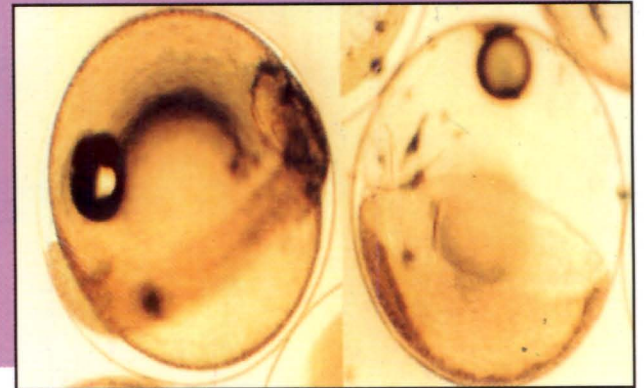
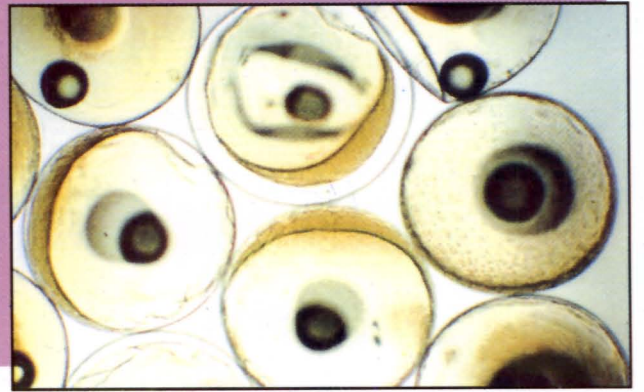
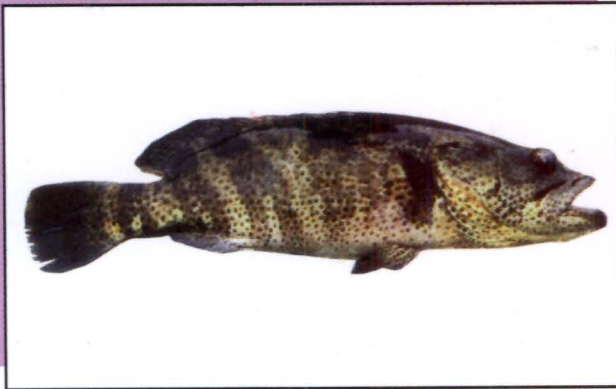


वार्षिक प्रतिवेदन  
**ANNUAL REPORT**  
**2002 - 2003**



भारत  
अनुप  
ICAR



केन्द्रीय खारा जलजीव पालन अनुसंधान संस्थान  
(भारतीय कृषि अनुसंधान परिषद्)  
75, सन्थोम हाई रोड, राजा अण्णामलैपुरम्, चेन्नई - 600 028

**CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE**  
(Indian Council of Agricultural Research)  
75, Santhome High Road, Raja Annamalaipuram,  
Chennai - 600 028.



# वार्षिक प्रतिवेदन

ANNUAL REPORT

**2002 - 2003**



भारत अनुप  
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Front cover : Top left - Mature grouper *Epinephelus tauvina*  
Top right - Fertilized eggs of *E.tauvina*  
Bottom left - Hatchling of *E.tauvina*  
Bottom right - Embryonic development of *E.tauvina*

## 1. PREFACE



Presently the brackishwater aquaculture sector is confronted with a host of issues affecting the core of shrimp culture enterprise. The issues that need immediate R & D support are prevention and control of viral diseases, environmental impact of shrimp farming, captive shrimp broodstock development including specific pathogen free (SPF) and specific pathogen resistant (SPR) broodstock, bioremediation measures to treat shrimp farm discharge water, disease diagnostics, development of prophylactics like probiotics and immunostimulants, cost effective and eco-friendly shrimp feed, diversification of species other than tiger shrimp and standardization of their farming technologies. The Institute has made concerted efforts to address these issues by prioritizing the research programmes and by developing clear strategies in its R & D programmes to find practical solutions for the above problems.

The Institute has developed and commercialized the DNA based Nested PCR technology for the diagnosis of white spot virus disease in shrimps. Another significant achievement was the development of a shrimp immunostimulant which showed promising results in terms of growth and production of healthy shrimps in all the field trials conducted in farmer's ponds. The year witnessed development of F1 generation of the kuruma shrimp and successful induced breeding of grouper by stripping.

Several training programmes on aspects of brackishwater aquaculture of immediate relevance to the aquafarmers / entrepreneurs were organized. To create an awareness about the best management practices, a number of farmers-scientists interaction meetings were conducted. Under the HRD programme, a number of scientists, technical and administrative staff were trained in different areas to improve the quality of research and work efficiency. Through extensive linkages with national and international institutions, the Institute further extended its activities.

The highlights of the research conducted by the Institute during 2002-2003 are presented in this report. The scientists and staff of the Institute contributed significantly to achieve the set targets of the Institute and I record my appreciation and gratitude to each one of them. I wish to record my thanks to Dr.Mangala Rai, Secretary, DARE and Director General, ICAR and Dr.S.Ayyappan, Deputy Director General (Fy.) for their constant support and encouragements. I also thank Dr.A.D.Diwan, Assistant Director General (M.Fy.), Dr.V.R.Chitranshi, Assistant Director General (I.Fy.) and Shri Anil Agarwal, Principal Scientist (M.Fy.) for their unfailing support and help to achieve the targets.

**MATHEW ABRAHAM**

Director

## 2. EXECUTIVE SUMMARY

During the year 2002-2003, the Institute effectively addressed the demands of the brackishwater aquaculture sector through 18 in-house projects and 6 externally funded projects. The research programmes of the Institute are guided by the Research Advisory Committee (RAC). The Staff Research Council (SRC) helps in research project formulation and planning and reviews regularly on a bi-annual basis the work programmes of the Institute. The overall activities of the Institute are supervised by the Institute Management Committee (IMC).

The salient research achievements of the Institute during the year are as follows:

- Domestication of the kuruma shrimp *Marsupenaeus japonicus* was successfully achieved within the hatchery and F1 generation was produced. The shrimps raised in black coloured FRP tanks showed higher growth and survival than those reared in blue coloured tanks.
- *Penaeus monodon* production in the range of 685-983 kg/ha/3-5 months was attained in tide-fed ponds at Kakdwip following extensive traditional culture.
- Berried females of *Scylla tranquebarica* and *S. serrata* were produced by eyestalk ablation in the hatchery. Sea ranching of zoea larvae was continued. Cage culture of *S. serrata* stocked @ 5 nos./m<sup>2</sup> registered a monthly growth rate of 15.8g when fed with chicken offal.
- A captive broodstock of grey mullet *Mugil cephalus* was maintained in 100 ton capacity RCC tank for induced maturation and breeding. Successful induced breeding was achieved in one experiment with broodfishes collected from the wild and the hatchlings survived upto 8 days. Mullet milt was cryopreserved and 50% post thaw motility observed.
- Sex reversal of captive grouper *Epinephelus tauvina* was achieved through hormonal manipulation. 82% of the fishes injected with 17 $\alpha$  methyl testosterone converted into males with oozing milt within 6-8 months.
- Induced breeding of captive grouper *E. tauvina* was achieved by injecting the hormone Human Chorionic Gonadotrophin (HCG). Stripping method was adopted. The larvae were reared upto 4 days.



Shri. Ajit Singh, Hon'ble Minister of Agriculture, Govt. of India releasing PCR kit developed by CIBA



Shri. Hukumdeo Narayan Yadav, Hon'ble Union Minister of State for Agriculture, addressing the Scientists

- Domestication of seabass *L. calcarifer* was achieved with F2 generation broodstock fishes. A total of 12 breeding trials were conducted and produced 25 days old larvae with an average survival of 10%. Around 78,400 seabass fry were supplied to farmers and governmental agencies.
- Chicken offal in dry form at an inclusion level of 5% in test diet exhibited better growth in *L. calcarifer* fingerlings.
- The bacteria, *Serratia* sp. elicited highest growth and phenoloxidase activity (28.5 units) in juveniles of *P. monodon* when given along with feed @  $8 \times 10^8$ /ml/day.
- 21 days old seabass larvae when fed on a diet containing 10% fish protein hydrolysate showed improved weight and survival.
- An isolate of *Vibrio* spp. with enhanced agarolytic activity was isolated from infected fish and water samples from the hatchery complex at Muttukadu.



The Hon'ble Minister is distributing shirmp immunostimulant to a farmer

- Dietary lipid requirements of crab, *S. tranquebarica* (75-85g) were studied by incorporating different oils in the diet at 6% level. Crabs fed with diet containing fish oil exhibited highest growth compared to sunflower oil, groundnut oil and palm oil. The



The Hon'ble Minister is distributing seabass seed to a farmer

dietary cholesterol requirement of the crab was also investigated. Diet having 0.5% cholesterol imparted highest weight and good moulting frequency in juvenile crabs (150 g).

- Piscine nodavirus infection was observed in 21 days seabass larvae. Both light and electron microscopy revealed the presence of membrane bound viral particles in the organelle of the nervous tissue from the brain and spinal cord of the larvae.
- A wide spectrum of protozoan, helminth and crustacean parasites were recorded from grouper *E. tauvina* collected from the wild as well as the captive broodstock.
- Survey of *P. monodon* broodstock along Chennai coast revealed that the shrimps caught from the inshore coastal waters showed higher



Dr.S. Ayyappan, DDG (Fy.) is addressing the Scientists



Dr. S.Ayyappan, DDG (Fy.) in discussion with the Director and Scientists

prevalence of white spot disease virus compared to that caught from deeper waters.

- 12s and 16s rRNA mitochondrial genes were amplified by PCR from *P. monodon*, *Fenneropenaeus indicus*, *S. serrata*, *S. tranquebarica*, *L. calcarifer*, *M. cephalus* and *Oreochromis mossambicus*. The PCR amplified products were subjected to restriction fragment length polymorphism.
- The yeast-like fungus, *Acremonium chrysogenum* showed positive probiotic activity in PL20 of *P. monodon*.
- Environmental impact assessment of shrimp farming in Krishna district, Andhra Pradesh, revealed that there is no adverse impact on soil and water quality of the farm sites / source water due to shrimp culture. The study showed that 10% of the shrimp farms reverted to paddy farming due to recurring problem of white spot virus disease in cultured shrimps.
- Developed methodology for the assessment of carrying capacity of water bodies in relation to shrimp farming.

- Surveyed shrimp farming areas of West Bengal, Andhra Pradesh, Kerala and West Bengal and collected data on shrimp farming systems practiced and the impact on the socio-economic aspects of the farmers in the coastal areas.
- Training programmes were organized on a calendar basis on different aspects of brackishwater aquaculture. 16 training programmes were conducted during 2002-2003. The Institute participated in four exhibitions held in different parts of the country.

In addition to the publication of research papers of scientists in national and international journals, the Institute also published the annual report for 2001-2002, bulletins, special publications, CIBA News, extension pamphlets and training calendar for 2003-2004. Extension pamphlets and special publication were also published in Hindi, Tamil, Telugu and Bengali.

The Institute excelled in the ICAR Sports Meet both at the zonal and national level by winning prizes in Javelin, Discus throw and shotput for women and Long jump and Caroms for men. Besides, the scientists of the Institute received awards for excellence in research. The staff of the Institute received training on various aspects of human resource development.



### 3. INTRODUCTION

The coastal bio-diversity of India is rich and varied with a long coastline of 8129 km, 3.9 million ha of estuaries and 3.5 million ha of brackishwater areas providing habitat for a wide spectrum of fauna and flora. About 1.2 million ha of brackishwater area suitable for development of aquaculture is available in the coastal areas in the country, besides the potential for the utilization of 8 million ha salt affected areas located inland (arid-zone).

The Central Institute of Brackishwater Aquaculture was established in April 1987 to serve as a nodal agency for the development of brackishwater aquaculture in the country. The Headquarters of the Institute is located at Chennai with an Experimental Field Station at Muttukadu, about 30 km south of Chennai. The Institute has two Research Centres at Kakdwip (West Bengal) and Puri (Orissa). The Institute has a Director, 47 Scientists, 31 Technical, 21 Administrative and 71 Supporting staff as on 31.3.2003.

#### Mandate

- To conduct research for development of technoeconomically viable and sustainable culture system for finfish and shellfish in brackishwater
- To act as a repository of information on brackishwater fishery resources with a systematic database
- To undertake transfer of technology through training, education and extension – education programmes
- To provide consultancy service

#### Organizational set-up

The research activities of the Institute are carried out under two Divisions and four Sections

- ❖ Crustacean Culture Division
- ❖ Fish Culture Division
- ❖ Nutrition, Physiology and Pathology Section
- ❖ Genetics and Biotechnology Section

- ❖ Aquaculture Engineering and Environment Section
- ❖ Extension, Economics and Information Section

A number of research programmes funded by various externally funded schemes are also implemented. In addition, the Institute undertakes consultancy programmes.

#### Head Quarters

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Web site : [www.icar.org.in/ciba/index.htm](http://www.icar.org.in/ciba/index.htm)

#### Research Centres

##### Kakdwip

##### Kakdwip Research Centre of CIBA

Kakdwip 743 347

West Bengal

Telephone: 03210-255072

##### Puri

##### Puri Research Centre of CIBA

15, B.S.Nagar, Talbania

Puri 752 002, Orissa

Telephone: 06752-223381

##### Muttukadu

##### Muttukadu Experimental Station of CIBA

Kovalam Post

Muttukadu - 603 112, Tamil Nadu

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95-4114 - 272061

**Financial Statement**

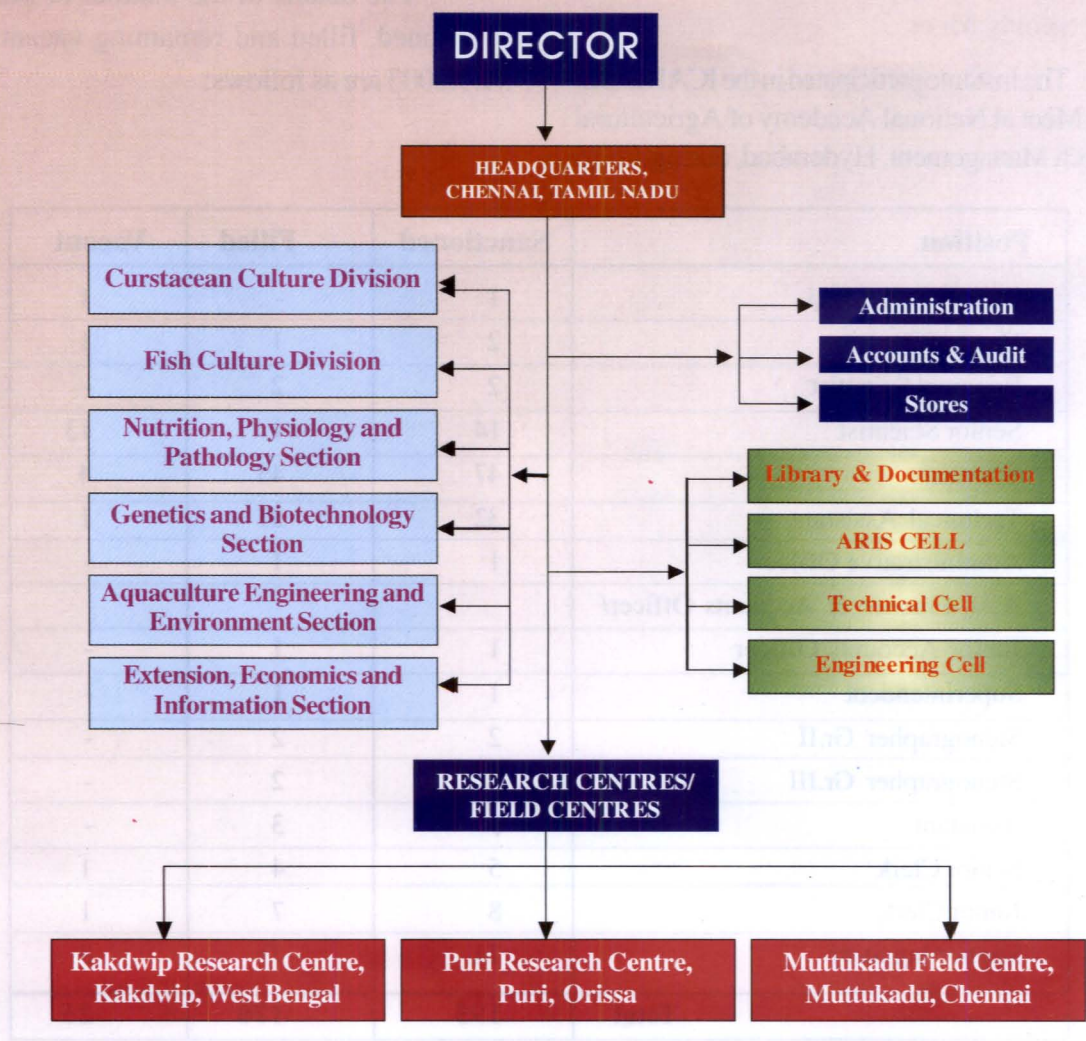
Budget 2002-2003  
(Rs. in lakhs)

	Allocation	Expenditure
Plan	104.62	97.49
Non-Plan	344.96	318.98

**Library and Documentation Section**

During 2002-2003, 22 books were added to the library which now has a total of 1300 books. Besides, 18 foreign and 18 Indian journals were subscribed during the year. Exchange of publications with Indian and international organizations was maintained. Reference and

**ORGANISATIONAL CHART**



reprographic facilities were also provided to scientists, visitors and students.

#### The Official Language Implementation Programme

Four meetings of the Official Language Implementation Committee were conducted and progress report on Hindi was sent to ICAR on quarterly basis. The in-house publication, CIBA NEWS was published in bi-lingual form. The Hindi Day was celebrated on 21 September 2002. Elocution and song competitions were conducted on the occasion.

#### ICAR Sports Meet

The Institute participated in the ICAR Zonal Sports Meet at National Academy of Agricultural Research Management, Hyderabad, during 12-16

November 2002 and won the first, second and third prize in Javelin Throw, Discuss Throw and Shotput respectively, for women and won the first prize in caroms and third prize in long jump for men.

The Institute also won the first prize in Javelin Throw and second prize in Discuss Throw among women in the ICAR Inter-Zonal Sports Meet held at the Central Inland Fisheries Research Institute, Barrackpore, during 28 April to 1 May 2003.

#### Staff Position

The details of the number of positions sanctioned, filled and remaining vacant as on 31.3.2003 are as follows:

Position	Sanctioned	Filled	Vacant
Director (R.M.P.)	1	-	1
Head of Division	2	1	1
Principal Scientist	2	2	-
Senior Scientist	14	1	13
Scientist	47	43	4
Technical Assistant	32	31	1
Administrative Officer	1	1	-
Asst. Finance & Accounts Officer/ Junior Accounts Officer	1	1	-
Superintendent	1	1	-
Stenographer Gr.II	2	2	-
Stenographer Gr.III	2	2	-
Assistant	3	3	-
Senior Clerk	5	4	1
Junior Clerk	8	7	1
Supporting Staff	74	71	3
<b>Total</b>	<b>195</b>	<b>170</b>	<b>25</b>

## ESTABLISHMENT OF CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE



## 4. RESEARCH ACHIEVEMENTS

### CRUSTACEAN CULTURE DIVISION

#### Research Projects

1. Title of project	Improvement of penaeid shrimp hatchery technology for the production of quality seed (CCD/SP/1)
Principal Investigator	Dr.S.Kulasekarapandian
Location of project	Chennai
Co-investigator	Dr.P.Ravichandran, Dr.S.M.Pillai, Dr.Azad Ismail Saheb, Dr. C. Gopal, Dr. C. P. Balasubramanian and Shri V. Chellapandian
2. Title of project	Improvement of production and productivity of shrimp in traditional culture system by suitable management practices (CCD/MT/1)
Principal Investigator	Shri R.K.Chakraborti
Location of Project	Kakdwip
Co-investigator	Dr.P.S.Sudeesh
3. Title of project	Culture of mud crabs ( <i>Scylla</i> spp.) (CCD/CF/1)
Principal Investigator	Shri M.Kathirvel
Location of project	Chennai and Kakdwip
Co-investigator	Dr.S.Kulasekarapandian, Dr.C.P.Balasubramanian and Shri.R.K.Chakraborti
4. Title of project	Culture of tiger shrimp <i>Penaeus monodon</i> in low saline environment (CCD/SC/1)
Principal Investigator	Shri S.R.Das
Location of project	Puri
Co-investigator	Nil

## 1. Improvement of penaeid shrimp hatchery technology for the production of quality seed (CCD/SP/1)

### Induced maturation of penaeid shrimps

Experiments on induced maturation in *Penaeus monodon* and *Fenneropenaeus indicus* under captivity were carried out by following (a) eye stalk ablation, (b) injection of thoracic ganglion extract and (c) electromagnetic stimulation.

#### Induced maturation of *Penaeus monodon* by eye stalk ablation

Three sets of experiments were conducted with adult *P. monodon* collected from the wild catches off Chennai coast. The duration of each experiment was one month. In the first experiment six females in the size range of 196-206 mm / 75-100 g were unilaterally ablated and stocked in a 5 ton maturation tank along with three unablated males (178-196 mm / 50 - 80g). Continuous water flow was provided in the tank. The shrimps were fed @ 15% body weight with polychaete worms, clam meat and a maturation diet in the ratio of 11:8:1 for the first 15 days. Squid was included in the diet from 16<sup>th</sup> day and the feeding rate was enhanced to 25% of body weight with a modified feed ratio of 5:14:4:12 for squid, polychaete worms, clam meat and formulated diet. Females showed ovarian development upto II stage in 8-10 days after ablation. There was no further development and the ovary resorbed subsequently.

In the second experiment, five females (240-245 mm / 80-150 g) were ablated and kept together with three males (173-207 mm / 50-80 g) in a 5 ton FRP tank. Daily, 200% water exchange was provided. Clam meat and polychaete worms were

fed to the shrimp @ 15% body weight for 15 days and @ 25% for the remaining 15 days. One female (207 mm / 80 g) attained full maturity after 21 days of ablation and released, 96,000 eggs. However, the eggs failed to develop. The remaining four females exhibited gonad development upto II stage within 8-10 days of ablation and subsequently the gonads resorbed.

In the third experiment, eight females in the size range of 210-245 mm / 100-160 g were ablated and maintained, two each, in four 500 litre FRP tanks with 200% water exchange, daily. No males were used in this trial. Feeding was followed as in the second experiment. All the shrimps matured upto II stage within 8-10 days of ablation and thereafter resorption of the gonads was noticed.

#### Induced maturation of *Penaeus monodon* by injection of thoracic ganglion extract

5-7 thoracic ganglia collected from maturing *F. indicus* were pooled and an extract was prepared by grinding them with 5 ml of distilled water / physiological saline and filtered through 100 micron filter cloth. 0.5 ml of this extract was injected into adult immature *P. monodon*. The details of three experiments are provided in Table 1.

#### Induced maturation of *F. indicus* and *P. monodon* under electromagnetic field

The experiments were conducted using an equipment (developed by a Non-Government research organization, namely, Madras Institute of Magnetobiology, Chennai), which produces sin type electromagnetic waves in the form of pulses, with an intensity of 3000 n testla, in a frequency of 0.1 hz. One 100 litre capacity FRP tank filled with 70 litres of sea water and holding two adult

immature *F. indicus* females or one adult immature female *P. monodon* was subjected to the electromagnetic field for 5 hours per day for 5 days. Control was also maintained. During the experiment, *F. indicus* showed normal behavior and activity. However, maturation was not observed both in experimental and control females and hence both were ablated in the subsequent experiments. Subsequently, ten experiments with *F. indicus* (116-193 mm / 15-70 g) and one experiment with

*P. monodon* (223-238 mm / 145-160 g) were carried out. Both experimental and control *F. indicus* and *P. monodon* moulted. 3 experimental and 2 control *F. indicus* matured, spawned and yielded nauplii. However, both treated and control *P. monodon* yielded only unhatched eggs. Since both control and experimental shrimps matured and spawned, the role of electromagnetic pulses on maturation could not be established.

**TABLE - 1 Induced maturation of *P. monodon* by injection of thoracic ganglion extract**

Experiment No.	Size (mm/g)	Treatment (Duration : One month)	Results
1	256 / 190 234 / 150	Eye stalk ablation + Injection of thoracic ganglia extract prepared in saline	Spawned on 3rd day and obtained 2,77,500 nauplii.
2	224 / 100 226 / 110	Only thoracic ganglion extract injection	No gonad development
3	223/ 85	Extract prepared in distilled water	No gonad development

### Larval rearing of *P. monodon*

Nauplii produced from wild *P. monodon* spawners collected off Chennai coast were reared, following the technology developed earlier, in 5 ton RCC tanks and 500 litre FRP tanks @ 100 nauplii / litre upto postlarvae 1. Out of nine trials, the larvae reached postlarval stage only in three trials (Table 2). The survival rate from nauplius to postlarva1 ranged from 31.25% to 11.74%. The larvae (PL 1) were transferred to nursery tanks for further rearing.

TABLE 2. Larval rearing of *P. monodon*.

S. No.	Spawner size (mm/g)	Nauplii (no.)	Protozoa I (no.)	Mysis III (no.)	Postlarvae I (no.)
1.	222/100	3,86,400	3,54,900	1,54,800	1,25,000
2.	225/115	1,84,000	1,45,000	61,000	21,600
3.	234/150	2,77,500	98,000	–	–
4.	226/110	2,34,000	1,23,600	–	–
5.	226/110	3,84,700	40,700	–	–
6.	201/ 80	1,29,500	36,400	–	–
7.	251/195	6,17,600	2,70,400	–	–
8.	245/150	4,22,100	3,82,200	–	–
9.	215/ 95	1,20,000	–	–	31,200

## 2. Improvement of production and productivity of shrimp in traditional culture system by suitable management practices (CCD/MT/1)

Culture of *P. monodon* was undertaken in three ponds (Nos. 6, 7 & 8) at Kakdwip Research Centre following traditional culture system with suitable management practices. PL 20 of *P.*

*monodon* was stocked in Pond 8 in April and ponds 6 & 7 in May 2002. Details of the three trials are shown in Table 3.



TABLE 3. Details of *P.monodon* culture.

Culture details	Pond No.		
	6	7	8
Area (ha)	0.090	0.275	0.375
Date of stocking	12.5.2002	29.5.2002	13.4.2002
No. of seed stocked (PL 20)	22500	16500	22500
Date of harvest	15-28 Oct. 2002	16-24 Oct 2002	2 July 2002
Culture period (days)	156-169	140-148	80
No. recovered	9158	7248	7735
Survival (%)	40.7	42.9	34.4
Av. final size (g)	23.76	23.23	25.55
Production (kg/crop)	29.9	168.4	197.6
Misc. prawn (kg/crop)	31.7	102.0	80.0
Yield (kg/crop)	61.6	270.4	277.6
Yield (kg/ha/crop)	684.4	983.2	740.0
Quantity of feed used (kg)	145	343	327
FCR	2.35	1.29	1.178

### 3. Culture of mud crabs (CCD/CF/1)

#### Broodstock development of mud crabs (*Scylla tranquebarica* and *S. serrata*)

13 experiments were carried out in both species of mud crabs viz., *S. tranquebarica* and *S. serrata* for the development of broodstock in captivity, induction of maturity, production of female

berried crabs, seed production and larval rearing.

#### Maintenance of broodstock

For all the experiments, adults of both the species were obtained from Pulicat lake. Crabs were stocked in the holding tanks for 3-7 days before starting the experiment. The experiments

on both the species were carried out in 0.3 / 0.5 or 1.5 ton FRP tanks stocked 1 no./ 0.3 or 0.5 ton tanks and 2 no./ 1.5 ton tank. Sea water of 24 to 33 ppt salinity was used for rearing the crabs. Daily, 100% of water exchange was ensured. A sand bed covering one-third floor area of each tank was provided to meet the burying habit requirement of both the species. The reared crabs were fed twice a day with bivalve meat / squid meat at a rate of 10% of stocked biomass.

### Induced maturation and production of berried females

In order to obtain berried crabs, females of both the species were subjected to induced maturation either by unilateral eye-stalk ablation or by injection of extract of thoracic ganglion of a brachyuran crab. The details of experiment on *S. tranquebarica* injected with thoracic ganglion extract and unilateral eyestalk ablation, are given in Table 4.

TABLE 4. Induced maturation of *S. tranquebarica*

No.	Duration	No. of days	No. of crabs		Ablation (A) Injection (I)	Date	Date of berry noticed	Date of hatching
			Female/ (F) Male (M)	Size : CW mm/g				
1.	16.3.02 to 01.06.02	78	F	164/515	I	16.3.02	-	-
			F	157/550	I	16.3.02	20.4.02	28.4.02
			F	185/775	I	16.3.02	13.5.02	-
			F	180/760	I	16.3.02	-	-
2.	16.3.02 to 02.06.02	79	F	162/515	A	16.3.02	-	-
3.	03.09.02 to 28.09.02	26	F	127/365*	A	03.09.02	-	-
			M	121/365	Not ablated			
4.	03.09.02 to 01.10.02	29	F	136/430*	A	03.09.02	-	-
			M	135/445	Not ablated			
5.	03.09.02 to 11.10.02	39	F	133/375*	A	03.09.02	-	-
			M	126/385	Not ablated			
6.	03.09.02 to 03.11.02	31	F	127/355*	A	03.09.02	-	-
			M	122/350	Not ablated			
7.	03.09.02 to 09.11.02	37	F	131/385*	A	03.09.02	-	-
			M	116/305	Not ablated			
8.	03.09.02 to 21.01.03	141	F	134/405*	A	03.09.02	17.01.03	-
			M	128/420	Not ablated			
9.	03.09.02 to 03.03.03	182	F	125/335*	A	03.09.02	24.02.03	
			M	119/270	Not ablated			

\* Experiment was terminated when female crab died.

A total of 12 female *S. serrata* were injected with the extract of thoracic ganglion obtained from juvenile mud crabs. However, no formation of berry was observed.

Altogether, 33 females of *S. serrata* were subjected to unilateral eyestalk ablation, of which, 14 became berried after an interval of 11 to 26 days

(average: 16 days) in summer months and 21 to 47 days (average : 34 days) in winter months. However, 8 viable hatching took place and the rest six berried crabs died during the incubation period. In one experiment, one female (CW 110 mm) become berried for the second time after an interval of 29 days. The details of larvae obtained from viable hatchings are given in Table 5.

