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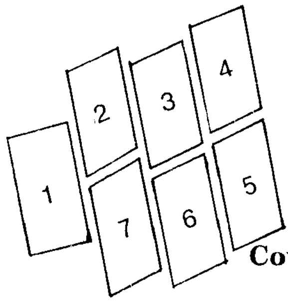
CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, COCHIN

Annual Report



Cover Photos:

Composite sea farming at Valinokkam Bay (Gulf of Mannar). Ramanathapuram District, Tamil Nadu.

1. Seaweed *Gracilaria edulis* on coir net
2. Edible oyster *Crassostrea madrasensis*- seed oysters on shell strings.
3. Green mussel *Perna viridis* and clam *Paphia malabarica*.
4. Live biopsy being carried out on spawner seabass *Lates calcarifer*
5. Young ones of sea cucumber *Holothuria scabra*
6. Seed of green tiger prawn *Penaeus semisulcatus* for cage culture
7. Pearl oyster *Pinctada fucata* with pearl *in-situ* cultured at valinokkam

CENTRAL MARINE FISHERIES
RESEARCH INSTITUTE,
COCHIN

Annual Report
1991 - '92

भाकृअनुप
ICAR

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Issued by

Dr. P.S.B.R. JAMES, Director,

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

Dr. Salim Ali Road,

Post Box No. 2704, Cochin - 682 031

Phone :369867 Telex : 885 - 6435 MFRI-IN

Compiled and Edited by:

Shri. A.A. JAYAPRAKASH, Scientist (S.G)

Technical Assistance:

Shri. M. ABDUL NIZAR, Jr. Technical Assistant

Hindi Translation and Editing by:

Ms. P.J. SHEELA, Assistant Director (O.L.)

Ms. E.K. UMA, Sr. Hindi Translator

Secretarial Assistance:

Ms. K.J. MALATHI DEVI, Jr. Stenographer

Ms. N.R. LETHA DEVI, Jr. Stenographer

Ms. K. BALAMANI, Jr. Clerk (Hindi)

PRINTED AT : AMARAKERALA INDUSTRIES, KOCHI - 682 018

ANNUAL REPORT 1991 - '92

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Annual Report 1991 - 92

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

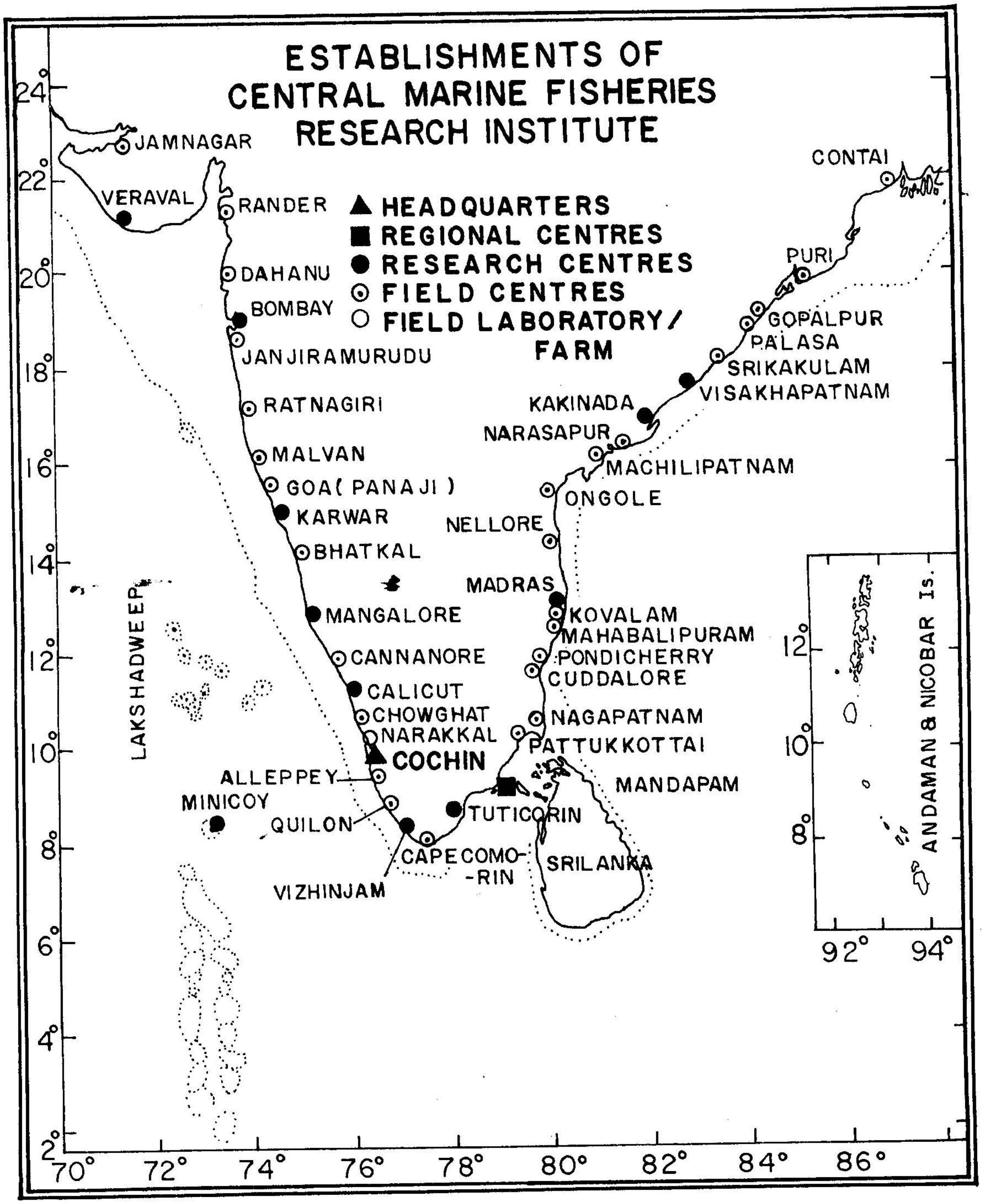
Brief History, Mandate and Organisational set up

