

# Annual Report

1986-87



**CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE**

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

12, LEITH CASTLE STREET, SANTHOME, MADRAS 600 028



*Cover Photo*

A view of the brackishwater farm at Kakdwip, West Bengal.

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*Issued by*  
DIRECTOR  
Central Institute of Brackishwater Aquaculture  
Madras.

*Compiled and Edited by*  
A. V. P. RAO  
Scientist S-3

*Cover Photo :*  
A view of brackishwater farm at Kakdwip, West Bengal

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## DIRECTOR'S PREFACE

The late '70s and early '80s witnessed an important growth in the research and development programmes in brackishwater aquaculture due to the various projects implemented at the different Fisheries Research Institutes of the Indian Council of Agricultural Research and under the centrally sponsored All India Co-ordinated Research Project on Brackishwater Farming. Among the various activities, prawn farming, particularly the penaeids, assumed considerable importance in view of the limitations of yields in the capture fisheries along our coasts. In fact, there has been a steady fall in the production of penaeid prawns despite increased efforts expended in the artisanal and commercial sectors of our fisheries. This matter has also caused considerable concern to the industry as penaeid prawns constitute the bulk of the export of marine products from the country, today realising about Rs. 396 crores.

During the latter half of the VI Five Year Plan period the Council felt that there was a need for re-structuring and re-orienting fisheries research and education undertaken by its institutes, so that greater focus could be given to priority areas and unnecessary duplication of work could be avoided. One of the areas identified was the coastal brackishwater, estuaries and inundated saline areas where there is considerable overlap in research activities

of the various institutes. In order to streamline the programmes and bearing in mind the importance of development of brackishwater aquaculture, the Council established the Central Institute of Brackishwater Aquaculture from 1-4-1985, the commencement of the VII Five Year Plan period.

I was appointed as Officer on Special Duty and later as Director for developing the Institute and also preparing the memorandum for the Expenditure Finance Committee for the VII Five Year Plan of the new Institute. In addition, the research centres at Madras, Puri and Kakdwip under the Central Inland Fisheries Research Institute and Narakkal under the Central Marine Fisheries Research Institute were being transferred to CIBA on terms of as is where is. During 1986-87 these centres were taken over in a phased manner with the infrastructure facilities and existing manpower.

The Council also constituted a three-man Committee consisting of Professor A. N. Bose (Chairman), Dr. K. N. Sankolli (Member) and Dr. E. G. Silas (Member-Secretary) to locate a suitable site for establishing the headquarters of the Central Institute of Brackishwater Aquaculture on the basis of the information the four maritime States of West Bengal, Orissa, Andhra Pradesh and Tamil Nadu along the

east coast of India had furnished to the Council. The Committee visited the various locations and had discussions with the concerned State Department officials and submitted its report to the Council in October, 1986. A decision on this is awaited from the Council.

It is well recognised that the following areas of research need immediate attention for support in large scale brackishwater aquaculture development in the country :

- (a) Reproductive physiology of crustaceans, finfish and shellfish.
- (b) Nutritional requirements and development of suitable formulated feeds.
- (c) Fish and shellfish pathology.
- (d) Fish and shellfish genetics.
- (e) Brackishwater aquaculture engineering.

The objectives and functions of the new Institute have been drawn up considering national priorities in brackishwater aquaculture. With the transfer of the centres at Puri and Madras from the Central Inland Fisheries Research Institute, it has been possible to meaningfully develop the new programmes of work to be taken up by CIBA focusing priority on the above-mentioned areas of research. Already a beginning has been made during the year on building up infrastructure for large scale seed production of *P. monodon* at the Ennur Field Centre at Madras. A few successful runs have already been completed and this initial experience will play a major role in sustained seed production of *P. monodon* and other species at the Ennur Hatchery. Similarly at Puri effort has gone into the production of *Lates calcarifer* and infrastructure for this is

being developed. Also a new project on the culture of *Limulus* has been initiated. It is proposed to enhance the R & D programmes on polyculture for the brackishwater system at Kakdwip. A major part of the work from Kakdwip will centre on the upgrading of the bheries in West Bengal for increasing production through selective stocking, better water management and use of suitable supplementary feeds.

The Centre at Narakkal which is under orders of transfer to CIBA has been chiefly involved in works on various aspects of seed production and culture of *Penaeus indicus*. It is proposed to enhance this activity to develop a suitable package of practices for the seed production as well as culture of this very hardy and versatile species.

The new Institute will play an important role in the transfer of technology in prawn culture and seed production through hatchery in the maritime States in the three major production systems, viz., the rainfed ponds as in Chilka, Orissa ; the tidal fed bheries of West Bengal and Pokali fields and kharlands along the south-west and west coasts (Kerala, Karnataka, Goa and South Maharashtra) and the pump fed systems. A suitable amount of research input is necessary to achieve good survival in seed production as well as in the nursery and grow out systems. With the programmes planned for the infant Institute and its existing manpower, I am confident that CIBA will be able to meet these challenges and also give the type of leadership necessary in tropical brackishwater aquaculture.

Madras  
10-8-1987

E. G. SILAS,  
Director,

## **BRIEF BACKGROUND**

The importance of coastal aquaculture in augmenting the fish production and the potential it has for boosting the foreign exchange earnings through export of cultured shrimps prompted the Central and State Governments as well as private agencies to initiate several developmental efforts in this field in the mid-seventies. The research inputs by the Central Marine Fisheries Research Institute and the Central Inland Fisheries Research Institute though provided very valuable information in areas of seed prospecting and production levels under various conditions, the gap between commercial level of exploitation and experimental production remained wide, requiring a reorientation of research and well co-ordinated efforts in extension and training. Since the CMFRI has the additional responsibility of providing research information of resources in the Exclusive Economic Zone and the CIFRI in the freshwater areas and considering the magnitude of the problem, the need for creation of an independent Institute was felt for providing the required research base, extension and training for development of coastal aquaculture in the country. Accordingly, during the VII Plan the Central Institute for Brackishwater Aquaculture was created with effect from 1-4-1986.



## MANDATE

The main objectives of the Institute are to conduct multidisciplinary, mission-oriented applied research to develop appropriate technologies for the aquaculture of organisms in estuaries, brackishwater and salt-intrusion areas which are prospective areas for augmenting fish production and to provide information base for sustained growth and accelerated development of the artisanal and industrial culture fisheries in the coastal sector and provide development support through technology transfer, training, education and linkages. The objectives are to be achieved through

- (i) organised research in thrust areas to solve immediate problems limiting the production.
- (ii) support fundamental research to lead to new advances and technologies in the aquaculture of finfish, and shellfish.

