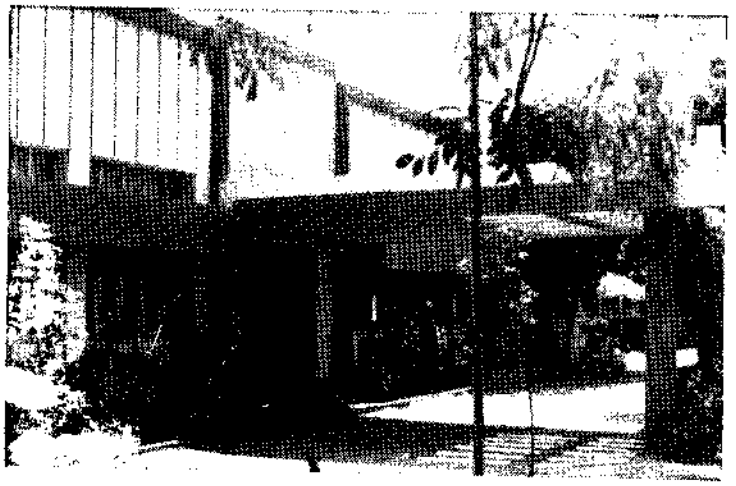
RESEARCH HIGHLIGHTS

1985 - 86



CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

COCHIN - 682 031

December, 1986

RESEARCH HIGHLIGHTS

1985 - 86

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
COCHIN - 682 031
December, 1986

Compiled and edited by Dr. K. Alagarswami, Joint Director and Shri M. S. Rajagopal, Scientist S-3 and published by Dr. P. S. B. R. James, Director, C. M. F. R. I., Cochin-682 031.

PREFACE

The publication of the series, *RESEARCH HIGHLIGHTS* of the Institute commenced with the issue of the research results for the year 1984-85. The present issue incorporates the major achievements of the Institute during 1985-86.

The Central Marine Fisheries Research Institute has been conducting multidisciplinary researches in capture fisheries and mariculture with a view to suggest methods of increasing marine fish production through rational exploitation, conservation and management of the resources. During the year 1985-86 the Institute has undertaken 96 research projects and 5 ad hoc training programmes in capture and culture fisheries besides Post-graduate Education and Research programmes in Mariculture and also the training of the fish farmers and others under the Krishi Vigyan Kendra and Trainers' Training Centre.

The most important event during the year has been the shifting of the Laboratories and Offices of the headquarters at Cochin to its own permanent building which was duly inaugurated by Hon'ble Shri Buta Singh, former Union Minister of Agriculture and Rural Development on March 1, 1986.

The Institute has now better facilities for its different Divisions and administrative sections.

The scientific programmes of the research vessel, FORV *Sagar Sampada* belonging to the Department of Ocean Development have been managed by the Institute during the year and a number of scientists of the Institute have participated in the cruises of this vessel and have collected valuable information on the fishery resources of the Exclusive Economic Zone coupled with oceanographic and other fishery related environmental parameters.

Cochin,
31 December 1986.

(P. S. B. R. JAMES)
Director

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

RESEARCH HIGHLIGHTS 1985—1986

PERMANENT BUILDING OF CMFRI HEADQUARTERS AT COCHIN

The Headquarters of the Central Marine Fisheries Research Institute has moved into its own permanent building at Cochin. The new building was inaugurated by the former Hon'ble Union Minister of Agriculture and Rural Development, Sardar Buta Singh on 1st March, 1986. The Hon'ble Chief Minister of Kerala Shri K. Karunakaran presided over the function. Dr. N. S. Randhawa, Director General, Indian Council of Agricultural Research spoke on the occasion highlighting the role of the CMFRI in ICAR Fisheries Research System.