**TABLE 5. Details of larval rearing of mud crabs**

Species	Size of crab (C Win.mm)	No. of larvae (in lakhs)	No. of larvae used for rearing	No. of larvae sea ranched
<i>S. tranquebarica</i>	157	19,54,680	1,00,450	18,54,230
	104	19,14,500	50,300	18,64,200
	97	9,81,750	5,000	9,76,750
	93	13,34,160	3,000	13,31,160
	98	18,11,840	92,000	17,19,840
	109	15,00,000	40,000	14,60,000
	110	17,08,500	1,10,000	15,98,500
	117	7,94,500	1,10,000	6,84,500
<i>S. serrata</i>	113	12,57,295	Nil	12,57,295

### Larval rearing

A total of 132.56 lakhs (*S. tranquebarica* : 19.54 & *S. serrata*: 113.02 lakhs) of larvae were produced. In *S. serrata*, the average larval production was 14.13 lakhs per female.

The larvae were stocked @ of 20 to 60 no. / litre. Both *S. tranquebarica* and *S. serrata* larvae (both of in-door broodstock and wild berried females) were reared on live feeds such as rotifers and nauplii of *Artemia*. Supplementary feed such as boiled and chopped clam meat was also offered in one of the trials on *S. serrata*.

However, in all the larval rearing trials, mortality of the larvae commenced on the third day

after hatching. The larvae failed to survive beyond 5 days.

### Cage culture of *S. serrata*

A 15 sq.m. bamboo split cage was erected in the canal area of B sector farm at Kakdwip Research Centre and mud crabs (belonging to smaller species *Scylla serrata*) having an average body weight of 51.4 g were stocked @ 5/m<sup>2</sup> and reared on a diet of chicken offal for a period of 138 days. The crabs attained an average size of 130 g with a survival rate of 52%. The monthly growth rate recorded was 15.78 g.

## FISH CULTURE DIVISION

### Research Projects

1.	Title of project	Broodstock development, breeding and seed production of <i>Mugil cephalus</i> and polyculture of finfishes and shrimps (FCD/B&C/1)
	Principal Investigator	Dr.M.Natarajan
	Location of project	Chennai and Kakdwip
	Co-Investigator	Dr.Mathew Abraham, Dr.C.P. Rangaswamy, Shri R.K.Chakraborti, Dr.(Mrs.) Munawar Sultana, Dr. S.V.Alavandi, Dr.M.Kailasam and Dr.(Mrs.) B.Shanthi
2.	Title of project	Controlled breeding, seed production and culture of <i>Epinephelus tauvina</i> (FCD/B&C/2)
	Principal Investigator	Dr.M.Kailasam
	Location of project	Chennai
	Co-Investigator	Dr.Mathew Abraham, Dr.A.R.Thirunavukkarasu, Dr.M.Natarajan, Dr.(Mrs.) Munawar Sultana, Dr.I.S.Azad and Dr. (Mrs.) B.Shanthi
3.	Title of project	Breeding, seed production and culture of seabass <i>Lates calcarifer</i> (FCD/B&C/3)
	Principal Investigator	Dr.A.R.Thirunavukkarasu
	Location of project	Chennai, Kakdwip and Puri
	Co-Investigator	Dr.Mathew Abraham, Dr.T.C.Santiago, Shri S.R.Das, Shri R.K.Chakraborti, Dr.N.Kalaimani, Dr.M.Kailasam, Dr.I.S.Azad and Dr.K.K. Vijayan

## Progress of Work

### 1. Broodstock development, breeding and seed production of *Mugil cephalus* and polyculture of finfishes and shrimps (FCD/B&C/1)

#### Development of *Mugil cephalus* broodstock

A captive broodstock of *Mugil cephalus* (56 fishes) in the size range of 300-900 g was maintained in a 100 ton RCC holding tank. The

water quality and health status of the stock were regularly monitored. The water quality conditions of the broodstock tank are presented in Table 6. Low salinity level of 22 to 23 ppt was recorded during November 2002 to February 2003. The fishes were fed on a specially formulated broodstock maturation pelleted feed twice daily @ 5% of body weight and they were examined periodically for their gonadal maturity.

TABLE 6. Water quality parameters of *M.cephalus* broodstock tank

Parameters	Range	Mean
Temperature (°C)	30.3±1.3	26-33.5
Salinity (ppt)	26.5±2.6	22-33
pH	7.06±0.25	6.4-7.7
DO (ppm)	4.2±1.5	
Total NH <sub>4</sub> - N (ppm)	0.12±0.09	0.0-0.23
NO <sub>2</sub> -N (ppm)	0.04±0.02	0.0-0.06

#### Photoperiod manipulation for gonadal maturation of *M. cephalus*

A batch of 18 adult *Mugil cephalus* in the size range of 300 to 900 g was maintained in a covered 33 t RCC tank under two photoperiod regimen to study the effect of photoperiod on gonadal maturation.

The photoperiod regimen followed was :

16 February 2002 to 15 June 2002  
(4 months) : 13L/11D

16 June 2002 to 15 February 2003  
(8 months) : 8L/14D

Temperature, salinity and pH were recorded daily and they were in the range of 27.4 – 30.5°C; 22.6-28.5 ppt and 6.80-7.15, respectively. The fishes were fed on a maturation diet @ 5% of body weight. The fishes were administered ovotide / ovaprim hormone injection @ 0.5 ml/kg body weight at monthly intervals. However, there was no marked improvement in the development of the gonads. Prevalence of low saline conditions (22-23 ppt) during breeding season (November – January) and the smaller size of the fishes could have delayed the onset of maturity.

### Formulation, preparation and management of feed for *M. cephalus* broodstock

Two broodstock maturation feeds were formulated with high lipid and low lipid content. The feeds were prepared using the Ring-die pelletizer. The ingredient used and proximate composition of the feeds are given in Tables 7 and 8, respectively.

**TABLE 7. Composition of mullet broodstock feeds**

Ingredients	High lipid feed	Low lipid feed
Dry fish meal powder	15	15
Soya cake or flour	17	17
Ground nut cake	20	20
Cotton seed cake	5	5
Wheat flour	15	15
Maida	2.2	2.2
Fish oil	5	2.5
Soy lecithin	1	1
Vitamins, minerals, yeast, <i>Spirulina</i> , binder & other additives	3.8	3.8
Wheat bran	To make up to 100%	

**TABLE 8. Proximate composition of mullet broodstock feeds**

Parameters (%)	High lipid feed	Low lipid feed
Crude protein	31.61	32.27
Crude lipid	8.83	5.21
Crude fiber	8.22	9.72
Total ash	14.11	14.85
Moisture	7.60	8.21
Nitrogen Free Extract	29.63	29.74

### Cryopreservation of *M. cephalus* milt

In order to overcome the problem of non-synchronization of maturation in males and females, cryopreservation of mullet milt was taken up. A total of 10.7 ml of *M. cephalus* milt was obtained

from oozing wild males collected from Muttukadu bar mouth and Kovalam coastal waters, during October and November 2002 (Table 9). Milt smears were stained with Rose Bengal (2%) and microphotographs were taken (200 x and 500 x) under oil immersion.

TABLE 9. Details of cryopreservaton of *M.cephalus* milt

	October 2002	November 2002
Collection area	Muttukadu bar mouth area	Kovalam coastal waters
No. of fish	15	4
Wt. of male fish (g)	200 - 300	600 - 770
Vol. of milt (ml)	7.2	3.5
Milt quality	Viscous, less free flowing	Less viscous, free flowing
Pre-freeze motility (%)	80 - 90	89 - 90
Post-thaw motility (%)	20 - 50 after 4½ months	30 to 50 after 3½ months

### Induced breeding and larval rearing of *M.cephalus*

Induced breeding of *M.cephalus* collected from Muttukadu bar mouth and Kovalam coastal waters was conducted from October 2002. Out of nine trial sets, one set exhibited spontaneous natural spawning and fertilization (Table 10). The fish released about 1.5 million eggs and the rate of fertilization was 11.5%. The eggs were collected carefully and incubated indoors in 1 ton FRP rectangular tanks @ 100 eggs/l at ambient temperature of 25-27°C and pH 7.8 under two salinity conditions of 26 ppt and 32 ppt. Continuous aeration was provided. The first movement of the embryo was noticed after 27 hours of fertilization and frequent twitching

movement (once in 30 seconds) was observed at 30 hrs. Hatching started after 32 hrs at both salinities and was prolonged. The hatching rate was very poor and only 730 larvae could be obtained on the second day. The larvae fed with rotifer (*Brachionus* sp.) from second day onwards survived upto 8 days.

**TABLE 10. Details of induced breeding of *M.cephaus***

<b>Date / time</b>	20/12/2002 4.00pm	
Female size (mm/g)	190 / 1220	190 / 1350
Male size (g)	480, 580, 550, 910 (oozing)	
Source	Kovalam coastal waters	Kovalam coastal waters
Initial ova dia ( $\mu$ ) 571	568	
Priming dose	HCG 10000 IU + B <sub>12</sub> 10 mg	Mullet pituitary extract 50 mg + B <sub>12</sub> 10 mg
Tank	Out door RCC nursery	
Water quality	Salinity : 23 ppt, Temperature : 31°C, pH 7.7	
<b>Date / time</b>	21/12/2002 4.00 pm	
Female wt. (g)	1530	1350
Resolving dose	LHRH <sub>a</sub> 305 $\mu$ g (250 $\mu$ g/kg) + Metclopramide 5 mg/kg	Ovaprim 4 ml (@3 ml/kg)
Water quality	Salinity : 26 ppt, Temperature : 29 °C, pH 7.5	
<b>Date / time</b>	22/12/2002 8.15 am	
Result	Natural spawning (partial)	No spawning

**Polyculture of finfishes and shrimp**

This programme was taken up at the Kakkwip Research Centre in a 0.57 ha pond. The pond was stocked on 30.5.2002 with *P.monodon* (40,000/ha), *L.parsia* (25,000/ha), *L. tade* (25,000/ha) and *E. suratensis* (7,000/ha). A locally

formulated feed was provided. The growth of the shrimp and fishes in 5 months are shown in Table 11.

A total production of 467 kg/ha/5 months was obtained from this experiment and a revenue of Rs.24,358/- was realized through sale.

**TABLE - 11. Growth details of shrimp/fishes under polyculture experiment**

Species	Initial weight (g)	Final weight (g)
<i>P. monodon</i>	2.67	19.20
<i>L. parsia</i>	2.00	18.00
<i>L. tade</i>	0.50	14.80
<i>E. suratensis</i>	0.30	9.00



## 2. Controlled breeding, seed production and culture of grouper *Epinephelus tauvina* (FCD/B&C/2)

### Development of captive broodstock

A total of 26 broodstock fishes in the size range of 3-9 kg were maintained in two 100 ton RCC tanks. Out of these, 15 fishes were kept separately to develop as females and the remaining 11 fishes were kept separately to convert them into viable males through hormone treatment. Water exchange was done @ 80% on alternate days. The fishes were fed daily with frozen trash fishes such as Tilapia @ 5% body weight. Water quality parameters such as temperature, salinity, pH and dissolved oxygen were regularly monitored and they varied between 27-33.7°C, 21-34 ppt, 6.9-7.8 and 3.6-5.9 ppm, respectively.

The fishes were examined at monthly intervals to assess gonadal development. Prophylactic treatment for parasitic infections, if any, was done whenever required with 100 ppm formalin bath for 1 hr.

### Development of males under captivity through hormonal manipulation

11 fishes maintained separately were administered with 17  $\alpha$  methyl testosterone. Hormone pellets prepared by mixing with cholesterol and cellulose (1:1) were administered @ 2 mg/kg body weight through feed (Tilapia) on alternate days. The fishes were examined regularly for sex conversion and the results are shown in Table 12. The results indicated that smaller fishes (3.0 to 4.0 kg) became males within six months while larger fishes (above 6.0 kg) took 8 months to convert into males.

### Induced breeding experiments

In the first experiment, female *E. tauvina* (7.0 kg) caught from the wild (average ova size 473.5  $\mu$ ) were used for induced breeding. On 23.12.2002, one female was injected with 4000 IU of HCG and maintained along with three males in a 20 ton RCC tank. After 24 hrs of first injection, the fish received a second dose of 2000 IU of HCG. On the third day, slight enlargement of belly was noticed and a third dose of 2000 IU

TABLE 12. Experiments on sex conversion of *E. tauvina*

Mont	Number of brood fishes	No. of fishes oozing milt (only trace)	No. of fishes oozing milt (free flowing)	Total number of fishes oozing milt
July-November 2002	11	Nil	Nil	Nil
December	11	1	2	3
January 2003	11	1	3	4
February	11	1	5	6
March	11	3	6	9

of HCG was administered. The fish then showed significant development of belly region. After 72 hrs of first injection, the fish spawned spontaneously and most of the eggs were found floating on the surface of the spawning tank. A total of 1 million eggs were collected from the spawning tank and stocked in the incubation tank @ 100 eggs/l. The mean size of the fertilized egg was 890  $\mu$  with a mean oil globule of 185  $\mu$ .

Embryonic development progressed upto 9 hrs and ceased thereafter. In the spawning tank, salinity, temperature and pH of the water were found to be 22 ppt, 28.4°C and 7.69, respectively.

In the second experiment, a female fish (3.3 kg) with ova diameter of 462.5  $\mu$ , was administered with 2000 IU of HCG at 3.15 p.m. on 26.2.2003. Since there was no further ovarian development, 2000 IU of HCG was given each time at 24, 48 and 72 hours. The fish was also administered with LHRHa @ 40 $\mu$ g/kg after 96 hrs of first injection of HCG. After 24 hrs of LHRHa injection, the fish showed enlarged belly. The water quality parameters viz., temperature, salinity and pH were 30°C, 31.00 ppt and 7.72, respectively. Stripping of the fish was done and 20,000 eggs were collected. The eggs were washed and distributed in three 250 litre rectangular tanks for hatching.

The fertilized eggs had mean ova size of 654.4 $\mu$ . The rate of fertilization was 20% and the hatching rate was 10%. The larvae hatched out between 22-24 hrs and measured 1.78 mm. The larvae were 2.40 mm and 2.58 mm in length on the second and third day, respectively. Mouth opening commenced at 56 hrs after hatching. Total mortality of larvae occurred on the fourth day.

### Electron microscopic structure of the spermatozoa

Transmission electron microscopic (TEM) studies on the fine structure of *E.tauvina* spermatozoa were carried out by fixing the milt in 2% gluteraldehyde. TEM studies revealed that the diameter of flagella (sperm tail) was 154-180  $\mu$ m with head (nucleus) diameter ranging between 1.88-2.5  $\mu$ m.

### 3. Breeding, seed production and culture of seabass *Lates calcarifer* (FCD/B&C/3)

#### Captive broodstock development

A total of 42 broodstock fishes (2-10 kg) (F 2 generation) were maintained in large RCC tanks (12x6x2m) and domesticated to complete the life cycle under captive conditions. 70% water exchange was done every alternate day and the water quality parameters were regularly monitored: temperature 27–29°C; salinity 23–32 ppt; pH 7.4–8.2; dissolved oxygen 3.8–5.47 ppm; total ammonia nil–1.21 ppm and nitrite-N 0.003-0.012 ppm. The fishes were fed daily @ 5% of body weight with trash fishes like Tilapia and their health was also monitored regularly. In April and June, parasitic infection caused by *Caligus* sp. and monogenic trematode *Deplectanum latesi* was noticed and it was controlled by the application of 100 ppm formalin bath for 1 hr.

#### Maturation and spawning

Maturation of gonads was observed from the month of February (salinity 25 ppt) and fully mature fishes were found from May onwards. Mature females with an ova diameter of 0.425 mm and oozing males were selected for breeding trials. Fishes were administered with a single dose of LHRH-a hormone intramuscularly @ 60-70 $\mu$ g/kg body weight for

females and @ 30-35µg/kg body weight for males, in the morning hours of new moon or full moon days and released into 20 ton RCC tanks @ 1 female : 2 males.

Out of 14 induced breeding trials conducted from May to first week of October 2002, successful spawning was observed in 12 cases. In 9 trials the same fish spawned again on subsequent day. The number of eggs released in the first spawning ranged from 0.80 to 1.30 million and in the second day spawning from 0.41 to 0.80 million. The rate of fertilization varied from 0 to 80 % in the first spawning and 0 to 42 % in the second day spawning. The hatching rate of eggs ranged from 64 to 80 % in the first spawning and 49 to 64 % in the second day spawning.

### Larval rearing

Seabass larvae were stocked in the rearing tanks @ 10 to 40 no./l and the larvae subsisted on the embryonic yolk upto 3 days. Thereafter, they were fed with rotifers *Brachionus plicatilis* @ 20-30 no./ml upto 9 days. From tenth day onwards, in addition to rotifers, the larvae were fed with *Artemia* nauplii @ 2-3 no./ml upto 15 days. From 16 to 25 days, the larvae were fed with *Artemia* nauplii alone. Daily water exchange upto 40-50 % was done with filtered seawater. Green water containing micro-algae, *Chlorella* or *Tetraselmis* (@ 12,000 cells/ml) was added to larval rearing tanks. The water quality parameters and larval health were regularly monitored.

TABLE -13 . Larval rearing of Seabass

Date of start	No. of larvae stocked	No. of fry (25 days old)	Survival rate (%)
12.05.02	5,20,000	75,000	14.42
26.05.02	4,10,000	48,000	11.70
27.05.02	1,80,000	12,000	6.67
11.06.02	3,00,000	45,000	15.00
25.06.02	2,90,000	33,000	11.38
11.07.02	4,30,000	62,000	14.42
12.07.02	1,70,000	3,800	2.24
28.07.02	4,50,000	33,000	7.33
29.07.02	1,70,000	6,000	3.53
12.08.02	5,70,000	70,000	12.28
13.08.02	2,40,000	8,000	2.67
23.08.02	3,00,000	27,000	8.67
07.09.02	1,13,000	29,800	26.37
08.09.02	3,90,000	23,500	6.03

The survival of larvae upto 25 days ranged from 2.24 to 26.37 % (Table 13) with an average survival rate of 9.78 %. The larvae obtained from first spawning showed better survival rate (6.03 to 26.37 %) than that from the second spawning (2.24 to 8.11%).

### Nursery rearing of Seabass fry

Seabass fry of 25 days old were stocked @ 10-12 nos./l and reared in the hatchery upto fingerling stage (upto 45-50 days) for stocking in grow-out pond. Daily water exchange @ 40-50%

was done. Larvae were fed with *Artemia* biomass or *Artemia* nauplii or egg custard *ad libitum*. The survival rate varied from 45 to 80 % for 20 to 25 days rearing with an average survival rate of 64.36 % (Table 14).

Hatchery reared seabass seed (52-62 mm/ 2.0-3.81 g) were stocked @ 5700 no./ha in a 700 m<sup>2</sup> confined brackishwater pond at Muttukadu. Minced trash fish like Tilapia @ 50 % of the biomass was given daily as feed. The stock was regularly monitored for growth and production.

TABLE 14. Larval rearing of Seabass

Sl. No	Date of stocking	No. stocked	Stocking density (no./l)	Rearing duration (days)	No obtained	Survival Rate (%)
1	08.06.02	20,000	4	20	16000	80.00
2	20.06.02	40,000	8	25	28000	70.00
3	07.07.02	45,000	9	22	32000	71.11
4	21.07.02	30,000	6	25	21000	70.00
5	23.08.02	30,000	6	24	19000	63.33
6	08.09.02	60,000	12	19	27000	45.00
7	24.09.02	25,000	9	23	18000	72.00
8	23.09.02	25,000	5	24	16000	64.00

### Live feed culture:

Mass culture of *Chlorella*, *Tetraselmis*, *Brachionus plicatilis*, *B. rodentiformes* was continuously maintained in outdoor culture tanks for feeding seabass larvae.

### Transportation of seabass eggs and fry

A study was conducted to standardize the optimum conditions required for transportation of

fertilized seabass eggs in different stages of development at various densities, to far-off hatcheries for further rearing. Eggs in blastula (4 hrs after fertilization), nuerala (8 hrs after fertilization) and early embryonic stages (12 hrs after fertilization) were transported at different densities (400-2000 no./l) under oxygen packing. The hatching rate of the larvae after 10 hours of transportation was evaluated. (Table 15).

**TABLE 15. Details of Transportation of seabass eggs**

Stage of egg after fertilization	Packing density (no. of eggs / litre)	Hatching after 10 hrs (%)	Water quality parameters			
			pH	DO (ppm)	Ammonia (ppm)	Nitrate N (ppm)
Control	Nil	—	8.40	20.02	ND	0.005
Blastula stage (4 hrs)	400	85.33	8.23	18.4	0.099	0.021
	800	84.67	8.17	15.6	0.203	0.017
	1000	81.33	8.12	12.0	0.283	0.140
	1500	81.00	8.16	13.33	0.355	0.010
	2000	81.00	8.14	13.87	0.333	0.014
Nuerala stage (8 hrs)	400	88.33	8.03	12.40	0.037	0.014
	800	80.67	8.06	9.80	0.037	0.017
	1000	83.00	7.99	9.73	0.087	0.017
	1500	80.00	8.14	9.20	0.117	0.018
	2000	7.67	7.87	9.20	0.174	0.016
Early embryonic stage (12 hrs)	400	87.67	8.00	10.80	0.114	0.018
	800	69.00	8.01	10.80	0.163	0.018
	1000	61.67	7.92	10.00	0.157	0.021
	1500	61.00	7.92	9.20	0.235	0.017
	2000	60.00	7.75	8.40	0.346	0.023

ND : Not detectable

There was no significant variation in the hatching rate of eggs in different stages of transportation. However, an increase in ammonia and nitrate levels, after 10 hours of transportation was noticed.

25-50 days old seabass fry were transported @ 100 to 250 no./l under oxygen packing, to different places in Tamil Nadu, Andhra Pradesh, Orissa, West Bengal, Haryana and

Rajasthan involving a duration of 4 to 18 hrs. The survival rate of fry varied from 82 to 95 % at the destination points.

Seabass seed produced in the Institutes' hatchery were supplied to farmers, State Fisheries Departments, Fisheries Colleges and Rajiv Gandhi Centre for Aquaculture, for grow-out culture. During the year, 78,400 fry were supplied to 14 farmers and Rs.1,03,710/- was realized from the sale of seed.

## NUTRITION, PATHOLOGY AND HYSIOLOGY SECTION

### Research Projects

1. Title of project	Development of feeds for aquaculture of brackishwater shellfishes and finfishes (NPPS/NT/2)
Principal Investigator	Dr.S.A.Ali
Location of project	Chennai and Kakdwip
Co-Investigators	Dr.M.Natarajan, Dr.C.Gopal, Dr.J.Syama Dayal and Mrs..M.Poornima
2. Title of project	Development and evaluation of immunodiagnosics and prophylactics for important brackishwater fish and shellfish (NPPS/PATH/1)
Principal Investigator	Dr.I.S.Azad
Location of project	Chennai
Co-Investigators	Mrs. M.Poornima
3. Title of project	Monitoring and surveillance of diseases in shrimp and fish with special reference to broodstock (NPPS/DIS/3)
Principal Investigator	Dr.K.P.Jithendran
Location of project	Chennai
Co-Investigators	Dr.K.K.Vijayan, Dr.S.V.Alavandi and Mrs.M.Poornima

### Progress of Work

#### 1. Development of feeds for aquaculture of brackishwater shellfishes and finfishes (NPPS/NT/2)

##### Development of larval diet for Asian seabass

Asian seabass (*Lates calcarifer*) is a carnivorous fish and its larvae are therefore fed with live-food organisms such as brine shrimp (*Artemia*) nauplii. To develop a compounded

diet for seabass larvae, a feed was formulated and prepared as semi-moist soft dough using indigenous raw materials having more than 45% protein. The diet was tested for growth and survival of 21-day old larvae (3.0 mg) produced in hatchery in comparison to brine shrimp nauplii and an imported larval diet. The seabass larvae were successfully weaned on the formulated diet for 15 days and the results are shown in Table - 16.

**TABLE 16. Growth and survival of seabass larvae (21 day old) on different diets**

Parameters	Diets		
	CIBA diet	Imported diet	Brine shrimp nauplii
Weight gain (%)	410.5	412.5	508.9
Survival (%)	74.5	78.3	70.2
Cannibalism (%)	12.2	11.7	19.1

**Improved seabass larval diet**

Protein hydrolysate prepared by enzymatic digestion of animal protein was incorporated at 10% and 15% level along with other ingredients in a larval feed containing 45% protein so as to improve the digestibility of compounded diet for

the larvae of seabass. The feed was prepared as semi-moist soft dough and tested on 21-day old larvae (13.1 mg). The diet without protein hydrolysate served as control. The results indicated that the diet with 10% protein hydrolysate improved weight gain and survival of larvae compared to that of control (Table 17).

**TABLE 17. Growth and survival of seabass larvae (21 day old) on different diets**

Parameters	Diets		
	Control (No protein hydrolysate)	10% protein hydrolysate	15% protein hydrolysate
Weight gain (%)	413.1	456.5	448.1
Survival (%)	76.1	80.1	78.7
Cannibalism (%)	11.2	9.9	10.6

**Nutrient and amino acid profiles of seabass egg and larvae**

Fertilized eggs and developing larvae of *L. calcarifer*, were analyzed to determine their proximate (Table 18) and amino acid compositions. The fertilized dry egg weighed 31 µg and contained 44.23% protein, 27.35% lipid and 0.157 calories of gross energy. Dry weight decreased by 38.7% during hatching. The protein and lipid followed declining trends from hatching (49.89 and 25.31%)

to pre-feeding stage (34.04 and 16.65%). The fertilized egg contained 1.287 µg, 1.132 µg, 0.964 µg, 0.942 µg, 0.787 µg and 0.713 µg of leucine, lysine, arginine, valine, threonine and phenylalanine, respectively and these six essential amino acids (EAA) constituted approximately 78% of the total EAA. The EAA accounted for 57.8% of the total amino acids in the egg and it reduced to 44.3% on second day of hatching indicating the role of EAA in the early larval development, especially in pre-feeding stage.

TABLE - 18. Nutrient composition and gross energy values of egg and larvae of *L. calcarifer*

Age (days)	Dry matter (µg)	Protein (µg)	Lipid (µg)	Carbohydrate (µg)	Energy (cal)
Egg	31	13.71	8.48	0.21	0.157
Hatch	19	9.48	4.81	0.18	0.090
1	23	10.13	4.78	0.15	0.103
2	26	8.85	4.33	0.12	0.093
5	41	19.41	5.66	1.05	0.167
9	85	48.06	8.85	3.34	0.383
17	984	530.18	88.56	15.94	3.935
21	2749	1459.68	210.12	29.87	10.68

#### Inclusion of chicken offal in seabass diet

Dry chicken offal was substituted for fishmeal in a grow-out feed formulation for seabass at 0, 5, 10 and 15% levels. The four diets were tested on the fingerlings of seabass (2.5 g) in a 30 day feeding trial. The results have shown that the fish fed with 5% offal in diet showed comparable growth (132%) and feed conversion ratio (2.2) to that of control (128% weight increase and 2.1 FCR). The rate of survival was same in both cases. The results have indicated that chicken offal at 5% level can replace the costly fish meal in seabass grow-out diet.

#### Grow-out feed for culture of seabass

Using indigenous ingredients a feed containing 40% crude protein was formulated for the grow-out culture of *L. calcarifer* as given below:

Crude protein	40.08	%
Fat	8.25	%
Crude fibre	4.0	%
Nitrogen free extract	24.77	%
Moisture	7.36	%
Ash	15.54	%

Field testing of the feed was carried out in a 0.08 ha pond at Kakinada Research Centre of CIBA. Seabass fry (1.7g) weaned to the formulated feed for 20 days were stocked @ 7500/ha. Initially, the feed prepared as a mash and made into soft dough was fed @ 8 - 10% of body weight (supplied in two rations in the morning and evening). After two months, the feed was prepared as floating pellets in an extruder and as sinking pellets in ring-die pellet mill and fed separately @ 5% of body weight. In four months, the fishes have reached the size of 255-340g. The survival recorded was 70%. It was observed that the fishes preferred floating feed pellets over the sinking feed pellets.



### Evaluation of a probiotic in shrimp feed

A bacterial species obtained from Microbial Type Collection Center (MTCC), Chandigarh, was cultured, centrifuged and washed with sterile sea water. Testing of these bacterial cells for their probiotic property was done by incorporating in feed at 100 micro liters ( $\mu\text{l}$ ) of cells ( $8 \times 10^8$  /ml) per day and by bath treatment of shrimp in sea water at two different cell concentrations of  $8 \times 10^3$  /ml and  $8 \times 10^2$  /ml. A control was maintained without any treatment. The experiment was conducted with juveniles of *P. monodon* (6.0 g) for 25 days. The shrimp fed with feed containing probiotics elicited highest growth (103.3%) and phenoloxidase activity (28.5 units)

compared to control (72.8% and 9.62 units, respectively). The shrimp that received bath treatment recorded a growth of 94 – 98% with a phenoloxidase activity of 22 – 24 units.

### Evaluation of lipids in mud crab diets

For developing a suitable formulated feed for the culture of mud crab *Scylla tranquebarica*, different lipids were evaluated. Fish oil, sunflower oil, groundnut oil and palm oil were incorporated at 6% level in a standard diet with 35% protein. The diets were fed to juvenile crabs (75–85g) in a 65-day feeding trial. The crabs fed with the diet containing fish oil showed highest weight increase followed by the diet with sunflower oil, groundnut oil and palm oil, in decreasing order (Fig.1).