- (iii) economically viable technologies of hatchery systems scaled to pilot scale levels.
- (iv) research into water quality management and aquaculture engineering to solve site-specific problems.
- (v) operational research in farmer's fields to propagate the technologies.
- (vi) As a part of coastal zone management critical examination of specialised ecosystems like mangrove areas as to their utilization without creating ecological imbalance.
- (vii) collaborative research and linkage with developmental agencies.
- (viii) conducting training programmes, demonstrations and need based extension projects.

## ORGANISATION

The following five Divisions will be responsible for the various projects: (i) Finfish Culture Division, (ii) Crustacean Culture Division, (iii) Fish Farm Survey and Engineering Research Division, (iv) Resource and Technology Improvement Division and (v) Training, Extension and Information Division. The Institute

with its headquarters at Madras has research centres at Madras, Puri and Kakdwip.

The Administrative and Accounts wings, Library and Documentation Sections and the Technical Cell are being organized.

## PROGRESS OF RESEARCH

### Ecology and fishery management of estuarine impoundments in lower Sunderbans

(BF/B/9)

*Personnel* : Shri R. K. Chakraborti  
Dr. M. L. Bhowmik\*  
Shri D. Nath\*  
Shri S. R. Das  
Shri A. Mukherjee\*  
D. Sanfui\*

*Duration* : 6 years      *Location* : Kakdwip

Observations on the ecology of three types of estuarine impoundments were undertaken at Bhagabatpur (highly saline), Kakdwip (medium saline) and Rangafala (low saline) areas and its effect on the culture management was studied.

At Bhagabatpur, pre-and post-monsoon salinity was 29.8 and 4.7 ppt. Silviculture around the pond resulted in a drop in alkalinity due to organic load during monsoon months. Bottom biota was very poor. Growth of *P. monodon* was satisfactory but survival was very poor.

At Kakdwip, salinity was in the range of 2.5 and 21.5 ppt. In mixed culture ponds, *P. monodon* grew upto 119.2 mm/13.2 g from initial 50.4 mm in two months during August-September (salinity 5.0 to 14.5ppt). In monoculture ponds, stocked with post-

larvae during March they grew upto 146.4 mm/24.0 g in three months. In the latter case high stocking but improved food and aeration system gave better results. Growth and survival of *Etroplus suratensis* in mixed culture gave satisfactory results i.e. 37.0 mm to 88.9 mm in two months with 87% survival. In the low saline estuarine impoundments at Rangafala (0.8 to 14.0 ppt), year round culture of fishes and prawns continued in the 11 ha private farm. During monsoon when salinity was 0.8 to 2.5 ppt major carp was introduced. A total production of 335.4 kg/ha was obtained with 92.9 kg/ha of *P. monodon*.

### Prawn and fish seed prospecting investigations in lower stretches of Hooghly-Matla estuarine system

(BF/B/10)

*Personnel* : Shri S. R. Das  
Shri R. K. Chakraborti  
Shri A. Mukherjee\*  
Shri S. K. Mandal  
Shri D. Sanfui\*

*Duration* : 6 years      *Location* : Kakdwip

A new type of floating net (nylon) is devised for the assessment of population of seed in the Hooghly-Matla estuarine

\* Transferred at the time of reorganisation.

system. This is a shooting net (25 mesh/ inch) having a rectangular mouth (5 m × 2 m) and tail length 5 m attached to a portable bamboo frame. Seed prospecting was initiated in August, 1986. In the post-monsoon months the shooting net catch composition showed the presence of prawn seed like *Penaeus monodon*, *P. indicus*, *Parapenaeopsis sculptilis*, *Metapenaeus monoceros*, *M. brevicornis* in less numbers but *Acetes* and *Leander* in large number and fish seed like *Liza tade*, *Eleutheronema* spp. *Pellona*, *Lutianus* and several species of gobiids in large numbers. Apart from this, fish seed collection was made from the pits in the inter-tidal zone with the help of hapa net. It was observed that juveniles of *L. tade*, *R. corsula*, *M. cunneus*, *Eleutheronema* sp., *Scatophagus* sp., *Therapon* sp. etc. are also available in good numbers upto December.

### MISSION PROJECT

#### Refinement of the formulated feed of tiger shrimp

**Personnel :** Dr. M. L. Bhowmik\*  
S/Shri Apurba Ghosh\*  
D. Nath\*  
R. K. Chakraborti  
C. Saha\*  
A. Hajra  
D. Sanfui\*

**Duration :** 3 years      **Location :** Kakdwip

A new record has been created in the tiger shrimp (*Penaeus monodon*) production at Kakdwip where 1194.1 (net) kg/ha/3 months under maximum stocking density of 2.0 lakhs/ha with a retrieval percentage of 41.1 was harvested. The culture pond

was stocked with postlarvae (20-40 mm, average 25 mm) thus eliminating totally the nursery phase. During harvest, two size groups viz. 18.3 g and 9.3 g were recorded. Such an achievement was possible through introduction of a special aeration device and use of the pelletized shrimp feed. The moisture percentage of the pelletized feed remained 8.4 with a dry matter composition of : protein, 45.93% : fat, 7.1% : crude fibre, 8.75% : Nitrogen free extract (NFE) 25.32% and ash, 12.9%. Culture details are presented in Table-I.

#### Breeding and nursery management of brackishwater fishes

(BF/A/3)

**Personnel :** Dr. (Mrs.) T. Rajyalakshmi  
Shri P. Ravichandran  
Dr. S. M. Pillai  
Shri A. N. Mohanty  
(Upto 28-1-87)

**Duration :** 7 years      **Location :** Puri

Short term camps were initiated at Bado Noi estuary near Balithotta for survey and breeding of *Lates calcarifer* during May and August. Fishes in the weight range 2-20 kg to 4-80 kg were not mature.

Due to non-availability of mature fish either in Chilka lake or Ramachandi lagoon, breeding of *Mugil cephalus* and *Liza macrolepis* could not be taken up. Further near-freshwater condition prevailed in the outer channel and lake mouth areas for most of the period. Late rains followed by heavy freshwater discharge into the sea reduced the salinity of the inshore waters for the second year in succession affecting the breeding programme of all finfishes.

\* Transferred at the time of reorganization.