Since shifting of the Headquarters of the Institute in 1970 from Mandapam Camp to Cochin, it was accommodated in several rented buildings. All the research laboratories and several administrative wings of the Institute have now been moved into the new building. It has a ground floor and 4 storeys with a total plinth area of 8865 sq. m. The campus has a total land area of 5.25 acres. With these facilities the Institute is organising well laid-out functional laboratories for different disciplines of research in fisheries, oceanography, mariculture, physiology, nutrition, pathology, electronics, remote sensing and laboratories for the MSc. and Ph. D. students for post-graduate research and education under the Centre of Advanced Studies in Mariculture.

Marine Fish Production In 1985

The total marine fish production in the country during 1985 has been provisionally estimated at 1.514 million tonnes as compared to 1.631 million tonnes during 1984 showing a reduction of about 7%. The maritime States which showed a loss in production over 1984 were Kerala (–68,000 t), Tamil Nadu (–52,000 t), Andhra Pradesh (–28,000 t), West Bengal (–16,000 t) and Karnataka (–11,000 t). The States which gained in production were Maharashtra (+30,000 t), Gujarat (+18,000 t) and Goa (+10,000 t). Orissa and Pondicherry showed a marginal increase.

The major fall in production by species was in Oil sardine (–68,000 t), and anchovy (*Stolephorus* spp.) (–20,000 t). The mackerel fishery gained by 16,000 t, and the cephalopods by 10,000 t. While the penaeid prawns showed a marginal decrease by 8,000 t, the non-penaeids gained by 5,000 t.

Pelagic Fisheries Resources

Studies on the stocks of *Euthynnus affinis* exploited by the purse-seine fishery from Cochin showed a total instantaneous mortality (Z) of 2.923, and fishing mortality (F) of 2.375 indicating an exploitation rate (E) of 0.81. The tuna fishery at Mangalore improved 10.6 times and at Vizhinjam 5.6 times in 1985-'86 from that of last year.

The mackerel (*Rastrelliger kanagurta*) fishery showed a general improvement in 1985-86. At Mangalore, its production was estimated at 11,300 t as compared to 3,400 t of 1984–85. But the fishery was highly sporadic and of short spells during September-November in Kerala, Karnataka and Goa. On account of the short season, the population has only limited exposure to fishing mortality in the year and therefore, chances of improvement of future fishery would appear good.

The stock assessment of mackerel from Cochin, Calicut, Mangalore and Karwar showed the present rate of exploitation (E = F/Z) at 0.63, 0.67, 0.65 and 0.60 respectively for the above centres.

The yield per recruit (Y/R) analysis indicated that at the present size of first capture at 200 mm, the present level of exploitation is just below that of MSY level, and any further increase in fishing effort may not result in significant increase in the yield. Based on the resources data for 1975–84, the MSY of Bombay-duck (*Harpodon nehereus*) for Maharashtra was estimated as 80,000 tonnes and optimum effort as 1.6 million hauls.

The oil sardine (*Sardinella longiceps*) fishery at Mangalore with an estimated production of 19,500 t in 1985–86, as against 12,200 t in 1984–85, surpassed production from other centres. The Cochin fishery which caught 15,000 tonnes in 1984–85, declined to 2,200 t in the current year.

All along the east and west coasts of India the fishery for lesser sardines was fairly good. However, at Karwar there was a setback in production probably due to fishery independent factors. The mean annual stock for *S. gibbosa* off Karnataka and Karwar coast was in the order of 10,701 tonnes and 2,614 tonnes *vis-a-vis* the average annual production levels of 1,3101 tonnes and 320 tonnes respectively. Similarly average annual stocks in the case of S. dayi were in the order of 3,639 tonnes and 653 mt *vis-a-vis* the average yield of 1,965 tonnes and 352 tonnes for both the coasts respectively. The above figures indicate that the present production from the two stocks could be substantially increased without effecting the stocks off Karnataka coast by increasing the fishing pressure.