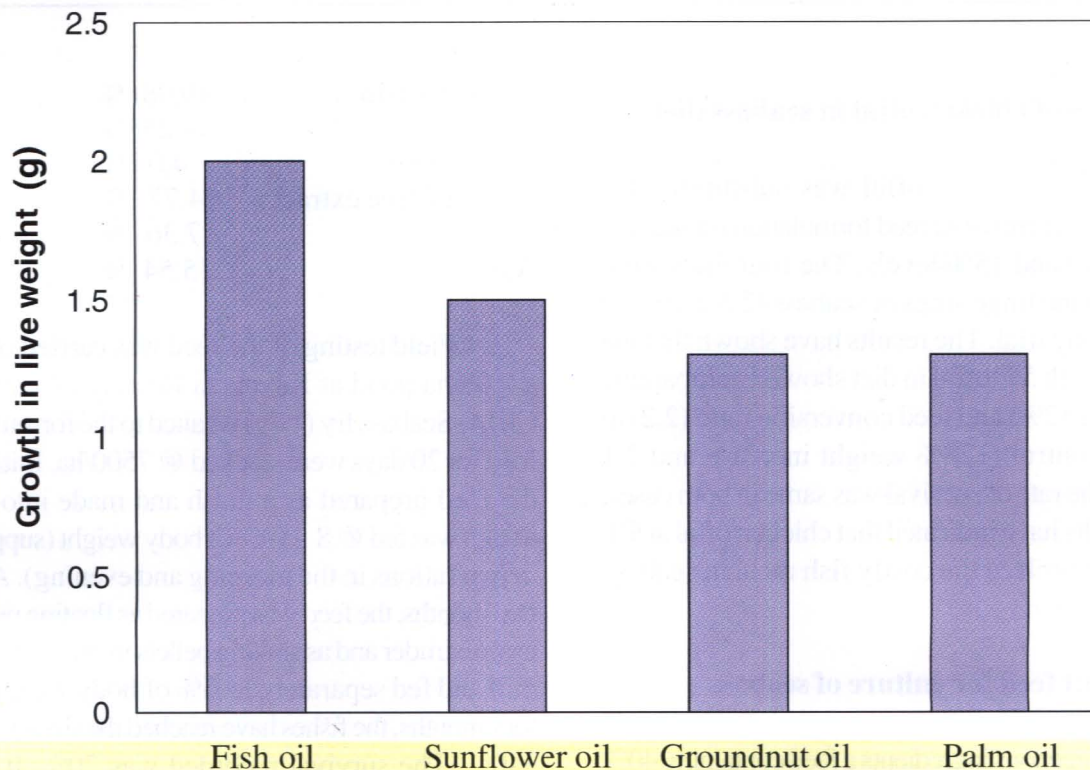


Fig-1 Evaluation of different oils in the diet of mud crab *Scylla tranquebarica*

### Dietary cholesterol requirement for mud crab

The dietary requirement of cholesterol for *Scylla tranquebarica* was determined using six purified diets having cholesterol levels ranging from 0 to 1.4%. The experiment was conducted with juvenile crabs (150g) for 120 days. The crabs fed with 0.5% cholesterol diet gained highest weight of 103.3% with good moulting frequency compared to other diets.

### Field testing of CIBA shrimp feed

CIBA shrimp feed was tested in a farmer's pond (0.52 ha) at Kalpakkam, near Chennai. The pond was stocked with 60,000 PL20 of *P. monodon*. 200 kg Starter grade feed was produced and supplied to the farmer on payment basis. The shrimp attained an average weight of 6.8g in 40 days and the culture is in progress.

## 2. Development and evaluation of immunodiagnosics and prophylactics for important brackishwater fish and shellfish (NPPS/PATH/1)

### Development of prophylactics and diagnostics for bacterial diseases

Fish serum containing anti-rabbit IgG antibodies from tilapia and *Mugil cephalus* was raised, measured using ELISA and pooled from different sets for characterization by affinity column. The purified antibodies from both fishes were similar with identically resolved light and heavy chain molecules. The purified pool of mullet antibody was used for immunizing rabbit for the production of polyclonal antibodies against fish immunoglobulin.

Using *Vibrio vulnificus* isolated from diseased *Mugil cephalus* broodstock pathogenicity was experimentally induced in healthy mullet to produce the histopathological manifestations. The bacterium was found to colonize the ducts of pancreas and periventricular

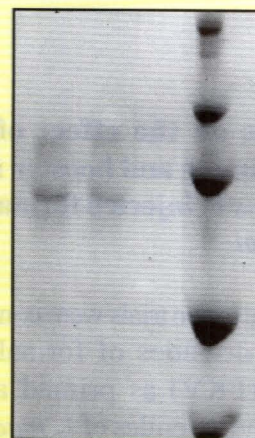


Fig. 2. Heavy and light chain molecule similarity between *O. mossambicus* and *M. cephalus* immunoglobulin molecules

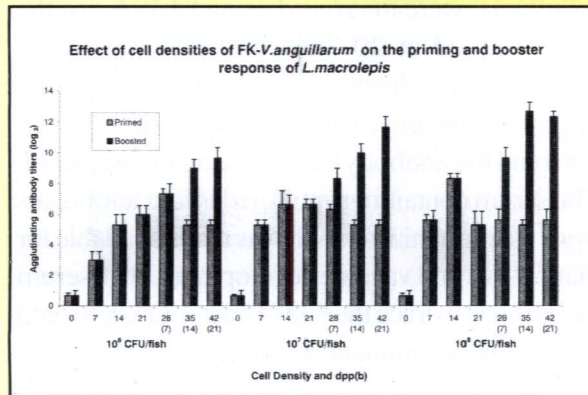
wall, causing wide spread histopathological manifestations at the site of injection, in kidney, liver, spleen and other vital organs.

Antibodies raised against *V. vulnificus* in New Zealand White Rabbit (0.9 kg) by intradermal injections, using formalin-killed *V. vulnificus*, were measured using ELISA and the titres peaked at 20 days post-priming (dpp). Three booster doses were given at 21 dpp, 35 dpp (15 days post I booster, dpb), 42 dpp (21 dpb) and the antibody titres were again measured. The serum containing anti-*V. vulnificus* antibodies from the immunized rabbit was made available for diagnostics and vaccine development. The serum can be used to trace the fate of bacterium delivered as an immunostimulant in shrimp.

An experiment was carried out to assess the survival response of *Lates calcarifer* fry (37 dph) immunized via bath treatment using *V. anguillarum* and *V. vulnificus* individually and in 1:1 combination, as a bivalent antigen. Survival of fry exposed to the bivalent antigen was significantly better than that elicited against monovalent antigens. The results indicated that complementing antigens in *Vibrio* species can act synergistically to elicit better protective response than monovalent antigens.

**Observations on the effect of bacterial density on priming and booster response in *Liza macrolepis* to injected formalin-killed *V. anguillarum***

Immunization trials were conducted using different cell densities of formalin-killed *V. anguillarum* (FKV) as primed and booster treatments in the juveniles of *L. macrolepis* (6-8 cm; 8-12 g). The experiments were conducted in triplicate with 50 fishes in each treatment. The fishes were injected with  $10^6$ ,  $10^7$  and  $10^8$  cells for each set. A booster injection was given on the 21<sup>st</sup> day of priming injection (dpi). Blood serum obtained at 7, 14, 21, 28, 35 and 42 dpi was used to determine the agglutinating antibody titres against FKV of respective cell densities. The highest titres ( $14.33 \pm 0.33$ ) were noticed at 42 dpi in the booster group of fishes immunized with the highest bacterial cell density (Fig.3). Similar results were obtained for the memory factor (MF).



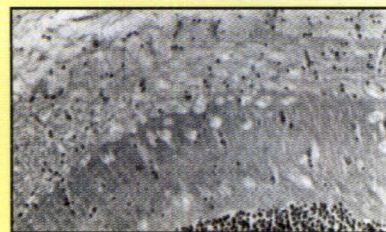
**Fig. 3. Priming and booster response of *L. macrolepis* to FKV at different cell densities**

**Observations on Nodavirus infection in the broodstock and larvae of seabass**

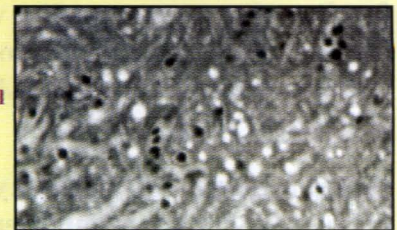
Investigation on the mortality of seabass larvae in the hatchery was undertaken to identify the causative agent. Sections of the nerve tissue of the larvae showed characteristic nodavirus –

induced histopathological manifestations. Both light and electron microscopy suggested viral infection with typical membrane bound viral particles in the organelle of the nerve tissue from the spinal cord and brain.

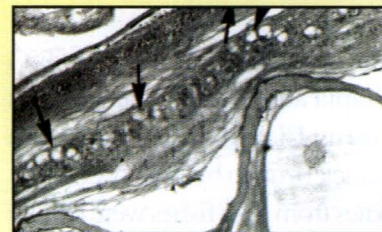
Histopathology of moribund seabass larvae revealed the presence of *Vibrio anguillarum* like bacterium (VAL), *V. alginolyticus* and *V. vulnificus*. Acute hyperplasia of the epithelium of the body surface, gills and pharyngeal lining were consistently noticed and rarely fusion of gill lamellae.



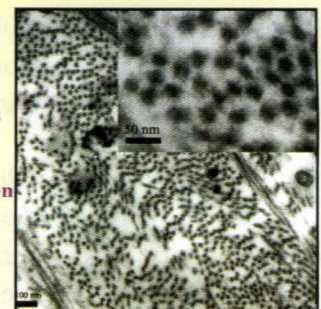
**Vacuolation induced by nodavirus in brain tissue**



**Vacuolated retinal layers**



**Vacuolated spinalcord**



**Nodavirus viral particles in the brain.**

**insert:High magnification of EM**

### 3. Monitoring and surveillance of diseases in shrimp and fish with special reference to broodstock (NPPS/DIS/3)

#### Disease monitoring and surveillance of shrimp and fish broodstock

Investigations on the mortality of broodstock of mullet, seabass and groupers during the month of March, 2002 revealed that the mortality was due to nervous system associated clinical symptoms, exophthalmia, corneal opacity, excessive mucous secretions, lateral pigmentation etc. Clinico-pathological, microbiological and parasitological investigations revealed that the mullets had typical haemorrhagic lesions on left side, atrophied left eyes and a thick opaque membranous layer over the cornea (corneal opacity) and pigmentation on sides with clinical history of incoordination and cork screw swimming pattern. Further the pale liver, kidney and enlarged spleen with pin-head-sized pestles, viscera containing fluids etc., suggested the involvement of nervous system and the occurrence of viral encephalopathy and retinopathy. The disease was suspected to be of viral etiology and a detailed experiment was conducted with mullets (16-24 cm) collected from the wild by artificially infecting them with extract from infected fishes. The fishes were divided into 5 groups (Gr. I, II, III, IV & V) of 6 fishes each and kept in 500l FRP tanks. Extracts of the brain and eye together and other major visceral organs were prepared separately from the clinically affected fishes. Similar extracts prepared from a clinically normal wild fish served as control. The Gr. I was intraperitoneally injected with 100-200 µl of the brain and eye extract, Gr II with the extract of other visceral organs, Gr III and Gr IV received extract of the brain / eye and visceral organs from normal healthy fishes, respectively. The control (Gr. V) fishes were injected with Phosphate Buffered Saline (PBS) alone.

The clinical symptoms, mortality, morbidity etc., of all the treated groups were recorded. All the fishes of Gr.I died by 9 day post injection, while mortality was nil in other groups. Except exophthalmia and corneal opacity in some dead fishes, there were no other apparent clinical symptoms. The fishes from the other groups were bled and sacrificed at the end of the experiment and the various organs were collected for histology and electron microscopy (EM). Samples from suspected nodavirus infected fishes were processed for histopathological investigation and EM. In the infected fishes, the serum showed higher level of protein (182-270 mg/ml) as compared to the control fish 151-165 mg/ml.

#### Parasites and parasitic infections of grouper

Groupers collected from the wild as well as the captive broodstock maintained in the fish hatchery at Muttukadu were found to be infested with a wide spectrum of protozoan, helminth and crustacean parasites. Among the protozoan parasites, myxosporidians were found to be the dominant group represented by species of *Myxidium*, *Ceratomyxa* and *Myxobolus* in various organs. The fishes examined for parasitic infection revealed the presence of monogenea on gill, digenea and cestodes in the intestine, and filaroid nematode infection in ocular cavity. Microsporidian parasites were also recorded from a broodstock fish. Generally, parasitic infections were less in the wild fishes.

The ectoparasitic monogenean, *Benedenia* sp., collected from both wild and broodstock fishes were maintained in captivity in the laboratory and its description and pathobiology were done. The parasite was found to infest the gills and skin of the fish and severe infections lead to small focal haemorrhages on the body, which often resulted in secondary bacterial infection. Freshwater bath dislodges the parasite from the fish. Treatment with 100 ppm formalin for 30 min. was found to be effective in controlling the parasites.

## GENETICS AND BIOTECHNOLOGY SECTION

### Research Projects

1. Title of project	Application of molecular genetics and biotechnology in genetic characterization, stock improvement and health care of finfish and shellfish (GBS/MG/1)
Principal Investigator	Dr.T.C.Santiago
Location of project	Chennai
Co-Investigators	Dr.N.Kalaimani, Dr.G.Gopikrishna, Dr.K.K. Vijayan, Dr.S.V.Alavandi and Shri M.Shashi Shekhar
2. Title of project	Development of probiotics for disease resistance in shrimp (GBS/PRO/1)
Principal Investigator	Dr.S.V.Alavandi
Location of project	Chennai
Co-Investigators	Dr.K.K.Vijayan, Dr.K.P.Jithendran and Mrs.M.Poornima
3. Title of project	Evaluation of <i>Penaeus monodon</i> broodstock along the Indian coast with special reference to pathogen loading (GBS/SHM/1)
Principal Investigator	Dr.K.K.Vijayan
Location of project	Chennai
Co-Investigators	Dr.T.C.Santiago, Dr.S.V.Alavandi, Dr.K.P.Jithendran and Shri M.Shashi Shekhar

### Progress of Work

#### 1. Application of molecular genetics and biotechnology in genetic characterization, stock improvement and health care of finfish and shellfish (GBS/MG/1)

##### Genetic characterization of *Lates calcarifer*

Landmark data collected from 356 nos. of *Lates calcarifer* from Chilka Lake (Orissa) and Kakinada (Andhra Pradesh) during 2002-03 and Kakdwip (West Bengal) and Chennai (Tamil Nadu) during 2001-02 were used to obtain the

truss measurements by computing the distances through the Pythagorean Theorem. The data were log transformed and principal component analysis was used to obtain the scores from the variance – co variance matrix.

Principal component analysis (PCA) revealed that first two components (PC I and PC II) explained 92.06% of variation in the data. The loadings on PC-1 were positive and of the same magnitude, indicating that PC-1 can serve as a size component. PC-II is the shape component but is confounded with size. For the shape component to be free from size, the algorithm of Humphries *et.al.* (1981) was deployed. The sheared PCA revealed that the first two components explained 94.64% of the variation in the data set and hence only the first two scores are used for further analysis. The loadings on PC-1 revealed that all the elements in the eigen vector are positive and of the same magnitude (0.18 to 0.24).

An examination of the elements of the second eigen vector revealed that the following truss measurements contribute to the variation in the data:

1. Truss measurement (TM) from tip of nostril to anterior portion of dorsal fin.
2. Four TM on the caudal peduncle region.
3. TM between anterior portion of ventral fin and anterior of anal fin.
4. TM between inter-opercular area and anterior portion of ventral fin.
5. A traverse TM between end of spiny dorsal fin and anterior portion of anal fin. (Fig.4.)

### Randomly Amplified Polymorphic DNA (RAPD) patterns of *P. monodon*

Preliminary study on the RAPD of *P. monodon* collected from various locations along the east coast of India was carried out. The chromosomal DNA was isolated from tissue samples.

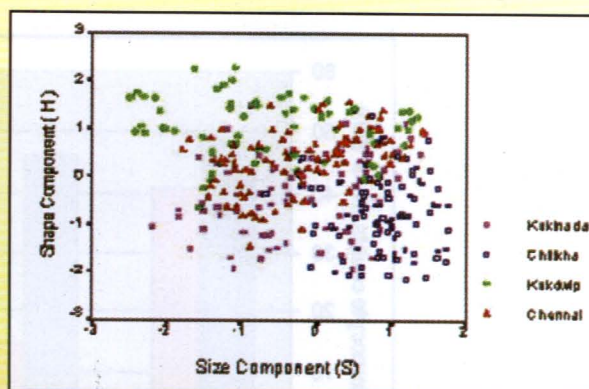


Fig.4 Truss analysis of *Lates calcarifer*

Using the random primers, the DNA was amplified and the PCR products were electrophoresed through agarose gels and the gel pattern was analysed using the programme quantity R1. The results revealed that *P. monodon* from east coast are genetically related (Fig.5)



Fig. 5 RAPD patterns of wild *P. monodon* collected from east and west coast

### Studies on Immune Index

Studies were conducted to develop immune index to assess the health status of *P. monodon* using haemolymph. It was observed that there is a variation in the haemocyte count of the shrimps affected with WSSV, when compared to healthy ones. There is a possible correlation between the number of haemocytes and the infection level. Further haemolymph collected from the WSSV infected shrimp did not show clotting properties (Fig.6&7). This simple observation on haemolymph clotting can be used as a practical tool to know the health status of farm-reared shrimp and shrimp broodstock.

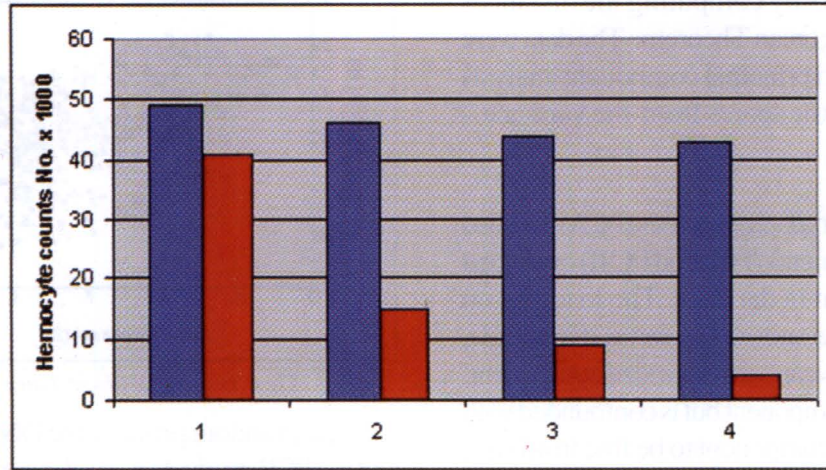


Fig.6 Haemogram of *P. monodon* experimentally infected with *V. alginolyticus*

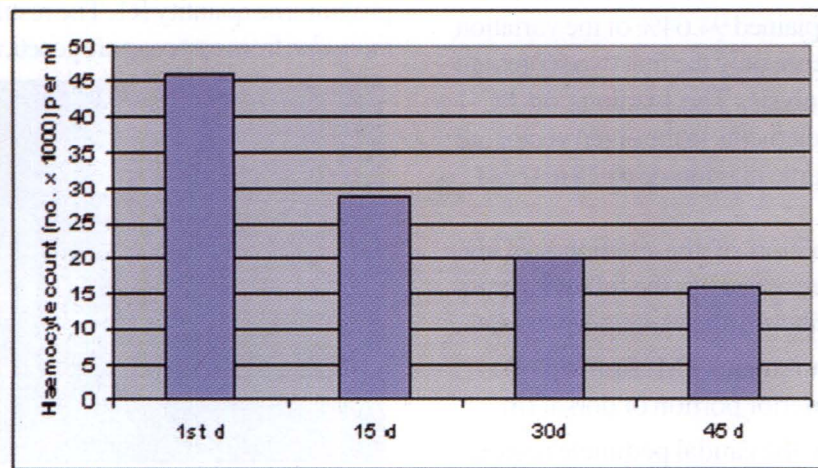


Fig. 7 Haemocyte counts in captive shrimp (*P. monodon*)

**Study on RAPD of *Pseudomonas***

A number of strains of *Pseudomonas* were isolated from the brackishwater environment to study their bioremedial properties. Preliminary studies using molecular methods such as RAPD revealed the existence of great genetic bio-diversity among the isolates (Fig.8). Interestingly, the same strains exhibited anti-bactericidal properties also.

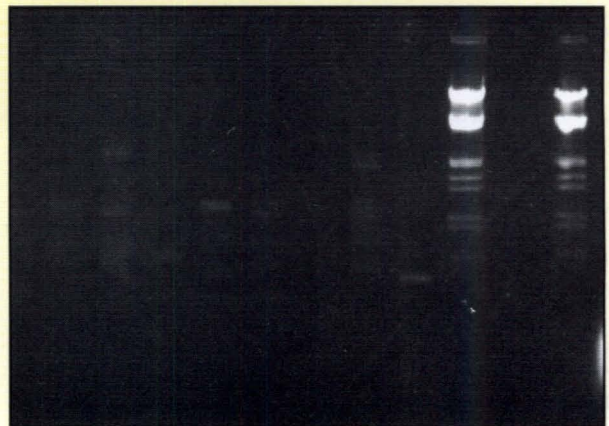


Fig. 8 RAPD fingerprints of *Pseudomonas* spp.

## PCR – Restriction Fragment Length Polymorphism

To study molecular level genetic variation, PCR – Restriction Fragment Length Polymorphism (RFLP) analysis of 12s and 16s mitochondrial rRNA genes from brackishwater finfish and shellfish was carried out. The PCR products of 415 bp size were obtained using 12s rRNA mitochondrial primers from shrimps (*P. monodon* and *F. indicus*), finfishes (*M. cephalus*, *O. mossambicus* and *L. calcarifer*) and mud crabs (*S. serrata* and *S. tranquebarica*) (Fig.9). In case of 16s rRNA mitochondrial PCR, shrimps and mud crabs showed the amplified products of 520 bp, whereas, finfishes showed amplified products of 700bp (Fig.10). PCR-RFLP analysis revealed Cla I and Mbo I restriction sites in 12s rRNA mitochondrial PCR products of *P. monodon*, *M. cephalus*, *S. serrata* and *S. tranquebarica*, whereas, Mbo I revealed restriction site in 16s rRNA mitochondrial PCR products of *P. monodon*, *M. cephalus*, *S. serrata*, *S. tranquebarica* and *O. mossambicus*. Hind III showed restriction sites in 16s rRNA mitochondrial PCR products of mud crabs.

## 2. Development of probiotics for disease resistance in shrimp (GBS/PRO/1)

### Screening of gut microbes with probiotic potential

A total of 44 bacterial isolates were obtained from the gut samples of fishes and shrimps collected from different areas in Tamil Nadu and Andhra Pradesh. Out of this, 27 were isolated from the gut samples of fish and 17 from shrimp. Among the 44 isolates, 30 were identified as *Vibrio* spp. and 14 as non-*Vibrio* spp. suggesting that *Vibrio* species dominate the gut microenvironment of fish and shrimp.

When the selected species was tested for the production of extracellular enzymes, 19 isolates were found to be positive for lecithinase, 25 isolates positive for gelatinase, 14 isolates positive for lipase and 30 isolates positive for amylase.

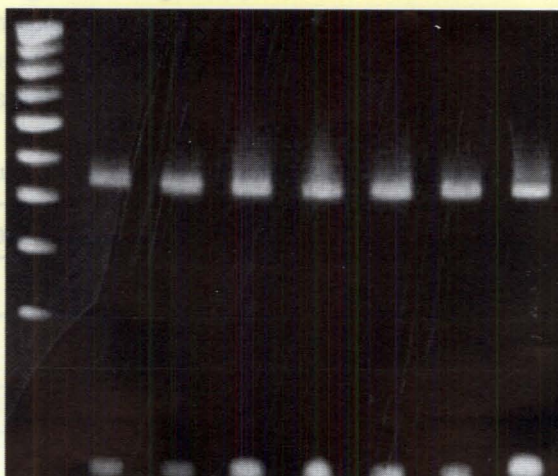


Fig - 9. 12s rRNA mitochondrial PCR amplified products.

Lane 1: 100 bp marker; Lane 2: *P.monodon*; Lane 3: *L.calcarifer*; Lane 4: *M.cephalus*; Lane 5: *S.serrata*; Lane 6: *S.tranquebarica*; Lane 7: *F.indicus*; Lane 8: *O.mossambicus*.





**Fig-10. 16s rRNA mitochondrial PCR amplified products.**

- Lane 1: 100 bp marker
- Lane 2: *P.monodon*
- Lane 3: *L.calcarifer*
- Lane 4: *M.cephalus*
- Lane 5: *S.serrata*
- Lane 6: *S.tranquebarica*
- Lane 7: *F.indicus*
- Lane 8: *O.mossambicus*

Based on the *in vitro* activities of the bacterial isolates, the ability of one strain of *V. fluvialis* mc17 to colonize the gut of *P. monodon* of 12-17 g size was tested by inoculating  $10^4$  bacterial cells per ml of rearing water at three days interval up to 18 days. Daily faecal samples were collected from third day for 20 days and attempts were made to recover the bacterial isolate on a selective medium developed specifically for this purpose. The experiment revealed that *V. fluvialis* failed to colonize the gut of shrimp.

The probiotic property of two isolates, viz., *Pseudomonas* pmh11 and *Vibrio fluvialis* mc17 on the health and survival of PL 21 of *P. monodon*

was tested. 50 shrimp larvae were treated @  $10^5$  cells/ml with the two strains in 10 litre tanks. Larvae treated with pmh11 strain showed 55% survival rate compared to the 45% survival obtained with the mc 17 isolate on the 12<sup>th</sup> day of the experiment.

***Acremonium chrysogenum* as a probiotic**

*Acremonium chrysogenum* is a yeast-like fungus belonging to the Phylum Ascomycota. *Acremonium* species are filamentous, cosmopolitan fungi, found in plant debris and soil. The fungus was experimented for its probiotic effect on PL 20 of *P. monodon* and it was found to improve the survival of the shrimp (Table 19).

**TABLE - 19 Survival of PL 20 of *P.monodon* treated with *A.chrysogenum***

Tank No.	Dosage (No. of conidia/ml)	Days post-inoculation							
		D-1	D2	D-3	D-4	D-5	D-7	D-8	D-13
1	7.2 x 10 <sup>3</sup>	29	28	24	23	18	13	12	11
2	8.1 x 10 <sup>4</sup>	30	30	26	19	16	14	13	11
3	6.4 x 10 <sup>5</sup>	29	26	25	23	17	13	12	12
4	6.9 x 10 <sup>6</sup>	30	29	26	23	18	17	16	13
5	Control	28	24	22	21	15	14	12	10

### 3. Evaluation of *Penaeus monodon* broodstock along the Indian coast with special reference to pathogen loading (GBS/SHM/1)

To study the prevalence of White Spot Syndrome Virus (WSSV) disease in the wild broodstock of *P.monodon* from the coastal seas along the east and west coast of India, 18 centers were identified, considering their availability and exploitation pattern (Table 20). Broodstock were collected from 12 centres and samples from 10

centres were already screened using *nested* PCR for the major viral pathogen, WSSV.

Analysis of data from four centers from east coast and five centers from west coast has shown wide contamination of WSSV along the Indian coast. The level of viral contamination in the east coast is comparatively lower than that in the west coast. In the west coast all the samples which tested positive for WSSV were 2<sup>nd</sup> step positive (Table 21), while in east coast a higher level of samples tested 1<sup>st</sup> step positive (Table 22).

TABLE - 20. Sampling centres of *P.monodon* broodstock

No	Place	State
1	Veravel	Gujarat
2	Mumbai	Mahrashtra
3	Ratnagiri	Maharashtra
4	Goa	Goa
5	Karwar	Karnataka
6	Munambam	Kerala
7	Neendakara	Kerala
8	Mandapam	Tamilnadu
9	Sirkazhi	Tamilnadu
10	Chennai	Tamilnadu
11	Nellore	Andhra Pradesh
12	Ongole	Andhra Pradesh
13	Kakinada	Andhra Pradesh
14	Visakhapattinam	Andhra Pradesh
15	Puri	Orissa
16	Kakdwip	West Bengal
17	Sundarbans	West Bengal
18	Port Blair	Andaman & Nicobar islands

**TABLE 21. Level of White Spot Syndrome Virus (WSSV) infection in the wild broodstock of *P. monodon* from west coast**

Collection site	Sample size	1 <sup>st</sup> Step PCR positive	2 <sup>nd</sup> step PCR positive	Contamination(%)
Karwar	17	Nil	13	76.5
Goa	16	Nil	9	56.3
Ratnagiri	18	Nil	12	66.7
Mumbai	24	Nil	8	33.3

**TABLE 22. Level of White Spot Syndrome Virus (WSSV) infection in the wild broodstock of *P. monodon* from east coast**

Collection site	Sample size	1 <sup>st</sup> Step PCR positive	2 <sup>nd</sup> step PCR positive	Contamination(%)
Karwar	17	Nil	13	76.5
Mandapam	9	1	4	55.6
Chennai (K)	12	2	5	58.0
Chennai (R)	8	Nil	3	37.5
Ongole	19	8	4	68.4
Kakinada	21	11	3	66.6
Visakapatnam	16	7	3	62.5
Kakdwip	4*	Nil	2	50.0

\* Pond reared broodstock (>80g); (K) Kalpakkam; (R) Royapuram

It was observed that the samples collected from shrimp trawlers operating in offshore waters showed lower prevalence of WSSV (26-46%) to that from near shore (<70%). Observation of

samples from Kakinada revealed higher level of viral pathogen during the post-monsoon months of September to January (Table 23).

TABLE 23. WWSV contamination in the broodstock of *P.monodon* from Kakinada

Month	Sample size (no.)	PCR positive (no.)	Contamination (%)
November 2002	21	17	80.9
December	15	12	80.0
January 2003	12	9	75.0
February	17	11	64.7
March	17	8	47.1
April	21	6	28.6
May	11	3	27.3
June	20	8	40.0
July	19	11	57.8
August	11	6	54.5
September	15	11	73.3
October	9	7	77.7

**AQUACULTURE ENGINEERING AND ENVIRONMENT SECTION**  
**Research Projects**

1. Title of project	Environmental and techno-socio-economic impacts of shrimp farming in coastal states of India (AEES/ETI/1)
Principal Investigator	Dr.B.P.Gupta
Location of project	Chennai
Co-Investigators	Dr.C.P.Rangaswamy, Dr.K.O.Joseph (upto 2.12.2002), Dr.M.Krishnan, Dr.K.K.Vijayan, Dr.S.V.Alavandi, Dr.K.K.Krishnani, Dr.M.Muralidhar, Dr.C.P.Balasubramanian, Dr.(Mrs.) M.Jayanthi, Shri K.Ponnusamy and Mrs.P.Nila Rekha
2. Title of project	Management of shrimp growing environment (AEES/SGE/2)
Principal Investigator	Dr.K.O.Joseph (upto 2.12.2002) and Dr.K.K.Krishnani (from 3.12.2002)
Location of project	Chennai
Co-Investigators	Dr.B.P.Gupta, Dr.K.K.Krishnani, Dr.M.Muralidhar Dr.(Mrs.) M.Jayanthi and Mrs. P.Nila Rekha
3. Title of project	Development of methodology for the assessment of carrying capacity of coastal water bodies and guidelines for EIA in relation to shrimp farming (AEES/CC/1)
Principal Investigator	Dr.M.Muralidhar
Location of project	Chennai
Co-Investigators	Dr.P.Ravichandran, Dr.B.P.Gupta, Dr.S.M.Pillai, Dr.K.O.Joseph (upto 2.12.2002) and Dr.(Mrs.) Ch. Sarada

## 1. Environmental and techno-socio- economic impacts of shrimp farming in coastal states of India (AEES/ETI/1)

### Assessment of impact of shrimp farm discharge water on open water bodies and soil and water quality of surrounding areas

A study was undertaken in Krishna District, Andhra Pradesh to assess the impact of shrimp farm discharge water on the soil and water quality conditions of the environment, pathogen load in the source waters and biodiversity of inhabiting organisms, besides socio-economic conditions of the farming community and salinization of ground water, if any, in the neighbouring villages.