Table 1

Growth, Survival and production of *P. monodon* under intensive culture system (Mission Project)  
at Kakdwip Research Centre, Kakdwip

Ponds	Area of pond	Date of stocking	Rate of stocking (Nos/ha)	Nos. stocked	Initial size at stocking (mm/g)	Size attained during harvesting (mm/g)		Duration of culture (days)	No. harvested		Survival (%)	Gross biomass harvested (kg)	Net production obtained (kg/ha)
						A	B		A	B			
1.	0.06	13.3.86	2.0	12,000	25/0.1	$\frac{146.4}{24.0}$	$\frac{106.8}{8.6}$	90	860	5990	57.02	72.2	1183.3
2.	0.06	30.3.86	2.0	12,000	10.0/0.01	$\frac{125.1}{14.0}$	$\frac{102.6}{8.6}$	90	1472	5706	59.8	69.68	1161.3
3.	0.06	30.3.86	2.0	12,000	10.0/0.01	$\frac{137.1}{18.3}$	$\frac{107.2}{9.3}$	90	2876	2059	41.1	71.77	1194.1
4.	0.15	30.3.86	1.5	22,500	10.0/0.01	$\frac{124.7}{14.8}$	$\frac{97.5}{7.0}$	90	1393	10477	52.5	92.841	617.4
5.*	0.08	23.3.86	1.5	1,200	10.0/0.01	$\frac{141.8}{23.3}$	$\frac{103.5}{8.4}$	90	2167	2277	37.0	69.318	864.9

\* Control.

**Breeding and hatchery development of  
*Penaeus monodon* and other shrimps**

(BF/A/6)

**Personnel :** Dr. (Mrs.) T. Rajyalakshmi  
Shri P. Ravichandran  
Dr. S. M. Pillai  
Shri A. N. Mohanty  
(Upto 28-1-1987)

**Duration :** 6 years      **Location :** Puri

Four larval rearing experiments were conducted during October-November using spawners of *Penaeus monodon*, *P. merguensis* and *P. indicus* collected from the inshore waters of the Bay of Bengal. Abnormalities were noticed in the development of the eggs perhaps due to their poor quality. Due to sudden lowering of salinity of inshore waters and inadvertent use of copper sulphate mortality occurred at the first protozoal and mysis stages.

C/N ratio of gut contents of Chilka and pond reared *P. monodon* were estimated to be 0.92 and 0.80 respectively.

Induced maturation trials in *P. monodon* by uni and bilateral eye-stalk ablation were not successful due to the low salinity values.

**Breeding and seed production of  
brackishwater finfishes**

(BF/A/4)

**Personnel :** Dr. K. V. Ramakrishna  
Shri K. N. Krishnamurthy  
Shri M. A. V. Lakshmanan  
(Upto 31-7-1986)  
Shri S. Krishnan

**Duration :** 6 years      **Location :** Madras

Forty females of *Liza macrolepis* (180-250 mm/60-200 g) were given combinations of carp pituitary extract + mullet pituitary

extract and carp pituitary plus HCG in different doses intramuscularly. The most effective combination and dose was found to be 5 mg of carp pituitary gland and 100 IU HCG per fish. Seven females spawned spontaneously after the first injection. The males were oozing milt without any injection. Fertilization and hatching rates were 80-90% and 70-80% respectively. Nearly 1500 hatchlings resulted from these. Total mortality occurred on the 8th day. The temperature and salinity ranges during the breeding were 26.1° to 30°C and 30 to 33 ppt respectively.

Attempts to raise broodstock in confinement in the case of *M. cephalus* and *Sillago sihama* were not successful.

**Breeding and seed production of portunid  
crabs *Scylla serrata* and *Portunus pelagicus***

(BF/A/7)

**Personnel :** Shri K. Raman  
Dr. C. P. Rangaswamy  
Shri S. Srinivasagam  
Dr. B. P. Gupta  
Shri S. Krishnan

**Duration :** 4 years      **Location :** Madras

Induced maturation was tried in the case of *Scylla serrata* and *Portunus pelagicus* through eye-stalk ablation. In the case of *S. serrata* the size range of the experimental animals was 80-145 mm in carapace length for the females and 100-135 mm for the males. Two replicates of 12 females and 3 males each in the first experiment and two replicates of 13 females and 2 males each in the second experiment were made, keeping as controls unablated specimens of both the sexes. Trash fish meat, prawn waste and green mussel meat were given *ad libitum* to the experimental crabs. One female *S. serrata* after ablation, became berried twice, but the eggs were not



FIG. 1. A pen at Pulicat being harvested.



FIG. 2. A haul of the milk-fish, *Chanos chanos* from cage.

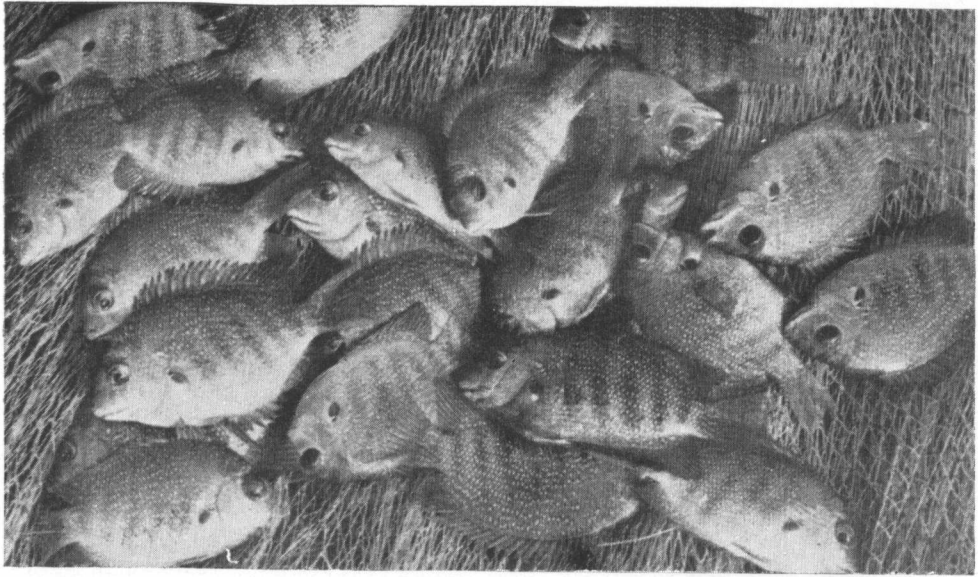


FIG. 3. *Etroplus suratensis* from a mixed culture pond.



FIG. 4. An inside view of the shrimp hatchery at Ennore.