Demersal Fisheries Resources

In continuation of the tentative assessments of the inshore stocks of the five main species of catfish already carried out, studies were continued to estimate, through yield-effort equation, the fishing effort that can be sustained by the stocks presently exploited. At almost all the 5 major centres studied, the species are being fished at maximum level in the present grounds, and more fishing effort will not produce greater catch, but would only adversely affect the stocks. This necessitates, for increasing production, the extension of fishing to areas beyond the present

grounds. Exploratory studies have indicated the presence of catfishes in fishable magnitude in the deeper waters. The study also indicated the need for continued monitoring of the status of the stocks presently fished.

Studies on the exploited populations of the threadfin-breams, have shown that fishing pressure in the Waltair-Kakinada region has been over the maximum sustainable. The catch trend during the past year has shown that lesser effort at Waltair has brought in a greater catch as compared to the previous year, while an increased effort at Kakinada has resulted in a decline in catch.

In the silver belly fisheries the studies on three species that are dominant on the east coast have indicated a present fishing mortality rate at Kakinada that is slightly higher than the one estimated for maximum sustainable yield. To overcome this, a reduction in effort or an increase in the mesh size is indicated. But, as in the case of such individual studies of component groups, the application is difficult in the context of the multi-species nature of the commercial fishery.

Crustacean Fisheries Resources

Compared to 1984–85 production there was a general decrease in the penaeid prawn catch on the west coast mainly due to the decline in catch of the two dominant species *Parapenaeopsis stylifera* and *Metapenaeus dobsoni*. A new winter fishery for prawns by small mechanised boats has come up at Ramchandani near Puri; the trawlers do night fishing and *M.ensis* forms 60% and *P.monodon* 20% of the prawn catch. About 90% of the penaeid prawns caught in the stake nets of the Godavary estuarine system appear to be 2–3 months old. A new feature of the dol net fishery at Bombay was that *Acetes johni* accounted for nearly 50% of the *Acetes* catch. At Sakthikulangara in Kerala the monsoon fishery for prawns exploits *P. stylifera* which occur only in the 5–25 m depth zone., they are absent in the depth range 25–50 m.

The stock assessment of *M.monoceros, P.stylifera* and *M.dobsoni* at karwar, and the latter two species at Mangalore

showed that the present level of exploitation does not adversely affect the stocks. However, increasing the mesh size from the present 16–25 mm to 30 mm would be beneficial to the stocks to maintain sustainable yields. Stock assessment studies on the penaeid prawns of the Kakinada coast revealed that there is scope for a slight increase in fishing effort for *M.dobsoni, M.monoceros* and *Penaeus monodon* to obtain a higher yield. Past evidence showed that if the catch exceeded the maximum sustainable yield in any year, the catch and catch per unit effort declined in the succeeding year or two. But within these limits the stocks appear to be quite resilient as the annual catch revives to normal levels. The possibility of increasing the yield per recruit by increasing the mesh size of the trawl nets was pointed out for *M.monoceros.*

Molluscan Fisheries Resources

The cephalopod resources of the Exclusive Economic Zone were surveyed during the cruises of FORV *Sagar Sampada.* Besides the inshore species such as *Sepia pharaonis, S. trygonina, S.elliptica, S.aculeata* and *Loligo duvaucelii* which have been taken in the offshore waters, oceanic squids have been collected from several areas. *Symplectoteuthis oualaniensis* from the northern sector of Eastern Arabian Sea and Andaman & Nicobar waters and *Thysanoteuthis* sp. from the latter area were the oceanic squids collected. Other oceanic Cephalopods recorded were *Cranchia* sp., *Lysocranchia* sp. and *Abralia* sp. The southern Bay of Bengal also yielded oceanic squids in almost all the 22 pelagic and 8 midwater trawl operations during cruise 16.