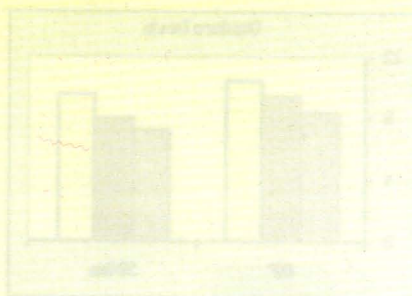
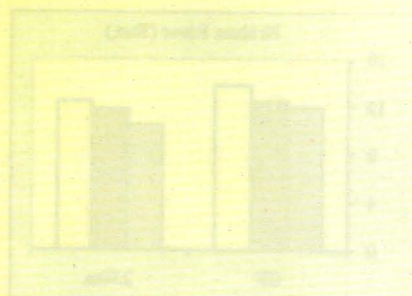
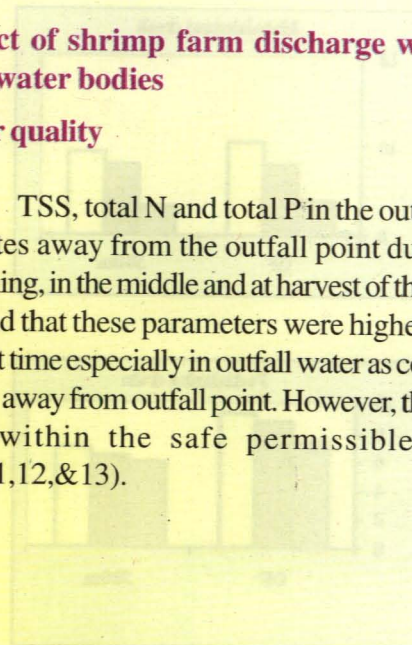
About 26,114 ha are under brackishwater aquaculture in Krishna district. Two crops of *P. monodon* are raised, one during February - June and the other during July - November. The present observations were carried out from the second crop of 2002 upto the first crop of 2003. Eight sampling places were selected based on the maximum number of shrimp farms located in major source waters namely Mahalakshmi creek, New Kona drain, Gunderu drain, Peddalanka drain, Lajjabanda creek, Upputeru, Krishna river east and Ratnakodu branch. Water samples were analysed for pH, total nitrogen (N), total phosphorus (P) and TSS and soil samples for organic carbon, total N and total P.

In order to study the impact of shrimp farming on the soil and ground water quality (salinisation) in the neighbouring villages, soil samples were collected from sites very close to shrimp farms and at a distance of 50, 100, 250 and 500 m away from the shrimp farms and analysed for pH and EC. Drinking water samples were collected from bore well waters in the villages adjoining to the shrimp farms and analysed for pH, Cl, TDS, Ca and Mg.

### Impact of shrimp farm discharge water on open water bodies

#### Water quality

TSS, total N and total P in the outfall area and sites away from the outfall point during the beginning, in the middle and at harvest of the culture showed that these parameters were higher during harvest time especially in outfall water as compared to sites away from outfall point. However, they were well within the safe permissible limits (Fig.11,12,&13).



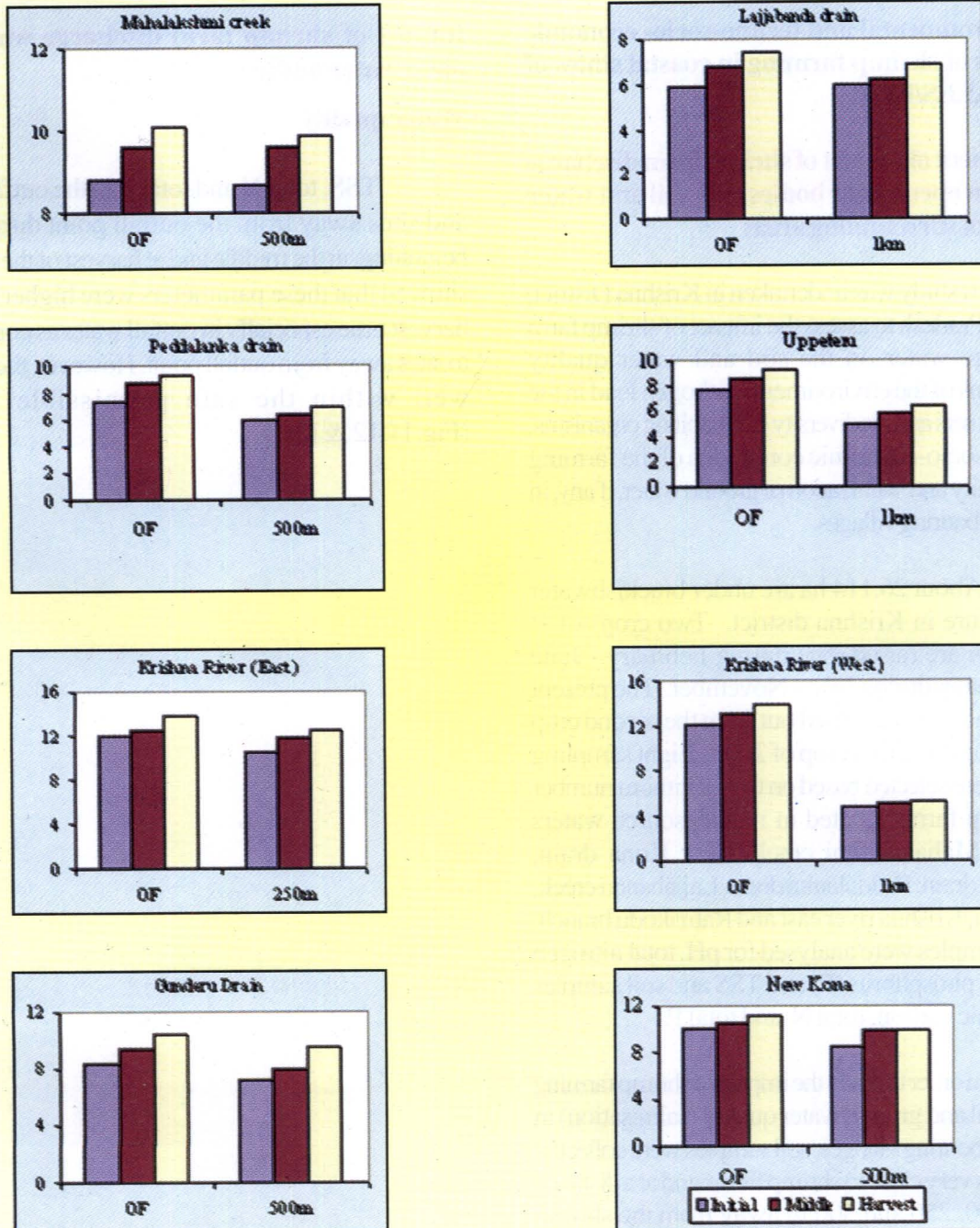


Fig. 11: Variation in TSS in the open water systems

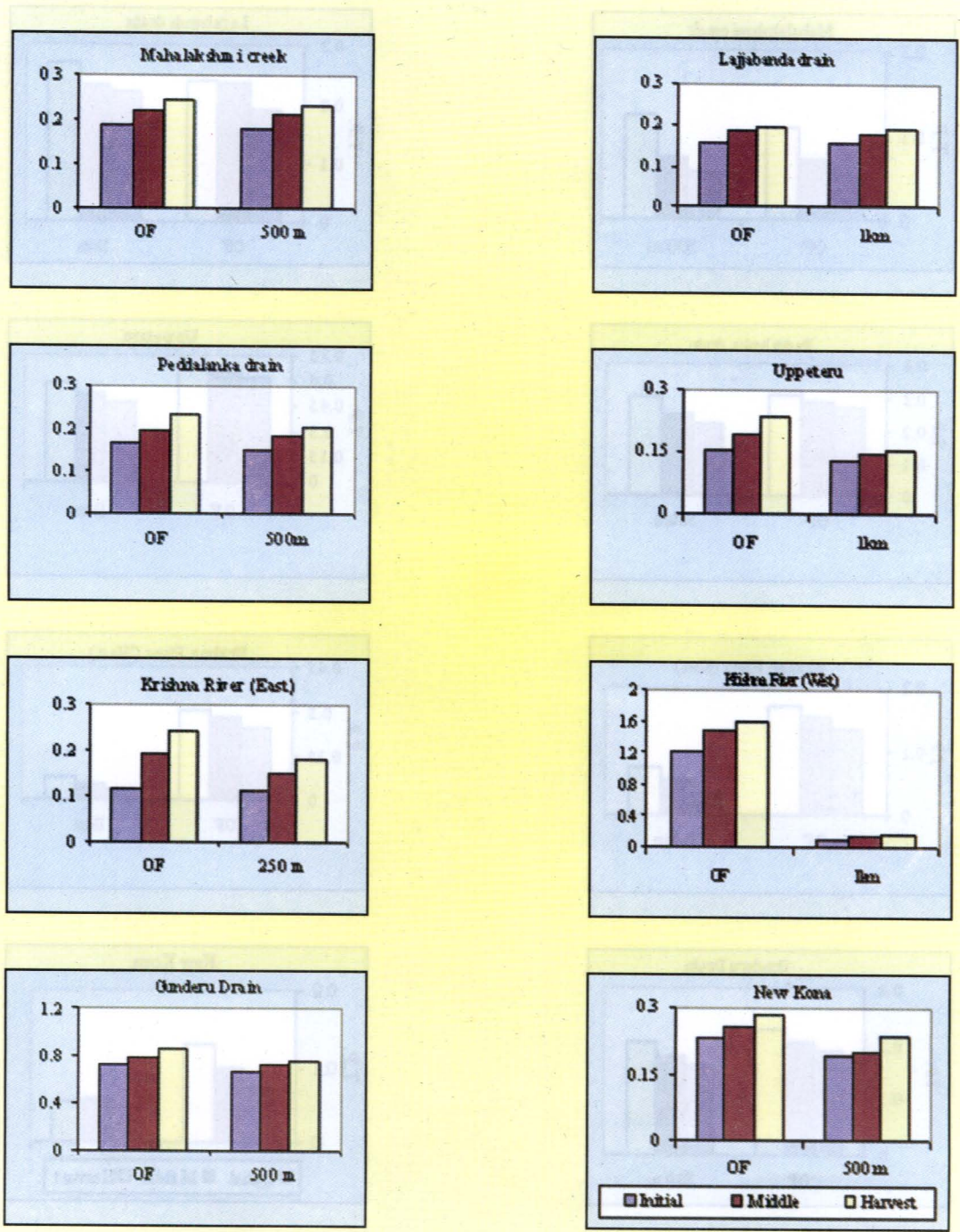


Fig. 12: Variation in Total N in open water systems



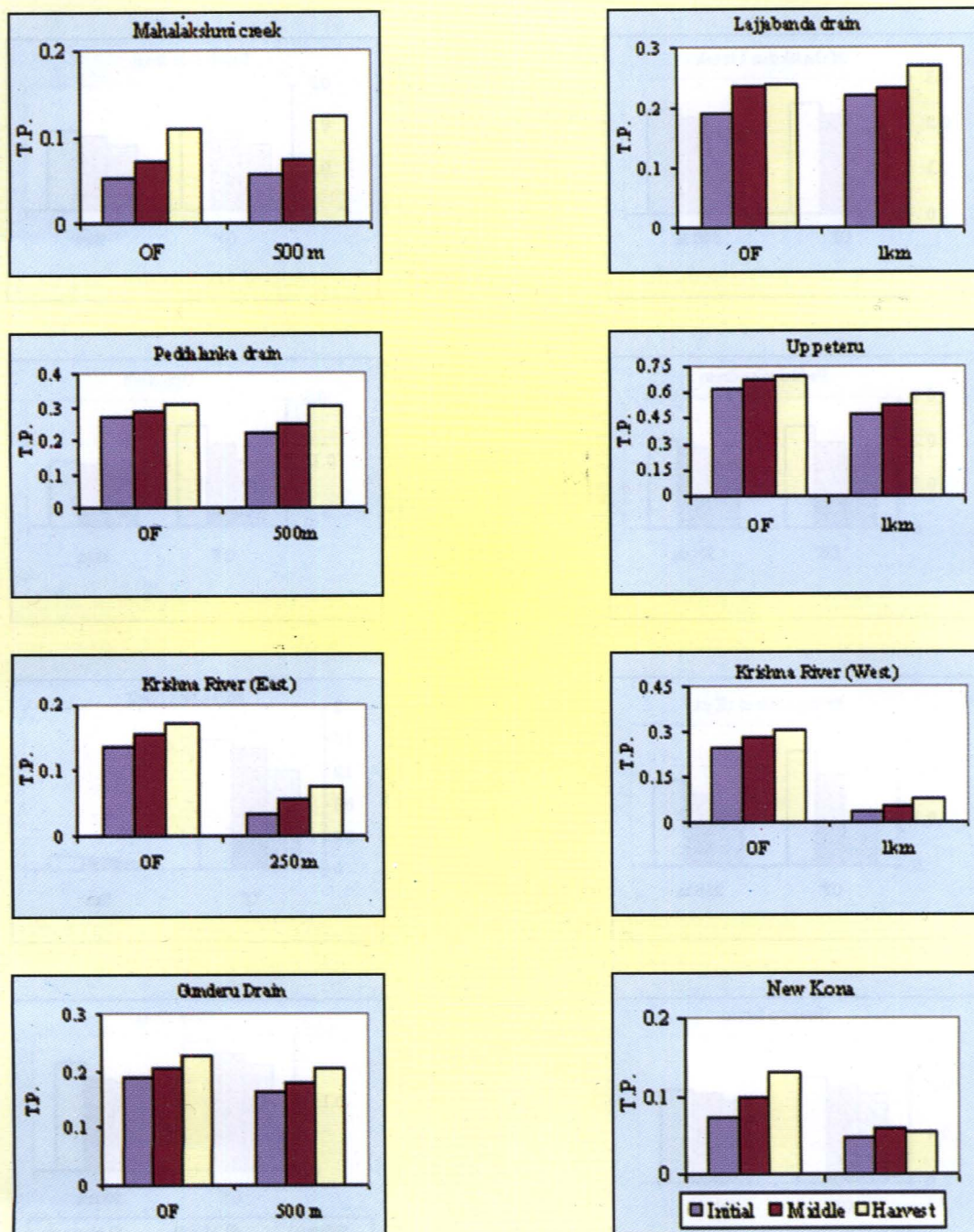


Fig. 13: Variation in total P in open waters systems

**Soil quality**

The values of organic carbon, total nitrogen and total phosphorus in soils collected from different water bodies during the second crop of 2002 showed that these parameters are high at outfall point during culture period and harvest time as compared to sites away from outfall point and pre-culture period (Table 24).

**Soil salinisation**

The average values of pH and electrical conductivity in soils collected from sites near and away from the shrimp farms showed that the soils are already saline in this coastal district (Table 25) and soil salinisation due to shrimp farming was not reported during the study.

**TABLE - 24. Soil characteristics at different sampling points**

Parameter	Sampling point	Phase of culture		
		Initial	Middle	Harvest
Organic carbon (%)	Outfall	0.39-1.21	0.36-1.44	0.44-1.38
	Away from outfall	0.39-1.18	0.24-1.34	0.38-1.77
Total nitrogen (mg/kg soil)	Outfall	280-864	325-794	296-784
	Away from outfall	305-1254	278-1401	285-1560
Total phosphorus (mg/kg soil)	Outfall	91-282	95-278	99-302
	Away from outfall	98-298	108-279	112-302

**TABLE - 25. pH and electrical conductivity of soils at different sites**

Sampling period during culture	pH					EC (dS/m)				
	Distance from farm (m)					Distance from farm (m)				
	0	50	100	250	500	0	50	100	250	500
Initial	7.63	8.12	8.66	7.6	8	9.7	8.13	5.95	8.92	8.55
Middle	7.24	7.05	6.36	6.21	6.94	7.6	7.29	6.07	4.95	5.16
Harvest	7.62	7.21	8.08	7.98	8.1	8.19	8.24	7.38	6.68	6.12

## Drinking water quality

Drinking water samples collected from bore wells of the Kona village adjoining to the shrimp farms showed that pH, Cl, TDS, Ca and Mg were within safe permissible limits and the water was potable (Table 26).

TABLE - 26. Drinking water quality of bore well adjacent to shrimp farms at Kona village

Sampling period during culture	pH	Cl (ppm)	TDS (ppm)	Ca (ppm)	Mg (ppm)	Hardness as CaCO <sub>3</sub> (ppm)
Initial	8.12	185	729	12	74	172
Middle	7.97	170	685	12	52	128
Harvest	8.17	142	742	10	46	116

### Pathogen status in the ecosystem White Spot Syndrome Virus (WSSV)

Examination of shrimp seed for WSSV revealed that 60% of the seed was first step PCR positive and 40% nested PCR positive, indicating high prevalence of WSSV infection in the ecosystem, adjoining the shrimp farms.

Bacteriological studies showed that *Vibrio* sp. (*V. alginolyticus*, *V. parahaemolyticus*, *V. fluvialis*, *V. campbelli*, *V. anguillarum*), *Pseudomonas*, *Bacillus* and *Micrococcus* were present in the range of  $9 \times 10^4$  to  $26 \times 10^6$  cfu/ml and were within the permissible limit. Heterotrophic bacterial load in the ecosystem was also within the acceptable levels for coastal water bodies.

### Status of phytoplankton, zooplankton and macrobenthos in ecosystem

To understand the impact of shrimp farming on the biota of natural ecosystem,

phytoplankton, zooplankton and macrobenthos of selected sites were studied.

The density of phytoplankton, zooplankton and macrobenthic community were generally low in the sites, when compared to the other tropical ecosystem (Table 27). This indicates that shrimp farm discharges have not caused eutrophication to natural ecosystem. However, the diversity index (number of taxa of phytoplankton, zooplankton and macrobenthos) was found to be very less. Shrimp farming in this area are generally of extensive type and a substantial number of farmers follow low-exchange/ zero-water exchange farming practices. Therefore, organic enrichment from shrimp farm effluent is almost unlikely.

### Socio-economic aspects

Survey of shrimp farm holdings revealed that the marginal farms have declined from 38% in 1990 to 24% in 2001 (Table 28).

TABLE 27. Primary and secondary productivity of the source water of shrimp farms

Station	Phytoplankton (Mean: no/l)	Zooplankton (Mean: no/m <sup>3</sup> )	Macrobenthos (Mean: no/m <sup>2</sup> )
Mahalakshmi creek	6387.5	13237.5	4202.0
New Kona drain	9500.0	13375.0	7650.0
Gunderu drain	11884.0	7930.0	2401.4
Lajjabanda drain	23225.0	23825.0	8750.0
Upputeru	20250.0	97150.0	371.0
Krishna river (east)	19650.0	5760.0	5112.0
Krishna river(west)	6510.0	Nil	Nil
Average density in tropical estuary	>50000.0	>60000	>40000

TABLE - 28. Changes in holding number of farms in Krishna district.

Year	Total No.	Marginal (<1ha)	Small (1-2 ha)	Medium (2-5 ha)	Large (> 5ha)	Corporate (ha)
1990	1120	425 (37.94%)	350 (31.25%)	200 (17.85%)	145 (12.94%)	-
1995	2775	720 (25.96%)	945 (34.05%)	655 (23.60%)	455 (16.39%)	80
2001	2685	645 (24.02%)	1145 (42.64%)	580 (21.60%)	315 (11.73%)	80

Perhaps the recurring losses incurred by the farmers in shrimp crops due to disease outbreaks led them to switch over to paddy farming. It was found that the farmers did not find any difficulty in switching over to paddy farming after a prolonged period of shrimp culture. This

shift in farming practice was observed in 10% of the holdings. The study also revealed that the marginal farmers suffered more crop losses in comparison to medium and large farmers on a relative scale.

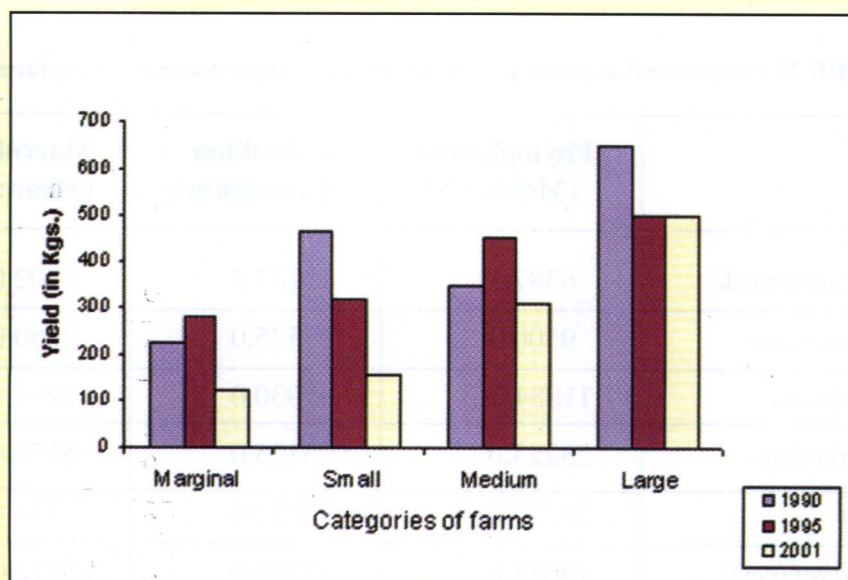


Fig. 14 . Shrimp production in different farms

Hence, there is a need for improving the credit and other input delivery systems including extension services in this district in order to improve the conditions of the marginal shrimp farmers.

## 2. Management of shrimp growing environment (AEES/SGE/2)

### Evaluation and development of water and soil treatment additives for brackishwater aquaculture

Four commercial bioaugmentors namely, Bio-OD, Amex, Bio-clean and Super bugs were tested in the laboratory for the removal of ammonia and nitrite from brackishwater of different salinities viz., 0, 12 and 35 ppt. Amex removed only ammonia. Bio-OD and Amex were more effective at higher salinity (35 ppt) and less effective at lower salinity (0 and 12 ppt).

### Treatment of shrimp farm wastewater

#### Physical method

There are many methods to treat shrimp farm waste water. As a bioremediation technique, the usefulness of pulse magnetic field at different frequencies on the growth of beneficial bacteria was studied in a preliminary experiment.

#### Biological method

Wastewater collected from a shrimp farm, near Chennai, was treated with six different

agricultural waste products such as coconut husk, paddy straw, rice corns, wheat corns, wood scrapings and saw dust. It was found that coconut husk @ 1g/litre was efficient in removing ammonia and nitrite to the extent of 55% in 48 hrs.

### Efficiency and cost economics of different materials for controlling seepage in brackishwater ponds

Seepage in ponds is one of the major problems encountered in shrimp farming. The high seepage rate not only results in water loss but also reduces the pond fertility by nutrient loss. Hence the strength of different plastering materials to prevent seepage were assessed by fabricating a mould of 1' x 1' in wood (Table 29).

After two days of casting, the slabs were cured in water under submerged condition for 21 days. Based on the strength of the block, lime and sand plastering in the ratio of 1:2, lime, sand and seashell in the ratio of 1:3:3, cement and *in situ* earth in the ratio of 1:6 and cement, sand and small jelly in the ratio of 1:3:6 were found to be the suitable combinations of plastering materials for arresting seepage.

**Table 29. Composition of different blocks tried for controlling seepage**

S. No	Materials	Proportions
1	Lime & sand	1:2, 1:3, 1:4, 1:5, 1:6
2	Lime, sand & sea shell	1:2:4, 1:3:3, 1:1:2, 1:3:2, 1:3:1
3	Cement & quarry dust	1:2, 1:4, 1:6, 1:8
4	Cement, sand & quarry dust	1:4:4, 1:3:6, 1:3:3
5	Cement & <i>in situ</i> pond earth	1:4, 1:6, 1:8, 1:10
6	Cement, sand & small jelly	1:3:6, 1:4:8
7.	Cement, sand, quarry dust & small jelly	1:3:3:3, 1:4:4:4

These plastering materials were tested in the field in controlling seepage from ponds. For this purpose, small ponds of 2.1x2x0.7 m was constructed in an elevated and drainable position. Seepage rate was estimated daily for one month.

It was found that in ponds lined with biocrete and surkhi and lime mortar, the rate of seepage was 1.2 to 1.8 cm/day. However, the cost of these materials are high (Table 30). Earth cement blocks were found to be economical.

**Table - 30. Seepage rate in ponds lined with different materials.**

S. No	Materials	Seepage rate (cm/day)	Cost (Lakh/ha)
1	Biocrete	1.2	9.50
2	Earth cement blocks	4.5	3.30
3	Surkhi & lime mortar	1.8	7.00
4	Asphalt	7.2	3.50
5	Lime : sand	6.3	3.65
6	Cement : sand : Lime	5.5	4.25
7	Lime: sand: sea shell	5.1	5.02
8	Sand : clay : lime	7.3	3.85
9	Control	14.9	-

## Changes in virgin soil due to shrimp farming and post-harvest pond soil regeneration

### Impact of shrimp culture on soil nutrients

Soil samples were collected immediately after harvest from 10 shrimp ponds located at Kokilamedu, Pooncheri and Cuddalore (Tamil Nadu) and Nellore (Andhra Pradesh) to assess the

nutrient status in the ponds after shrimp culture. Soil samples were also collected from near by shrimp farms, where there was no culture (virgin soils) to compare the nutrient status with shrimp pond soils (Table 31). It was observed that organic carbon content (0.42–0.54%), total nitrogen (450 – 710 mg/kg) and total P (105 – 147 mg/kg) in post-harvest shrimp pond soils were comparatively higher as compared to virgin soils (OC: 0.17 – 0.45%; total N: 205–390m.g/kg; total P: 27 – 54 mg/kg):

Table -31. Impact of shrimp culture on soil nutrients

S. No	Place	Soil	Organic carbon (%)	Total nitrogen (mg/kg soil)	Total phosphorus (mg/kg soil)
1	Kokilamedu	Virgin	0.18	390	27
2		Harvested pond*	0.42	480	118
3	Pooncheri	Virgin	0.17	330	43
4		Harvested pond*	0.45	710	147
5	Cuddalore	Virgin	0.38	215	54
6		Harvested pond*	0.54	640	105
7	Nellore	Virgin	0.45	205	39
8		Harvested pond*	0.51	450	140

\* Average values of 10 ponds

### Effect of drying on regeneration of nutrients

A study was conducted to understand the changes in soil conditions of ponds due to shrimp farming and the effect of drying on organic matter accumulation and regeneration of nutrients at Kattur village, Tamil Nadu. Soil samples were collected from two shrimp farms (A and B) before the start of culture (virgin soil from newly constructed shrimp ponds), during culture period and at harvest time to assess the changes after one crop. An increase in organic carbon from 0.59% to 0.92% in farm A and 0.99%

in farm B, total N from 685 mg/kg soil to 1028 mg/kg soil in farm A and 996 mg/kg soil in farm B and total P from 188 mg/kg soil to 369 mg/kg soil in farm A and 378 mg/kg soil in farm B was observed at harvest time, as compared to virgin soil. After harvest, the ponds were dried for one month and the soils were analysed for OC, TN, TP and moisture. In farm-A, the OC (0.86%) and nutrients (total N : 929 mg/kg soil, total P : 289 mg/kg soil) were more as compared to farm B (OC : 0.64%, total N : 764 mg/kg soil and total P : 246 mg/kg soil). This may be due to improper drying of farm A (moisture content 42%) as compared to farm B (moisture content 19%).

### Impact of increase in shrimp farming area on open water bodies

To study the impact of increase in shrimp farming area on the environment, Kattur village in Tamil Nadu was selected. In this village the area under shrimp farming is expanding at a faster rate. Only 47.6 ha were under shrimp farming till May 2002 and during June to September 2002, another 14.4 ha were added. Buckingham canal is the source water for all the farms.

Water and soil samples were collected from three stations in the Buckingham canal during shrimp culture and after harvest. Total ammonia N, nitrite N, phosphate and total P were high in the Buckingham canal which may be due to the combined discharge / washings from the Chennai Harbour, Ennore Thermal Plant and casuarina plantations on the banks of the canal.

### 3. Development of methodology for the assessment of carrying capacity of coastal water bodies and guidelines for EIA in relation to shrimp farming (AEES/CC/1)

Carrying capacity can be defined as “the minimum level of production that a site might be expected to sustain without any environmental problems” or “the number of enterprises or total production which can be supported by a defined area, ecosystem or coastline”.

Carrying capacity or Environmental carrying capacity differs from Environmental capacity. Environmental capacity is a property of the environment and its ability to accommodate a particular activity or rate of activity without unacceptable impact *eg.* the rate at which nitrogen (N) or phosphorus (P) can be assimilated without triggering eutrophication or volume of discharge for unit time. Carrying capacity depends on both environmental capacity and the rate of waste output

from aquaculture. It is a self-limiting density factor and is not fixed for a given area and varies with time. It is useful for development of environmentally compatible aquaculture programmes.

Work on carrying capacity of water bodies are mostly reported from suspended aquaculture (Mussels, Oysters, Scallops etc.). The models developed are very complex involving hydrodynamics, ecophysiology, population dynamics, N,P,C cycling and output.

### Carrying capacity of water bodies related to shrimp culture

A few studies on carrying capacity of water bodies with respect to shrimp culture have been conducted in (1) Kung Krabeau Bay – Eastern Thailand, (2) Rio Chouleteca Delta on the Gulf of Fonseca– Southern Honduras and (3) Kandaleru creek – Nellore district, AP, India, (MPEDA-NACA study.)

### Methodology for carrying capacity of the water body (creek) for shrimp farming

Shrimp culture management requires an evaluation of water quality in the regions where shrimp farming is already existing and where it is proposed, especially how the water quality is influenced by the anticipated waste loads from the shrimp farm themselves and from other wastewater discharges that may be located in the region. If the combined effect of collection of effluent loads is to reduce water quality below its acceptable value, then it can be said that the carrying capacity of the system has exceeded. Evaluation of the carrying capacity requires a suitable mathematical model to determine the concentration of important parameters that result from a given level of waste loading. The interaction between individual farms, in which the effluent from one farm is drawn into the intake of another, may necessitate detailed field studies and more refined model.



I. Primary data collection on pre-aquaculture geometry and secondary data on existing shrimp farm configurations, culture practices, production, tidal variation, rainfall etc.