The Central Marine Fisheries Research Institute was established in 1947 by the Ministry of Agriculture and Irrigation and subsequently brought under the Indian Council of Agricultural Research in 1967. The Insititute headquarters is located at Cochin and its Regional Centre at Mandapam Camp. The 11 Research Centres and 28 Field Centres are situated along the east and west coasts.

The Institute has been actively conducting research both in the capture and the culture fisheries and has contributed significantly to the overall development of marine fisheries in the country. The Institute has the mandate to conduct research for assessing and monitoring the exploited marine fishery resources leading to rational exploitation, conservation and management; to assess the under-exploited and unexploited marine fisheries resources of the EEZ; to understand the fluctuations in abundance of marine fisheries resources in relation to changes in the environment by conducting vessel based programmes; to study the coastal ecology as related to artisanal fishing, endangered ecosystems and pollution; to develop suitable mariculture technologies for finfish and shellfish in open seas to supplement marine fish production; and to conduct transfer of technology and post-graduate and specialised training, education and extension education programmes and provide institutional constultancy services.

The Institute implements its research programmes through the following eight major Divisions: Fishery Resources Assessment Division; Pelagic Fisheries Division; Demersal Fisheries Division; Molluscan Fisheries Division; Crustacean Fisheries Division; Fishery Environment Management Division; Physiology, Nutrition and Pathology Division and Fishery Economics and Extention Division.

The Post-Graduate Programme in Mariculture affiliated to the Cochin University of Science and Technology conducts M.Sc and Ph.D. programmes in Mariculture. The Library and Documentation Section provides reference facilities to the staff and students of the Institute and to visitors both within and outside the country. It is also responsible for bringing out the Institute's publications. The Krishi Vigyan Kendra and Trainers' Training Centre at Narakkal are involved with extension programmes and imparting training in capture and culture fisheries.



