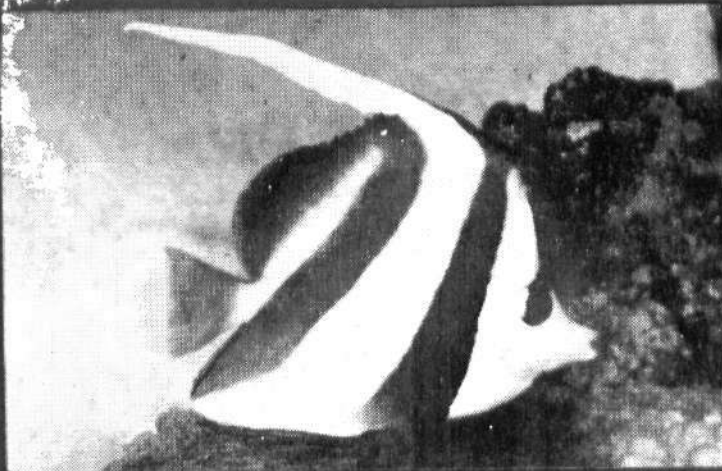


RESEARCH HIGHLIGHTS  
1986 - 87



CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

P. B. No. 2704, COCHIN - 682 031

September, 1987

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## PREFACE

The present issue of *RESEARCH HIGHLIGHTS* incorporates the major achievements of the Institute during 1986-87.

The Central Marine Fisheries Research Institute has been conducting multidisciplinary research in marine capture and culture fisheries with a view to suggest methods of increasing marine fish production through rational exploitation, conservation and management of the resources. During 1986-87, the Institute has undertaken 121 Research projects in capture fisheries and mariculture besides post-graduate Education and Research Programme in Mariculture and also the training of the fish farmers and others under the Krishi Vigyan Kendra and Trainers' Training Centre.

The Institute recorded all round progress during 1986-87 and the most important event during the year has been the special surveys of the Lakshadweep group of islands aimed at an overall assessment of marine fisheries resources and their potentials. Similarly, the Institute also conducted a detailed survey of the seaweed resources along the Kerala coast for identifying potential areas for commercial exploitation of seaweeds. Studies on marine mammals and turtles were taken up from a conservation angle.

The scientific programmes of the FORV *Sagar Sampada* were managed by the Institute and the vessel collected valuable data on oceanographic features in relation to the fishery resources of the EEZ

Cochin - 682 031,  
September, 1987.

**P. S. B. R. JAMES**  
*Director*

## CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

### RESEARCH HIGHLIGHTS 1986-87

#### RESOURCES

##### Marine Fish Production In 1986

The total marine fish production in the country during 1986 has been provisionally estimated at 1.726 million tonnes, showing an increase of about 12.4% over 1985 production of 1.514 million tonnes. The increased landings during this year were mainly due to the unprecedented bumper catch of carangids; about 91,100 tonnes more than the previous year. This phenomenon was mainly observed in Kerala and Karnataka. Another salient feature was the very high landings of 23,841 tonnes of mackerel in Andhra Pradesh thus enabling this state to score over Kerala (21,205 tonnes) and Karnataka (21,175 tonnes). Although oil sardine and Bombay duck registered a decline in the landings to the tune of about 36,600 and 18,000 tonnes respectively, this decline was more than compensated by the gain in the landings of carangids (+91,100 t), anchovy (+36,600 t), perches (+22,600 t), mackerel (+19,600 t), silver bellies (+18,400 t), penaeid prawns (+16,200 t) and ribbon fish (+11,000 t). The mechanised landings accounted for 75% of the total landings in the country.

##### Pelagic Fisheries Resources

There was an increase in the trend of production of tunas during the current year with an estimated landings of about 34,057

tonnes in 1986 compared to 30,722 tonnes in 1985. Analysis of the data on catch, effort, size ranges and other biological information collected during 1982-83 to 1985-86 showed that in the case of little tunny (*Euthynnus affinis*) except at Mangalore and Vizhinjam at all the other centres namely Calicut, Cochin and Tuticorin there is likely to be increase in yield with increasing fishing effort. With regard to the frigate tuna (*Auxis thazard*) it was found, there may not be significant increase in yield at Cochin with increase in effort. However, at Tuticorin increased effort may result in higher yields of frigate tuna. At Minicoy, there is scope for getting increased catches of the skipjack tuna (*Katsuwonus pelamis*) with increase in effort.