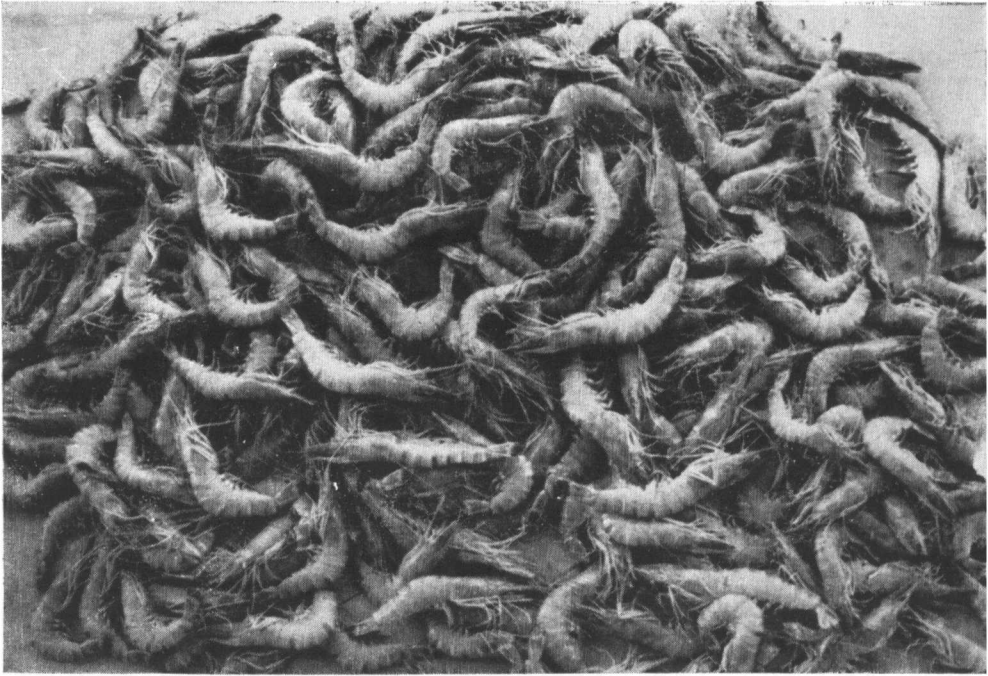


FIG. 5. A haul of *Penaeus monodon*.

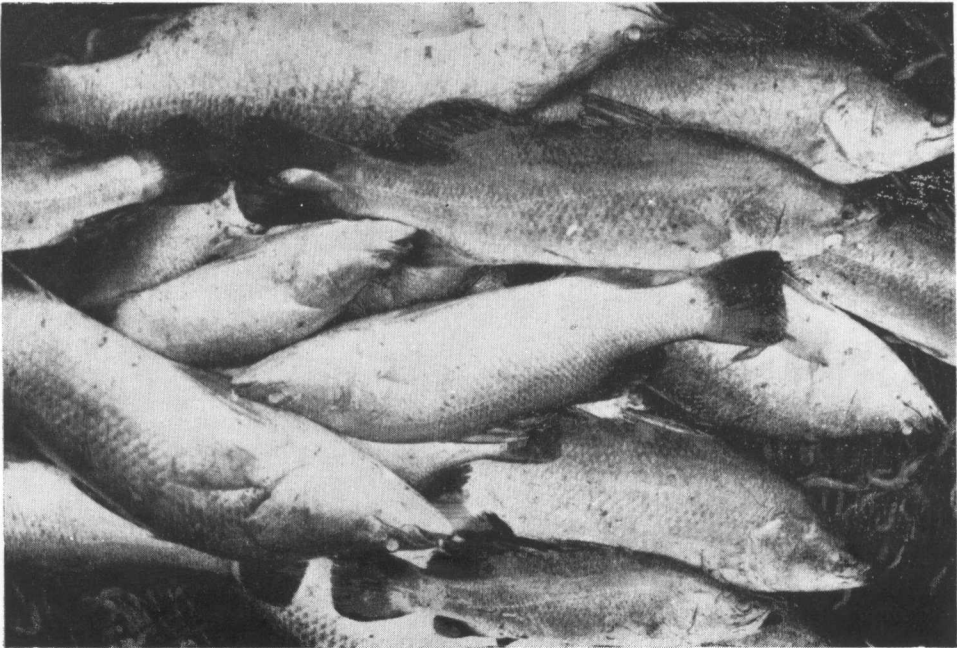


FIG. 6. *Lates calcarifer* harvested from cages at Pulicat.



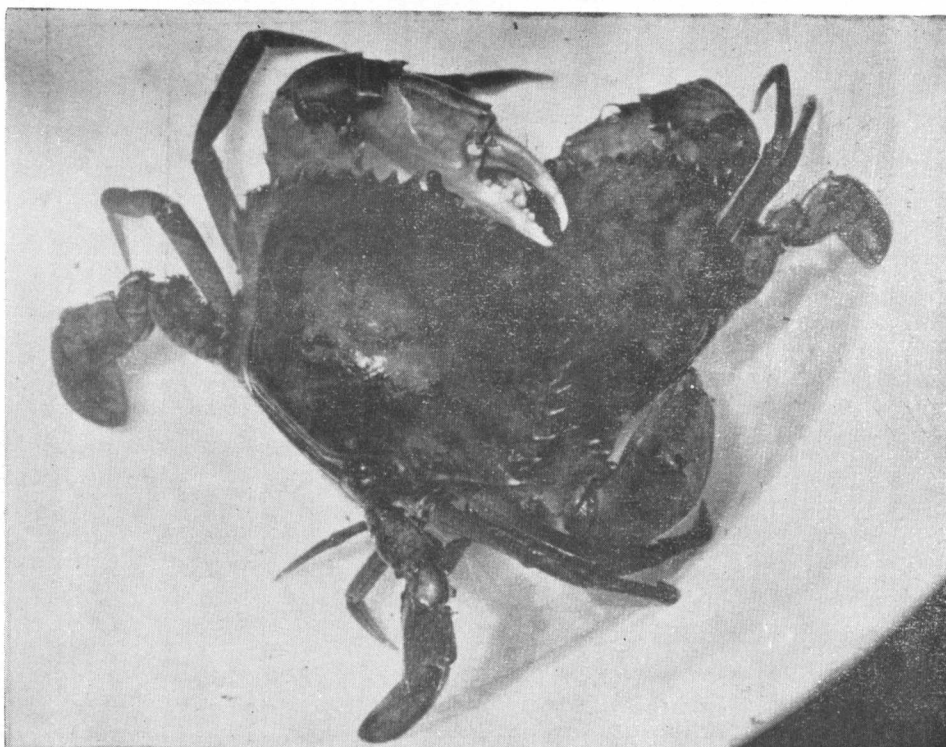


FIG. 7. The mud crab, *Scylla serrata*, an important species for breeding at Ennore hatchery.

