (x10 ⁶ /ml)	Soil (x10 ⁶ /g)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	19.3.91	4.00	230.00				+			+	+									
	26.4.91	0.90	6.70						+		+	+				+	+		+	
	28.5.91	0.40	11.00	+						+	+									+
	26.6.91	12.30	140.00		+						+								+	+
2.	11.6.91	0.60	23.00	+	+	+				+		+							+	
	26.6.91	0.94	17.00		+	+					+					+				
4.	19.3.91	10.40	216.00				+					+	+							
	26.4.91	0.10	1.80								+									
	28.5.91	0.80	62.00							+	+						+			
	26.6.91	7.00	190.00							+	+	+							+	+
6.	19.3.91	0.90	8.00				+			+	+									
	26.4.91	0.10	0.70							+	+						+			
	28.5.91	0.60	30.00							+	+						+			
	26.6.91	3.60	40.00		+					+	+						+			
7.	19.3.91	0.10	31.00							+	+		+	+			+			
	26.4.91	0.30	6.00								+	+								
	28.5.91	0.50	10.00	+	+						+	+				+				
	26.6.91	1.30	160.00		+						+					+		+	+	+
10.	19.3.91	0.80	5.00					+		+	+									
	26.4.91	0.20	9.40		+				+		+								+	
	28.5.91	1.00	22.00						+	+	+					+				
	26.6.91	24.00	210.00			+				+						+		+		

1. *V.alginolyticus** 2. *V.Parahaemolyticus** 3. *V.anguillarum** 4. *V.fischeri*
5. *V.vulnificus* 6. *V.fluvialis* 7. *Aeromonas* spp.** 8. *Pseudomonas* spp.**
9. *Flavobacterium* spp.** 10. *Flexibacterium* spp. 11. *Cytophaga* spp 12. *Moraxella* spp
13. *Alcaligenes* spp. 14. *Alteromonas* spp. 15. *Bacillus* spp. 16. *Micrococcus* spp.
17. *Acinetobacter* spp.

*Pathogenic **Pathogenic of low virulence.

V.alginolyticus, *V. parahaemolyticus*, *V. vulnificus*, *Aeromonas* sp. and *Alcaligenes* sp. from haemolymph and *V. anguillarum*, *V. parahaemolyticus*, *V. vulnificus*, *Aeromonas* sp., *Pseudomonas* sp., *Flavobacterium* sp., *Cytophaga* sp., *Alteromonas* sp., *Bacillus* sp. and *Micrococcus* sp. from the exoskeleton were isolated. Incidence of soft shelling among white prawns, *Penaeus indicus* under culture in the MATSYAFED farm near Narakkal, was

also reported in June, 1991. Microbiological investigations of the affected prawns indicated the occurrence of *Vibrio anguillarum* epibiotic on the affected prawns and also within the haemolymph. Bacteria isolated from these soft prawns both from haemolymph and exoskeleton were: *Vibrio anguillarum*, *V. fluvialis*, *Pseudomonas* sp., *Micrococcus* sp. and *Alcaligenes* sp. from haemolymph and *V. anguillarum*, *Aeromonas* sp., *Pseudomonas* sp.,

Table 7: Bacterial flora of *P. monodon* in TASPARC shrimp farm

Pond No.	Bacterial Load in Date of sampling	Bacterial flora																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	19.3.91							+										
	26.4.91				+													
	28.5.91	+			+				+						+			
	26.6.91				+				+						+			+
2.	11.6.91	+		+					+								+	+
	26.6.91	+		+					+								+	
4.	19.3.91							+										
	26.4.91								+	+						+	+	
	28.5.91	+						+	+				+					
	26.6.91								+						+			+
6.	19.3.91							+										
	26.4.91															+	+	
	28.5.91			+				+	+				+					
	26.6.91								+							+		
7.	19.3.91							+										
	26.4.91								+							+		
	28.5.91			+				+	+					+	+		+	
	26.6.91		+	+			+		+						+			+
10.	19.3.91							+										
	26.4.91		+	+					+									
	28.5.91				+			+	+									
	26.6.91			+	+													

1. *V.alginolyticus** 2. *V.Parahaemolyticus** 3. *V.anguillanum** 4. *V.fischeri* 5. *V.vulnificus*
6. *V.fluvialis* 7. *Aeromonas* spp.** 8. *Pseudomonas* spp.** 9. *Flavobacterium* spp.**
10. *Flexibacterium* spp. 11. *Cytophaga* spp 12. *Moraxella* spp 13. *Alcaligenes* spp.
14. *Alteromonas* spp. 15. *Bacillus* spp. 16. *Micrococcus* spp. 17. *Acinetobacter* spp.