A drastic decline of oil sardine fishery of the west coast was noticed during the current year. However, unusually, some east coast centres landed good quantities of oil sardine. Studies on the stocks of *Sardinella longiceps* at Cochin (1980-85) indicated that the MSY of oil sardine stock off Cochin and Kerala in general was in the order of 12,500 tonnes and 150,000 tonnes as against the average annual yield of 10,340 tonnes and 123,620 tonnes respectively. It is therefore suggested that any further increase in the rate of exploitation (0.65) by the purse seine fishery may not result in any significant increase in the production under the present characteristics of the fishery.

Observations on mackerel fishery indicated a general decline of the fishery in the Cochin - Karwar stretch. However an unusual quantity of 23,841 tonnes of mackerel was landed in Andhra Pradesh.

Marine landings of *Hilsa* during the present year showed improvement at all centres of observation when compared with that of the previous year.

Monitoring of eggs and larvae in the inshore waters showed higher abundance during this year along the south west coast, especially at Cochin and Vizhinjam with dominance of carangid eggs and larvae.

Among dolphins landed (202 nos.) along the coasts, the long-beaked dolphin *Stenella longirostris* was dominant. Few numbers

of stranded sperm whale (*Physeter macrocephalus*), baleen whale (*Balaenoptera borealis*) and pilot whale (*Globicephalus macrorhynchus*) were observed during the year. Eight dugongs were also caught at Mandapam in the current year.

#### **Demersal Fisheries Resources**

The landings of major demersal resources, monitored at the selected centres, indicated that there was a marginal increase in the catches of sciaenids and perches, a slightly decreasing trend for catfishes at most centres, while the threadfin-breems showed substantial increase at all centres, except Waltair, where there was a pronounced fall.

During the current year special studies were made on the catfish resources in the Karnataka zone, where a serious decline of the purse-seine fishery for *Tachysurus tenuispinis* was noted. The large-scale destruction of the eggs and egg-bearing adults by the purse-seiners over the past few years, had an impact on the stock particularly of *T. tenuispinis*, and it was the decline of the fishery for this species that was responsible for the failure at places like Karwar. The results of the study on the catfish fishery of Karnataka have already been communicated to the State Government for necessary regulations.

A special survey of the northern Bay of Bengal, carried out with the Institute vessel R.V. *Skipjack* gave valuable information on the sizeable, practically unexploited silverbelly resources of this region. *Leiognathus bindus* was the main species observed during the season (February) and a positive correlation was observed between size of fish and depth of occurrence.

#### **Crustacean Fisheries Resources**

A preliminary analysis of the fishing data collected from the large trawlers operating on the north-east coast of India from the Visakhapatnam base revealed that the prawn resources in the area from Visakhapatnam to Sandheads can support about 105 trawlers of the Mexican type (23 m). The number of big trawlers at Visakhapatnam has already exceeded this limit (118 at present) and it is cautioned that any further introduction of large trawlers in this

area will lead to growth overfishing and depletion of the stock and hence to be avoided.

Studies on the stock assessment of prawns on both the east and west coast have shown that increasing the fishing effort beyond the optimum level is not likely to increase the prawn yield except at Kakinada. In Kakinada there is a possibility of increasing the yield by putting in more fishing effort.

In the Palk Bay sail boats have started operating small trawl nets for capturing the juveniles of *Penaeus semisulcatus* on a large scale. This destructive practice is bound to affect the marine trawl fishery of the small mechanised boats of Palk Bay region, which are mainly dependent on the adults of *P. semisulcatus*.

#### **Molluscan Fisheries Resources**

There has been a noticeable increase in the cephalopod production especially that of *Sepia pharaonis* from the inshore waters in almost all the centres. The highest monthly catch was 1896 tonnes at Bombay - Sasoon docks in December with a c.p.u.e. of 1016 kg. Significant collections of *Symplectoteuthis oualaniensis* were made from a depth range of 40 to 250 m off Bombay-Okha region in October 1986 using pelagic trawl operated from FORV *Sagar Sampada*. The survey conducted at Lakshadweep waters to investigate the octopus fishery has shown that this resource could support the fishery at a sustenance level only.