II. Establishment of environmental quality objectives and standards of the creek in terms of nutrient (Total NP) concentrations

III. Quantification of the amount of wastes generated from shrimp farms around the creek

IV. Use of numeric models to predict the impact into the creek

V. Relate the predictions to the predetermined standards

#### **Estimation of carrying capacity**

Environmental capacity = Threshold value – measured value before the start of culture. Water exchange = Volume of creek segment x dilution rate. Carrying capacity = Environmental capacity x water exchange.

#### **Environmental impact assessment**

Traditionally, environmental impact assessments (EIAs) have been a tool for both planning and decision-making. EIAs are concerned with identifying, predicting and evaluating the potential environmental effects of public and private development activities. They provide information on the present situation and future trends of an environmental resource and propose alternatives for action. Initially, EIAs were carried out with respect to physical, chemical and ecological aspects but now the objective is to cover social and health impacts also. In the past it was based on least economic cost but now social and environmental costs are also considered. Cumulative environmental assessment (CEA) is more important because the size threshold for EIA in India is >40 ha, by which many of the small farms are not covered. Hence, EIA is essential for more integrated environmental management of coastal aquaculture.

EIA requires an evaluation of the impact of the aquafarms on water source, ground water quality, drinking water resources, agriculture and soil salinisation, land use pattern, socio-economics, conversion of wet lands, soil erosion and siltation etc. Information on the above parameters will be helpful in evolving suitable management measures for proper development of environmental friendly aquaculture.

## EXTENSION, ECONOMICS AND INFORMATION SECTION

### Research Projects

1.	Title of project	Extension approaches for sustainable shrimp and fish farming (EEIS/EXTN/03)
	Principal Investigator	Dr. N.Kalaimani
	Location of project	Chennai
	Co-Investigators	Dr.M.Krishnan, Dr.V.S.Chandrasekaran, Dr.T.Ravisankar, Mrs. D.Deboral Vimala, Dr.(Mrs.) B.Shanthi, Shri K.Ponnusamy, Dr.M.Kumaran, Dr.(Mrs.) Ch. Sarada and Mrs.P.Mahalakshmi (upto 16.2.2003)
2.	Title of project	Socio-economic appraisal of traditional and diversified coastal aquaculture in India (EEIS/EXTN/04)
	Principal Investigator	Dr.T.Ravisankar
	Location of project	Chennai
	Co-Investigators	Dr.N.Kalaimani, Dr.V.S.Chandrasekaran, Dr.(Mrs.) B.Shanti, Shri K.Ponnusamy, Dr.M.Kumaran, Dr.(Mrs.) Ch. Sarada, Mrs.P.Mahalakshmi (upto 16.2.2003)

### Progress of Work

#### 1. Extension approaches for sustainable shrimp and fish farming (EEIS/EXTN/03)

To assess the status of shrimp / fish farming, alternate cropping pattern (species / systems) and the extension requirements of the farmers, data was collected through a questionnaire based survey of the shrimp / fish farmers in Tamil Nadu, Andhra

Pradesh, Kerala and West Bengal in the year 2002-2003. In general, creek / canal / drain water was used for shrimp aquaculture except a few cases in Andhra Pradesh where the source water was either from sea or borewell. *P. monodon* was the prime species cultured everywhere and normally two crops were taken. The stocking density followed was higher in Tamil Nadu and Andhra Pradesh compared to Kerala and West Bengal. The details of the culture operations and the production trends are summarized in Table 32.

Table - 32. Details of shrimp culture followed in different coastal states

Sl. No.	State	District	No. of Farms Surveyed	Source water	Species	No. of Crops	Stocking density (no/m <sup>2</sup> )	Seed Quality testing	Feed used	Other treatments	Average Production (t/ha)
1	Tamil Nadu	Thiruvallur	13	Canal / Creek	<i>P.monodon</i>	Two	5-6	PCR	Commercial	Probiotics	1-15
		Kancheepuram	24	Creek	<i>P.monodon</i>	Two	10-12	PCR	Commercial	Feed water Probiotics	3.5
		Cuddalore	25	Canal / Creek	<i>P.monodon</i>	Two	5-6	PCR	Commercial Indigenous	Feed water Probiotics	1.5-2
		Nagapattinam	5	Creek	<i>P.monodon</i>	Two	4-6	PCR	Commercial		1.13
		Ramanathapuram	34	Creek	<i>P.monodon</i>	Two	4-7	PCR	Commercial	Probiotics	1-15
		Tuticorn	6	Canal	<i>P.monodon</i>	Two	4-6	PCR	Commercial	Probiotics	1-15
2	Andhra Pradesh	Nellore	5	Canal / Bore well	<i>P.monodon</i>	Two	5-8	PCR	Commercial	Probiotics	0.5-2.0
		Prakasam	50	Canal/ Creek/ Drain/ Sea	<i>P.monodon</i>	Two	4-10	PCR	Commercial	Probiotics	0.5-2.0
		Guntur	30	Canal/ Creek/ Drain/ Sea	<i>P.monodon</i>	Two	2-5	PCR	Commercial	Probiotics	0.5-1.5
		Krishna	18	Creek	<i>P.monodon</i>	Two	2-8	PCR	Commercial	Probiotics	0.5-2.0
3	Kerala	Quilon	50	Canal	<i>P.monodon</i>	Two	3-8	PCR	Commercial	Nil	0.5-2.0
		Trivandrum	11	Canal	<i>P.monodon</i>	Two	3-5	PCR	Commercial	Nil	0.2-1.0
4	West Bengal	South 24 Parganas	1	Canal	<i>P.monodon</i>	Two	1-2	NIL	Indigenous	Nil	0.45-0.7
		North 24 Parganas	7	Canal	<i>P.monodon</i>	Two	1-2	NIL	Indigenous	Nil	0.45-0.7

### Extension requirements of shrimp farmers Tamil Nadu

Farmers of Kancheepuram district were interested to learn more about water quality management and good management practices of shrimp farming. The prime channel of information dissemination to farmers was the input dealers or / technicians and majority of the farmers laised with them and also entered into buy-back arrangement with the input dealers. Their contact with extension agency and mass media exposure in respect of aquaculture were at very low levels. Unless institutional credit is offered to farmers it will be difficult to free them from the influence of technicians and input dealers. It is felt that the local civic and revenue department personnels need to be informed about aquaculture, its significance and

impact on society and nature. The State Fisheries Department should gear up its extension machinery for providing necessary technical information and all possible help to the farming community.

In Cuddalore district the problems encountered by the farmers were non-availability of quality seeds, occurrence of white spot virus disease, societal objection for practicing shrimp farming and inadequate laboratory testing facilities. The farmers need training in shrimp disease management and feed management. The problems faced by the women engaged in aquaculture activities were irregular and long period of working hours, drudgery and lack of training skills or experience. They are also interested in learning more on shrimp feed management.

Farmers of Ramanathapuram district felt that there were no standard recommendations for the use of inorganic fertilizers and lime. Molasses, rice bran, lime yeast and sugar were used for maintaining optimum plankton concentrations in the ponds. Among 34 farmers, 5 have already attended training in shrimp culture. The farmers were eager to get trained by CIBA in feed preparation, identification of disease symptoms and diagnostics and they also need technical support from concerned government institutions.

The main reasons for shrimp crop failure in Tuticorin district were environmental pollution caused by chemical factories situated in and around Tuticorin and white spot virus disease. The farmers desired to be trained on seabass culture and disease management.

### Andhra Pradesh

Many farmers in Nellore district have switched over to culture of freshwater prawn due to the recurring white spot virus disease in *P. monodon*. Only limited fish farmers watch television or listen to radio for information on aquaculture. Most of the farmers are interested in attending training programmes on shrimp disease diagnosis and control and water quality management.

At Kanaparti village in Prakasam district the farmers are facing seepage problem in the ponds which adversely affects shrimp farming. They wanted lasting solution to arrest seepage.

The main constraints/problems expressed by farmers of Guntur district are high salinity, water contamination and disease outbreaks. Farmers are interested in alternative crops like culture of seabass and scampi.

In Krishna district, the entire infrastructure requirements of shrimp culture were met by 38 private companies engaged in feed manufacturing and processing, packaging and export of the shrimps. Fish culture is yet to take off in the district.

Lack of proper information on shrimp farming and misinformation regarding shrimp culture practices seem to be the impediments.

### West Bengal

Brackishwater from adjacent water bodies, viz., river, creek, backwater, lake, lagoon etc., is let by gravity flow into shallow areas (60-100 cm depth) of 2 to 10 ha size, called as *Bheris* in South and North 24 Parganas Districts. Traditional/Improved traditional farming is done in these leased areas. Usually the lease period extends for 3 years with an annual lease value of Rs.20,000-75,000/ha. Short period of lease with high lease value put off the operator from incurring heavy repair works on *Bheris*.

### Kerala

A case study of shrimp farming was undertaken in Trivandrum and Quilon districts and the details are given in Table 33.

### Survey database

The primary data collected from different surveys were compiled and tabulated. A relational database was designed in MS-Access for easy retrieval of the information. This survey database comprises eight tables viz., general information, (which gives information of the farm and the farmer) shrimp farming practices, history of crop losses, knowledge of finfish culture, social status of shrimp farmers, fisheries extension, constraints and problems experienced by farmers. User-friendly forms were created in MS-Access 2000 to enable the users to feed the data.

### Statistical analysis

The primary data collected and entered in the above-mentioned database were retrieved, modified for statistical analysis. Consolidating the primary data in to tables, demographic analysis was

Table - 33. Average cost frame work of shrimp farming in Kerala

Sl. No.	Particulars	Rate (Rs.)	Quantum of excavation	Amount (Rs.)
<b>CAPITAL COSTS (A)</b>				
1.	Earthwork excavation/ strengthening of bunds etc.	Rs. 4.5/- per cu.m.	1500 m <sup>3</sup>	67500.00
2.	Sluice gate-open type			15000.00
3.	Inlet / Outlet			5000.00
4.	5 HP pump with electric motor			16000.00
5.	5 HP diesel pump set (stand by)			16000.00
6.	Watchman shed			5000.00
7.	Electrification			5000.00
8.	Misc. 5% of 1-7 items (nets, feeding trays etc.)			5900.00
	Sub-total (A)			135400.00
<b>RECURRING COSTS (B)</b>				
1.	<i>Penaeus monodon</i> seed	0.60 / seed	60000 no.	36000.00
2.	Mahua oil cake	9/kg.	100 kg.	900.00
3.	Single super phosphate	3/kg.	60 kg.	180.00
4.	Lime	4/kg.	400 kg.	1600.00
5.	Urea	5/kg.	60 kg.	300.00
6.	Cow dung	500 / ton	1.2 ton	600.00
7.	Feed (FCR 1.5:1)	40/kg.	1890 kg.	75600.00
8.	Diesel	16 /lit.	500 lit. (approx.)	8000.00
9.	Wages for watch and ward for 5 months	1000/ M	1 labour	5000.00
10.	Harvesting and marketing charges	5 / kg.	1260 kg.	6300.00
	Sub-total (B)			134480.00
	Rounded of			134500.00
	Grand Total (A+B)			269900.00

done through calculation of frequencies, scoring and ranking. Correlation studies of productivity with other social and management variables were carried out. Constraints and problems were ranked by the method of combining incomplete order of merit ratings as outlined by Garrett (1981). A sample of 148 farmers was considered. The analysis revealed that disease problem ranked first followed by soil and water quality and lack of knowledge of other alternative brackishwater cultures.

## 2. Socio-economic appraisal of traditional and diversified coastal aquaculture in India (EEIS/EXTN/04)

The project contained seven entities of alternate crops related to species and systems of aquaculture practiced by the farmers in different coastal states. The details are given in Table 34.

### Alternate crops (species /systems) practiced by farmers

#### Seabass culture

Seabass culture was taken up by few farmers in Tamil Nadu, Pondicherry and Andhra Pradesh. In Tamil Nadu, the farms were located at Ilanthankudi and in Pondicherry at Karaikal. The problems presented by the farmers were small size of the seed, difficulties in managing the stock during the first 60 days of culture and non-availability of low cost feeds.

In Nellore, seabass seed were procured by the farmers from RGCA, Mayiladuthurai @ Rs.1/seed. Cost of labour and transport adds up another Rs.0.50/seed. Though commercial floating feed was given @ 2% body weight to the fishes during culture, non-availability of a suitable indigenous feed was reported as a constraint by the farmers. Harvested fishes fetched Rs.50-60/kg.

Table 34. District-wise enumeration of farms practicing alternate aquaculture

Sl.	State	Districts	Alternate crops followed	No of farms visited
1	Tamil Nadu	Nagapattinam	Seabass	2
2	Tamil Nadu	Tuticorin	Artemia	4
3	Tamil Nadu	Tiruvallur	Crab fattening	3
4	Andhra Pradesh	Nellore	Scampi-shrimp/ carp culture	6
5	Andhra Pradesh	Krishna	-do-	8
6	Andhra Pradesh	Nellore Seabass		6
7	Kerala	Ernakulam	Traditional, polyculture	6
8	Kerala	Quilon	Crab fattening	5
9	Kerala	Trivandrum	Pearl spot	1
10	West Bengal	North & South 24 Parganas	Traditional perennial culture	8
			<b>Total farms visited</b>	<b>49</b>

### Crab fattening

Farmers perceived crab fattening as a lucrative enterprise. However, the main problem was non-availability of adequate number of water crabs for stocking (mostly exporters supply the water crabs and take back the fattened crabs). The shrimp farmers were against crab fattening in ponds as crabs may be the carriers of White Spot Virus. In Quilon district of Kerala crab fattening was done in bamboo cages in 5 farms continuously in batches throughout the year and only family labour was employed. Juvenile / smaller crabs were purchased at Rs.50/ kg and the selling price of fattened crabs ranged from Rs.150 to 160/kg. Feed consisted of cut pieces of eel meat, costing Rs.15/ kg.

### Artemia cyst production

*Artemia* cyst production was practiced on small scale in Tuticorin district of Tamil Nadu. Brine shrimps collected from the wild along with hatchery produced ones were used as stocking materials in shallow salt pans. Water pollution and bird menace were the major operational problems reported by the farmers.

### Scampi-tiger shrimp bi-crop and rotation crop

Scampi as rotational and supplemental crop alternating with shrimps is practiced in Nellore District, Andhra Pradesh. Mixed varieties of Indian major carps were also cultured at low density (200/ha) as cleaning agents along with scampi.

### Traditional mixed species culture

Polyculture of brackishwater species was observed in traditional fields in Ernakulam district,

Kerala. Milk fish, pearlspot and mullets collected from the wild and postlarvae of tiger shrimp obtained from hatchery were stocked in the fields. Rice bran, groundnut oil cake, tapioca and clam meat were given as feed.

In South and North 24 Parganas districts of West Bengal, 8 traditional shrimp/fish farms (*Bheris*) were surveyed. The size of *Bheris* range from 2 to 10 ha. Tidal water was let into these shallow areas or *Bheris* upto a depth of 60-100 cm. Supplementary stocking with hatchery produced *P.monodon* seed was also followed. Mixture of groundnut oil cake and rice bran was used as feed. The system of traditional / improved traditional farming was done in these leased areas. Usually the lease period extends for 3 years with an annual lease value of Rs.20,000 to 75,000/ha. The average annual production of shrimps and fishes from these fields ranged from 200 to 350 kg/ha.

### Pearlspot culture

Juveniles of pearlspot (10 g) were collected from the wild and stocked in ponds. The culture was continued for 6 months and the fishes attain size of 150 - 250 g. Fresh / live fish fetched a price of Rs.100/ kg while frozen fish was sold at Rs.65/ kg. The farmers incurred operational cost of Rs.5,000/crop/ha and the returns ranged between Rs.10,000 to 15,000/crop/ha. Collective family labour is involved in this culture, which is mostly carried out in small homestead ponds fed with tidal water from creeks / canals.

## 5. TECHNOLOGY ASSESSED AND TRANSFERRED

The following technologies/ knowledge-base developed by the Institute were extended during the year to progressive fish farmers/private entrepreneurs/officials of State Fisheries Dept. / BFDA officials/Scientists from ICAR Fisheries Research Institutes/officials from MPEDA and other Govt. agencies etc. through short-term training programmes.

### Training programmes organized by CIBA:

- \* “Extension Methodologies for Brackishwater Aquaculture”, during 7-11

January 2002. Three officials from Marine Products Export Development Authority participated in the programme.

- \* “Crab Breeding and Culture”, during 17-22 June 2002. Two research scholars from Centre of Advanced Studies in Marine Biology, Annamalai University, Parangipettai and a private fish hatchery operator from Chennai participated.
- \* “Brackishwater Finfish Breeding (Seabass)”, during 18-27 July 2002. Three trainees from private hatcheries participated.



**Demonstration of analytical methods to trainees**

**Interaction of Scientist - women aquafarmers**







← Demonstration of post-harvest methods to trainees



- \* “Brackishwater Finfish Breeding”, during 5-14 September 2002. Five trainees from Pancham Aquaculture Ltd., Mumbai participated in the programme.
- “Brackishwater Aquaculture”, at Nellore, Andhra Pradesh, during 24-28 March 2003. 20 fisherwomen participated.

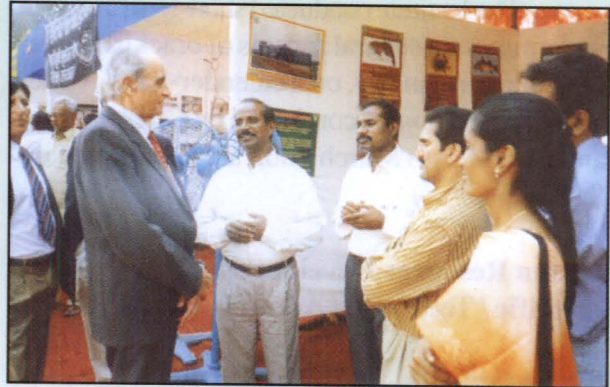
The following field-level training / orientation programmes were conducted by CIBA under the NATP / IVLP project for Technology

Assessment and Refinement in Coastal Agro-ecosystem of Tiruvallur district of Tamil Nadu:

- \* Rearing Madras red sheep for 10 farmers, on 24 October 2002.
- \* Cultivation of medicinal plants for 20 farmers, on 26 October 2002.
- \* Training cum demonstration on fish cutlet and wafer preparation for 20 farmers, on 29 October 2002.
- \* Raising kitchen garden for 40 farmers, on 8 November 2002.
- \* Biotechnological pest control methods in rice for 50 farmers, on 23 November 2002.



**Visitors to CIBA shall at Sunderbau Utsav at Kakdwip**



**Dr.S.Z.Qasim, visiting CIBA stall during sixth Indian Fisheries Forum at CIFE, Mumbai**

- \* Integrated pest management in coconut for 20 farmers, on 27 November 2002.
- \* Backyard turkey farming for 20 farmers, on 1 December 2002.
- \* Ornamental fish culture for 10 farmers at Southern India Aquarists, Chennai, on 28 December 2002.
- \* Immunostimulation techniques in aquaculture for 10 farmers, on 3 January 2003.
- \* Package of practices for green gram cultivation for 20 farmers, on 24 January 2003.
- \* Vermicompost preparation for 10 farmers, on 12 February 2003.

### **Exhibitions**

- \* The Institute participated in the exhibition conducted in connection with SUNDERBAN UTSAV, at Kakdwip, during 23-26 January 2002.

- \* CIBA participated in Aquafair conducted in connection with the National Symposium on "Fisheries Enhancement in Inland Waters -challenges Ahead", held at Central Inland Fisheries Research Institute, Barrackpore, Kolkata, during 27-28 April 2002.

- \* The Institute participated in Agri-Intex Exhibition 2002, organised by Coimbatore District Small Industries Owners Association (CODISSA), at Coimbatore, during 1-6 August 2002.

- \* CIBA participated in the exhibition organized by Central Institute of Fisheries Education, Mumbai, on the occasion of the Sixth Indian Fisheries Forum, at Mumbai, during 17-20 December 2002.

## 6. TRAINING AND EDUCATION

The Institute conducted short-term training programmes on several aspects of brackishwater aquaculture regularly, on a calendar-basis. (The training programmes conducted by CIBA during January 2002 to March 2003 are mentioned in Chapter 5).

### Human Resource Development Scientific / Technical / Administrative

#### International

- \* Dr.K.P.Jithendran, Senior Scientist, attended the international training programme on "Diagnostics for viral diseases in shrimps and marine fishes", at SEAFDEC, Philippines, 6-20 November 2002.

#### National

- \* Shri R.Puthiavan, Technical Officer, T-5, participated in the training programme on "Leadership – HRD", at Mandapam Regional Centre of CMFRI, Mandapam, 15-29 January 2002.
- \* Shri R.Subburaj, Technical Assistant, T-3, attended the training programme on "Culture of live food organism", at CIFE, Mumbai, 8-14 January 2002.
- \* Dr. (Mrs.) Ch. Sarada, Scientist, participated in the training programme on "Designing vortals for NARS", at IASRI, New Delhi, 6-26 February 2002.
- \* Dr.C.P.Balasubramaniam and Dr.(Mrs.)B.Shanthi, Scientists (SS), underwent training in Summer School on "Recent advances in agricultural research management", conducted by NAARM, Hyderabad, 15 April to 5 May 2002.

- \* Mrs.P.Mahalakshmi, Scientist, participated in the training programme on "Advanced software training covering RDBMS concepts, MS Access, Networking & Oracle Essentials, D2K, GIS & Spatial data management concepts", at NIIT, New Delhi, 15 April to 16 May 2002.
- \* Dr.M.Muralidhar and Dr.(Mrs.) M.Jayanthi, Scientists (SS), attended the training programme on "ERDAS IMAGINE – 8.5", organized by ESRI India Ltd., Chennai, 20-24 May 2002.
- \* Shri A.Nagavel and Shri Vasanthakumar Charles, Technical Assistants, T-4, participated in the ICAR short course entitled "Water quality and waste water management in aquaculture systems", organized by the Dept. of Fisheries Environment, Fisheries College & Research Institute, Tuticorin, TANVASU, 8-17 July 2002.
- \* Mrs.K.Nandini, Senior Clerk, attended the training programme on "Computer applications for administrative and financial management", at NAARM, Hyderabad, 17-27 July 2002.
- \* Shri R.Kandamani, Assistant, underwent training on "Financial Management Systems (FMS)", conducted by ICAR under NATP, at Kerala Agricultural University, Trissur, 12-13 September 2002.

- \* Dr.M.Kailasam, Scientist (SS), participated in the Winter School on "Recent advances in diagnosis and management of diseases in mariculture", conducted by CMFRI, Cochin, 7-27 November 2002.
  - \* Shri Mahesh Kumar, Jr. Hindi Translator, underwent training on "Hindi Translation", conducted by the Central Translation Bureau, Bangalore, 1 October to 31 December 2002.
  - \* Mrs.D.Deboral Vimala, Scientist (SS), participated in the refresher course on "Recent advances in agricultural research project management", conducted by NAARM, Hyderabad, 6-26 November 2002.
  - \* Shri K.Ponnusamy, Scientist, attended the ICAR short course on "Monitoring and evaluation of extension programme", at IARI, New Delhi, 18 February to 10 March 2003.
  - \* Dr.K.P.Jithendran, Senior Scientist, underwent training on "Advances in fish disease diagnostics", conducted by CIFE, Mumbai, 25 February to 17 March 2003.
- Lectures and demonstrations were arranged for the following at Muttukadu Experimental Station:**
- 21 students (M.Sc. Chemistry) from Delhi University, New Delhi, 6 January 2002.
  - 30 students (B.Sc. Zoology) from Islamia College, Vaniyambadi, Tamil Nadu, 22 January 2002.
  - 5 Students (B.F.Sc.) from College of Fisheries, G.P.Pant University, U.P., 2-3 May 2002.
  - 12 trainees from Staff Training Institute, Dept. of Fisheries, Govt. of Tamil Nadu, 13 May 2002.
  - 5 students from Central Agricultural University (IMPHAL), College of Fisheries, Tripura, 17 May 2002.
  - 29 students (B.Sc. Zoology) and two staff of Nirmalagiri College, Tellichery, Kerala, 1 November 2002.
  - 27 post-graduate students and 4 staff from Somaiya College of Science, Mumbai, 11 December 2002.
  - 50 students (B.Sc. Industrial Fish & Fisheries) and two staff from Karnatak Science College, Dharwad, 17 December 2002.
  - 37 students (M.Sc. Zoology) and 3 staff from Ethiraj College for Women, Chennai, 27 January 2003.
  - 64 students (B.Sc., M.Sc., Microbiology and M.Sc., Biotechnology) and two staff from Hindustan Arts College, Kelambakkam, Chennai, 4 February 2003.
  - 19 students (M.Sc. Zoology) and 2 staff from Thiruvalluvar University, Vellore, 13 February 2003.
  - 30 students (M.Sc. Zoology) and two staff from Pachiappa's Arts College, Chennai, 17 February 2003.
  - 27 students (B.Sc. Microbiology) from Pachiappa's Arts College, Chennai, 28 February 2003.
  - 125 students (B.Sc.) from Quaide-E-Milleth Government College, Chennai, 7 March 2003.
  - 19 students (B.F.Sc.) from Fisheries College and Research Institute, Tuticorin, 13 March 2003.

## 7. AWARDS AND RECOGNITIONS

\* Dr.K.P.Jithendran, Senior Scientist, received Dr.V.A.Alwar Memorial Award for the year 2001, alongwith Dr.J.R.Rao, Principal Scientist, IVRI, Izatnagar, for the Best Research Article, "Antigenic characterization of blood stream variants of an Indian isolate of *Trypanosoma evansi* from buffaloes", published in the Journal of Veterinary Parasitology, during December 2002.

\* Dr. (Mrs.) M.Jayanthi, Scientist (SS), received the Young Scientist Award for the year 2002, for her paper entitled "Application of remote sensing and geographic information system in assessing the impact of aquaculture in Vellar-Coleroon estuary system", from the Asian Fisheries Society during the Sixth Indian Fisheries Forum, held at CIFE, Mumbai, during 17-20 December 2002.

Shri. Mahesh Kumar, T-3 (Hindi Translator), was awarded a Silver Medal for his outstanding performance in the examination conducted by the Central Translation Bureau, Department of Official Language, Ministry of Home Affairs, at Bangalore, on 26 December 2002.

The following Scientist / staff won the following prizes during the ICAR Zonal Sports Meet held at NAARM, Hyderabad, during 12-16 November 2002 ;

Mrs.P.Nila Rekha, Scientist :

I Prize	Javelin Throw
II Prize	Discuss Throw
III Prize	Shotput

Shri R.Kumaresan, SS.Gr.I :  
III Prize Long Jump

Shri R.Mathivanan, SS.Gr.I :  
Winner Carroms

Mrs. P. Nila Rekha, Scientist won the following prizes at the ICAR Inter-Zonal Sports Meet held at CIFRI, Barrackpore, during 28 April -1 May 2003.

I Prize	Javelin Throw
II Prize	Discuss Throw

## 8. LINKAGES AND COLLABORATION INCLUDING EXTERNALLY FUNDED PROJECTS

### Linkages and collaboration

During the year the Institute had linkages with the following:

#### National

##### I. ICAR Institutes

###### CMFRI

The Mandapam Research Centre of the Central Marine Fisheries Research Institute (CMFRI), is one of the co-operating centres in the Inter-Institutional NATP Project entitled "Shrimp and fish broodstock development and breeding under captive conditions", with CIBA as Lead Centre for the same project.

###### ICAR Research Complex, Goa

The Institute in collaboration with the ICAR Research Complex Goa, organized a Farmers' Meet, at Goa, on 6 August 2002.

##### 2. Other Institutes / SAUs / State Agriculture Depts. / Co-operating centres under the NATP Projects

- College of Fisheries, Konkan Krishi Vidyapeeth, Ratnagiri.
- Fisheries Station, Kerala Agricultural University, Pudukkottai.
- Orissa University of Agriculture & Technology, Rangailunda, Berhampur.
- Central Marine Fisheries Research Institute, Regional Station, Mandapam.
- College of Fisheries, University of Agricultural Sciences, Mangalore.
- College of Fisheries, ANGRAU Agricultural University, Muthukur.
- Fisheries College and Research Institute, Tamil Nadu University of Veterinary and Animal Sciences, Tuticorin.

- West Bengal University of Animal and Fisheries Sciences, Kolkata.
- Central Institute of Fisheries Education, Mumbai.
- Haryana Agricultural University, Hisar.
- Gujarat Agricultural University, Okha.
- Rice Research Station, Tamil Nadu Agricultural University (TNAU), Tirur.
- State Dept. of Agriculture (Govt. of Tamil Nadu), at Ponneri and Minjur.
- Livestock Research Station, Tamil Nadu University of Veterinary and Animal Sciences (TANVASU), Kattupakkam.
- Poultry Research Station, Tamil Nadu University of Veterinary and Animal Sciences (TANVASU), Nandanam.
- Dept. of Horticulture, Govt. of Tamil Nadu, Chennai.
- Dept. of Animal Husbandry, Govt. of Tamil Nadu, Chennai.
- Tamil Nadu Rice Research Institute, (TNAU), Aduthurai, Tanjore District.
- Tamil Nadu Agricultural College and Research Institute, Tiruchirappalli.

##### 3. State Fisheries Departments/BFDAs

The Institute has well established linkages with State Fisheries Depts./BFDAs mainly with regard to transfer of technology programmes.

#### International

##### 1. M/s.COFREPECHE/Govt. of France

The Institute has taken up an Indo-French Collaborative Project entitled 'Seabass Pilot Unit' with M/s.COFREPECHE/Govt. of France for a period of three years from November 1999.

## 2. World Bank

The Institute receives World Bank aid under the following programmes :

- (i) The World Bank-aided Institutional consultancy programme on Environmental Monitoring of Shrimp Culture, under the Shrimp and Fish Culture Project of the Ministry of Agriculture, Govt. of India.
- (ii) The World Bank-aided National Agricultural Technology Projects (NATP) of the ICAR, viz.,
  - a) Shrimp and fish broodstock development and breeding under captive conditions.
  - b) Shrimp and fish health management
  - c) Fish production using brackishwater in arid ecosystem
  - d) Institution Village Linkage Programme for technology assessment and refinement in coastal agro-ecosystem of Tiruvallur district of Tamil Nadu.
  - e) Integrated national agricultural resources information system.

### Externally funded projects

#### I. Projects funded by AP Cess Fund of ICAR

1. Shrimp health and water and soil quality monitoring for development of sustainable shrimp farming (Sanction Order F.No.4(3)/96-ASR-I dated 25 June 1998).

Project Investigator: Dr.B.P.Gupta  
 Project Associates : Dr.K.O.Joseph  
 (upto 2.12. 2002)

Dr.M.Muralidhar  
 Shri.R.K.Chakraborti  
 Dr.I.S.Azad  
 Dr.S.V.Alavandi  
 Dr.C.P.Balasubramanian  
 Project location : Chennai, Kakdwip  
 and Puri

This project funded by the AP Cess Fund of ICAR has a total outlay of Rs.13,58,816/- and a duration of 3 years from July 1999.