*Pathogenic **Pathogenic of low virulence.

Flavobacterium sp., *Alcaligenes* sp. and *Micrococcus* sp. from the exoskeleton.

Though nutritional stress and environmental problems in the prawn ponds etc. associated with soft shell syndrome remains to be studied, the presence of the bacterium *Vibrio anguillarum* invariably in all the affected prawns suggests the positive role played by this bacterium in the problem of soft shelling. A questionnaire has been prepared

and circulated among the prawn farmers and other agencies engaged in prawn farming to evaluate the predisposing factors leading to soft shelling and economic loss due to the disease.

Microbiological quality of *Artemia* cysts

Investigations were conducted on the *Artemia*, sea water and prawn larval samples sent by TASPARC and OSPARC shrimp hatcheries

at Visakhapatnam and Gopalpur during March and December 1991 so as to study the microbiological quality of *Artemia* cysts with special reference to prawn pathogenic bacteria. The studies revealed that the cysts of an imported strain were contaminated with a bacterium pathogenic to prawns, *Vibrio parahaemolyticus* in addition to another gram negative bacterium *Aeromonas hydrophila*. Another important strain of *Artemia* cysts harboured *Aeromonas salmonicida*, a non-motile gram negative bacterium. *Photobacterium mandapamensis* was isolated from yet another strain of *Artemia* from India. From the mysis and postlarvae of *Penaeus monodon* also *Aeromonas hydrophila* was isolated. Seawater samples from Visakhapatnam hatchery were found to contain *Acinetobacter* sp. and were found to be free from prawn pathogenic bacteria.

Similar studies were conducted on samples of *Artemia* sent by OSPARC, Gopalpur. Bacterial load of two strains of *Artemia* was found to be too high (5.04×10^6) and (4.56×10^6) while another strain had 8.0×10^6 per gram of cysts. *Micrococcus* sp., *Bacillus* sp., *Flavobacterium* sp., *Vibrio vulnificus*, *Cytophaga* sp., *Vibrio anguillarum* and *Acinetobacter* sp. were recorded from some of the strains.

Fish disease investigations

An outbreak of EUS (Epizootic Ulcerative Syndrome) was reported in the Kuttanad area of Kerala during August - September, 1991 leading to mass mortality of freshwater fishes. Detailed investigations carried out on the affected fishes indicated large necrotic ulcers on their body and in some cases mild internal haemorrhage. In some fishes the liver was found to be pale. Sloughing of scales in localised areas with mild ulcerations was observed in less affected fishes. In pearl spot *Etroplus suratensis*, massive internal haemorrhage and reddish lesions were noticed. A gram negative bacterium, *Aeromonas hydrophila* was isolated from the ulcerous lesions of the affected fishes and also gram positive cocci, *Micrococcus varians*, was

found consistently from ulcerous lesions of affected fish. The fishes affected by the disease were *Channa striatus*, *Mastacembelus* sp., *Wallago attu*, *Mystus* sp., *Etroplus suratensis*, *E. maculatus* etc.