Analysis of catch statistics of chanks from 1978 to 1986, along Ramanathapuram and Tirunelveli coast, revealed that the years 1981-82 to 1983-84 were the most productive from the point of view of total landings. Chanks varying from 55 to 70 mm in size were marked using embossed plastic tapes and released in the chank beds off Tuticorin for further studies. Egg capsules of chank were kept alive at Tuticorin to observe the progress of development of fertilized eggs inside the capsule. A total of 1134 baby chanks were released off Tuticorin after a period of 45 days in one capsule.

#### **Seaweed Resources**

A comprehensive survey of the Kerala coast was undertaken from August 1986 to March 1987 to assess the potential of natural



seaweed resources and the possibilities for their culture. During this survey 148 stations were covered from Poovar in the south to Cannanore in the north. In all 27 species of seaweeds were recorded along the coast of which 14 were observed to be occurring commonly. The coastal area from Cannanore to Kadalundi, in the northern zone, was found to be more productive in terms of standing crop of seaweeds as well as their species diversity. Based on biomass estimates, possible areas for exploitation have been indentified.

#### **Environmental Studies**

During the year 1986 there was a delay in the onset of monsoon and consequently studies were intensified to observe the oceanographic parameters relevant to pelagic and demersal fisheries. Off Cochin the upwelling commenced in the month of July and intensified by the end of July. It was prolonged up to the middle of November.

A systematic programme of release of drift bottles from different centres along the east and west coasts was undertaken to study coastal currents which aid the migration of prawns and fishes. The recoveries of the drift bottles indicated the generally southward drift of coastal current along east and west coast during the months of February to March which later gets dissipated as a weak current. The recovery of drift bottles from Sri Lanka coast and Somali coast during the last year is worth mentioning.

### **MARICULTURE**

#### **Prawn Culture**

A new candidate species, *Penaeus latisulcatus* which is suitable for culturing in sandy coastal areas has been grown in the Muttukadu farm near Madras to adult size and induced to mature and spawn in captivity. The larvae have been successfully reared to postlarval and juvenile stages and restocked in the ponds, thus completing the life cycle in the farm itself. The 'domestication' of *P. latisulcatus* in the farm is a major breakthrough. The growth potential of another prospective candidate species *Penaeus canaliculatus* was also assessed at the Muttukadu farm.

Under the technical assistance of the Institute, a private salt pan owner at Tuticorin has developed 3.5 ha of pump-fed prawn ponds and harvested a record production of 1200-1600 kg/ha of *Penaeus indicus* in a period of 6 months. This was the highest production rate so far obtained in India from large ponds under commercial conditions. It is also significant that the white prawns could grow well even in hypersaline conditions of 38-48 ppt.

At the instance of the ICAR the flood affected coastal areas of East Godavari, W. Godavari and Krishna districts of Andhra Pradesh were surveyed and the research support needed to assist the rapid developments in prawn culture taking place in Andhra Pradesh were assessed and the detailed report submitted to ICAR. Follow up actions to implement the recommendations contained in the report have already been initiated.

#### **Prawn Hatchery Technology**

During the current year the State Fisheries Departments of Kerala, Karnataka and Andhra Pradesh sought the technical assistance of the Institute to survey the coastal areas and select suitable sites for establishing prawn hatcheries. Accordingly the surveys were carried out by the Institute and suitable sites at Mopla Bay in Kerala, Kumta in Karnataka and M.G. Peta in Andhra Pradesh were selected. Plans and project proposals for the hatcheries at Mopla Bay and Kumta were also prepared and submitted to the respective State Fisheries Departments.

#### **Culture of Molluscs**

The pearl oyster, *Pinctada fucata* in the Harbour farm at Tuticorin showed a growth rate of 2.6 to 3.6 mm per month in size and 1.87 to 2.25 gm per month in weight during the period, December 1985 to December 1986, while in the commercial farm at Krusadi Island showed a growth rate of 1.1 to 3 mm per month in size and 0.42 to 1.19 gm per month in weight. Pearl oyster spat supplied to Lakshadweep in October at the mean size of 13.2 mm have grown to 29.1 mm in Bangaram and 22.9 mm in Agathi by mid February 1987. In the pearl oyster surgery programme, single and double implantations were done and the pearl production rate (gross) was 29% in one batch and 31.5% in another.

Studies on biology of *Crassostrea madrasensis* at Tuticorin were continued. The major spawning of this species took place during April to May and the secondary spawning in September.