There has been a notable increase in the cephalopod production from the inshore waters over the previous year. The increase was 154% in Bombay – New Ferry Wharf, 132 % in Madras, 81% in Cochin and 55% in Visakhapatnam. At centres such as Bombay – Sassoon Dock, Mangalore, Cochin and Visakhapatnam, increase in landings was recorded in spite of a marginal decrease in fishing effort. The average CPUE was the highest in the Bombay region (240-250 kg/unit), followed by Veraval (48 kg/unit) and Mangalore (25kg/unit). In the rest of the centres the average CPUE ranged 3 – 8 kg/unit.

Seaweed Resources

Genetic studies for developing economically important varieties of agarophytes have been initiated at Mandapam and Madras. A study on the life-history of *Gracilaria* sp. has been completed *in vitro*.

Fishery Environment

Extensive monitoring of oceanographic/fishery hydrographic parameters was carried out in the country's EEZ. A systematic survey of the sea around Andaman and Nicobar Islands was conducted on board FORV *Sagar Sampada* with the objective of assessing the fishery resources and oceanographic conditions. The survey which covered the disciplines of meteorology, oceanography, planktonology, meso-pelagics, pelagic and demersal fishery resources and the acoustic bathymetry threw light on the mechanism of various physical, chemical and biological processes active in these areas. The surface waters up to a depth of about 75 m were found to be well mixed with a sharp thermocline between 75 m and 100 m. A well developed salinity maximum, characteristic of the Bay, was observed between 100 m and 300 m. The oxygen minimum layer (2 ml/l) more or less corresponded with the salinity maximum layer. The pH values less than 8 were encountered below 100 m depth.

The samples of zooplankton are being sorted for detailed analysis by specialists. Productivity measurements using C^{14} technique were carried out from different stations. In collaboration with Space Application Centre, studies were conducted in the Arabian Sea for development of K-algorithm for ocean colour mapping using Nimbus-7, CzCs data.

Heavy metal levels in selected bivalves were monitored from samples collected from four different centres. Laboratories for pollution monitoring, microbiology, remote sensing, biochemistry, and biological, chemical and physical oceanography were developed in the new campus.

Prawn culture

At Narakkal prawn hatchery, out of 516 eye-ablated *Penaeus indicus* 447 females spawned viable eggs, giving a success rate of 86.6%. All the spawner requirements of the hatchery were met from the broodstock induced to mature in captivity. The larval rearing techniques were further standardized and 1.3 million seed of *P. indicus* were distributed to the local prawn farmers for stocking in their ponds. Survival rates ranging 24-47% were obtained after 18-26 days rearing of PL 5 indicating that these post-larvae can be reared in specially prepared earthern nursery ponds attached to the grow-out ponds. *P. japonicus* was reared at Kovalam/Muttukad for the third successive generation.

Using the technique of artificial insemination developed at the Institute, one of our scientists successfully bred the American prawn *Sycionia ingentis* at the Bodega Marine Laboratory, California, U.S.A.

Monitoring of the growth of post-larvae of *P.indicus* supplied by the Institute's experimental hatchery to the prawn farmers was done and the results at harvest were as follows;

Sl No.	*Location of farm*	*Area*	*Duration of culture*	*Size at harvest*	*Harvest*	*Gross revenue*	*Net profit to farmer*
1.	Ernakulam Dist.	1 ha	42 days	7·1 g	311 kg	Rs. 8,400	Rs. 5,000
2.	"	1.6 ha	80 days	14.7 g	441 kg	Rs.17,430	Rs. 8,000
3.	Tuticorin	1 ha	5 months	17.5 g	577 kg	Rs.21,000	Rs.14,000

Culture of molluscs

In oyster culture, the emphasis was on finding an alternate strategy to the rack-culture system to reduce cost of production. Stake and ren culture techniques were experimented which have given encouraging results. Farm oysters from Tuticorin, yielding one tonne of meat, were handed over to the Integrated Fisheries

Project for their experimental programme on product development and marketing. Extension of oyster culture programme was taken up at Kakinada for *Crassostrea madrasensis* and at Karwar for *Saccostrea cucullata*.