Physiological responses of prawns to important environmental factors (RTID/EP/1)

Madras: A.R. Thirunavukkarasu (PL), B.P. Gupta, K.O. Joseph, K.K. Vijayan and C. Gopal

Studies were taken up in a semi-intensive prawn culture farm of TASPARC at Paduva, 2 km from Puduparthi village in Nellore Dt., Andhra Pradesh along the Kandleru creek. A total of 11 ponds with a waterspread area of 5.86 ha is under prawn culture. The ponds were stocked during March 1991 with hatchery produced post larvae of the tiger prawn, *Penaeus monodon*. The stocking density varied from 1,50,000 to 4,80,000 no/ha. In ponds 1 and 6 along with the tiger prawn seed, wild seed of the white prawn, *Penaeus indicus* were also stocked @ 2,10,000 and 1,70,000 no/ha. An imported feed was used. The project aimed at understanding the production related parameters of growth, survival and well-being of the prawns through an ecophysiological approach of environmental conditions, moult cycle, biochemical composition of prawns and pathobiology.

In the pond environment, the parameters of soil texture, EC values, pH, organic carbon, available P, redox potential etc., were monitored (Table 8). Plankton and benthos in the ponds were observed.

Observations on the moulting of *P. monodon* under culture indicated that during full and new moon days, majority of the prawns were in premoult stage (38.4-69.5%) followed by postmoult stage (9.7-46.2%) and intermoult stage (15.4-23.6%). Five days either prior to or after full and new moon, majority of the prawns were in intermoult stage (33.3-53.9%), followed by premoult stage (41.5-50.0%) and

Table 8: Physico-chemical features of soil and water of TASPARC ponds in Nellore Dist.

SOIL QUALITY		
Sand (%)	:	38.0-43.7
Silt (%)	:	10.8-17.0
Clay (%)	:	42.5-50.7
EC (mmhos/cm)	:	9.73 \pm 3.83 - 18.4 \pm 3.85
pH	:	7.96 \pm 0.43 - 8.24 \pm 0.13
Organic Carbon (%)	:	0.46 \pm 0.20 - 0.92 \pm 0.44
Calcium Carbonate (%)	:	1.66 \pm 0.36 - 2.73 \pm 0.35
Available Phosphorus (mg/100g)	:	3.76 \pm 0.55 - 4.77 \pm 0.85
Redox potential (mv)	:	+ 10 to -300
WATER QUALITY		
Water depth (cm)	:	59-132
Transparency (cm)	:	14-99
Surface temperature (°C)	:	26.0 - 33.0
Bottom temperature (°C)	:	26.0 - 33.0
Water salinity (ppt)	:	8.5 - 21.0
pH	:	7.5 - 9.4
Surface DO (ppm)	:	1.9 - 15.0
Bottom DO (ppm)	:	2.2 - 15.0
Total Alkalinity (ppm)	:	156.0 \pm 2.0 - 176.0 \pm 34.7
Total hardness (ppm)	:	2770 \pm 674.48 - 3429 \pm 1735.18
Phosphate (ppm)	:	0.004 \pm 0.004 - 0.06 \pm 0.02
Ammonia (ppm)	:	0.4 \pm 0.048 - 1.17 \pm 0.55
Nitrite (ppm)	:	0.027 \pm 0.01 - 0.084 \pm 0.067
COD (ppm)	:	24.38 \pm 6.34 - 44.30 \pm 10.40
Iron (ppm)	:	0.03 - 0.14
H ₂ S (ppm)	:	Below detection level.

post moult stage (3.8-16.6%). During harvest which coincided with 4 to 8 days after full or new moon, most of the prawns were in intermoult stage. The environmental parameters in general were in stable condition for most part of the culture.

In pond 2, where disease manifestation was noticed at harvest 7 days after new moon, it was found that majority of prawns were in premoult stage (50.7%). In this pond *Zoothamnium* infestation on the exoskeleton of prawns was also observed. Prolonged intermoult duration and inhibition of moulting was noticed among diseased prawns and also on prawns infected with an epizootic protozoan, *Zoothamnium*.

Studies on the biochemical composition of hepatopancreas and muscle of both healthy and diseased prawns were undertaken and analysis of protein, lipid, carbohydrate, moisture and ash content of the tissues was made. Compared to the normal prawns, the biochemical reserves, lipid and carbohydrate were found depleted in both hepatopancreas and muscle tissues of the diseased prawns. However, the protein content was reduced in the muscle tissue and marginally increased in the hepatopancreas. The moisture and ash content were more in the diseased prawns than the normal prawn. The details are furnished in Table-9.