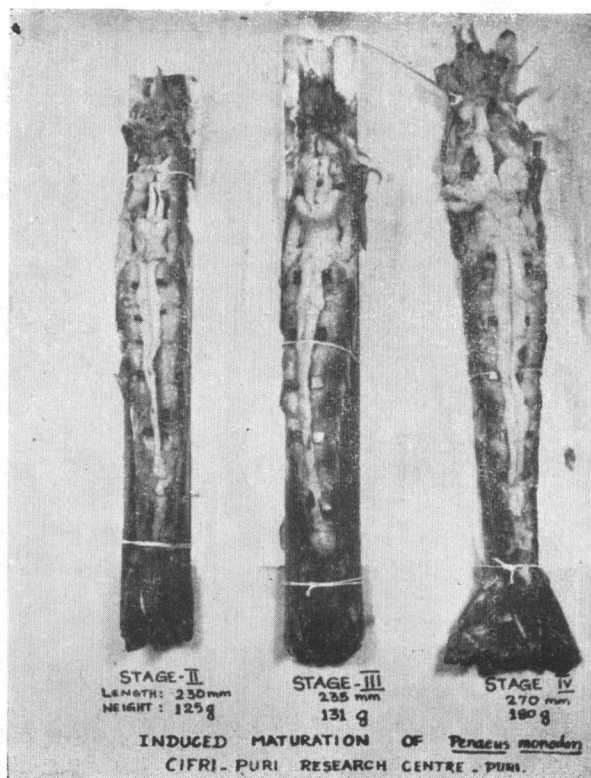


FIG. 8. Maturity stages of *P. monodon*.

fertilized at the second time. The same crab after one month became berried for the third time and hatched into zoea larvae in 7 days. Heavy mortality took place in the second zoeal stage on the 10th day after hatching.

During experimental work, the mating process was observed to last for 10 hours.

In experiments on induced maturation in *Portunus pelagicus* 12 eye ablated females (110-148 mm/100-180 g) were reared in a 100 m<sup>2</sup> tide-fed pond at Pulicat, feeding them with trash fish @ 10 to 20% of body weight daily. One female reared for 3 months, spawned and the larvae could be reared only upto 2nd zoeal stage. Ovigerous *S. serrata* collected from nature were used in the larval rearing experiments. There was heavy mortality between the fourth and eighth days in the 2nd zoeal stage after hatching usually due to ciliate infection.

#### **Pen and cage culture of fishes and prawns in lagoon ecosystem (Pulicat/Ennore)**

(BF/A/9)

**Personnel :** Dr. R. D. Prasadam  
Dr. K. V. Ramakrishna  
Shri. K. Raman  
Shri K. N. Krishnamurthy  
Shri M. A. V. Lakshmanan  
(Upto 31-7-86)  
Dr. B. P. Gupta

**Duration :** 6 years      **Location :** Madras  
(Pulicat)

Two phase culture was adopted in the pen and cage culture during this year. This has helped in successfully tiding over the flood season without loss in numbers. The small fry collected were first reared in small cages and at the time of monsoon they were kept in protected closed cages inside the ponds. After the floods they

were successfully reared in larger cages and pens.

Fingerlings of *Mugil cephalus* (av. 1/wt. 78.8 mm/7.9 g) and *Liza macrolepis* (57.2 mm/2.0 g) were stocked in 3 cages (50 m<sup>2</sup> each) at a combined stocking rate of 40,000/ha. The fish in two cages were given supplementary feed of ground nut oil cake and rice bran (1:1) @ 5% body weight daily while those in the third cage were on natural food only.

At the end of 8 months *M. cephalus* showed an average size of 232.3 mm/133.7 g recording an increment of 153.5 mm/125.8 g with supplementary feed. In the control it has grown to 197.0 mm/80.0 g showing an increment of 18.2 mm/72.1 g. *L. macrolepis* showed increments of 87.3 mm/37.8 g with feed and 65.4 mm/18.0 g in the control, both the species recording better growth with artificial feed.

Three experiments were carried out in *Chanos* culture sequentially, one in cages and the other two in pen. Fingerlings of *Chanos chanos* (128.4 mm/16.6 g) were stocked in 2 cages (50 m<sup>2</sup>) @ 60,000/ha and reared with supplementary feed, groundnut oil cake and rice bran (1:1) given at the rate of 10% body weight once daily. Another cage was kept as control with natural food only. At the end of 5 months an average production of 15.44 kg/cage/5 months with survival of 75.4% was obtained in the experimental cages while a production of 6.07 kg/cage/5 months with a survival of 85.7% was got from the control.

In the second experiment advanced fingerlings of *Chanos chanos* (219.3 mm/68.1 g) were stocked in a pen of 0.05 ha area @ 15,600/ha and reared on natural food alone for a period of 4 months.

In the third experiment also, in the same pen *C. chanos* (249.6 mm/79.9 g) were

stocked @ 14,000/ha and reared with the supplementary feed, groundnut oil cake and rice bran (1:1) for a period of 3 months. 77.6 kg of fish were harvested. The percentage survival was 92.3. The net production worked out to 518 kg/ha/3 months.

Fingerlings of *Lates calcarifer* (163 mm) were reared in a 10 m<sup>2</sup> cage with trash fish (2.5% body weight) as feed; the stocking density being 6/m<sup>2</sup>. After 115 days when they had reached an average size of 201.4 mm/110.1 g (survival 100%) they were removed to a larger cage 70 m<sup>2</sup> and stocked @ 1/m<sup>2</sup> in April 1986. In 9 months they had registered an average increment of 98.8 mm/257.9 g, the average size at the stage being 300.2 mm/368 g.

In mixed culture, *Chanos* (280.0 mm/199.3 g) and *L. macrolepis* (180.0 mm/88.2 g) were stocked in a small cage (50 m<sup>2</sup>) in October 1985. At the end of one year the former had attained an average size of 400 mm/435 g and the latter a size of 239 mm/187 g. *L. macrolepis* females had matured in the cage and eggs were oozing on slight pressure. In a fresh experiment initiated in October 1986 *Chanos* (260.9 mm/170 g) and mullets (70.8 mm/1.0 g) have been stocked in the same type of cage (50 m<sup>2</sup>) and are being reared on natural food only.

**Breeding and seed production of *Penaeus indicus* and other penaeid prawns**  
(BF/A/13)

**Personnel :** Shri A. V. P. Rao  
Dr. L. H. Rao  
Dr. S. Radhakrishnan  
Dr. B. P. Gupta  
Shri P. M. A. Kadir

**Duration :** 4 years      **Location :** Madras  
(Ennore)

Due to poor availability of spawners and break down of pumping system on several occasions, only seven trials could be made at post-larval production of *P. indicus* using both unfiltered and filtered estuarine water. Using unfiltered water and six spawners (137-154 mm) 3,06,800 nauplii were obtained. Using the usual feeds such as *Chaetoceros affinis*, *Tetraselmis* sp., *Brachionus plicatilis* and tissue suspension of *Perna viridis*, 35,820 post-larvae at P<sub>2</sub> could be obtained. Large scale mortality occurred at late mysis stage. P<sub>2</sub> stages could not be reared further due to lack of regular water exchange. In the other trials using filtered water 9 breeders (142-179 mm) were used. High densities at naupliar stage were tried—254 to 630 per litre. Using the same items as larval feed survival rates of 14.1% and 11.4% respectively were obtained at densities 477 and 630 nauplii per litre whereas the survival ranged between 41.6 and 59.4% at densities of 254 to 338/litre. These survival rates are higher than those reported in 1985.