A minimum programme of monitoring the natural beds of pearl oyster in the Gulf of Mannar was continued. The presence of flat pearl oysters to the extent of 13.5% in the shoreward *paars* was noted. The mean size of *Pinctada fucata* in the collections continued to be low at 27.5-30.0 mm as in the previous years. Experimental pearl oyster farming was started in Vantivu island near Tuticorin, while maintaining the main farm in the harbour basin. Pearl oyster under farming in Krusadai island by the commercial venture was monitored for comparing growth potential under different ecological conditions. Experiment was taken up to understand the pearl-producing potential of different size groups with reference to size of nuclei. Control of fouling with shading of rafts did not prove positive in the first instance.

In the Muttukadu saltwater lagoon, mussels suffered heavy mortality due to monsoon floods in November-December. Reproductive activity in the green mussel population in the lagoon was sub-normal due to gamete resorption. A new project on ecophysiological factors influencing developmental biology of clams was initiated and several species were maintained under laboratory conditions.

Hatchery Technology for Molluscan Seed Production

The Shellfish Hatchery Laboratory constructed at Tuticorin became functional and all hatchery operations were shifted to this new laboratory. Mass production of spat of pearl oyster and edible oyster has been achieved. Five larval rearings of pearl oyster yielded production of 7,60,000, 5,000, 4,00,000 70,000 and 6,00,000 spat. Experimental work showed that aeration during larval phase yielded poor spatfall (1.1%); antibiotic treatment enhanced spat settlement to 31% from 22% in control; larvae could also be reared to settlement on a diet of mixed phytoplankton; and Culling of larvae at different stages improved spat production rate.

A searanching programme was initiated by transplanting hatchery-produced pearl oyster spat on a pearl bank of Gulf of Mannar.

The hatchery programme on edible oyster was further strengthened. From eight successful spawnings, a total of 8,90,000 spat was produced. Experimental work involved varied larval densities, salinity tolerance of oyster larvae, use of different algal species as food and production of cultchless spat.

Work on mussel larval rearing suffered a setback due to subnormal development of ova in the brown mussel at Vizhinjam not leading to spawning under thermal stimulation. Further success was achieved in the laboratory culture of the cuttlefish *Sepia pharaonis*. The young ones raised from eggs reached maturity and spawned, although these eggs were not viable.

Finfish Culture

In fin-fish culture, experiments on the culture of selected species under different conditions of mono and polyculture systems in ponds, cages and pens were carried out at the different centres on the east and west coasts. Pond culture of milkfish and mullets was carried out at Tuticorin, Mandapam and Madras. Cage culture of selected species of groupers was successful at Mandapam. The programme of polythene sheet-lined pond culture on sandy beach was completed after successfully rearing species of *Chanos, Mugil* and *Megalops* to marketable sizes. Studies for greater utilization of low-lying coastal areas was continued with the culture of milkfish and mullet in pens constructed in the extensive shallow lagoons at Mandapam.

Physiology, Nutrition And Pathology

Physiology

With a view to determine the osmoregulatory capabilities of adult *Penaeus monodon*, an experiment was conducted by exposing the prawns to salinities ranging from 3‰ to 45‰. The osmolaity of the haemolymph of prawns increased from 506

mosm at 3‰ to 912 mosm at 45‰ after 24 hours; whereas after 48 hours of exposure it increased from 483 mosm at 3‰ to 905 mosm at 45‰. The isoosmotic point for 24 hours and 48 hours duration was found to be around S 18.5‰ and S 21.0‰ respectively. Thus the experiment showed that the prawns are highly efficient osmoregulators.

Studies on the hepatopancreas of female *P.semisulcatus* showed that the glycogen content increase from the early maturing stage (4.56%) to the mature stage (7.64%). However, in the male, there was no significant change in the glycogen content. The total carotenoids content in the hepatopancreas also showed an increase with the progress of maturation.