Table 9: Mean percentage proximate composition of muscle and hepatopancreas of normal and diseased prawns from TASPARG, Nellore farm during March-July 1991

Size range (mm)	Type	MUSCLE					HEPATOPANCREAS				
		Moisture	Ash	Protein	Lipid	CHO	Moisture	Ash	Protein	Lipid	CHO
100-129	Normal	74.62	18.28	61.76	15.23	3.38	74.65	21.35	48.38	18.38	9.89
	Diseased	79.58	24.44	58.05	13.67	3.44	79.32	25.49	46.42	21.42	5.65
130-159	Normal	74.23	19.67	60.03	16.00	3.44	75.38	22.26	49.67	18.38	9.00
	Diseased	78.26	22.90	57.65	14.00	4.55	79.00	26.65	46.38	19.45	5.25
160-189	Normal	74.66	19.67	59.65	16.65	3.04	76.45	21.00	49.67	19.67	8.25
	Diseased	79.23	22.65	56.95	13.95	4.67	79.64	26.10	45.67	20.67	6.67
190-200	Normal	75.56	20.67	59.67	15.40	3.67	74.82	21.95	48.95	18.95	8.15
	Diseased	79.78	22.75	56.67	13.80	5.75	79.67	27.71	46.67	19.67	5.95

Detailed histopathological examination of the diseased prawns were carried out and pathological changes in the three tissues viz., cuticle, hepatopancreas and gills were observed.

The observations have been reported under project RTID/DIS/1. The duration of culture varied from 101 to 127 days and the size of the prawn *Penaeus monodon* at harvest ranged 121.24 mm/19.0 g-165.4 mm/33.5 g with an average of 141.3 mm/25.1 g. The rate of survival ranged from 39.7% (Pond No. 2) to 95.3% (pond 5), the average being 64.9%. In all, a total of 26,699 kg of prawns were harvested from the 11 ponds (5.86 ha area), with gross production ranging from 2.6 tonnes to 6.3 tonnes/ha, the average production being 4.556 t/ha. 37,538 kg of feed was used for feeding the prawns and the FCR ranged from

1.251 to 2.083 (average 1.405). Monoculture of tiger prawn, *Penaeus monodon* was done in nine ponds while in two ponds (pond 1 and 6) biculture of *P. monodon* with white shrimp *P. indicus* was attempted and a maximum production rate of 6.3 t/ha was achieved with two species combination (Table 10).

Reproductive physiology of brackishwater fish and prawns(RTID/RP/1)

Madras: K. Alagaraswami (PL), N. Kalaimani, Munawar Sultana, T.C. Santiago and K.K. Vijayan

Puri: L. Krishnan

Mugil cephalus

Detailed studies were taken up on the biological, physiological and endocrinological aspects of reproduction of the grey mullet, *Mugil cephalus* from different ecosystems viz., from the inshore areas off Kovalam, from Pulicat lake, Ennore backwaters and from Chilka lake. Fishes of both sexes in different

with immature gonads.

Penaeus indicus

With a view to construct a cDNA library from the thoracic ganglia of the white prawn *Penaeus indicus*, total RNA was isolated and passed through oligo dT column to separate messenger RNA. This was subjected

Table 10: Pond-wise performance during second crop at Nellore TASPARG Farm

Pond No.	Area of Pond (ha)	Seed Stocked (Nos.)	Stocking density (nos/m ²)	Culture days	Yield (kg)	Production Rate (ton/ha)	Feed given (kg)	Average size of prawn (mm/g)	Survival Rate (%)	FCR
1.	0.28	77000 pm 6000 pi	27 21	101 74	947 822	6.3	2364	121.2/19.0 114.2/11.0	80.2	1.334
2.	0.30	91200	30	111	790	2.6	1646	141.0/21.0	39.7	2.083
3.	0.30	96400	30	124	1405	4.4	1796	141.0/32.5	44.8	1.278
4.	0.31	93600	30	111	1222	3.9	1876	144.2/23.3	56.0	1.535
5.	0.31	50000	15	125	1596	14.8	2112	165.4/33.5	95.3	1.323
6.	0.35	88200 pm 60000 pi	25 17	101 74	743 7970	4.4	1926	135.8/19.0 121.6/13.0	62.6	1.251
7.	0.91	255300	28	127	4181	4.6	6577	135.9/24.7	66.3	1.573
8.	0.72	180000	25	114	3017	4.2	4246	145.5/29.6	56.6	1.407
9.	0.79	198000	25	123	3732	4.7	5154	145.5/27.0	69.2	1.381
10.	0.75	188300	25	123	4310	5.7	5723	139.2/25.8	88.8	1.328
11.	0.80	2017500	25	120	3137	3.9	4119	145.6/29.4	52.9	1.313