Cultures of *Tetraselmis* sp and *Chaetoceros affinis* were maintained as usual using the culture media—Walnes medium and modified 'F' medium respectively. The latter medium was successfully used for the culture of *Brachionus plicatilis* also.

Attempts to induce maturation through eye-stalk ablation in *P. monodon* and *P. indicus* were not successful due to problems encountered in water management and aeration on account of frequent mechanical failure of water pumps and lack of air-blower.

## THRUST AREAS

Future endeavours should be directed towards developing technologies in the following thrust areas.

- (a) *Seed Production* :— Technologies should be standardised for the Hatchery production of seed of *Penaeus monodon*, *Penaeus indicus* and *Mugil* species so as to embark upon pilot scale production.
- (b) *Limulus sp* :— In view of the importance of the haemolymph of the species in biomedical investigations, detailed studies on its biology and breeding in confinement need to be taken up.
- (c) *Mangrove areas* :—As mangrove ecosystem offers good nursery grounds for the young ones of finfish and shellfish, their rational utilisation for capture of shrimp and fish seed, traditional and scientific farming, without causing ecological imbalance is an area for further studies.
- (d) The nutritional requirements of all the candidate species for brackishwater farming are to be investigated. At the Narakkal centre of this Institute, *Penaeus indicus* has been subjected to detailed investigations and considerable information is already available. Similiar studies on other species should lead to commercial production of feeds, which is an important constraint in achieving higher productivity.
- (e) *Pathology* :—The Institute should develop a diagnostic laboratory and service facility for identification of diseases affecting the formed species and provide measures to control their incidence.
- (f) *Aquaculture Engineering* :— Since ill-planned farms are not economically viable, the engineering aspects for farming and hatchery should be investigated in depth and economically viable designs to be evolved for small, medium and large scale ventures suiting different economic strata.
- (g) *Consultancy* :—The Institute should also take up consultancy services to look into the interests of small and marginal fish farmers and the entrepreneurs in developing the brackishwater aquaculture.
- (h) *Training* :—Since brackishwater Aquaculture is being taken up on a large scale in all the maritime states, the Institute should organise regular training programmes in brackishwater culture and hatchery maintenance and the low cost technologies evolved should be passed on to the target groups through extension programmes.

## LIST OF PUBLICATIONS DURING 1986-87

1. BHOWMIK, M. L., R. K. CHAKRABORTI, APURBA GHOSH and P. K. CHAKRABORTI, 1986. Brackishwater seed prospecting, present status and future prospects. *In* Souvenir in commemoration of second National Seed Congress, Calcutta, July 3-4: 95-98.
2. CHAKRABORTI, R. K. and M. L. BHOWMIK, 1985. Ecology and productivity of brackishwater paddy-cum-fish culture on river Hooghly. *J. Indian Soc. Coastal Agril. Res.* 3 (2): 137-148.
3. CHAKRABORTI, R. K. P. RAVICHANDRAN, D. D. HALDER, S. K. MONDAL and D. SANFUI, 1985. Some physicochemical characteristics of Kakdwip Brackishwater ponds and their influence on the survival, growth and production of *Penaeus monodon* (Fabricius) *Indian J. Fish.*, 32 (2): 224-235.
4. CHAKRABORTI, R. K., 1986. Pelagic fishery resources of lower Sunderbans, West Bengal and its exploitation by power boats. *Seafood Export J.*, 18: No. 5.
5. CHAKRABORTI, R. K., D. D. HALDER, N. K. DAS, S. K. MONDAL and M. L. BHOWMIK, 1986. Growth of *Penaeus monodon* (Fabricius) under different environmental conditions. *Aquaculture*, 51: 189-194.
6. GHOSH, A., M. L. BHOWMIK and P. K. CHAKRABORTI, 1986. Rearing of commercially important brackishwater shellfish and finfish for promoting aquaculture. *In*: Souvenir in commemoration of the second National Seed Congress, Calcutta, July 3-4: 102-105.
7. PILLAI, S. M., P. K. GHOSH, T. RAJYALAKSHMI and A. K. ROY, 1984. Observations on growth, survival and production of grey mullets, *Mugil cephalus* (Linnaeus), *Liza parsia* (Hamilton) and *Liza tade* (Forsk.) in a coastal low saline polyculture pond. *In Proc. Symp. Coastal Aquaculture* 3: 776-781.
8. PILLAI, S. M. 1986. Observations on the gonadal maturation of penaeid prawn, *Metapenaeus brevicornis* H. M. Edwards from brackishwater ponds. *J. Indian Soc. Coastal Agric. Res.*, 4 (1): 57-62.
9. PILLAI, S. M., T. RAJYALAKSHMI and P. RAVICHANDRAN 1986. An ecological interpretation on the distribution of early stages of penaeid prawns along Orissa coast. *In*: *National Conf. Natural Heritage Conservation Orissa Environ. Soc.* Berhampur 4-6 June 1986.
10. PILLAI, S. M., P. K. GHOSH, T. RAJYALAKSHMI, D. D. HALDER, A. K. ROY and R. K. CHAKRABORTI, 1986.