Workdone : Commercial shrimp farms in Tamil Nadu, Andhra Pradesh and Orissa were regularly monitored to study the soil and water quality of the farms and to understand the health status of shrimps. Data on production of shrimps from the different farming systems followed was also regularly collected. An overall analysis of shrimp production and environmental conditions indicated that out of 34 culture cycles monitored, 17 cultures were affected by white spot virus disease leading to crop failure and low production (50-667 kg/ha). In the remaining cultures, higher production levels (780-2902 kg/ha) were recorded. The project work was completed in July 2002.

2. Development and evaluation of shrimp immunostimulants using whole cell preparation of *Vibrio*. (Sanction order F.No.4(37)/99-ASR-II dated 27 June 2000).

Project Investigator : Dr.I.S.Azad  
 Project Associates : Dr.C.Gopal  
 Dr.K.K. Vijayan  
 Dr. S.V.Alavandi  
 Project location : Chennai

This project funded by the AP Cess Fund of ICAR has a total outlay of Rs.11,09,390/- and a duration of 3 years with effect from 23 May 2000.

Work done : Studies were conducted both in grow-out and hatchery production systems of shrimps to understand the routes of immunostimulation using heat-killed *Vibrio* isolates. In two hatchery trials, the immunostimulant treated shrimp larvae were found healthy and showed 7-15% survival more than the untreated larvae. 13 field trials were conducted in farmer's ponds wherein the immunostimulant was provided to *P. monodon* through feed. In all the treated ponds harvest of healthy shrimps with enhanced growth, survival and production was achieved compared to the control ponds. In none of the treated ponds white spot virus disease was noticed. The field studies have generated interest among shrimp farmers in the localities to use CIBA developed immunostimulant to get a healthy shrimp crop.

## II. Projects funded by ICAR/National Agricultural Technology Project (NATP)-(World Bank funded projects)

### A. Coastal Agro-ecosystem :

1. Shrimp and fish broodstock development and breeding under captive conditions (Sanction order No.F.AED (FLP)/99/P-1 dated July 1999)

Project Investigator : Dr.P.Ravichandran,

Project Associates : Dr.S.M.Pillai

Dr.A.R.Thirunavukkarasu

Dr.M.Natarajan

Dr.K.O. Joseph

(upto 2.12.2002)

Dr.C.Gopal

Dr.K.K.Vijayan

Dr.M.Kailasam

Project location : Chennai (Muttukadu)

CIBA is the lead centre for this project and the cooperating centres are Central Marine Fisheries Research Institute, Mandapam; College of Fisheries, Konkan Krishi Vidyapeeth, Ratnagiri;

Kerala Agricultural University, Pudukkottai, Ernakulam; Orissa University of Agriculture and Technology, Bhubaneswar. The total outlay for the project is 136.34 lakhs, the amount allotted to CIBA being 67.9 lakhs. The project duration is four years from July 1999.

Work done : Sub-adults of *P. monodon* (36.2 g) were further reared in an earthen pond for 6 months to develop as broodstock. The shrimp above 85 g size were harvested and maintained in RCC tanks. Induced maturation of the female shrimps (90-95 g) resulted in gonadal development upto II stage. Larval rearing of *Marsupenaeus japonicus* was completed and further rearing in the hatchery under dark conditions was followed to raise captive broodstock.

14 breeding trials of *L. calcarifer* were conducted and successful spawnings were observed in 12 trials. In 9 cases second spawnings were noticed. The rates of fertilization and hatching ranged from 0-80% and 64 to 80% respectively in the first spawning and 0-42% and 49 to 64% respectively in the second spawning. Induced breeding of *E. tauvina* was successfully achieved and hatchlings were obtained. Sex reversal of grouper was also achieved by means of hormones.

2. Shrimp and fish health management (Sanction Order No.F.AED/FLP/PSR/P-2/8 dated 27 July 1999)

Project Investigator : Dr.T.C.Santiago

Project Associates : Dr.K.K. Vijayan and

Dr. S.V.Alavandi

Project location: Chennai (Muttukadu)

CIBA is the lead centre for this project and the cooperating centres are College of Fisheries, University of Agricultural Sciences, Mangalore ; ANG Ranga Agricultural University,



Muthukur; Fisheries College and Research Institute (Tamil Nadu Veterinary and Animal Sciences University), Tuticorin; and West Bengal University of Animal and Fisheries Sciences, Kolkata. The total outlay of the project is 142.27 lakhs. CIBA has been allotted an amount of 49.04 lakhs. The project has a duration of 4 years from July 1999.

Work done : Health monitoring of shrimp farms in Andhra Pradesh and Tamil Nadu revealed that about 60% farms were affected by White Spot Syndrome Virus (WSSV). WSSV contamination in wild spawners of *P. monodon* was lower in east coast compared to west coast. Studies on immune index of shrimps revealed that there is variation in the haemolymph count of WSSV infected shrimps compared to healthy ones. Further, haemolymph of diseased shrimps failed to show clotting properties.

2. Institutional Village Linkage Programme for Technology Assessment and Refinement in coastal Agro-ecosystem of Tiruvallur district of Tamil Nadu (Sanction order No.F.AED (A&H)/2000/TAR dated 31 July 2000.

Project Investigator : Shri.K.Ponnusamy

Project Associates : Dr.I.S.Azad  
Dr.T.Ravisankar  
Dr.K.Ambasankar  
Dr.M.Kumaran

Project location : Chennai

CIBA is the lead centre for this project. The project work was carried out in close linkage with Rice Research Station, Tamil Nadu Agricultural University, Tirur; Poultry Research Station, Tamil Nadu Veterinary and Animal Sciences University, Chennai and the departments of Agriculture/Horticulture/Animal Husbandry/Fisheries of the Government of Tamil Nadu. The total outlay for the project is 28.27 lakhs and the duration of the project is 3 years from April 2000.

Work done : The project work was carried out at Kattur village, Ponneri Taluk, 50 km away from CIBA headquarters, Chennai. The technological interventions like use of shrimp immunostimulants, adoption of biological pest control measures, Azolla application in rice fields, Rhizobium treatment and use of DAP foliar spray in green gram helped the farmers to increase the yield and profit.

Value addition of fishery products, vaccination to control haemorrhagic septicemia, increased egg production in Rhode Island Red poultry bird, salt-lick for calves, backyard vegetable gardens, use of insect traps to control storage pests, utilization of solar lantern and sack holder are the other popular interventions which were well accepted by the farmers.

### B. Arid Agro-ecosystem :

3. Fish production using brackishwater in the arid ecosystem (Sanction order F.No.NATP/ AED (ARID) PAL-026/99 dated 22 May 2000)

Project Investigator : Dr.A.R.Thirunavukkarasu

Project Associates : Dr.M.Kailasam

Project location : Chennai

CIBA is the lead centre for this project and the cooperating centres are Central Institute of Fisheries Education, Mumbai; Fisheries Station, Gujarat Agricultural University, Okha and Haryana Agricultural University, Hissar. The total outlay for the project is Rs.119.62 lakhs with budget allotment for CIBA being Rs.44.61 lakhs. The duration of the project is three years from May 2000 to December 2003.

Work done : A semi-permanent shed with 10 RCC tanks of 8 t capacity each were constructed within the premises of CIBA headquarters at Chennai, to rear fish / shrimp seed. Seed of *M. cephalus*, *C.*

*chanos, L. parsia, P. monodon* and *M. rosenbergii* were procured from Tamil Nadu and transported to Udaipur in Rajasthan and Hissar in Haryana. Studies on acclimatization of milk fish fry of 28.5 mm to underground saline waters of different hardness revealed that the fry can efficiently tolerate hardness from 4000 to 5000 ppm.

### III. Indo-French Collaborative Project

4. Seabass pilot unit hatchery and culture (MOU signed between DARE/ICAR and COFREPECHE (Govt. of France) dated 8 March 1999)

Principal Investigator : Dr.A.R.Thirunavukkarasu  
Project Associate : Dr.M.Kailasam  
Project location : Chennai (Muttukadu)

This Indo-French collaborative project between IFREMER/COFREPECHE and CIBA has a total outlay of Rs.4,73,00,000 (French loan component : Rs.2,73,00,000 (3.9 million FF) and ICAR component : Rs.2,00,00,000). The project duration is three years. This is a transfer of technology project aimed at acquiring the technology from France for setting up a pilot-scale hatchery and grow-out facilities for the Asian seabass *Lates calcarifer*, at Muttukadu and for demonstrating the technology on seabass breeding/culture and to train CIBA scientists/technicians enabling them to train extension workers and farmers for adoption of this technology.

Work done: Work under the project commenced during January 2000. Site selection, site validation including preliminary studies of topographical survey, soil mechanical survey, water

sample survey, hydrogeological survey and water quality assessment were completed by February 2000. A detailed project documentation / EFC Memo of Rs.473 lakhs (Rs.273 lakhs for repayment of loan component and Rs.200 lakhs towards infrastructure facilities and other expenditure), submitted to the Govt. of India in August 2000 under the IX plan, was approved in March 2001.

Consultancy charge of Rs.76.17 lakhs was paid to the French consultant through the Dept. of Economic Affairs, Government of India. For the development of infrastructure facilities, an amount of Rs.62.13 lakhs was deposited with the CPWD. Earth-filling work for the construction of hatchery and larval rearing facilities were initiated. Steps were taken to obtain permission from Coastal Zone Management Committee, Tamil Nadu and other local body agencies for the construction work as directed by the Aquaculture Authority, Govt. of India. Due to the delay in starting the works under the project, ICAR / DARE, Govt. of India, has been requested for extension of the project protocol upto June 2005.

The first consignment of hatchery equipments was received from COFREPECHE in June 2002. An amount of Rs.12,25,107/- was remitted to the Department of Economic Affairs, through DARE / ICAR, as part repayment of the loan to the Government of France.

## 9. LIST OF PUBLICATIONS

### CIBA PUBLICATIONS

- ◆ CIBA Annual Report for the year 2001-2002
- ◆ Training Programmes 2002-2003
- ◆ CIBA News Vol.7 Nos. 1, 2, 3 & 4
- ◆ CIBA Bulletin No.14 - Traditional System of Brackishwater Aquaculture of Kerala
- ◆ CIBA Bulletin No.15 - Coastal Agro-ecosystem Analysis using Participatory Rural Appraisal Techniques
- ◆ Achievements of Technological Interventions under Institution Village Linkage Programme at CIBA, CIBA Special Publication No.17
- ◆ CIBA Extension Series No.1. - Shrimp culture : Pond preparation (Revised)
- ◆ CIBA Extension Series No.3. - Shrimp culture : Feed and feed management (Revised)
- ◆ CIBA Extension Series No.6 - Lime and its applications in brackishwater aquaculture (Revised)
- ◆ CIBA Extension Series No.12. - Shrimp nutrition and feed technology (Revised)

### Telugu Publications

- ◆ Brackishwater Aqua Sagu, (Brackishwater Aquaculture) Training Manual, CIBA Special Publication No.16, pp.21.
- ◆ Royyal Pempakamu: Metha mariyu yajamanyamu (Shrimp Culture: Feeds and Feed management), CIBA Extension Series No: 21
- ◆ Royyala Pempakamu: Cheruvunu thayaru cheyu vidhanam (Shrimp Culture: Pond preparation), CIBA Extension Series No.22
- ◆ Royyala Pempakamu: Kalushya rahitha paryavaranam (Shrimp Culture: Pollution free environment), CIBA Extension Series No.23
- ◆ Royyala Pempakamu: Samasyalu mariyu nivarhana charyalu (Shrimp Culture: Trouble indicators and remedial measures), CIBA Extension Series No.24

- ◆ Royyala Pempakamu: Patinchavalasina arogya nirvahana charyalu (Shrimp Culture: Health management practices), CIBA Extension Series No.25
- ◆ Royyala Pempakamu: Tella Machhala vyadi - Nirvahana charyalu (Shrimp Culture: White Spot Virus Disease and its management), CIBA Extension Series No.26

### TAMIL PUBLICATIONS

#### CIBA/IVLP/NATP Extension Series

- ◆ No.20. Backyard Turkey farming
- ◆ No.21 Sheep rearing
- ◆ No.22 Vermicomposting
- ◆ No.23 Package of practices for greengram cultivation
- ◆ No.24 Integrated Pest Management in coconut.
- ◆ No.25 Kitchen garden
- ◆ No.26 Biofertilizers for agricultural crops
- ◆ No.27 Role of non-conventional energy sources in rural development
- ◆ No.28 Medicinal plant cultivation
- ◆ No.29 Scientific fish drying
- ◆ No.30 Preparation of fish cutlet/wafers
- ◆ No.31 Ornamental fish culture
- ◆ Achievements of Technological Interventions under Institution Village Linkage Programme at CIBA, CIBA Special Publication No.18

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\* Also includes publications of scientists of the Institute based on their work in previous Institutes

- Ahamad Ali, S., J. Syama Dayal and K. Ambasankar. 2002.** Effect of dietary protein level on its *in vitro* digestibility in the cultured shrimp *Penaeus indicus*.  
In: *The Fifth Indian Fisheries Forum Proceedings*. (Eds., S.Ayyappan, J. K. Jena and M. Mohan Joseph). pp. 67-71.
- Ahamad Ali, S., K. Ambasankar, J. Syama Dayal, A. R. Thirunavukkarasu, and M. Kailasam. 2002.** Preliminary studies on the formulation and presentation of compounded diet to Asian seabass, *Lates calcarifer* (Bloch). In: *The Fifth Indian Fisheries Forum Proceedings*. (Eds., S.Ayyappan, J. K. Jena and M. Mohan Joseph). pp.73-76.
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**Vijayan, K.K., C.P. Balsubramanian, K.P. Jithendran, S.V. Alavandi and T.C.Santiago. 2003.** Histopathology of Y-organ in Indian white shrimp *Fenneropenaeus indicus*, experimentally infected with white spot syndrome virus (WSSV). *Aquaculture*, 221:97-106.

## 10. LIST OF ON-GOING RESEARCH PROJECTS

No.	Title of the Project	Principal Investigator
<b>CRUSTACEAN CULTURE DIVISION</b>		
1.	Improvement of penaeid shrimp hatchery technology for the production of quality seed (CCD/SP/1)	Dr.S.Kulasekarapandian Principal Scientist
2.	Improvement of production and productivity of shrimp in traditional culture system by suitable management practices (CCD/MT/1)	Shri R.K.Chakraborti Principal Scientist
3.	Culture of mud crabs ( <i>Scylla</i> spp.)(CCD/CF/1)	Shri M.Kathirvel Principal Scientist
4.	Culture of tiger shrimp <i>Penaeus monodon</i> in low saline environment (CCD/SC/1)	Shri S.R.Das Principal Scientist
<b>FISH CULTURE DIVISION</b>		
5.	Broodstock development, breeding and seed production of <i>Mugil cephalus</i> and polyculture of finfishes and shrimp (FCD/B&C/1)	Dr.M.Natarajan Principal Scientist
6.	Controlled breeding, seed production and culture of <i>Epinephelus tauvina</i> (FCD/B&C/2)	Dr.M.Kailasam Scientist (SS)
7.	Breeding, seed production and culture of seabass ( <i>Lates calcarifer</i> ) (FCD/B&C/3)	Dr.A.R.Thirunavukkarasu Principal Scientist
<b>GENETICS &amp; BIOTECHNOLOGY SECTION</b>		
8.	Application of molecular genetics and biotechnology in genetic characterization, stock improvement and health care of shellfish and finfish (GBS/MG/1)	Dr.T.C.Santiago Principal Scientist
9.	Development of probiotics for disease resistance in shrimp (GBS/PRO/1)	Dr.S.V.Alavandi Scientist (SG)
10.	Evaluation of <i>Penaeus monodon</i> broodstock along the Indian coast with special reference to pathogen loading(GBS/SHM/1)	Dr.K.K. Vijayan Senior Scientist

No.	Title of the Project	Principal Investigator
<b>NUTRITION PHYSIOLOGY &amp; PATHOLOGY SECTION</b>		
11.	Development of feeds for aquaculture of brackishwater shrimp and finfishes (NPPS/NT/2)	Dr.S.Ahamad Ali Principal Scientist
12.	Development and evaluation of immuno-diagnostics and prophylactics for important brackishwater fish and shellfish (NPPS/PATH/1)	Dr. I.S.Azad Senior Scientist
13.	Monitoring and surveillance of diseases in shrimp and fish with special reference to broodstock (NPPS/DIS/3)	Dr.K.P.Jithendran Senior Scientist
<b>AQUACULTURE ENGINEERING &amp; ENVIRONMENT SECTION</b>		
14.	Environmental and techno-socio-economic impacts of shrimp farming in coastal states of India (AEES/ETI/1)	Dr.B.P.Gupta Principal Scientist
15.	Management of shrimp growing environment (AEES/SGE/2)	Dr.K.O.Joseph Senior Scientist (upto 2-12-2002) Dr.K.K.Krishnani (from 3-12-2002)
16.	Development of methodology for the assessment of carrying capacity of coastal water bodies and guidelines for EIA in relation to shrimp farming	Dr.M.Muralidhar Scientist (SS)
<b>EXTENSION, ECONOMICS &amp; INFORMATION DIVISION</b>		
17.	Extension approaches for sustainable shrimp and fish farming (EEIS/EXTN/3)	Dr.N.Kalaimani Principal Scientist
18.	Socio-economic appraisal of traditional and diversified coastal aquaculture in India (EEIS/EXTN/04)	Dr.T.Ravisankar Scientist(SS)

No.	Title of the Project	Principal Investigator
<b>FUNDED PROJECTS</b>		
19.	Shrimp health and water and soil quality monitoring for development of sustainable shrimp farming (AP Cess Fund)	Dr.B.P.Gupta Principal Scientist
20.	Development and evaluation of shrimp immunostimulants using whole cell preparations of <i>Vibrio</i> (AP Cess Fund)	Dr.I.S.Azad Senior Scientist
21.	Shrimp and fish broodstock development and breeding under captive conditions (NATP World Bank funded project)	Dr.P.Ravichandran Principal Scientist
22.	Shrimp and fish health management (NATP World Bank funded project)	Dr.T.C.Santiago Principal Scientist
23.	Fish production using brackishwater in arid ecosystem (NATP World Bank funded project)	Dr.A.R.Thirunavukkarasu Principal Scientist
24.	Institute Village Linkage Programme for technology assessment and refinement in coastal agro ecosystem of Tiruvallur district of Tamil Nadu (NATP World Bank funded project)	Shri K.Ponnusamy Scientist
25.	Seabass Pilot Unit (Indo-French Collaborative project) IFREMER / COPREPECHE	Dr.A.R.Thirunavukkarasu Principal Scientist

## 11. Consultancy / Commercialisation of Technology

The on-going consultancy programmes during the period under report are given below:

### **Nested PCR kit for rapid detection of White Spot Syndrome Virus**

The White Spot Syndrome virus (WSSV) is the most virulent virus known to affect cultured shrimps. Early diagnosis and scientific health management practices are the limited options available to combat this disease. To meet this objective, a genomic fragment of the Indian strain of WSSV has been sequenced and a two step PCR (Nested) has been developed by CIBA.

After extensive laboratory trials and comparative evaluation of its efficacy and performance, the technology for Nested PCR kit was transferred to Bangalore Genei Pvt. Ltd., a biotech company, through an MOU on 21 February 2002. This kit was released by Shri Ajit Singh, Hon'ble Union Minister for Agriculture, Govt. of India on 21 March 2002 at New Delhi.

The highlights of the PCR kit are as follows:

- i) PCR diagnostics developed for Indian strain of white spot virus.
- ii) Primers designed on the basis of sequence information generated on the Indian strain of white spot virus with a sensitivity of detecting 10 copies of virus.
- iii) Disposable tissue homogenizers provided in the kit to prevent viral contamination during sample preparation.
- iv) Simplified and easy to follow procedures provided as flow charts. Simple method of sample preservation in 95% ethanol.
- v) Simple, rapid and user's friendly method of DNA template preparation in 30 minutes, in place of time consuming DNA extraction protocol, with specially designed DNA-extraction buffer.
- vi) As the ablated eye-stalk or a piece of pleopod is sufficient for the diagnosis, sacrifice of the shrimp is avoided in the present technique. Hence the technique is a non-lethal diagnostic tool for the early detection and screening of shrimps by the farmers, hatchery managers and researchers to tackle the White Spot Virus problem.
- vii) The whole nested PCR (1<sup>st</sup> step and 2<sup>nd</sup> step PCR) can be performed within 5 hours.
- viii) The nested PCR kit is cost effective costing only Rs.300 / sample. This kit may help to bring down the present testing cost of WSSV for nested PCR from Rs.800 - 1200 to about Rs.500, making this kit more affordable for the farmers.

## 12. RAC, IMC, SRC and IJSC Meetings

### Research Advisory Committee (RAC)

The Research Advisory Committee was constituted by ICAR for a period of 3 years from 25 July 2001 (Council's order F.No.18-3/2001-ASR-I dated 30 August 2001).

The composition of the Research Advisory Committee (RAC) of the Institute is as follows :

1. **Dr.P.V.Dehadrai** Chairman  
Ex-DDG (Fisheries)  
D-III/3403, Vasant Kunj  
New Delhi 110 070
2. **Dr.I.Karunasagar** Member  
Professor and Head,  
Dept. of Microbiology,  
College of Fisheries, Mangalore
3. **Dr.M.Devaraj** Member  
Ex-Director, CMFRI &  
Emeritus Scientist  
CMFRI, 68/3, Greams Road  
Chennai 600 006
4. **Dr.Sher Ali** Member  
Head, Dept. of Molecular Biology  
National Institute of Immunology  
New Delhi
5. **Dr.Y.S.Yadava** Member  
National Co-ordinator  
Bay of Bengal Programme (BOBP)  
91, St. Mary's Road, Abhirampuram  
Chennai 600 018
6. **Dr.A.D.Diwan** Member  
Assistant Director General (M.Fy.)  
Fisheries Division, ICAR  
New Delhi.

7. **Dr.Mathew Abraham** Member  
Director, CIBA, Chennai

8. **Dr. S.M. Pillai** Member  
CIBA, Chennai Secretary

### Institute Management Committee (IMC)

The Institute Management Committee was reconstituted by ICAR for a period of 3 years with effect from 28.9.1999 (Council's order F.No.6-9/96-IA(VI) dated

- |                |                    |       |
|----------------|--------------------|-------|
| 14.10.1999,    | F.No.6-9/96-IA(VI) | dated |
| 15.01.2001,    | F.No.6-9/96-IA-VI  | dated |
| 28.05.2001,    | F.No.6-9/96-IA-VI  | dated |
| 26.06.2001,    | F.No.6-9/96-IA-VI  | dated |
| 21.12.2001 and | F.No.6-9/96-IA-VI  | dated |
| 13.09.2002.    |                    |       |

The composition of the IMC is as follows:

1. **Director, CIBA, Chennai** Chairman
2. **Commissioner of Fisheries** Member  
Govt. of Tamil Nadu, Chennai
3. **Director of Fisheries** Member  
Govt. of Kerala  
Thiruvananthapuram
4. **Dr.K.Venkataramanujam** Member  
Director of Research&Extension (Fy.)  
Fisheries college and Research Institute  
Tuticorin
5. **The Finance & Accounts Officer** Member  
Project Directorate of Oil  
Seed Research, Hyderabad

- |     |   |                         |
|-----|---|-------------------------|
| 6.  | <b>Shri Durgesh Rai</b><br>Lohlya Ashram<br>Behind DRM Office<br>Samastipur, Bihar    | Member                  |
| 7.  | <b>Shri Koslender Prasad Singh</b><br>At & PO Halder Chak<br>Dist. Nalanda, Bihar     | Member                  |
| 8.  | <b>Dr.A.D.Diwan</b><br>Asst. Director General (M.Fy.)<br>ICAR, New Delhi              | Member                  |
| 9.  | <b>Dr.S.Kulasekarapandian</b><br>Principal Scientist<br>CIBA, Chennai                 | Member                  |
| 10. | <b>Dr.A.R.Thirunavukkarasu</b><br>Principal Scientist,<br>CIBA, Chennai               | Member                  |
| 11. | <b>Dr.T.C.Santiago</b><br>Principal Scientist<br>CIBA, Chennai                        | Member                  |
| 12. | <b>Shri.R.K.Chakraborti</b><br>Principal Scientist<br>Kakdwip Research Centre of CIBA | Member                  |
| 13. | <b>Administrative Officer</b><br><br>CIBA, Chennai                                    | Member<br><br>Secretary |

The 23<sup>rd</sup> and 24<sup>th</sup> Meetings of the Institute Management Committee (IMC) were held on 7 June 2002 and 21 January 2003, respectively, at CIBA, Chennai.

The major recommendations of the 23<sup>rd</sup> IMC meeting included approval for executing major and minor works under Institute and externally funded projects through CPWD; annual maintenance of headquarters building at Chennai, hatchery and laboratory buildings at Muttukadu by CPWD; procurement of laboratory equipments

and office equipments (as replacement) and purchase of computers.

The major recommendations of the 24<sup>th</sup> IMC meeting included depositing money with CPWD for annual maintenance of hatchery, laboratory and residential buildings at Muttukadu; minor works by CPWD and enhancement of remuneration to AMA at Kakdwip.

#### **Staff Research Council (SRC)**

Annual Staff Research Council Meeting was held at CIBA headquarters, Chennai on 15 May 2001 under the Chairmanship of the Director, CIBA. Dr.A.D.Diwan, Assistant Director General (M.Fy), ICAR, New Delhi, Head of Division / Scientist In-charge of Divisions and Principal Investigators of on-going projects as members attended the meeting. The progress of work in the on-going projects was reviewed and the major recommendations made at the meeting are briefly mentioned below:



**Annual Staff Research Council meeting**

- \* Development of hatchery technology of *F. merguensis* should be standardized and suitable culture techniques developed.



- \* There is an urgent need to find alternative techniques for eyestalk ablation followed for years. Use of hormones, ganglionic extracts may be tried for induction of maturation in shrimps.
- \* More research is needed to develop disease free or / and disease resistant shrimp broodstock.
- \* Development of berried crabs through injection of hormones / ganglionic extracts and improvement of larval rearing of the two species of crabs are to be intensified.
- \* The problem of low salinity during monsoon and post - monsoon period may be overcome by pumping seawater direct from sea for maintenance of broodstock of mullets and groupers.
- \* Reduced photoperiod and the role of pituitary hormones in maturation of *M. cephalus* may be studied. A technology package for culture of this species may be developed by conducting experiments with wild seed at Kakdwip or an adopted farmer's pond near to Chennai.
- \* Time bound programmes may be formulated to achieve success in breeding and seed production of grouper and standardize the technology.
- \* In the context of increasing demand for seabass seed, it is high time that the technology of breeding and seed production is popularized. Culture technology of seabass needs standardization.
- \* Genetic characterization of seabass of Orissa, Andhra Pradesh, Kerala and Goa regions is to be undertaken on a time bound basis.
- \* A short-term project on the survey of WSV infection of shrimp broodstock in east coast may be taken up.
- \* Propagation of CIBA feed among the farmers through field demonstrations may be urgently arranged and more experimental trials are also to be conducted.
- \* Health / immune index of *P. monodon* is to be studied and popularized for the benefit of the farming community.
- \* A new project on parasitology of shrimps / fishes is to be taken up in view of the problems faced in hatcheries.
- \* Studies on acid sulphate soils of the west coast has to be continued in view of the serious problems faced by the farmers during monsoon season, as a part of any one of the new projects.
- \* The new project on environmental and socio-economic aspect of shrimp farming should address all issues including culture technologies and post harvest technologies adopted by farmers.
- \* Field trails of seepage control agents are to be made to solve this problem.
- \* A short term project for assessment of carrying capacity of a creek / water body in relation to development of aquaculture may be initiated.
- \* All the publications of CIBA should be included in the website and the data base developed may be made available for end users.

- \* Publication of pamphlets in regional languages may be made for extending the technologies to the farming community.

### Institute Joint Staff Council (IJSC)

(Reconstituted by CIBA for a period of 3 years with effect from 12 August 1999, vide office order F.No.13-1/99-Admn. dated 12 August 1999).

The composition of the Institute Joint Staff Council (IJSC) is as follows :

#### Official side

- |   |          |
|---|----------|
| 1. Director, CIBA   | Chairman |
| 2. Dr.S.A.Ali,<br>Principal Scientist                         | Member   |
| 3. Dr.P.Ravichandran<br>Principal Scientist                   | Member   |
| 4. Dr.T.C.Santiago<br>Principal Scientist                     | Member   |
| 5. Shri.S.Krishnaswamy<br>Asst. Finance &<br>Accounts Officer | Member   |

- |  |        |
|--|--------|
| 6. Shri.J.A.S.Sayuja<br>Administrative Officer | Member |
|--|--------|

#### Staff side

- |   |           |
|---|-----------|
| 7. Shri.S.Krishnan<br>Technical Officer (T-5) | Secretary |
| 8. Shri P.Manickyam<br>T-1                    | Member    |
| 9. * Shri.R.Kandamani,<br>Assistant           | Member    |
| 10. Shri.A.Manoharan<br>Junior Clerk          | Member    |
| 11. Shri.N.Harinathan<br>SS.Gr.II             | Member    |
| 12. Shri.N.Mani<br>SS.Gr.III                  | Member    |

\* Shri.R.Kandamani is also a Member of Central Joint Staff Council, New Delhi.

### 13. Participation in Conferences / Meetings / Workshops / Symposia

**Dr.G.R.M.Rao, Director** attended the following workshops/seminars/ symposia/ meetings:

- 25<sup>th</sup> Meeting of the Aquaculture Authority, at Chennai, on 8 January 2002.
- 34<sup>th</sup> Meeting of the Academic council of TANVASU, at Madras Veterinary College, Chennai, on 18 January 2002.
- 8<sup>th</sup> Convocation of TANVASU, at Kalaivanar Arangam, Chennai, on 20 February 2002.

**Dr.Mathew Abraham, Director,** attended the following workshops/ seminars/ symposia/ meetings

- Review Meeting of NATP projects under Coastal Agro Eco-system, at CIBA, Chennai, on 4 March 2002.
- Launching Ceremony for the commercialization of the Nested PCR kit developed by CIBA and marketed by M/s Bangalore Genei, at New Delhi, on 21 March 2002
- Twentieth Executive Committee Meeting of the Rajiv Gandhi Centre for Aquaculture, (Myiladuthurai), at MPEDA, Cochin, on 22 March 2002.
- Fisheries Divisional Committee Meeting for Zero-Base Budgeting, at ICAR, New Delhi, during 11-12 April 2002.
- NATP-IVLP Site Committee Meeting, under Institution Village Linkage Programme for Technology Assessment and Refinement

in Coastal Agro-ecosystem of Tiruvallur district of Tamil Nadu, at CIBA, Chennai, on 16 April 2002.