pm-*Penaeus monodon*; pi-*Penaeus indicus*

stages of maturity were obtained from these areas and the cyclical changes of the gonads in various stages of development observed. Electrophoretic analysis of the serum of the fish indicated additional number of protein bands in mature fishes as compared to fishes

to electrophoretic analysis which showed that the RNA isolated was not degraded. The total amount of RNA isolated was 80 micrograms of which 3% was mRNA.

FISH FARM SURVEY AND ENGINEERING RESEARCH DIVISION

Characteristics of coastal saline soils of different agro-climatic zones and formulation of management practices for aquaculture (FFS/ ERD/SS/1)

Madras: B.P. Gupta (PL) and K.O. Joseph

Kakdwip: R.K. Chakraborti

Detailed survey and collections of soils from Andhra Pradesh, Tamilnadu, Goa and Gujarat were made in order to study the soil characteristics from different agro-climatic regions. A study was also made to find out the feasibility of utilising the saline groundwater in Rajasthan for brackishwater aquaculture.

Andhra Pradesh

Two areas from Nellore District of Andhra Pradesh were surveyed viz., TASPARG farm and Muttukur. The soil of TASPARG farm was clayey in texture with a range of clay 45-50%, silt 9.5-16.5% and sand 37.5-43.5%. The soil was found to be alkaline in reaction with pH 8.0-8.4. Other parameters were: CaCO_3 1.9-2.5% and available P 4.2-4.5 mg/100g of soil indicating productive nature of the soil. The soil at Muttukur area of Nellore was found to be mildly alkaline in nature (pH 6.8-7.9) and the texture varied between sandy clay loam to sandy clay. The EC values ranged 5.75-45.0 mmhos/cm, organic carbon 0.26-0.54% and available P 1.8-3.6 mg/100 g of soil.

Tamil Nadu

The area surveyed was near Velankanni in Nagapattinam Quaid-e-Millat district in Tamil Nadu and about 1.5 km away from the sea and connected by a canal from which water can be drawn for culture

purposes. However, the bar mouth remains closed for 2-3 months (April-June) during the year. The texture of the soil was found to be sandy-clay with sand constituting 57.8%, silt 6.2% and clay 36.0%. The soil was alkaline in reaction with an average pH value of 8.2. Judged by the chemical characteristics of the soil, it was found to be fertile with organic carbon content of 0.35%, CaCO_3 2.6% and available P 4.1 mg/100 g. The EC values ranged 10.5-55.5 mmhos/cm with an average of 34.3 mmhos/cm indicating saline nature of the soil suitable for brackishwater aquaculture.

Goa

Soil samples were collected in Carmona village and analysed for the physico-chemical constituents. The soil texture varied from sandy clay to sandy clay loam and the pH was low and acidic in nature (4.3-5.5). The EC values ranged 13.75-24.50 mmhos/cm, organic carbon 0.24-0.81% and iron content 0.35-1.34%. The surface soil collected from a site from dry embankment indicated high acidic nature with a pH of 2.9 and had high organic carbon (2.2%) and iron content (1.23%). However, the EC value was low 7.5 mmhos/cm.

Gujarat

Two sites from Valsad District in Gujarat were surveyed and soil samples collected. At Borsi, the soil texture was predominantly clayey in texture with clay 50.17%, sand 25.00% and silt 24.8% and alkaline in reaction (pH 8.3-8.5). Other parameters indicated the fertile nature of the soil: organic carbon 0.98%, CaCO_3 3.5% and available P 4.41 mg/100 g and EC 33.8 mmhos/cm.