The hepatopancreas of *P.indicus* was found to contain calcium, zinc, iron and copper in concentrations of 1256.69, 167.31, 163.59 and 14.87 µg/g of dry tissue; whereas the muscle had 379.71, 80.54, 20.14 and 76.63 µg/g dry tissue of Ca, Zn, Fe and Cu.

Nutrition

Experimental studies have shown that the milkfish, *Chanos chanos* fry require a dietary lipid level of 6% for maximum growth and utilization of food and protein. Lipid levels in excess of 9% resulted in reduced growth and decreased efficiency of food and protein conversion.

Salinity has been found to influence the survival and growth significantly and utilization of food and protein in the fry of the mullet, *Liza parsia*. Salinity range 15 to 25‰ was found to promote growth and survival significantly. However, salinity of 30‰ and 35‰ induced high mortality rates.

Studies have shown that the water soluble vitamins, ascorbic acid, choline and iositol are indispensable in the diets of milkfish fry. Ascorbic acid deficiency induced a 43 % mortality, whereas choline (35%) and iositol deficiency induced mortality rates of 35% and 19% respectively.

Pathology

Studies on the soft prawns were continued during the year. The data collected on Eh distribution in the prawn culture fields and the occurrence of soft prawns showed that the soft prawns occur when redox potential of the field generally builds up above - 250 and this condition occurs in ponds after August. In the fair season (October - February) the redox potential of the ponds was found to be less than - 250, when the prawns in the ponds were healthy.

Fishery Economics And Extension

A socio-economic study was conducted in 4 marine fishing villages of Gujarat and 3 of Maharashtra and the results showed that for the group owning/sharing mechanised crafts the fishing expenditure was Rs. 50,000 - 60,000 per annum per family. This was 3–4 times that of non-mechanised group and 8–11 times that of fishing gear owners. The number of fishing days ranged 200–244 per annum. The annual net fishery income over operating cost for mechanised group, non-mechanised group, gear owners and fishery allied groups was about Rs. 11,000 Rs. 5,000, Rs. 4,000 and Rs. 3,500 respectively. About 75% of the families in Maharashtra and 68% in Gujarat were under debt amounting to about Rs. 3,000 and Rs. 4,000 per family respectively.

Socio-economic studies of fishermen households in Pudumanikuppam and Thiruvottiyoorkuppam fishing villages in Tamil Nadu showed that the average initial investment on a catamaran unit was Rs. 8,300 and the average annual gross income was Rs. 20,000. Marginal analysis indicated that higher initial investments can be recommended for better returns.

Studies on the economics of mechanised units in Cochin indicated that during the season the gross revenue per day of operation worked out to about Rs. 4,200 for purse-seiners, Rs. 930 for trawlers and Rs. 780 for gill-netters, the net revenue thereof being about Rs. 1,170, Rs. 140 and Rs. 180 respectively.

An evaluative study on the utilization of knowledge gained by women in Cochin region through training programmes in

fish/prawn farming showed that the trained women showed favourable attitude towards prawn culture technology as well as the KVK, the average attitude score being 4.3 and 4.75 respectively in a five-point scale. The major constraints in the utilization of knowledge were non-possession of suitable holdings, lack of opportunities for working in others' holdings and lack of finance.

A study of the infrastructure of prawn peeling units in Cochin showed that the score was well above average in the centralised units and below average in the decentralised units. Significant differences between centralised and decentralised units were observed in all parameters related with quality control. The analysis of the socio-personal data of the women in prawn peeling units revealed their low socio-economic status, medium status of health and hygiene, low motivation and very low working climate.

Post-Graduate Research And Education

Nine Junior Research Fellows joined the Sixth batch of M.Sc. Mariculture Course in the year under the ICAR/UNDP/FAO Centre of Advanced Studies in Mariculture at this Institute. Nine out of the 10 candidates in the Fourth batch passed the M.Sc., Mariculture Examination conducted by the University of Cochin. All of them had first class and one of them got distinction.