At Madras green mussel, *Perna viridis* gave an average production of 3.49 kg per kg of seed used by pole culture and bags containing mussel seeds at a rate of 3.2 kg per bag gave a production of 18.03 kg after six months. Spat settlement was recorded at Ennore in all months, more intensively during October-November. Settlement of *Perna viridis* was good at Calicut area during July-September. Experiments at Vizhinjam indicated that primary settlement of *Perna indica* took place mostly on smooth surfaces, but the secondary attachment was always found more on hard substrata. Mussels with 20-30 mm length secreted maximum number of byssus threads within 18 hrs. Seed slipping from HDP ropes was insignificant when mussels of these sizes were used.

#### Hatchery Technology for Molluscan Seed Production

Experimental success has been achieved in breeding and rearing of black lipped pearl oyster (*Pinctada margaritifera*) under controlled conditions in the hatchery at Tuticorin. A total of 48,000 spats of *P. margaritifera* were produced. Four larval rearings of *Pinctada fucata* yielded an estimated production of 2.4 million spats. Experimental work indicated that the percentage of settlement was more among the culled larvae, while larval rearing under aeration reduced the rate of spat production and more number of pearl oysters reached maturity when fed with mixed algae and cornflour. *P. fucata* spat of 5-20 mm size survived for 102 hrs with less than 4% mortality, in polythene bags under oxygen fillings.

The hatchery programme on edible oyster was further perfected and strengthened. Out of the eighteen batches of *Crassostrea madrasensis* conditioned, fourteen batches spawned in the hatchery at Tuticorin and seed could be obtained from eight spawnings. Fourteen to twentythree days of thermal conditioning of this species fed on a diet of mixed phytoplankton alone or with boiled cornmeal flour induced gonadal maturation. Spawning took place under thermal stimulation as well as by the use of 5 M hydrogen peroxide. The spat setting period varied from 15 to 22 days when the larval density was maintained at 500-3000 nos/ litre during different phases.

## **Finfish Culture**

In finfish culture, experiments on mono and polyculture of selected species in ponds, cages and pens were carried out at different centres on the east and west coast. The emphasis had been on the rearing of new species, such as *Lates calcarifer*, *Epinephelus* spp. *Sillago* spp. and also on the development of suitable technology for seed production of selected species of spawners collected from the wild or by induced spawning of specimens collected in advanced maturity stages. Attempts were also made to raise pond - grown grey mullets to broodstock level.

## **PHYSIOLOGY, NUTRITION AND PATHOLOGY**

### **Induced Maturation and Breeding of *Mugil cephalus***

*Mugil cephalus* measuring 540 mm in total length and weighing 2 kg was induced to mature from maturity stage III to the final stage through salinity manipulation of the medium in which the fish was maintained in the laboratory and constructive dosage of CPH, MPH and HCG. After four days under this treatment, it spawned releasing viable eggs. On further incubation of eggs, about 5 lakh larvae were obtained and they survived for 10 days.

### **Physiology of Penaeid Prawns**

Following the results of experiments on osmoregulatory capabilities of *Penaeus monodon* in salinity ranging from 3 to 45‰, experiments were conducted with normal, eyestalk ablated and destalked prawns injected with eyestalk extract to study the influence of eyestalk factors controlling osmoregulation. The osmolality values of haemolymph were of relatively higher profile in the normal and destalked injected prawns with isosaline sea water throughout the period than in the eyestalk ablated prawns. This indicates the involvement of eyestalk factors in the control of osmotic - concentration of the haemolymph in *P. monodon*.

### **Ecophysiology of Edible Oyster**

Studies on the influence of feeding on the lustre and colour of the nacre secreted by *Crassostrea madrasensis* showed that the spats

(3-5 mm) fed with *Isochrysis galbana* along with a suspension of ferrous citrate at a rate of 8 nanogram per litre, developed rosy discolouration of the nacre. However, such discolouration of the nacre was not observed in the spat fed with the algae in ferrous citrate suspension at the rate of 4 and 2 ng/l.

#### **Fish and Shellfish Nutrition**

The milkfish fry showed preference to the diet containing a mixture of sardine oil and ground nut oil incorporated in the compounded feed having a protein level of 40%, carbohydrate 45%, lipid 6%, vitamin mix 1% and mineral mixture 3% with gelatin as the binder.