At Matwad, the soil texture was clayey with clay 47.8%, sand 24.05% and silt 28.1%. The fertility status of the soil was good with available P 4.5 mg/100 g. The EC value

indicated saline nature of soil with 40.25 mmhos/cm.

Rajasthan

To study the feasibility of utilising the saline ground water in Rajasthan for brackishwater aquaculture, a survey of the open wells and borewells in the districts of Sikar, Jodhpur, Pali, Jalore, Ajmer and Nagaur were made for assessing the soil and water qualities. In addition, the salt lakes of Sambhar and Didwana located in Jaipur and Nagaur districts also were surveyed. The soils of the sites surveyed were mainly lighter in texture, (sandy loam) except in Jeevan Mata Road (Sikar Dt.) and Didwana lake (Nagaur Dt.) where it was silty clay. At Santa tank (Pali) and Kuchman (Nagaur) the soils were silty loam. The soils were poor in organic matter and were moderate to highly alkaline in reaction.

Water samples collected from different sites exhibited different chemical composition. Open well waters had salinity ranging from 2-16 ppt except Kuchaman where the salinity was very high (100 ppt). Two tube

wells at Jeevan Mata Road II and Nuwa II are used exclusively for extraction of brine and the waters showed very high salinity. Chloride was the principal anion in all the water samples analysed and ranged 54-93% of the total anions and sodium was dominant among cations. Seawater type of calcium/magnesium ratio was observed in 16 samples ranging 0.033-0.622. Details of the soil characteristics from different states are furnished in Table 11 and 12.

Layout, Systems and Design of small-scale prawn hatchery (FFS & ERD/HD/1)

Madras: K. Alagarwami (PL), M.S. Muthu (upto 1.3.1992), A.V.P. Rao, L.H. Rao, A.R. Misra (upto 24.2.1992) and P. Lakshmanadoss

Based on the design provided by the Institute for the establishment of a prawn hatchery with a capacity of 2 million seed at Chinnaveerampattinam, the Department of Fisheries, Govt. of Pondichery, has completed

Table 11 : Characteristics of brackishwater sites sampled

	Texture %			pH	Org. C (%)	CaCO ₃ (%)	EC (mmhos/cm)	Av. P (mg/100 g)	Iron (%)
	Sand	Silt	Clay						
Tamil Nadu Velankanni	57.80	6.20	36.00	8.20	0.35	2.60	34.30	4.10	-
Andra Pradesh TASPARC (av)	40.00	13.00	47.00	8.20	0.92	2.20	-	4.30	-
Muthukur (av)	60.20	7.70	32.10	7.50	0.41	1.20	25.70	2.60	-
Goa, Carnona									
Site I (av)	55.00	6.00	39.00	5.50	0.45	NA	18.40	NA	1.15
Site II (av)	64.80	4.40	30.40	4.50	0.35	NA	13.80	NA	0.69
Site III (av)	60.40	6.20	33.70	2.90	2.20	NA	7.50	NA	1.23
Gujarat Borsi	25.00	24.80	50.20	8.40	0.98	3.50	33.80	4.41	-
Matwad	24.00	28.10	47.80	8.40	0.71	6.30	40.25	4.50	-