Under the Ph.D., programme 9 Senior Research Fellows in the Fifth batch were admitted. Twelve students belonging to the Second and Third batches have completed their work and the thesis are in various stages of completion. Two students of the earlier batch have submitted their thesis to the Cochin University of Science and Technology for Ph.D., in the year.

Three foreign experts offered consultancy service at the Centre, and 8 scientists had advanced training abroad. Two workshops were organised. FAO Consultants and our scientists on return from foreign training gave a total number of 16 seminars. Besides, 4 special lectures by eminent visiting scientists were held.

Eight Fellows under the CAS Mariculture programme got selection in the Agriculture Research Service Examination held in 1985.

Extension Education

Krishi Vigyan Kendra conducted 42 training courses. A total of 786 farmers (269 men and 517 women) benefited from them. The courses offered were scientific farming of prawns and finfishes; post-harvest training on prawn and fish; integration of prawn culture with paddy; eradication of predators from culture of fields; pond construction and fixing of sluice gate; prawn/fish farm management; prawn/fish seed collection and transportation; prawn/fish harvesting, handling and marketing; environmental sanitation; coconut cultivation; vegetable cultivation; social forestry; poultry farming; kitchen gardening; food preservation; and nutrition. Lab-to-Land programme on prawn/fish farming was implemented.

Under the Trainers, Training Centre, the following courses were conducted with the involvement of the scientific divisions; Hatchery production of edible oyster seed (Tuticorin), Farming of edible oysters (Tuticorin), Sea Weed culture (Mandapam Camp), Hatchery production of marine prawn seeds (Narakkal) and Prawn farming (Narakkal).

Research Vessels

FORV *Sagar Sampada*

The scientific programme of FORV *Sagar Sampada* were managed by the Institute. The vessel made 15 research cruises, surveying a total area of over 9,00,000 sq. nautical miles in the EEZ and beyond, including the equatorial region. She cruised a total track distance of over 28,000 nautical miles. The survey included pelagic, demersal, mesopelagic and tuna live-bait resources; physical, chemical and biological oceanography. She logged 234 days of operation and occupied a total number of 426 multidisciplinary stations.

Scientists and research scholars belonging to the Central Marine Fisheries Research Institute, Central Institute of Fisheries Technology, National Institute of Oceanography, Naval Physical Oceanographic Laboratory, Space Application Centre, Fishery Survey of India, Zoological Survey of India, Cochin University of Science & Technology, Kerala University, Annamalai University, University of Madras, Andhra University and Colleges of Fisheries at Tuticorin and Mangalore participated in the cruises, accounting for 93% occupancy of the scientists' berths. Eighteen scientists from 14 countries attending the IOC/DOD Training Workshop on "Ocean Engineering and its interface with Ocean Science in Indian Region" held at the Indian Institute of Technology, Madras, participated in a one-day training cruise on board *Sagar Sampada* in March 1986.

R. V. Skipjack

The vessel was engaged in the collection of seatruth data related to remote sensing, hydrography, upwelling, primary production, plankton, egg and larval survey and fish resources survey mainly in the area between Cape Comorin and Calicut.

Cadalmin

The seven small vessels of *Cadalmin* series were engaged in the fishery resources and oceanographic studies in the coastal waters off Cochin, Vizhinjam, Waltair, Madras, Mandapam and Tuticorin.

Publications

The following publications were issued during the year :

Indian Journal of Fisheries

Vol. 32 Nos. 1, 2, 3, and 4.

Annual Reports

1982-83, 1983-84 and 1984-85.

Special Publications :

R & D Series for Marine Fishery Resources Management (Handouts) Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10

CMFRI Newsletters

Nos. 27 & 28 and 29 & 30.

Research Highlights 1984-85.

Souvenir

A Souvenir was issued on the occasion of the inauguration of the permanent building of the Institute's Headquarters at Cochin.