- Production potential of rain-fed ponds in coastal aquaculture in Sunderbans. *In: Nat. Seminar on Problems and Management of Coastal Ecosystem.* Indian Soc. Coastal Agric. Res., Canning 29-31 December 1986 Calcutta.
11. RAJYALAKSHMI, T., S. M. PILLAI, P. U. VERGHESE and A. K. ROY, 1982 (Published in 1986). Studies on rearing of *Penaeus monodon* Fabricius in brackishwater ponds using pelleted feeds. *J. Inland Fish. Soc. India* **14** (1) : 28-35.
  12. RAJYALAKSHMI, T. 1986. Extension education to women agriculture (fisheries) labour and the role of women scientists. *Proc. Women Scientists Wing. 73rd Session. Indian Sci. Cong. Assn.*, New Delhi 2-7 January 1986.
  13. RAJYALAKSHMI, T. 1986. Some observations on the present status of the biology and fisheries of prawns of the Chilka lagoon. *In Nat. Conf. Natural Heritage Conservation. Orissa Environ. Soc.*, Berhampur 4-6 June 1986.
  14. RAJYALAKSHMI, T. 1986. Coastal lagoon fisheries development and management: A case report on Pulicat lagoon. *In: Nat. Seminar on Problems and Management of Coastal Ecosystem.* Indian Soc. Coastal Agric. Canning 29-31 Dec. 1986.
  15. RAJYALAKSHMI, T. 1987. The role of science and technology in India's coastal zone management *In Internat. Symp. Sci. Tech. Develop. World Federation of Scientific Workers.* 20-25 March 1987 New Delhi.
  16. RAJYALAKSHMI, T., S. M. PILLAI and P. RAVICHANDRAN, 1986. Some observations on the biology of the banana prawn *Penaeus merguensis* De Man, off Orissa coast. *In: 56th Annual Conf. National Acad. Sci.*, Allahabad, Univ. Rajasthan, Jaipur, 25-26 October, 1986.
  17. RAJYALAKSHMI, T., S. M. PILLAI, A. K. ROY and P. U. VERGHESE, 1986. Feeds and nutrition of the prawn *Penaeus monodon* Fabricius. *Environ & Ecol.*, **4** (3) : 415-422.
  18. RAMAN, K. and K.V. RAMAKRISHNA. Aquaculture Development in the Pulicat lake area, prospects and problems. *Proc. Seminar on Development of Inland Aquaculture in Tamil Nadu*, Fisheries College, TNAU Tuticorin : 194-202.
  19. RANGASWAMY, C.P., On the identification of fry of grey mullet, *Valamugil cunnesius* (Valenciennes), *Proc. Symp. Coastal Aquaculture, Mar. Biol. Assn. India*, Cochin 3 : 970-975.
  20. RAVICHANDRAN, P., T. RAJYALAKSHMI and S. M. PILLAI, 1986. On the growth of *Penaeus monodon* in pens in Chilka lagoon and its ecological significance. *In Nat. Conf. Natural Heritage Conservation. Orissa Environ. Soc.*, Berhampur 4-6 June, 1986.
  21. SILAS, E.G., 1986. Significance of the Mangrove ecosystems to the recruitment of fry and larvae of finfishes and crustaceans along the east coast of India, particularly the Sunderbans. *Workshop Proc. on Conversion of Mangrove areas for Aquaculture*, Iloilo City, Philippines.

22. SILAS, E. G., 1986. Management of Mangrove associated fisheries and aquaculture in the Sunderbans, India. FAO/IPFC Worskhop on 'Strategies for the management of fisheries and aquaculture in Mangrove ecosystem, Bangkok, Thailand.'
23. SRINIVASAGAM, S. 1986. An instance of large scale parasitism of *Heterosaccus dollfusi* (Bosehma). On the edible crab *Portunus sanguinolentus* (Herbst) in Pulicat lake. *J. Inland Fish. Soc. India*, **14** (1) : 88-90.
24. SRINIVASAGAM, S. and K. RAMAN, 1986. Crab fisheries of Pulicat lake with special reference to catches from the Southern Sector. *Proc. Symp. Harvest and Post-Harvest Technology of Fish, Fishery Technology*. 63-68.
25. SULTANA, M., K. RAMAN, P.M.A. KADIR, S. SRINIVASAGAM and G.R. M. RAO, 1986. Observations on the biology of *Hemirhamphus gaimardi* (C & V) of Pulicat lake. *J. Mar. Biol. Ass. India*, **22** (1 & 2) : 89-109.

#### ADVISORY/CONSULTANCY SERVICE PROVIDED

Dr. E. G. Silas, Director served as

- (i) Member on the Advisory Committee of Bombay Natural History Society ;
- (ii) Member on the Scientific Advisory Committee of the National Institute of Oceanography, Goa ;
- (iii) Member of the ICAR Committee to review areas of responsibilities constituted by the Director General, ICAR, New Delhi ;
- (iv) Member of the Committee constituted by the Maharashtra Government for National Parks ;
- (v) Member of the National Mangrove Committee constituted by

the Department of Environment, Government of India ;

- (vi) Member of the Indian National Science Academy Scientific Panel, New Delhi;
- (vii) Member-Secretary of the ICAR Expert Group constituted for Site Selection of the Central Institute of Brackishwater Aquaculture.

Dr. (Mrs.) T. Rajyalakshmi, Scientist S-3 (Spl.) provided advisory services to Andhra Pradesh Fisheries Development Corporation. She was a member of the Sectoral Committee on Agriculture and Rural Development (SCOARD) of Andhra Pradesh.

## DISTINGUISHED VISITORS

The following distinguished persons visited the Institute :

Dr. R. M. Acharya, Deputy Director General (AS), ICAR, New Delhi.

Mr. T. K. A. Nair, Chairman, MPEDA, Cochin.

Dr. M. Sakthivel, Director, MPEDA, Cochin.

Dr. A. N. Bose, Professor, Aquaculture Engineering, IIT, Kharagpur, West Bengal.

Dr. K. N. Sankolli, Associate Dean, Krishi Vidyapeeth, Rathnagiri, Maharashtra.

Dr. S. Satyarajan, Director, Integrated Fisheries Project, Cochin.

Dr. N. T. Singh, Director, CARI, Port Blair, Andaman.

Dr. A. G. Jhingran, Director, CIFRI, Barrackpore, West Bengal.

Dr. K. Dorairaj, Head, Fisheries Division, CARI, Andaman.

Dr. C. L. Angell, BOBP, Madras.

Dr. V. G. Jhingran, Former Director, CIFRI, Barrackpore.

Shri Nilamani Das, Hon'ble Minister of Agriculture and Fisheries, Government of Assam.

Dr. Oliver Millous, FAO/UNDP.

Dr. D. Nagaraja Rao, Nagarjuna University, Andhra Pradesh.

Prof. Y. Radhakrishna, Nagarjuna University, Andhra Pradesh.

Prof. A. Chowdhury, Calcutta University, Calcutta, West Bengal.

Mr. M. M. Dowell and Mr. K. Sudupa of College of Fisheries, Mangalore, Karnataka.



## SEMINARS/SYMPOSIA etc. ATTENDED BY THE SCIENTISTS

**Dr. E. G. Silas**, Director attended the following meetings :

Workshop on 'Conversion of Mangrove areas for Aquaculture' held at Iloilo City, Philippines during 24-26 April 1986 and presented a paper entitled 'Significance of the Mangrove ecosystems to the recruitment of fry and larvae of finfishes and crustaceans along the east coast of India, particularly the Sunderbans'.

FAO/IPFC Workshop on 'Strategies for the management of fisheries and aquaculture in Mangrove ecosystem' and the IPFC Third Working Party Meeting on Inland Aquaculture from 21-26 June, 1986 at Bangkok, Thailand. A paper on the 'Management of Mangrove associated Fisheries and Aquaculture in the Sunderbans, India' was presented by Dr. Silas.

**Dr. (Mrs.) T. Rajyalakshmi**, Scientist S-3 (Special) attended the following meetings :

Indian Science Congress at New Delhi in January, 1986.

Women Scientists Forum.

National Conference on Natural Heritage Conservation at Berhampur in June, 1986.