Table 12 : Characteristics of soil from Rajasthan

Site	Texture	EC (mmhos /cm)	pH	Org. Carbon (%)	Cation (mg/100g)				Anion (mg/100g)			
					Na ⁺	K ⁺	Ca ⁺⁺	Mg ⁺⁺	Cl ⁻	SO ₄ ⁻	CO ₃ ⁻⁻⁻	HCO ₃ ⁻
Jeevan Mata Road	Silty clay	36.20	8.22	0.30	30.76	7.85	0.40	0.20	34.13	5.85	0.30	0.60
Bari	Sandy loam	4.50	7.37	0.15	0.75	2.76	0.45	0.17	6.48	0.14	0.20	0.90
Khuntami Tank	Sandy loam	10.20	8.11	0.18	9.67	3.04	0.25	0.20	6.05	1.57	-	0.75
Santa Tank	Silty loam	1.70	7.92	0.24	8.96	2.38	0.25	0.40	7.37	29.68	0.10	0.70
Jogni	Sandy loam	3.70	7.43	0.09	0.56	1.18	0.35	0.10	0.22	-	-	0.45
Kampura I	Sandy loam	9.00	8.59	0.06	8.96	2.38	0.10	0.15	3.67	1.14	0.40	1.85
Dangawas I	Sandy loam	4.70	8.27	0.21	3.11	1.69	0.10	0.40	0.22	0.71	0.30	1.20
Dangawas II	Sandy loam	4.20	8.19	0.50	1.35	1.76	0.15	0.20	0.22	0.86	0.05	1.10
Kuchaman	Silty loam	135.00	8.20	0.42	168.6	12.12	1.40	1.25	108.0	30.82	0.15	0.95
Didwana Lake	Silty clay	135.00	9.26	0.42	181.3	19.34	-	0.50	94.18	27.97	23.40	6.35

the civil works and action has been taken for the procurement of equipment. The hatchery at Kumta, Karnataka which is under construction with designs provided, was visited. A number of suggestions for improvement in the water intake points, quality of pumps to be installed, pipe line systems, filtration systems, water storage tanks, aeration devices etc., were given.

Design and development of machineries and structures for aquaculture (FFS & ERD/AE/1)

24.2.1992) and P. Lakshmanadoss

To develop an indigenous, cost-effective paddle wheel aerator, detailed studies were made on an imported aerator. Based on the information, an indigenous design was prepared taking into account the availability of materials locally and their requirements. A design of feed dispensing unit has been drawn and a prototype developed for trial. Designs for temperature control units for hatcheries during winter were made and one unit has been assembled for trial.

Madras: A.R. Misra (PL upto

COLLABORATIVE PROJECTS

The Institute took up a collaborative project entitled 'Studies on the quantitative requirements of essential amino acids and fatty acids for the prawn *P. monodon* and use of additives in growout feeds for improving feed efficiency and growth promotion, with CIFT, Kochi. The scheme is funded by Department of Biotechnology, Government of India. During the year, infrastructure facilities required for the scheme were developed and equipments procured.

CIBA/BOBP Study on shrimp fry by-catch in West Bengal

A collaborative study on 'Shrimp fry by-catch in West Bengal' with FAO/BOBP was carried out by the Institute at its Kakdwip Research Centre for one year from October 1990 to September 1991. The objective of the study was to assess the destruction of organisms during seed collection operations for *P. monodon* by quantitatively describing the seasonal and spatial variations in the species composition of organisms other than

Penaeus monodon captured as by-catch.

The shrimp (*P. monodon*) fry by-catch in the region consisted of sergestid *Acetes indicus*, carideans *Exopalaemon styliferus*, *Nematopalaemon tenuipes* and *Macrobrachium rüde*, penaeid prawns, *Parapenaeopsis sculptilis*, *Penaeus penicillatus* and *Metapenaeus ensis* and fish represented by 49 species belonging to 29 families with dominance of *Gobioides rubicundus*, *Glossogobius giuris*, *Stolephorus* spp, *Liza parsia*, sciaenids, *Lutianus* spp. and *Rhinomugil corsula*. The peak period of availability of *P. monodon* was during February-June 1991, and the ratio of *P. monodon* and by-catch (all species by numbers) was 1:1.64 at Harwood point, 1:4.67 at Nazat and 1:190.87 at Ramnagar. Among the three centres maximum activity for *Penaeus monodon* seed collection was at Nazat. The study indicated that there is heavy destruction of by-catch at Ramnagar as compared to Harwood point.

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PERSONNEL

(Not a gradation list)

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Principal Scientist

Shri M. S. Muthu (on voluntary
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Shri N. Harinathan
Shri V. Jeevanandam
Shri Amar Gharami
Shri K. Mariappan
Shri Maharaja Majhi
Shri Narendra Nath Jani
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