- Discussion with Hon'ble Minister for Fisheries, Govt. of TamilNadu, about the enrichment of coastal fisheries to benefit the fishermen community, at Neelankarai, Chennai, on 22 April 2002.
- 14<sup>th</sup> Meeting of the Annual SRC for the year 2001-2002 at CIBA, Chennai, on 27 April 2002
- Meeting of the Mid-term Review of Vision 2020 in Fisheries Sector, at ICAR, New Delhi, on 21 May 2002.
- 5<sup>th</sup> Scientific Workers Conference of Tamil Nadu Veterinary and Animal Sciences University, at Madhavaram, Chennai, on 3 July 2002.
- 6<sup>th</sup> Meeting of the National Committee on Introduction of Exotic Species in Indian Waters, at Aquaculture Authority, Chennai, on 30 July 2002.
- 12<sup>th</sup> Scientific Advisory Committee Meeting of NATP projects, at CIBA, Chennai, during 12-13 August 2002.
- Meeting to finalise the X Plan EFC document of CIBA at ICAR, New Delhi, during 3-4 September 2002.
- Meeting convened by the Joint Secretary, Ministry of Agriculture, New Delhi at ICAR Headquarters, during 19-20 September 2002.

- Meeting of Stakeholders in Brackishwater Aquaculture, organized at CIBA, Chennai, on 27 September 2002.
  - Meeting of the High Power Committee of ICAR, at the Project Directorate of Biological Control, Bangalore, on 5 October 2002.
  - ICAR High Power Committee Meeting, at MSSRF, Chennai, on 9 November 2002.
  - National Conference of State Secretaries of Animal Husbandry, Dairying and Fisheries, under the Chairmanship of Secretary (AS & D), at New Delhi, during 14-15 November 2002.
  - Inspection of Quarantine facilities in private farms at Gudur and Nellore along with the Site Committee Members, during 18-19 November 2002.
  - Fisheries Panel Meeting to discuss AP Cess Fund Projects and NEH component of the Institute, during 25-28 November 2002.
  - 1<sup>st</sup> Meeting of the sub Group II on Responsible Aquaculture Development and Application of Fisheries Research of the Aquaculture Authority of India, at New Delhi, on 10 January 2003
  - Meeting convened by the Financial Adviser, DARE to discuss matters related to IFREMER project, at ICAR, New Delhi, on 20 January 2003.
  - 24<sup>th</sup> Meeting of the Institute Management Committee at CIBA, Chennai, on 24 January 2003.
  - Financial Review Meeting of the NATP Sub projects at the College of Agriculture, Pune, on 31 January 2003.
  - Interaction Meeting with the Principal Advisor, Planning Commission, New Delhi, regarding X Plan EFC of CIBA at CMFRI, Cochin, on 13 February 2003.
  - Expert Committee Meeting to scrutinize the applications for setting up shrimp nauplii production centers in Andaman and Nicobar Islands and the meeting of Aquaculture Authority, at Port Blair, during 21-23 February 2003.
  - National Workshop on Shrimp Disease Control and Coastal Management, jointly organized by MPEDA, NACA and Ministry of Agriculture, Govt. of India, at Chennai, during 5-6 March 2003.
  - Meeting convened by the Joint Secretary (EEC), Ministry of Finance, regarding the Indo French Collaborative Project on Seabass Breeding and Culture, at New Delhi, on 12 March 2003.
- The scientists / technical staff attended the following Meetings / Seminars / Workshops:
- Dr. Mathew Abraham, Principal Scientist & Head, Fish Culture Division, Dr. S.M. Pillai, Dr. S.A. Ali, Dr. B.P. Gupta and Dr. N. Kalaimani Principal Scientists, conducted on-farm visit to Kattur Village (Ponneri Taluk, Tamil Nadu) to inspect the performance of different technological interventions under the NATP-IVLP project "Technology assessment and refinement in coastal agro-ecosystem of Tiruvallur District of Tamil Nadu" on, 17 January 2002.

- Dr.P.Ravichandran, Principal Scientist & Principal Investigator of NATP project “Shrimp and fish broodstock development and breeding under captive conditions”, visited College of Fisheries (OUAT), Rangailunda, Orissa, to review the progress of work at the NATP Co-operating Centre, during 28-30 January 2002.
- Dr.(Mrs.) M.Jayanthi, Scientist (SS), delivered a lecture on “Wetland Management using Remote Sensing and Geographic Information System”, at M.S.Swaminathan Research Foundation, Chennai, on 7 February 2002.
- Shri K.Ponnusamy, Scientist & Principal Investigator, NATP-IVLP project “Technology assessment and refinement in coastal agro-ecosystem of Tiruvallur District of Tamil Nadu”, delivered a talk on the activities of the NATP-IVLP project, on 20 February 2002, through AIR, Chennai.
- Dr.N.Kalaimani, Principal Scientist gave a talk on Extension activities of CIBA and Dr.T.Ravisankar, Scientist (S.S.) delivered a talk on Technological interventions in horticulture which were broadcasted by AIR on 18.3.2002.
- Dr.T.C.Santiago, Principal Scientist and Dr.K.K.Vijayan, Senior Scientist, attended the launching ceremony of the Nested PCR Kit developed by CIBA and marketed by M/s Bangalore Genei, at New Delhi, on 21 March 2002.
- Dr.B.P.Gupta, Principal Scientist and Mrs.P.Mahalakshmi, Scientist, participated in the National Conference on Coastal Agricultural Research, at ICAR Research Complex for Goa, Goa, during 6-7 April 2002.
- Shri K.Ponnusamy, Scientist, participated in the NATP-IVLP Site Committee Meeting of NATP-IVLP Project “Technology Assessment and Refinement in Coastal Agro-ecosystem of Tiruvallur district of Tamil Nadu” at CIBA, Chennai, on 16 April 2002.
- Dr.B.P.Gupta, Principal Scientist, participated in the Symposium on Seafood Safety – Status and Strategy, at CIFT, Cochin, during 28-30 May, 2002.
- Dr.B.P.Gupta, Principal Scientist, attended the Meeting on Network Project entitled “National Risks Assessment Programme for Fish and Fish Products for Domestic and National Markets, at CIFT, Cochin, on 30 May 2002.
- Dr.P.Ravichandran and Dr.N.Kalaimani, Principal Scientists, Dr.K.K.Vijayan, Senior Scientist and Shri S.V.Alavandi, Scientist (SG), participated in the National Seminar on Shrimp Disease Management – Selection of Best Species for Shrimp Culture and Health Management, held at Nellore, Andhra Pradesh, on 15 June 2002.
- Shri R.Elankovan, T-6, attended the NATP - Workshop on Library Improvement and Networking within ICAR and SAU Libraries, at IASRI, New Delhi, during 17-19 June 2002.
- Shri K.Ponnusamy, Scientist, participated in the Annual Review Workshop under NATP Agro-ecosystem, at CTCRI, Trivandrum and presented the annual plan of the NATP-IVLP project “Technology Assessment and Refinement in coastal Agro-ecosystem of Tiruvallur district of Tamil Nadu”, during 20-21 June 2002.

- Dr.T.C.Santiago, Facilitator, NATP for Coastal Agro Ecosystem and Dr.P.Ravichandran, Principal Scientist attended the 12<sup>th</sup> Scientific Advisory Committee meeting of NATP projects, at CIBA, Chennai, during 12-13 August 2002.
- Dr.P.Ravichandran, Dr.T.C.Santiago and Dr.A.R.Thirunavukkarasu, Principal Scientists participated in the Farmers Meet jointly organized by ICAR Research Complex for Goa and CIBA, at Goa, on 6 August 2002.
- Dr.P.Ravichandran, Principal Scientist represented CIBA in the meeting of the Expert Committee constituted by the Aquaculture Authority for drafting Guidelines on Good Management Practices for Sustainable Shrimp Farming, at Chennai, on 19 August 2002.
- Shri.K.Ponnusamy, Scientist participated in the Agri-Intex Exhibition 2002 organised by CODISSA, at Coimbatore, during 1-6 August 2002.
- Dr.M.Kumaran, Scientist attended the Expert Consultation Meeting on Sustainable Shrimp Aquaculture Development in India organized by Aquaculture Authority, at Chennai, on 6 August 2002.
- Dr.P.Ravichandran, Principal Scientist, participated in the Expert Consultation on Development of Sustainable Shrimp Farming in India, organized by the Aquaculture Authority, at Chennai, during 28-29 August 2002.
- Dr.S.M.Pillai, Principal Scientist attended the meeting to finalise the X Plan EFC document of CIBA at ICAR, New Delhi, during 3-4 September 2002.
- Shri K.Ponnusamy, Scientist participated and presented progress report of TAR-IVLP project in the National Workshop on Technology Assessment and Refinement through IVLP conducted at UAS, Dharwad, Karnataka, during 3-5 September 2002.
- Dr.S.M.Pillai, Principal Scientist and Dr.I.S.Azad, Senior Scientist participated in the National Conference on Fourth Aquaculture Expo 2002 organized by the NRS Publications, Aqua International, Hyderabad, at Nellore, on 26 September 2002.
- Shri K.Ponnusamy, Scientist, attended and presented the progress report and action plan at the Annual Review Meeting of KVKs/TTC/IVLP/ATIC/ZRS at Gandhigram Rural Institute, Dindigul district of Tamil Nadu organized by Zonal Coordination Unit of ICAR, Bangalore, during 7-9 October 2002.
- Dr.A.R.Thirunavukkarasu, Principal Scientist, attended the 3<sup>rd</sup> Meeting for Fixing Standards for Aquaculture Inputs, at Marine Products Export Development Authority (MPEDA), Kochi, on 12 November 2002.
- Dr.S.M.Pillai, Principal Scientist, participated in the Brain Storming Session on Government – Industry Partnership in Fisheries and Aquaculture organized by Central Institute of Fisheries Education, Mumbai and Confederation of Fisheries and Aquaculture Welfare Organisation, Visakhapatnam, on 20 November 2002

- Dr.S.A.Ali, Principal Scientist participated in the 4<sup>th</sup> Biennial Conference of Animal Nutrition Association of India at the West Bengal University of Animal and Fisheries Sciences, at Kolkata, during 20-22 November 2002.
- Dr.K.K.Krishnani, Scientist (SS), attended the World Neem Conference organized by Neem Foundation, at Mumbai, during 27-30 November 2002.
- Dr.S.M.Pillai and Dr.T.C.Santiago, Principal Scientists participated in the NATP Review Workshop organized by the Coastal Agro Eco-System Directorate, at Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad, during 15-17 December 2002.
- Dr.K.K.Vijayan, Senior Scientist, Dr.M.Muralidhar, Dr.(Mrs.)M. Jayanthi, Scientists (SS), Shri K.Ponnuswamy, and Dr.J.Syama Dayal, Scientists attended the Sixth Indian Fisheries Forum, at CIFE, Mumbai, during 17-20 December 2002.
- Mrs.D.Deboral Vimala, Scientist (SS) attended the National Fair on Women Scientists and Entrepreneurs and Shaping India's Bio-future organised by the Golden Jubilee Biotech Park for Women Society, at Siruseri Village, Kanchipuram Dist., during 7-8 January 2003
- Dr.I.S.Azad, Senior Scientist participated in the National Hindi Seminar on Fisheries Research Development in India, at CIFE, Mumbai, during 15-16 January 2003.
- Dr.S.A.Ali, Principal Scientist attended the FISHNET meeting including Fish Nutrition and Biochemistry convened by the Deputy Director General (Fy.), at ICAR, New Delhi, on 21 January 2003.
- Dr.B.P.Gupta, Principal Scientist participated in the National Hindi Seminar on "Samudree Matsyikee Mein Anusandhan Ki Nayee Samasyayein – Ek Pahachan", at CMFRI, Kochi, during 30-31 January 2003.
- Dr.T.C.Santiago, Principal Scientist & Facilitator, NATP attended the Financial Review Meeting of the NATP projects, at the College of Agriculture, Pune, on 31 January 2003.
- Dr.B.P.Gupta, Principal Scientist attended the Meeting on Aquatic Environment Management convened by the Deputy Director General (Fy.), at ICAR, New Delhi, on 4 February 2003.
- Dr.K.P.Jithendran, Senior Scientist participated in the Coloquium on Biotechnology Applications in Fisheries Research and Development, organized by Fisheries Technocrats Forum, Chennai in collaboration with TANUVASU, at Madras Veterinary College, Vepery, Chennai, on 7 February 2003.
- Dr.P.Ravichandran, Principal Scientist participated in the Interaction Meeting with the Principal Advisor, Planning Commission, New Delhi regarding X Plan EFC of CIBA, at CMFRI, Cochin, on 13 February 2003.
- Dr.P.Ravichandran, Principal Scientist attended the 4<sup>th</sup> Meeting of the committee constituted by MPEDA to scrutinize applications for Registration of Aquaculture Consultants, at Cochin, on 14 February 2003.

- Dr.P.Ravichandran, Principal Scientist, Dr.K.K.Vijayan, Senior Scientist and Dr.M.Muralidhar, Scientist (SS) attended the National Workshop on Shrimp Disease Control and Coastal Management, jointly organized by MPEDA, NACA and Ministry of Agriculture, Govt. of India, at Chennai, during 5-6 March 2003.

- Dr.J.Syama Dayal, Scientist participated in the National Conference on Aquaculture Nutrition, at CMFRI, Cochin, during 12-14 March 2003.

- Dr.P.Ravichandran and Dr.T.C.Santiago, Principal Scientists participated in the NATP Review Workshop related to NATP projects "Shrimp and fish broodstock development and breeding under captive conditions" and "Shrimp and fish health management", respectively, at CTCRI, Trivandrum, during 17-18 March 2003.

- Dr. G. Gopikrishna, Senior Scientist attended the National Symposium on Genetics and Gene Banking of Fish and Shellfish organized by CIFE, at Mumbai, during 29-30 March 2003.



## 14. Services in Committees

### Dr.Mathew Abraham, Director, CIBA served in the following committees

- \* Member, Executive Committee and Governing Body, Rajiv Gandhi Centre for Aquaculture (MPEDA), Mayiladuthurai.
- \* Member, National Committee to Oversee and Regulate Introduction of Exotic Aquatic Species, Ministry of Agriculture, Govt. of India.
- \* Member, Committee for Orientation Courses in Aquaculture, Indira Gandhi National Open University, New Delhi.
- \* Member, Aquaculture Authority, Ministry of Agriculture, Govt. of India.
- \* Member, Tamil Nadu State Marine & Inland Fisheries Advisory Council.
- \* Member, Planning Board, Tamil Nadu Veterinary and Animal Sciences University, Chennai.
- \* Member, ICAR Regional Committee
- \* Member, Expert Committee constituted by the Andaman & Nicobar Administration to scrutinise applicants for giving permission to set up Nauplii Production Centres in Andaman & Nicobar Islands.
- \* Member, Sub Group-II on Responsible Aquaculture Development and Application of Fisheries Research, Aquaculture Authority of India.
- \* Member, Expert Group to formulate guidelines for setting up and operation of shrimp hatcheries, Aquaculture Authority of India.
- \* Dr.P.Ravichandran, Principal Scientist served as a member in the Committee for Registration of Aquaculture Consultants constituted by MPEDA, Cochin.
- \* Dr.A.R.Thirunavukkarasu, Principal Scientist served as a member in the Committee for Fixing Standards for Aquaculture Inputs set up by MPEDA, Cochin.
- \* Dr.B.P.Gupta, Principal Scientist served in the following Committees:
  - Member of the Sub-committee of the Aquaculture Authority to Design Common Effluent Treatment System for Cluster – Based Shrimp Farms.
  - Nodal Officer to conduct the All India Combined Examination for ICAR JRF and admission to Master Degree Programmes of IARI, IVRI, NDRI, CIFE, CAU and SAU for the academic session 2002-03.

## 15. Workshops/ Seminars/ Meetings etc. organized by the Institute

### Hon'ble Minister Shri Hukumdeo Narayan Yadav visits CIBA

Shri Hukumdeo Narayan Yadav, Hon'ble Minister of State, Department of Agriculture, Govt. of India, New Delhi visited the Institute on 16 October 2002. While addressing the scientists and other staff members of CIBA, the Hon'ble Minister stressed the need for Transfer of Technology programmes so that the benefits of research are made available to the farmers who are the backbone of the economy of the country. The Hon'ble Minister has distributed seed of Asian seabass to Shri Arulnadhan and Shri Babu and shrimp immunostimulants to Shri Sampath and Shri Kumar, adopted farmers of Kattur Village under the NATP – IVLP programme viz., Institution Village Linkage Programme for Technology Assessment and Refinement in Coastal Agro-ecosystem of Tiruvallur district of Tamil Nadu”.

### Peer Review Meeting of NATP Projects

The peer review team of the NATP projects (Coastal Agro-ecosystem) comprising Dr.E.G.Silas, Chairman, Dr.M.Devaraj, Member and Dr.S.Ramamurthy, Expert Member, has critically evaluated the progress of work of the following three NATP projects viz., (i) Shrimp and fish broodstock development and breeding under captive conditions; (ii) Shrimp and fish health management and (iii) Institution Village Linkage Programme for technology assessment and refinement in coastal agro-ecosystem in Tiruvallur district of Tamil Nadu, being implemented at CIBA, on 4 March 2002.

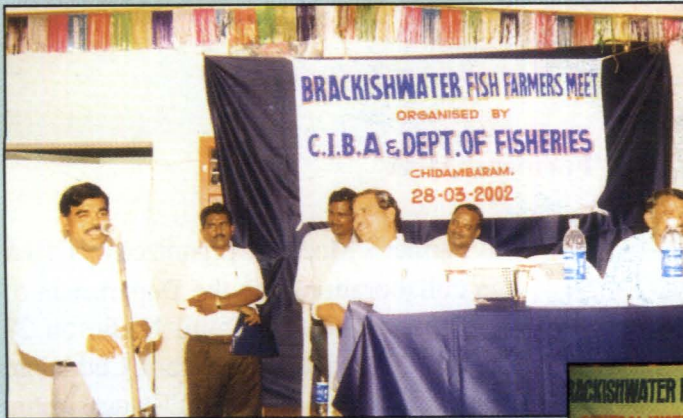
### Farmers' Meet

\* A Farmer's Meet was organized by CIBA in collaboration with the Department of Fisheries, Govt. of Tamil Nadu, on 28 March 2002, at Chidambaram, Cuddalore District, Tamil Nadu. Shri S.Thangaswami, Collector, Cuddalore district, presided over the function and issued licences to 36 shrimp farmers. About 150 farmers and 50 officials from various fisheries organizations, NGOs and other departments participated. Dr.P.Ravichandran, Principal Scientist and Scientist-in-Charge, Crustacean Culture Division, CIBA, inaugurated the meet. Shri R.Tillai Govindan, Joint Director of Fisheries (Regional), Govt. of Tamil Nadu, Chennai, Prof. T.Balasubramanian, Director, Centre for Advanced Studies in Marine Biology, Annamalai University, S/Shri M.Sivaraman and M.Rajavel, progressive shrimp farmers, offered felicitations.

\* The Institute organized a Farmers' Meet at Goa in collaboration with ICAR Research Complex for Goa, on 6 August 2002. 70 farmers and 12 officials attended the programme.

\* A Farmers' Meet was conducted at Pudupattinam in Kalpakkam, Kanchipuram District, Tamil Nadu in collaboration with the Department of Fisheries, Govt. of Tamil Nadu, on 26 October 2002. 70 farmers participated in this meet. Mrs.M.P.Nirmala, IAS, Director of Fisheries, Govt. of Tamil

### FARMERS MEET



At Chidambaram



At Kalpakkam



At Nagapattinam



At Ramanathapuram

Nadu, inaugurated the meet and Dr.Mathew Abraham, Director, CIBA presided over the function.

\* A Farmer-Scientist Interaction Meet-cum-Kisan Divas was conducted at Indukurpet, Nellore district, Andhra Pradesh, on 23 December 2002, in collaboration with the Department of fisheries, Govt. of Andhra Pradesh and the College of Fisheries, Muthukur, Nellore. CIBA honoured six aqua-farmers with Outstanding Farmers Awards in recognition of their contribution to the growth and development of brackishwater aquaculture. A total of 60 farmers participated. Dr.P.Ravichandran, Principal Scientist & Director-in-Charge, inaugurated the function which was presided over by Dr.K.Gopal Rao, Dean,

College of Fisheries, Muthukur. Shri. S.Gopal Reddy, Honorary President and Shri D.Radhakrishna Reddy, President, Prawn Farmers' Welfare Association, Nellore, offered felicitations.

\* The Institute has organized a Farmers' Meet in collaboration with the Department of fisheries, Govt. of Tamil Nadu, at Nagapattinam, on 26 February 2003. Shri Sudeep Jain, IAS, Collector, Nagapattinam District presided over the function. Dr.P.Ravichandran, Principal Scientist CIBA inaugurated the meet. Shri Thillai Govindan, Joint Director of Fisheries, Govt. of Tamil Nadu, Shri S.Vijayakumar, Assistant Director, MPEDA, Thanjavur, Shri Ali Hussian and Shri Sethupathy, representatives of Aquafarmers' Association, Nagapattinam District, offered felicitations. About 150 farmers from Nagapattinam, Thanjavur and Thiruvarur districts participated in the meet, besides officials from various departments.



**Kissan Divas celebration at Muthukur, Nellore.**



\* CIBA and the Department of Fisheries, Govt. of Tamil Nadu, jointly organized a Farmers, Meet at Ramanathapuram, on 25 March 2003. A total of 65 shrimp farmers and 10 officials participated. The meet was inaugurated by Shri T.Jeyaseelan Jeevandham, Deputy Director of Fisheries, Madurai and it was presided over by Dr.S.Kulasekarapandian, Principal Scientist, CIBA. Shri K.Thangaraj, Assistant Director of Fisheries, Ramanathapuram and Shri M.A.Sheik, President, Shrimp Farmers' Association, Ramanathapuram, offered felicitations.

### Women's Day

The Institute celebrated Women's day at Kattur Village on 8<sup>th</sup> March 2002. A batch of 20 farm women from Self Help Groups were trained in fish / shrimp pickle preparation under the NATP-IVLP project.

### Site Committee Meeting of NATP-IVLP Project

The Site Committee meeting of the NATP – IVLP programme viz., “Institution Village Linkage Programme for Technology Assessment and Refinement in Coastal Agro-ecosystem of Tiruvallur District of Tamil Nadu” was held on 16

April 2002, at Chennai under the Chairmanship of Dr.Mathew Abraham, Director, CIBA. Dr.T.V.R.S.Sharma, Director, Coastal Agro-ecosystem, Pedavegi; Dr.K.Nilakantapillai, Professor & Head, Rice Research Station, Tirur; Dr.H.M.Kasim, Officer-in-Charge, MRC of CMFRI, Chennai; Shri Nallu Chinnappan, Joint Director of Fisheries (Research), Govt. of Tamil Nadu, Chennai and Scientists from CIBA participated in the meeting.

### CIBA – NACA Expert Consultation Meeting

The Institute along with Network of Aquaculture Centres in Asia-Pacific (NACA), Thailand, jointly organized a three day Expert Consultation Meeting on Rapid Diagnosis of Shrimp Viral Diseases, at CIBA, Chennai, during 12-14 June, 2002. 42 experts from various fields of research in aquaculture attended the meeting, including five from abroad and progressive farmers. The workshop discussed the methods to standardize the PCR protocol followed by various researchers in order to get consistent results for rapid and accurate diagnosis of white spot virus disease in shrimps. The PCR techniques followed in India were critically examined by the Expert group and the need for collaborative research and knowledge sharing in the area of shrimp health management was highlighted.



CIBA - NACA Expert consultation meeting

### Scientific Advisory Panel Meeting

The 12<sup>th</sup> Scientific Advisory Panel (SAP) meeting of the National Agricultural Technology Project (NATP) under the Coastal Agro-Ecosystem was organized at CIBA, Chennai, during 12 – 13 August 2002.

### Interaction Meeting

An Interaction Meeting of Scientists-Farmers in brackishwater farming was held at CIBA, Chennai, on 27 September 2002 for prioritizing the research programmes of the Institute and to prepare a demand-driven perspective plan for the next 10 years.



Scientist - Farmer interaction meeting

### Hindi Day

The Hindi Day was celebrated on 21 September 2002. Dr.Mathew Abraham, Director, chaired the celebrations and Dr.B.P.Gupta, Principal Scientist and Officer-in-Charge, Hindi Cell, presented the annual Hindi progress report. Elocution and song competitions were held among the staff. The following were the winners:

Elocution:

- I - Shri S.Rajukumar, T-4
- II - Shri M.Shenbaga Kumar, T-5

- III - Dr.Azad Ismail Saheb, Senior Scientist
- IV - Mrs. D.Deboral Vimala, Scientist (SS)

Consolation prize: Shri P.Srikanth, Junior Clerk

Song Competition:

Special prize :

Dr..S.A.Ali, Principal Scientist

- I - Dr.I.S. Azad, Senior Scientist
- II - Dr.(Mrs.)B.Shanti, Scientist (SS)
- III - Dr.K.K.Krishnani, Scientist (SS)



Hindi Day celebration

Consolation prize :

Shri R.Kandamani, Assistant

Shri M.Ravi, T-4

### **NATP-IVLP Project programme – Broadcast by All India Radio**

A series of programmes on the impact of the technological interventions effected through NATP-IVLP project implemented by CIBA at Kattur Village and the experiences of the adopted families were broadcasted by AIR, Chennai, under Farm & Home programme during 15-27 February 2002.

### **NATP-IVLP Programme – Broadcast by Doordarshan Kendra, Chennai**

- Doordarshan Kendra, Chennai covered the activities under NATP/IVLP project being implemented at Kattur village, Tiruvallur district, on 31 January 2003.

- The success stories of NATP / IVLP project was telecast by the Pothigai TV (in Tamil), on 4 February 2003 and 11 February 2003.

### **Training programme under NATP special funding**

A training programme was conducted for 20 rural women of Krishnapattinam village, Nellore District, Andhra Pradesh at the College of Fishery Science, Muthukur, during 24-28 March, 2003. The training was inaugurated by Dr.Ravindranath, Professor, College of Fishery Science, Muthukur under the presidentship of Dr.S.Gopal Rao, Dean, College of Fishery Science, Muthukur. Scientists from CIBA and College of Fishery Science, Muthukur trained the participants in various aspects of shrimp farming. Nearly 50% of the trainees were directly involved in shrimp culture and the rest were indirectly occupied as farm hands.