56th Annual Conference of National Academy of Sciences, Allahabad at Jaipur in October, 1986.

International Symposium on Science, Technology and Development at New Delhi in March, 1987.

**Shri K. Raman**, Scientist S-3 attended a Seminar on Brackishwater Prawn Farming organised by MPEDA and the Indian Bank at Cannanore on 23 October, 1986.

**All the Scientists** of the Madras Research Centre attended a Seminar on 'Ocean Resources' at the Anna Technological University, during 1-5 December, 1986.

**Dr. M. L. Bhowmik**, Scientist S-2 attended the Second National Seed Congress held at Calcutta during 3-4 July, 1986 and the National Seminar on Problems and Management of Coastal ecosystem held at Calcutta on 29th and 30th December, 1986.

## EXTENSION

The Kakdwip Research Centre offered technical advice to local fish farmers as well as those from Raidighi, Rajarhat, Nischintapur and Lakshmikantapur on various aspects of fish culture.

The technologies evolved at Kakdwip were demonstrated to the officer trainees of the Government of West Bengal.

Scientists of the Puri Research Centre gave lectures to students of fisheries science from Fisheries College, Mangalore ; Fisheries College, Berhampur ; Central Institute of Fisheries Education,

Bombay ; and Postgraduate students from Nagarjuna University on the hatchery technology for prawns and fishes.

## HONOURS AND AWARDS

In an exhibition organized by the Department of Fisheries, Tamil Nadu in connection with the World Food Day during 13-16 October 1986, the combined stall put up by CMFRI and CIFRI was adjudged the best and a cup was received as FIRST PRIZE from the Hon'ble Minister for Industries, Shri K. Rajaram.

## PROMOTIONS

The following scientists were promoted to the next higher cadre on the basis of five yearly assessment :

<i>Name</i>	<i>From</i>	<i>To</i>	<i>With effect from</i>
Dr. K.V. Ramakrishna	S-2	S-3	1-1-1984
Dr. S. M. Pillai	S-1	S-2	1-7-1983
Dr. C. P. Rangaswamy	S-1	S-2	1-1-1984

## RETIREMENT

Shri M. A. V. Lakshmanan, T-8 retired on 31-7-1986.

## TRANSFERS

Nil

## FINANCE

The following is the expenditure during 1986-87 :

Plan	Rs. 4.49 lakhs
Non-Plan	Rs. 19.27 lakhs

## STAFF

(Not a gradation list)

Dr. E. G. Silas, Director

Dr. (Mrs.) T. Rajyalakshmi, Scientist S-3 (Special)

### Scientists S-3

Shri K. Raman  
Dr. K. V. Ramakrishna  
Shri A. V. P. Rao

### Scientists S-2

Shri K. N. Krishnamurthy  
Dr. R. D. Prasadam  
Dr. L. H. Rao  
Dr. S. Radhakrishnan  
Shri S. Srinivasagam  
Dr. K. Gopinathan  
Dr. C. P. Rangaswamy  
Dr. B. P. Gupta  
\*Dr. M. L. Bhowmik  
Shri R. K. Chakraborti  
Shri S. R. Das  
\*Shri A. Mukherjee  
\*Shri D. Nath  
\*Shri S. K. Mondal  
Shri P. Ravichandran  
Dr. S. M. Pillai  
Dr. P. K. Mukhopadhyay (On deputation  
with IIRI, Calcutta)

### Scientist S-1

Mrs. M. Sultana (On study leave)

### Technical

Shri M. A. V. Lakshmanan, T-6  
\*Shri D. Sanfui, T-2  
Shri P. M. A. Kadir, T-II-3  
Shri S. Krishnan, T-II-3  
\*Shri A. N. Mohanty, T-I-3  
Shri P. C. Mohanty, T-1  
Shri M. G. Subramani, Driver  
Shri B. B. Roy, Driver

### Administrative Staff

Shri B. R. Chatterjee, Assistant (On deputation with CIRG)  
Shri M. Subramanian, Senior Clerk  
Smt. S. Bagirathi, Junior Clerk  
Shri P. Prasad, Junior Stenographer  
Shri A. B. Mandal, Junior Clerk  
Shri P. K. Ray, Junior Clerk  
Shri S. K. Bindu, Junior Clerk

\* Transferred at the time of reorganization.

**Supporting Staff**

		Shri A. K. Biswas	Gr. II
Shri B. Sasmal	Gr. IV	Shri K. M. Das	Gr. II
Shri M. I. Raju	Gr. III	Shri P. C. Saha	Gr. II
Shri A. E. Raju	Gr. II	Shri S. Pari	Gr. I
Shri M. Ramalingam	Gr. II	Shri P. Arumugam	Gr. I
Shri P. Manickyam	Gr. II	Shri N. Mani	Gr. I
Shri Dhaneswar Das	Gr. II	Shri R. Subramani	Gr. I
Shri D. N. Sahoo	Gr. II	Shri K. C. Samal	Gr. I
Shri Shyam Bhoi	Gr. II	Shri Bijoy Bhoi	Gr. I
Shri R. K. Behera	Gr. II	Shri Sudarsan Naik	Gr. I
Shri N. C. Jena	Gr. II	Shri M. C. Behera	Gr. I
Shri N. N. Mondal	Gr. II	Shri Balaram Das	Gr. I
Shri S. R. Bahadur	Gr. II	Shri Baman Jally	Gr. I
Shri A. Bijali	Gr. II	Shri R. B. Das	Gr. I
Shri S. L. Dhanuk	Gr. II	Shri N. Bhuyan	Gr. I
Shri B. K. Jena	Gr. II	Shri Gourhari Jena	Gr. I
Shri N. C. Samanta	Gr. II	Shri Phani Gharami	Gr. I
Shri A. K. Mondal	Gr. II	Shri Sasadhar Betal	Gr. I
Shri S. C. Mondal	Gr. II	Shri Kalipada Mondal	Gr. I
Shri Sitaram Das	Gr. II	Shri B. C. Paik	Gr. I
Shri G. Das	Gr. II	Shri Mansur Ali	Gr. I
Shri B. Dhanuk	Gr. II	Shri Paresh Ch. Saha	Gr. I
Shri L. C. Manna	Gr. II	Shri A. Naskar	Gr. I
Shri S. S. Maity	Gr. II	Shri N. C. Som	Gr. I
Shri G. Santra	Gr. II	Shri R. K. Roy	Gr. I
Shri Biswanath Mondal	Gr. II	Shri P. S. Samanta	Gr. I
Shr M. N. Biswas	Gr. II	Shri N. C. Mondal	Gr. I
	Gr. II	Shri Patit Paban Halder	Gr. I

ORGANIZATION CHART, 1986-87

APPENDIX-I

CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE

DIRECTOR