To study the effect of food additives and flavouring agents on the food intake, feeding efficiency, growth and survival of *Penaeus indicus* four isonitrogenous and isocaloric diets (Protein 35%, Carbohydrate 41%, Lipid 10%, Cholesterol 0.5%, vitamin and mineral premix) with glycine, taurine and glutamic acid as stimulants were formulated. Among these diets, *P. indicus*, fed with the diet containing glycine registered higher growth rate and better food conversion.

#### **Pathology**

Studies on the soft prawns were continued during the year. The relationship between the oxidation - reduction potential of the pond bottom and the occurrence of 'soft' prawn syndrome showed that, as the bottom of the pond reduced progressively beyond - 250, the percentage of 'soft' prawns also showed an increase and once the 'soft' condition set in due to increased reduction, the phenomenon did not reverse appreciably even when the bottom condition showed improvement.

#### **Fish and shellfish Genetics**

In the edible oyster, *Crassostrea madrasensis* the tissue specific expression of protein was determined in four tissues. A genetically variable protein locus was identified in the adductor muscle of edible oyster from Cochin and Tuticorin populations.

#### CASE STUDIES ON FISHERY ECONOMICS

Studies on the economics of mechanised units at Sakthikulangara, indicated that average gross income per fishing day of a trawler was about Rs. 1200 and for gill netter about Rs. 950. Average net income per day for these two types of units was calculated at Rs. 220 and Rs. 200 respectively.

A study on fish marketing in Madras region revealed that fisherman's share in consumer's rupee ranged from 20 paise for rays to 75 paise for seerfishes and pomfrets. The marketing margin for cheaper varieties ranged from 50 to 80% of the retail price at major fish markets. Fisherman's share in consumer price of different varieties of fish was directly correlated to the degree of consumer preference.

Studies on the cost and returns of dol net operation was conducted at 2 centres in Maharashtra and 1 in Gujarat and the results revealed that the variable cost ranged from Rs. 324 per operating day for *Khamba* system to Rs. 450 for *sus* system. Of the operating expenditure, 37 to 43% was incurred on crew members which formed the single biggest item of variable cost. Average net profit per operating day for dol net units in north-west coast ranged from Rs. 75 to Rs. 88.

#### SPECIAL SURVEYS OF LAKSHADWEEP GROUP OF ISLANDS

A series of special surveys are planned and implemented since January 1987, aimed at an overall assessment of various types of fishery and ancillary living resources and their potentials. During the surveys, it was found that considerable damage had taken place to the coral reefs around Minicoy and certain other islands due to dredging, silting and sand mining.

Skipjack (*Katsuwonus pelamis*) and young yellowfin tunas (*Thunnus albacares*) constituted the major tuna resources exploited by the islanders by live bait pole and line fishery. There seemed to be no scarcity for live baits in the islands surveyed, except in Amini and Kiltan. Over 45 species of live baits were observed during the

survey. *Spratelloides delicatulus* and *S. japonicus* dominated among them.

The survey results also indicated that over 70 species of ornamental fishes occur in these islands, of which 30 are exportable. The survey teams collected information on seaweeds, sponges, echinoderms, crustacean resources and other invertebrates and gathered interesting data on marine mammals and seabirds and locations which could be developed as marine parks.

#### EDUCATION TRAINING AND TRANSFER OF TECHNOLOGY

##### **Post-Graduate Education and Research Programme in Mariculture**

The Post-Graduate Education and Research Programme in Mariculture of the Institute - a continuation of the Centre of Advanced Studies in Mariculture started under ICAR/FAO/UNDP in 1979 continued to impart training in mariculture leading to M.Sc. and Ph.D. programme on many specialised aspects relating to mariculture. During the year seven out of the eight Junior Research Fellows in the fifth batch passed the M.Sc. examination with first class. Eighteen candidates belonging to sixth and seventh batch are currently undergoing the course.

Under the Ph.D. programme three Senior Research Fellows were awarded Ph.D. degree from the Cochin University of Science and Technology. Four candidates of the earlier batch have submitted their theses to the University for Ph.D. in this year.

Under the expert Consultancy Programme, two foreign experts Dr. Milton Fingerman, Professor, Department of Biology, Tulane University, New Orleans, U.S.A. was at the Centre to offer consultancy on Fish and Shellfish Endocrinology and Dr. D.J.M. Moriarty, Division of Fisheries Research, C.S.I.R.O., Australia offered consultancy on Microbial Ecology in Grow out Ponds. In the programme of training of faculty members, two scientists of the Institute had advanced training abroad. Two workshops were organised. FAO consultants and our scientists on return from foreign training gave a total number of 12 seminars.