## 16. Visitors



**Shri.M.Radhakrishnan, Hon'ble Minister for Fisheries,  
Govt of Tamil Nadu visiting the Aris laboratory**

### The following visited CIBA Headquarters/Muttukadu Experimental Station.

Dr.P.V.Dehadrai, Ex-DDG (Fy.), ICAR, New Delhi	31 January 2002	Dr.(Mrs.) Lalitha John, Head, Dept. of Parasitology, TANVASU, Chennai	4 February 2002
Dr.T.J.Pandian, National Professor, School of Biological Sciences, Madurai Kamaraj University, Madurai	4 February 2002	Dr.A.D.Diwan, ADG (M.Fy.), ICAR, New Delhi	4 February 2002, 18 April 2002 & 21 January 2003
Dr.K.V.Devaraj, Former Vice-Chancellor, University of Agricultural Sciences, Bangalore	4 February 2002	Dr.R.Kadirvel, Vice-Chancellor, TANUVAS, Chennai	22 February 2002
Dr.S.D.Kulkarni, Head of Division, CIAE, Bhopal	4 February 2002	Shri Iniyan Nehru, Principal Systems Engineer, National Informatics Centre, Chennai	22 February 2002
Shri K.Nagappan Nair, Principal Scientist (Retd.), CMFRI, Cochin	4 February 2002		



Dr.K.Kaliyaperumal, Deputy Librarian, University of Madras, Chennai	22 Feb 2002	Shri Nallu Chinnappan, Jt. Director of Fisheries (Research), Fisheries Dept., Tamil Nadu	16 April 2002
Dr.D.Viswanathan, Director, Audio-Visual Research Centre, Anna University, Chennai	22 Feb 2002	Mr.Michael Phillips, Co-ordinator, NACA, Bangkok, Thailand	31 May 2002, 20 June 2002 & 7 March 2003
Dr.S.Govindarajan, Professor & Head, Department of Chemistry, Loyola College, Chennai	22 Feb 2002	Dr.Boonsrim Withychunnarnkul, Professor, Centex Shrimp, Thailand	20 June 2002
Dr.E.G.Silas, Chairman, Scientific Advisory Panel, NATP Peer Review Committee	4 March 2002	Dr.I.Karunasagar, Professor & Head, Dept. of Fishery Microbiology, College of Fisheries, Mangalore	20 June 2002
Dr.M.Devaraj, Expert Member, Scientific Advisory Panel, NATP Peer Review Committee	4 March 2002	Dr.(Mrs.) Indrani Karunasagar, Director, UNESCO Centre for Marine Biotechnology, College of Fisheries, Mangalore	20 June 2002
Dr.S.Ramamurthy, Expert Member, Scientific Advisory Panel, NATP Peer Review Committee	4 March 2002	Dr.T.Jawahar Abraham, Reader (Microbiology), University of Animal and Fishery Sciences, Kolkata	20 June 2002
Dr.B.Panda, Expert Member, Scientific Advisory Panel, NATP Peer Review Committee	4 March 2002	Prof. R.Madhavi, Vice Chancellor, Sri Padmavathi Mahila Visva Vidyalayam, Tirupathi	20 June 2002
Dr.K.Durairaj, Expert Member, – Scientific Advisory Panel, NATP Peer Review Committee	4 March 2002	Dr.C.V.Mohan, Associate Professor, College of fisheries, Mangalore	20 June 2002
Shri Thampi Samraj, Project Director, RGCA	10 April 2002	Dr.Peter Walker, Senior Principal Research Scientist, CSIRO, Australia	20 June 2002 & 7 March 2003
Dr.T.V.R.S.Sharma, Director, NRC on Oil Palm & AED, NATP (Coastal Agro-ecosystem), Pedavegi	16 April 2002 & 12-13 Aug 2002	Dr.Richard Hodgson, Senior Research Fellow, Centex Shrimp, Bangkok, Thailand	20 June 2002
Dr.K.Nilakantapillai, Professor & Head, Rice Research Station, Tirur	16 April 2002		

Dr.K.M. Shankar, Associate Professor, College of Fisheries, Mangalore	20 June 2002	Dr.M.R.Sethuraj, Retd. Advisor, Rubber Board, Thiruvananthapuram	12-13 Aug 2002
Mr.P.C.Thakur, Associate Professor, College of Fisheries, Mangalore	20 June 2002	Dr.K.V.Peter, Vice Chancellor, KAU, Thrissur	12-13 Aug 2002
Dr.Tim Flegel, Professor, Centex Shrimp, Bangkok, Thailand.	20 June 2002	Dr.M.S.Chari, Advisor, Pest Management, Secunderabad	12-13 Aug 2002
Mrs.A.Uma, Assistant Professor, TANVASU, Chennai	20 June 2002	Dr.D.P.Singh, National Coordinator, NATP, New Delhi	12-13 Aug 2002
Mr.B. Vishnu Bhat, Deputy Director, MPEDA, Vijayawada	20 June 2002	Shri S.K.C.Bose, F&AO, CRIDA, Hyderabad	12-13 Aug 2002
Dr.K.Gopal Rao, Dean, College of Fisheries, APAU, Muthukur	20 June 2002 & 26 Feb 2003	Dr.A.K.Raheja, Ex-National Director, PIU, NATP, Gurgaon	12-13 Aug 2002
Shri Ashok Kumar Tripathy, IAS., Commissioner-cum-Secretary, Department of Fisheries and Animal Husbandry, Govt. of Orissa	24 June 2002	Dr.C.L.Mehta, National Director, NATP, New Delhi	12-13 Aug 2002
Shri R.Manickam, Dean, Tamil Nadu Veterinary and Animal Sciences University (TANVASU), Chennai	5 July 2002	Shri P.V.Eappachan, F&AO, NATP, AED (Coastal), Pedavegi	12-13 Aug 2002
Shri M.G.Chandrasekhar, Under Secretary, Govt. of India	11 July 2002	Dr.S.Ayyappan, Deputy Director General (Fy.), ICAR, New Delhi	24 August 2002
Dr.S.Kaushik, Director, Fish Nutrition Lab, INRA, Saint Pee Sur Nivelles, France	24 July 2002	Shri Satyabrata Sahu, I.A.S., Director of Fisheries, Govt. of Orissa	27 August 2002
Dr.M.V.Rao, Chairman, Scientific Advisory Panel (SAP) and Former Vice Chancellor, ANGRAU, Hyderabad	12-13 Aug 2002	Dr.M.Sakthivel, President, Aquaculture Foundation of India, Chennai	27 August 2002
Dr.V.Rajagopalan, Former Vice Chancellor, TNAU, Coimbatore	12-13 Aug 2002	Shri Hukumdeo Narayan Yadav, Hon'ble Minister of State for Agriculture, Govt. of India, New Delhi	16 Oct 2002
		Dr.P.Natarajan, Prof. & Head, Dept. Aquatic Biology & Fisheries, Kerala University, Trivandrum.	8 January 2003
		Dr.Mohan Joseph Modayil, Director, CMFRI, Cochin	8 January 2003

Prof. V.Balakrishnan, Head, Dept. of Animal Nutrition, Madras Veterinary College, Chennai	8 January 2003	Dr.P.Keshavanath, Professor, Fisheries College, Mangalore	26 Feb 2003
Dr.R.Subramaniam, Prof. (Retd), TANVASU, Chennai	8 January 2003	Dr.G.Thulasi, Professor & Head, Dept. of Library Sciences, Madras Veterinary College, Vepery, Chennai	27 Feb 2003
Dr.D.Satapathy, Associate Professor, College of Fisheries, OUAT, Rangailunda	9-10 Jan 2003	Dr.M.Natesan, Estate Officer, TANVASU, Chennai	27 Feb 2003
Dr.V.P.Joshi, Associate Professor, KKV, Ratnagiri	9-10 Jan 2003	Dr.Pedro P.Bueno, Director General, NACA, Bangkok, Thailand	7 March 2003
Dr.K.S.Purushan, Associate Professor, KAU, Puduveypu, Kerala	9-10 Jan 2003	Dr.M.C.Nandeesh, Prof. & Head, Dept. of Aquaculture, College of Fisheries, CAU, Tripura	15 March 2003
Shri M.Subramaniam, F& AO, Directorate of Oil Seed Research, Hyderabad.	21 January 2003	Dr.C.Vasudevappa, Associate Professor, UAS, Bangalore	18 March 2003
Shri Durgesh Rai, Samastipur, Bihar	21 January 2003	Dr.D.Seenappa, Associate Professor, UAS, Bangalore	18 March 2003
Shri Koslender Prasad Singh, Dist. Nalanda, Bihar	21 January 2003	Dr.G.Y.Keshavappa, Associate Professor, UAS, Bangalore.	18 March 2003
Mr.Mohammad Gholizadeh, Iran	25 Feb 2003	Dr.Rajamani, Director, CRRI, Cuttack	19 March 2003
Mr.T.C.Tanwar, ASRB, New Delhi	26 Feb 2003	Dr.Sinha Babu, Principal Scientist, CRRI, Cuttack	19 March 2003
Dr. Prince Jayaseelan, Professor, Fisheries College & Research Institute, Thoothukudi	26 Feb 2003	Shri S.Hemachandran, Development Commissioner-cum-Secretary (Fy.), Andaman & Nicobar Administration, Port Blair	20 March 2003
Dr.Rigi John, Assistant Professor, Fisheries College & Research Institute, Thoothukudi	26 Feb 2003		
Dr.Felix, Assistant Professor, Fisheries College & Research Institute, Thoothukudi	26 Feb 2003		

## 17. Personnel (Not a Gradation List)

### DIRECTOR - Dr.Mathew Abraham

#### SCIENTISTS

##### Head of Division

Dr.Mathew Abraham, Fish Culture Division

##### Principal Scientist

Shri S.R.Das  
 Dr.P.Ravichandran  
 Shri M.Kathirvel  
 Dr.S.Kulasekarapandian  
 Dr.S.M.Pillai  
 Dr.T.C.Santiago  
 Dr.A.R.Thirunavukkarasu  
 Dr.Syed Ahamad Ali  
 Shri R.K.Chakraborti  
 Dr.C.P.Rangaswamy  
 Dr.B.P.Gupta  
 Dr. N.Kalaimani  
 Dr.M.Natarajan  
 Dr.(Mrs.) Munawar Sultana

##### Senior Scientist

Dr.M.Krishnan  
 Dr.K.O.Joseph (expired on 3.12.2002)  
 Dr.G.Gopikrishna  
 Dr.K.P.Jithendran  
 Dr.Azad Ismail Saheb  
 Dr.K.K.Vijayan  
 Dr.V.S.Chandrasekaran  
 Dr.C.Gopal  
 Dr. S.V.Alavandi

##### Scientist (Senior Scale)

Dr.C.P.Balasubramanian  
 Dr.M.Kailasam  
 Dr.K.K.Krishnani

Dr.M.Muralidhar  
 Dr.T.Ravisankar  
 Mrs. D.Deboral Vimala  
 Dr.(Ms.) Shiranee Periera (on deputation to CPCSEA, Chennai from 12.6.2000)  
 Dr.P.S.Sudheesh  
 Dr.(Mrs.) M.Jayanthi  
 Shri M.Shashi Shekhar  
 Dr.(Mrs.) B.Shanthi  
 Dr.J.Syama Dayal (w.e.f. 3.2.2002)  
 Dr.M.Kumaran (w.e.f. 26.2.2002)  
 Dr.S.Kannappan (w.e.f. 22.3.2002)  
 (Transferred as Scientist from CIFE, Mumbai on 11.2.2003)

##### Scientist

Shri V.Chellapandian  
 Shri K.Ponnusamy  
 Shri Akshaya Panigrahi  
 Shri J.K.Sundaray  
 Dr.K.Ambasankar  
 Mrs. P.Nila Rekha  
 Dr.T.K.Ghoshal  
 Dr.(Mrs.) Saradha Chundari  
 Mrs.P.Mahalakshmi  
 Mrs.M.Poornima

##### Technical

Shri R.Elangovan, T-6 (w.e.f. 13.12.2000)  
 Shri S.Krishnan, T-5  
 Shri M.Shenbagakumar, T-5  
 Shri S.Sivagnanam, T-5  
 Shri D.Rajababu, T-5  
 Shri S. Rajamanickam, T-5  
 Shri R.Puthiavan, T-5 (w.e.f. 27.3.2002)  
 Shri V.R.Senthil Kumar, T-5  
 (w.e.f.30.3.2002)

Shri Vasanthakumar Charles, T-4 (w.e.f. 20.11.2000)  
(resigned on 18.10.2002)  
Shri S.Stanline, T-4 (w.e.f. 17.2.2002)  
Shri M.G.Subramani, T-4  
(w.e.f. 1.1.2000)

Shri M.Gopinathan Nair, T-4  
(w.e.f. 1.1.2000)  
Shri B.B.Roy, T-4 (w.e.f.1.1.2000)  
Shri S.Rajukumar, T-4 (w.e.f. 28.11.2000)  
Shri Joseph Sahayarajan, T-4  
(w.e.f. 8.12.2000)  
Shri Marella Ravi, T-4 (w.e.f. 11.12.2000)  
Shri A.Nagavel, T-II-3  
Shri R. Subburaj, T-3  
Shri Maheshkumar, T-3  
Shri N.Ramesh, T-2  
Shri S.Saminathan T-2  
Shri C.Ananthanarayanan, T-2  
(w.e.f. 6.10.2000)  
Shri P.C.Mohanty, T-2  
Shri K.Paranthaman, T-2  
Shri R.Balakumaran, T-2  
Shri P.Manickyam, T-2  
Shri P.S.Samantha, T-2  
Ms.Chanda Mazumdar, T-2  
Shri N.Jagan Mohanraj, T-2  
Shri D.M.Ramesh Babu, T-1  
Shri G.Thiagarajan, T-1  
Shri K.Karayan, T-1

**ADMINISTRATIVE PERSONNEL**

Shri J.A.S.Sayuja, Admn. Officer  
Shri S.Krishnaswamy, Asst. Fin. & Accts. Officer  
(relieved on 31.1.2003)  
Mrs.K.Nandini, Junior Accounts Officer (w.e.f.  
22.3.2003)  
Mrs.S.Bhagirathi, Superintendent  
Shri A.B.Mondal, Assistant  
Shri R.G.Ramesh, Assistant  
Shri R.Kandamani, Assistant  
Shri S.K.Halder, Stenographer  
Ms.S.Nalini, Stenographer Gr.II  
Mrs.K.Hemalatha, Stenographer Gr.III  
Mrs.K.Subhashini, Stenographer Gr.III  
Mrs.V.Usharani, Senior Clerk

(under suspension)  
Shri P.K.Roy, Senior Clerk  
Shri S.K.Bindu, Senior Clerk  
Shri S.Pari, Senior Clerk  
Mrs.E.Amudhavalli, Junior Clerk  
Shri A.Manoharan, Junior Clerk  
Shri A.Sekar, Junior Clerk  
Mrs.E.Mary Desouza, Junior Clerk  
Shri P.Srikanth, Junior Clerk  
Mrs.R.Vetrichelvi, Junior Clerk  
Shri H.Pandarath, Hindi Typist

**AUXILIARY PERSONNEL**

Shri N.Mani, Gestetner Operator

**SUPPORTING STAFF**

**S.S.Gr.IV**

Shri D.N.Sahoo  
Shri N.C.Jana  
Shri S.C.Mondal  
Shri Gunadar Das  
Shri L.C.Manna  
Shri Prakash Chandra Saha  
Shri Badlu Dhanuk

**S.S.Gr.III**

Shri Dhaneswar Das (VRS on 26.3.2003)  
Shri R.K.Behera  
Shri Shyam Bhoi  
Shri Sita Ram Bahadur  
Shri M.N.Biswas  
Shri A.K.Biswas  
Shri Biswanath Mondal  
Shri B.K.Jana (VRS on 1.2.2003)  
Shri N.N.Mondal  
Shri Amulya Bijali  
Shri N.C.Samanta  
Shri P.Arumugam  
Shri Baman Jally

**S.S.Gr.II**

Shri Sasidar Betal  
Shri R.B.Das  
Shri Gaur Hari Jena  
Shri Kalipada Mondal  
Shri M.C.Behera  
Shri K.C.Samal  
Shri Pani Gharami  
Shri Sudarshan Naik  
Shri Bijay Bhoi  
Shri Balram Das  
Shri Nitai Chandra Som (expired on 15.12.2001)  
Shri Patit Paban Halder  
Shri Abhimanyu Naskar  
Shri R.K.Roy  
Shri N.C.Mondal (expired on 26.9.2002)  
Shri P.C.Saha  
Shri M.Santhosam  
Shri Maharaga Majhi  
Shri N.Harinathan  
Shri Narendra Nath Jana  
Shri V.Jeevanandam  
Shri Amar Gharami  
Shri K.Mariappan  
Shri Krishna Pada Naskar  
Mrs.S.Santhi  
Shri Premananda Bisoi  
Shri V.M.Dhanapal  
Shri K.Nityanandam

**S.S.Gr.I**

Shri N.K.Jana (expired on 27.2.2003)  
Shri B.C.Paik  
Shri M.Subramani (ACP on 18.5.2001)  
Smt Lashmi Rani Bhuiya (ACP on 29.12.2000)  
Shri V.Kumar (ACP on 12.6.2002)  
Shri E.Manoharan (ACP on 12.6.2002)  
Shri K.V.Delli Rao  
Shri C.Saravanan  
Shri S.Kuppan  
Shri Uttam Kumar Santra  
Shri M.Pichandi  
Shri R.Kumaresan  
Shri S.Selvababu  
Shri D.Senthilkumaran  
Shri C.Raghu  
Shri P.G.Samuvel  
Shri M.Sakthivel  
Shri R.Mathivanan  
Shri A.Paul Peter  
Shri R.Indrakumar  
Shri G.Dayalan  
Shri Kanaka Prasad  
Ms.M.Annamary  
Mrs.S.Premavathy  
Shri Bholalal Dhanuk  
Shri Purna Chandra Das  
Shri J.Devaraj (joined on 7.3.2003)

## 18. Infrastructure Development

### Headquarters/Muttukadu Experimental Station

At the headquarters of the Institute, construction of a compound wall was completed. A cold room facility was also established.

At Muttukadu, construction of the first floor over the existing Nutrition shed and compound wall for the hatchery complex were executed.

### Kakdwip Research Centre

Renovation of ponds and sluice gates in Sector-A of the farm were completed.

## 19. Library, Information and Documentation

### Library holdings

The Institute's library holdings in March 2003, included 1300 books, 525 reprints and photocopies, 500 reports / bulletins and 1250 miscellaneous publications. 12 foreign journals and 21 Indian journals were subscribed during the year.

### Exchange services

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

### Information services

The Library Section extended information services to the scientific personnel of research organizations, universities, research scholars, students and individuals through reference of books and journals in the library.

### Library information system under NATP

Under the information system development of the organization and 10 management reforms component of the National Agricultural Technology Project (NATP), the following items were procured and installed in the library.

- \* CD-Roms of Marine, Oceanographic and Freshwater Resources from 1969 to 2003.
- \* Computer hardware items such as server and thin client (work stations) for information storage and retrieval system.
- \* Digitization of CIBA publications as CDs.



## 20. Summary in Hindi

### सारांश

भारत की तटीय जैव-विविधता समृद्ध है तथा 8129 कि. मी. लंबी तटरेखा है। 3.9 मि.हे. ज्वारनदमुख क्षेत्र तथा 3.5 मि. हे. खारापानी क्षेत्र अत्यधिक जैविक संसाधनों हेतु स्थान प्रदान करते हैं। देश के तटीय क्षेत्र में स्थित लगभग 1.2 मि. हे. खारापानी क्षेत्र जलकृषि के विकासार्थ उपयुक्त है। इसके अलावा अंतरस्थलीय क्षेत्रों (शुष्क क्षेत्र) में 8 मि.हे. खारापानी क्षेत्र भी उपयोगी है।

केन्द्रीय खारा जलजीव पालन अनुसंधान संस्थान की स्थापना देश में खारेपानी जलकृषि के विकासार्थ नोडल अभिकरण के रूप में कार्य करने हेतु अप्रैल, 1987 में की गई। संस्थान का मुख्यालय चेन्नई में तथा इसका प्रायोगिक केन्द्र चेन्नई से 30 कि.मी. दूर मुत्तुकाडु में स्थित है। संस्थान के दो शोध केन्द्र क्रमशः काकद्वीप (पश्चिम बंगाल) व पुरी (उड़ीसा) में स्थित हैं। 31.03.2003 तक संस्थान में निदेशक, 47 वैज्ञानिक, 31 तकनीकी, 21 प्रशासनिक तथा 71 सहायक कर्मचारी हैं।

#### लक्ष्य :

- \* खारेपानी में परख-मछली व कवच-मछली के तकनो-आर्थिकी रूप से व्यवहार्य व टिकाऊ पालन प्रणाली के विकासार्थ अनुसंधान का आयोजन।
- \* प्रणालीबद्ध डेटा बेस युक्त खारेपानी मात्स्यिकी संसाधनों पर सूचनाओं के भंडार के रूप में कार्यरत रहना।
- \* प्रशिक्षण, शिक्षण, प्रचार - शिक्षण कार्यक्रमों द्वारा प्रौद्योगिकियों का हस्तांतरण।
- \* परामर्श सेवाएं प्रदान करना।

संस्थान में निम्नलिखित दो प्रभागों व चार अनुभागों के अन्तर्गत शोध कार्य किए जाते हैं :

क्रस्टेशियन संवर्धन प्रभाग

मत्स्य संवर्धन प्रभाग

पोषण, शरीर क्रिया विज्ञान व रोग विज्ञान अनुभाग

आनुवंशिकी व जैव-प्रौद्योगिकी अनुभाग

जलकृषि अभियांत्रिकी एवं पर्यावरण अनुभाग

विस्तार आर्थिकी एवं सूचना अनुभाग

संस्थान ने 2002-2003 के दौरान 18 गृह परियोजनाओं तथा 6 बाहर से वित्तीय सहायता प्राप्त परियोजनाओं के द्वारा खारेपानी जलकृषि क्षेत्र की मांगों को प्रभावी रूप से पूर्ण किया। संस्थान के शोध कार्यक्रम, शोध सलाहकार समिति के द्वारा दिशा-निर्देशित होते हैं। कर्मचारी शोध परिषद, शोध परियोजनाएँ बनाने व उनके नियोजन में सहायता प्रदान करती है तथा नियमित रूप से (द्विवार्षिक आधार पर) संस्थान के कार्यों का पुनरीक्षण करती है। संस्थान प्रबंध समिति द्वारा संस्थान की संपूर्ण गतिविधियों का पर्यवेक्षण किया जाता है।

### इस वर्ष संस्थान की महत्वपूर्ण शोध उपलब्धियाँ निम्नलिखित रहीं :

- \* स्फुटनशाला में कूरमा झींगा *मासूपेनिअस जपॉनिकस* को सफलतापूर्वक पालतू बनाया गया तथा F1 पीढ़ी उत्पादित की गई। नीले रंग के टैंकों में पालित झींगों की अपेक्षा काले रंग के FRP टैंकों में पालित झींगों में उच्च वृद्धि तथा उत्तरजीविता दिखाई दी।
- \* काकद्वीप में ज्वार तालाबों में व्यापक पारंपरिक पालन से प्रति 3-5 महिनों में 685-983 /कि. ग्रा./हे. *पेनिअस मोनोडान* का उत्पादन हुआ।
- \* स्फुटनशाला में नेत्र स्टॉकएबलेशन द्वारा *साइला ट्रंक्यूबेरिका* व *एस. स्रेटा* के निषेचित अंडों युक्त मादा का उत्पादन किया गया। जोड़्या डिंभक की समुद्री रैंचन जारी रही। 5nos/m<sup>2</sup> की दर से संग्रहित *एस. स्रेटा* के पिंजरा पालन में जब उन्हें मुर्गी मांसावशिष्ट आहार दिया गया तो उनकी मासिक वृद्धि दर 15.8 ग्रा. आँकी गई।
- \* ग्रे *मुल्लेट मुगिल सेफालस* के नियंत्रित प्रजनक को प्रेरित परिपक्वन व प्रजनन हेतु 100 टन क्षमता वाले RCC टैंक में रखा गया। प्राकृतिक जल स्रोत से प्रजनकों को एकत्र करके एक प्रयोग में सफलतापूर्वक प्रेरित प्रजनन किया गया तथा स्फुटनिकाएँ 8 दिन तक जीवित रहीं। मुल्लेट शुक्र का हिमपरिरक्षण किया गया तथा हिमद्रवण के पश्चात 50% गतिशीलता देखी गई।
- \* हारमोनल परिवर्तन के द्वारा नियंत्रित गुपर *इपाइनिफेलस टौविना* का लिंग बदलाव किया गया। 82% मछलियों में 17 $\alpha$  मिथाइल टेस्टोस्टेरोन की सूई लगाकर उन्हें 6-8 महिनों के अन्दर रिसते हुए शुक्र युक्त नर में बदला गया।

- \* ह्यूमन कोरियानिक गोनेडोट्राफिन (HCG) हारमोन की सूई लगाकर नियंत्रित ग्रुपर *ई.ट्रौविना* का प्रेरित प्रजनन किया गया। स्ट्रिपिंग विधि अपनाई गई। डिंभकों का 4 दिन तक पालन किया गया।
- \* सी बास *एल. कैल्कैरिफर* को पालतू बनाया गया तथा F2 पीढ़ी की प्रजनक मछलियां प्राप्त की गईं। कुल 12 प्रजनक परीक्षण किए गए तथा औसतन 10% उत्तरजीविता के साथ 25 दिनों के डिंभक उत्पादित किए गए। कृषकों तथा सरकारी अभिकरणों को लगभग 78,400 सी बास पोना की आपूर्ति की गई।
- \* मुर्गी के सूखे मांसावशिश्ट के 5% स्तर युक्त परीक्षण आहार से *एल. कैल्कैरिफर* अंगुलिक में अच्छी वृद्धि दिखाई दी।
- \* *पी.मोनोडान* के अल्प वयस्क को जब आहार के साथ  $8 \times 10^8$ /ml/day की दर से जीवाणु, *सरेटिया* प्रजाति दी गई तो उनमें उच्चतम वृद्धि तथा फिनालाक्सीडेज क्रिया (28.5 इकाई) दिखाई दी।
- \* 21 दिनों के सी बास डिंभकों को जब 10% मछली प्रोटीन हाइड्रोलाइसेट युक्त आहार दिया गया तो उनके वजन व उत्तरजीविता में वृद्धि दिखाई दी।
- \* मुत्तुकाडु के स्फुटनशाला कॉम्प्लेक्स में संक्रमित मछली के नमूनों तथा जल से *विब्रियो* प्रजाति के वियुक्तक (बढ़ी हुई एग्लोलाइटिक क्रियाशीलता युक्त) अलग किये गए।
- \* आहार में 6% स्तर पर विभिन्न तेलों का समावेश करके केकडा, *एस.ट्रंक्यूबेरिका* (75-85 ग्रा) के लिए लिपिड की आवश्यकता पर अध्ययन किए गए। केकडों को सनप्लावर तेल, मूंगफली तेल, पाम तेल युक्त दिए गए आहार की अपेक्षा मछली तेल युक्त दिए गए आहार से उच्च वृद्धि दिखाई दी। केकडों के लिए आहार में कोलेस्ट्रॉल की आवश्यकता का पता भी लगाया गया। अल्प वयस्क केकडों (150 ग्रा.) में 0.5% कोलेस्ट्रॉल युक्त आहार से उच्चतम भार तथा उत्तम निर्मोचन आवृत्ति देखी गई।
- \* 21 दिनों के सी बास डिंभक में पिरसाइन नोडोवाइरस संक्रमण देखा गया। लाइट व इलैक्ट्रान माइक्रोस्कोप, डिंभक के मस्तिष्क व मेरू रज्जू के तंत्रिका ऊतक के कोशिकांग में झिल्ली से लगे विषाण्विक कणों की उपस्थिति दर्शाते हैं।
- \* स्वाभाविक व नियंत्रित प्रजनक समूहों से एकत्रित ग्रुपर *ई.ट्रौविना* में प्रोटोजोन, हेलमिन्थस तथा क्रस्टेशियन परजीवियों की अधिकता देखी गई।
- \* चेन्नई तट के *पी.मोनोडान* प्रजनक समूहों के सर्वेक्षण से पता चला कि गहरे पानी से पकड़े गए झींगों की अपेक्षा तटवर्ती पानी से पकड़े गए झींगों में व्हाइट स्पॉट रोग विषाणु की अधिकता है।

- \* पी. सी.आर. के द्वारा *पी.मोनोडान*, *फेन्नरोपेनिअस इंडिकस*, *एस.सेरेटा*, *एस.ट्रंक्यूबेरिका*, *एल.कैल्कैरिफर*, *एम.सेफालस* से 12s तथा 16s rRNA माइटोकान्डेरायी जीन प्रवर्धित किए गए। पी.सी.आर.प्रवर्धित उत्पाद आंशिक लंबाई बहुरूपता नियंत्रण के अधीन थे।
- \* *पी. मोनोडान* के PL-20 में *एक्रेमोनियम क्राइसोजेर्नम*, कवक जैसे यीस्ट से सकारात्मक प्रोबायोटिक क्रियाशीलता दिखाई दी।
- \* आंध्र प्रदेश के कृष्णा जिले में झींगा कृषि के पर्यावरिक प्रभाव निर्धारण से पता चला कि झींगा पालन से प्रक्षेत्र स्थल /स्रोत जल की मृदा व जल की गुणवत्ता पर कोई प्रतिकूल प्रभाव नहीं पड़ता है। अध्ययन यह बताते हैं कि पालित झींगों में व्हाइट स्पॉट विषाणु रोग की समस्या के कारण 10 % झींगा प्रक्षेत्रों को धान की खेती हेतु परिवर्तित किया गया।
- \* झींगा कृषि के संबंध में जलक्षेत्रों की धारण क्षमता के निर्धारण हेतु प्रविधि विकसित की गई।
- \* पश्चिम बंगाल, आंध्र प्रदेश तथा केरल के झींगा प्रक्षेत्रों का सर्वेक्षण किया गया तथा प्रयुक्त झींगा कृषि प्रणालियों एवं तटीय क्षेत्रों में कृषकों के समाजार्थिकी पहलुओं पर प्रभाव से संबंधित आंकड़े एकत्रित किए गए।

खारेपानी जलकृषि के विभिन्न पहलुओं पर कैलेंडर पर आधारित प्रशिक्षण कार्यक्रम आयोजित किए गए। 2002-2003 के दौरान 16 प्रशिक्षण कार्यक्रम आयोजित किए गए। संस्थान ने देश के विभिन्न भागों में आयोजित चार प्रदर्शनियों में भाग लिया।

राष्ट्रीय तथा अंतर्राष्ट्रीय पत्रिकाओं में वैज्ञानिकों के अनुसंधान परक *प्रपत्रों* के प्रकाशन के अतिरिक्त संस्थान द्वारा वार्षिक प्रतिवेदन 2001-2002, बुलेटिन, विशेष प्रकाशन, केखाजपाअसं समाचार, प्रसार पुस्तिकाएं तथा 2003-2004 हेतु प्रशिक्षण कैलेंडर प्रकाशित किए गए। प्रसार पुस्तिकाएं तथा विशेष प्रकाशन हिंदी, तमिल, तेलुगु व बंगाली में भी प्रकाशित किए गए।

**वित्तिय विवरण**  
**बजट 2002-2003**  
(रु. लाखों में)

	नियतन	व्यय
योजनार्थ	104.62	97.49
योजनेतर	344.96	318.98

### पुस्तकालय एवं प्रलेखन अनुभाग

2002-2003 में 22 पुस्तकों को शामिल करने के पश्चात पुस्तकालय में पुस्तकों की कुल संख्या 1300 है। इसके अतिरिक्त 18 विदेशी तथा 18 भारतीय पत्रिकाएं मंगाई गईं। भारतीय व अंतर्राष्ट्रीय संगठनों से प्रकाशनों का आदान-प्रदान जारी रखा गया। वैज्ञानिकों, आगंतुकों व छात्रों को संदर्भ व रेप्रोग्राफिक सुविधाएं भी प्रदान की गईं।

### राजभाषा कार्यान्वयन कार्य

संस्थान द्वारा भाकृअनुप को नियमित रूप से तिमाही हिंदी प्रगति रिपोर्ट भेजी गई तथा इस वर्ष राजभाषा कार्यान्वयन समिति की चार बैठकों का आयोजन किया गया। 21 सितंबर, 2002 को हिंदी दिवस मनाया गया तथा इस अवसर पर भाषण व गायन प्रतियोगिताओं का आयोजन किया गया। संस्थान के गृह प्रकाशन जैसे सीबा न्यूज का द्विभाषी रूप (हिंदी व अंग्रेजी) में प्रकाशन किया गया। श्री महेश कुमार, हिंदी अनुवादक को अनुवाद प्रशिक्षण हेतु केन्द्रीय अनुवाद ब्यूरो के बेंगलूर केन्द्र पर नामित किया गया। वहां उन्हें परीक्षा में अच्छे प्रदर्शन के लिए रजत पदक प्रदान किया गया। हिंदी कक्ष को केन्द्रीय सरकार के विभिन्न कार्यालयों से हिंदी गृह पत्रिकाएं प्राप्त हो रही हैं।

### भाकृअनुप खेल-कूद प्रतियोगिता

संस्थान ने 12-16 नवंबर, 2002 को राष्ट्रीय कृषि अनुसंधान प्रबंध अकादमी, हैदराबाद में आयोजित भाकृअनुप आंचलिक खेल-कूद प्रतियोगिता में भाग लिया। श्रीमती पी. निला रेखा, वैज्ञानिक ने महिलाओं के जैवलिन श्रो, डिस्कस श्रो तथा शाटपूट में क्रमशः प्रथम, द्वितीय तथा तृतीय पुरस्कार प्राप्त किए। श्री आर. मदिवानन, SS Gr.I पुरुषों के कैरम में विजेता रहे तथा श्री आर. कुमरेसन, SS Gr.I. ने लंबी कूद में तृतीय पुरस्कार प्राप्त किया।

श्रीमती पी. निला रेखा, वैज्ञानिक ने 28 अप्रैल - 1 मई, 2003 को केन्द्रीय अंतरस्थलीय प्रग्रहण मात्स्यिकी अनुसंधान संस्थान, बैरकपूर में आयोजित भाकृअनुप अंतरांचलिक खेल-कूद प्रतियोगिता में महिलाओं के जैवलिन श्रो तथा डिस्कस श्रो में क्रमशः प्रथम एवं द्वितीय पुरस्कार प्राप्त किए।