### **Krishi Vigyan Kendra**

During 1986 Krishi Vigyan Kendra conducted 57 training courses. The Kendra has trained 1146 farmers consisting of 322 men and 824 women. Besides the main subject of fisheries the K.V.K. has also conducted short duration courses on Agriculture, Animal Husbandary, Home Science, Health and Hygiene etc. Follow up surveys conducted to assess the impact of the training have revealed that about 35% of the trainees have taken up employment directly or indirectly connected with prawn and fish farming. The Lab-to-Land programme on prawn/fish farming was implemented.

### **Trainers' Training Centre**

The Trainers' Training Centre organised training courses with the involvement of various divisions of the Institute on hatchery production of penaeid prawn seeds, prawn farming, hatchery production of edible oyster seed, farming of edible oysters and seaweed culture for senior level officers of the Maritime States. Under this programme, 48 personnel from Universities, State Fisheries Departments and MPEDA have been trained.

### **VESSEL - BASED RESEARCH PROGRAMMES**

#### **FORV *Sagar Sampada***

CMFRI is the nodal organisation for the planning and execution of the research programme of FORV *Sagar Sampada* of the Department of Ocean Development. During the period April 1986 to February 1987, the vessel made 15 research cruises spending 210 days out at sea and surveyed a total area of 1,305,440 sq. nautical miles in the EEZ of the country including Lakshadweep and Andaman Sea. For the first time FORV *Sagar Sampada* undertook a 29-day cruise around the Andaman and Nicobar Islands in April 1986, covering 41 stations. Preliminary results showed that Andaman waters were rich in oceanic squids of the genera *Sepia* and *Sepiella* and crustacean resources consisted of *Penaeus latisulcatus*, *P. canaliculatus*, *Metapenaeopsis* spp. and *Trachypenaeus* spp.. A



variety of juvenile fishes, especially tunas in the Lakshadweep area were observed in July-August period. The vessel has been able to locate large concentration of thread- fin breams, cuttlefish and squids in the Wadge Bank in August-September period.

Scientists, technical assistants and research scholars belonging to Central Marine Fisheries Research Institute, Central Institute of Fisheries Technology, National Institute of Oceanography, Naval Physical Oceanographic Laboratory, Zoological Survey of India, Fishery Survey of India, Space Application Centre, Central Institute of Fisheries Education, Cochin University of Science and Technology, Kerala University, Andhra University, Annamalai University, Madras University and Indian Institute of Technology participated in the cruises.

#### *R V Skipjack*

The vessel continued to monitor environmental data along the south west coast and also concentrated on studies on the seasonal and depth-wise distribution of commercial penaeid prawns off Cochin. The prawns are found to migrate to deeper waters during the south west monsoon period.

#### *Cadalmin*

The vessels of this category stationed at 6 centres studied the inshore fisheries in relation to environmental conditions. Studies on fish eggs and larvae and benthos of the inshore waters also conducted.

## PUBLICATIONS

The following publications were issued during the year :

1. *Indian Journal of Fisheries*  
Vol. 33, Nos. 2, 3 and 4
2. *Bulletin of Central Marine Fisheries Research Institute*  
Nos. 36, 37, 38 and 39.
3. *CMFRI Special Publications*  
Nos. 24, 25, 26, 28 and 29
4. *Marine Fisheries Information Service, T & E Series*  
Nos. 62, 63, 64, 65, 66, 67, 68 and 69
5. *CMFRI Newsletters*  
Nos. 31 and 32
6. *R & D Series for Marine Fishery Resources Management*  
(Handouts)  
Nos. 12 and 13
7. *Handbook of Training Programme in CMFRI*
8. *Annual Report 1984-85.*
9. *Research Highlights 1985-86.*

## SEMINARS

1. A Seminar on 'Potential Marine Fishery Resources' was organised by the Institute at Cochin on 23rd April 1986 to mark the occasion of the Institute moving into its own permanent building.
2. A National Seminar on 'Shellfish Resources and Farming' was conducted at Shellfish Hatchery Laboratory of CMFRI, Tuticorin during 19th to 21st January 1987.