ESTABLISHMENTS OF
CENTRAL MARINE FISHERIES
RESEARCH INSTITUTE
HEADQUARTERS
REGIONAL CENTRES
RESEARCH CENTRES
FIELD CENTRES
FIELD LABORATORY/
FARM
JAMNAGAR
VERAVAL
RANDER
DAHANU
BOMBAY
JANJIRAMURUDU
RATNAGIRI
MALVAN
GOA(PANAJI)
KARWAR
BHATKAL
MANGALORE
CANNANORE
CALICUT
CHOWGHAT
NARAKKAL
COCHIN
ALLEPPEY
QUILON
VIZHINJAM
CAPE COMO-
-RIN
TUTICORIN
MANDAPAM
PATTUKKOTTAI
NAGAPATNAM
CUDDALORE
PONDICHERRY
MAHABALIPURAM
KOVALAM
MADRAS
NELLORE
ONGOLE
MACHILIPATNAM
NARASAPUR
KAKINADA
VISAKHAPATNAM
SRIKAKULAM
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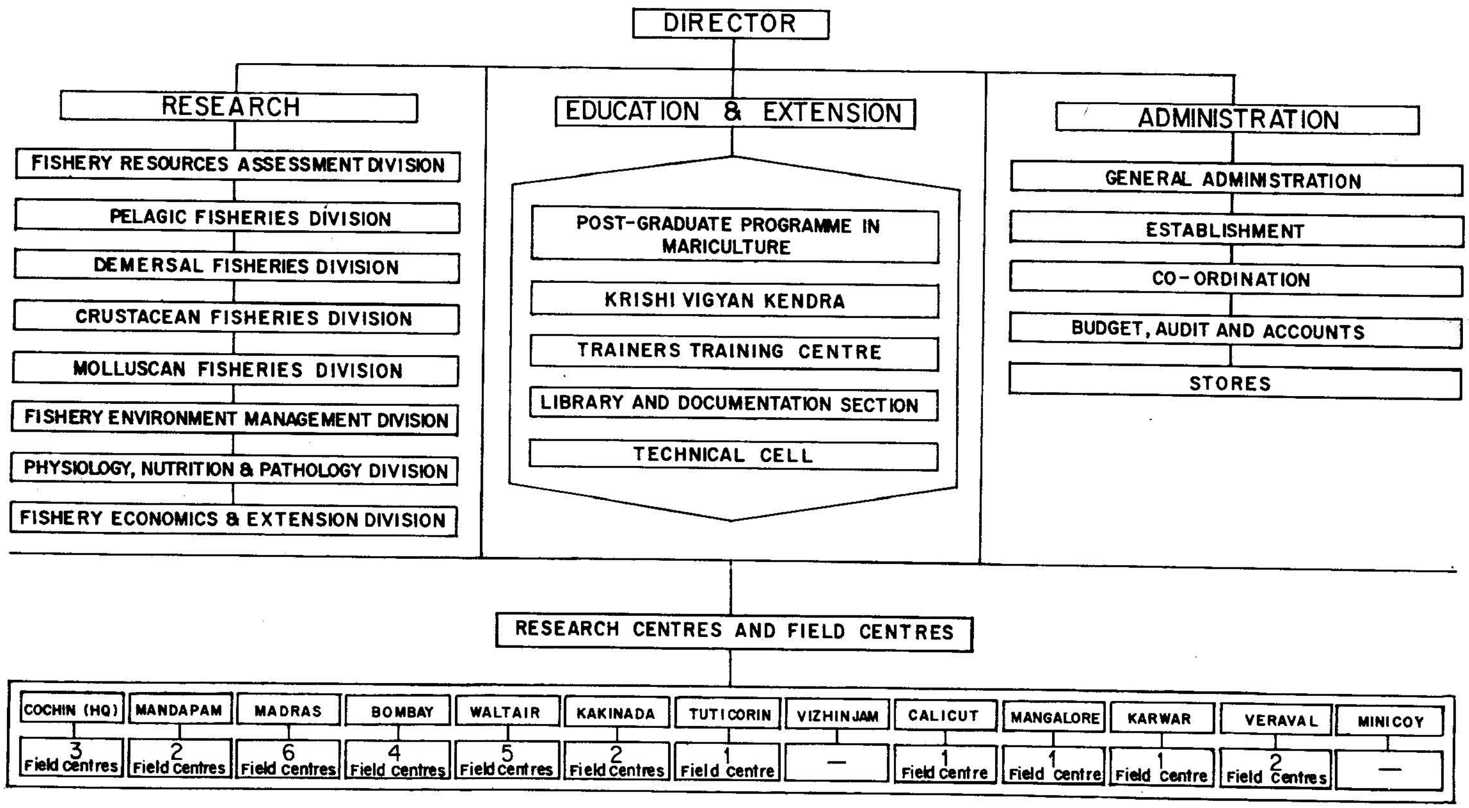
CENTRAL MARINE FISHERIES RESEARCH INSTITUTE (ICAR)
ORGANISATIONAL CHART



INTRODUCTION

The Institute has been carrying out research activities under 34 need based marine capture and culture fisheries research projects to assess the total marine fish production in this country, to study the fishery, biology and population characteristics of commercially important finfishes and shellfishes exploited by the different gears to make estimates of their present stock for rational exploitation; culture fisheries; monitoring of environmental parameters; fishery economics and extension programmes and basic researches on ecology, fishery, biology, physiology, nutrition, pathology and genetics. Postgraduate Education and Research Programmes in Mariculture were continued. The KVK/TTC conducted training courses in mariculture and related aspects. Stock assessment of 40 groups of finfishes and shellfishes have been completed.

Marine Fish Production

Marine fish production in India during 1991 has been provisionally estimated at 2.16 million t. Compared to last year there was no change in the total production. West coast accounted for 1550,000 t (71.8%) and east coast 587,000 t (27.2%). The trawlers and purse seiners contributed 50%, motorised crafts 34% and the non-motorised crafts 16% of the total production. The estimated catch was 796,000 t from the south-west coast; 755,000 t from the north-west coast; 489,000 t from the lower east coast and 98,000 t from the upper east coast.

Pelagic resources

The pelagic group of fishes formed 54% with an annual production of 1,163,223 t, showing an increase of 50,780 t compared to last year. Landings of oil sardine, mackerel, bombay duck and tunnies have declined, whereas the production of whitebaits, carangids and ribbonfishes have shown an increase. At Lakshadweep, the pole and line mainly exploited tunas, and skipjack dominated the catch.

Demersal resources

The estimated catch of the demersal fishes was 995,168 t. The catch increased by 46,000 t compared to last year. Small trawlers (14 m & below) contributed 9.2 lakh t as against 8.7 lakh t during the previous year. Along the east coast silver bellies and along the west coast penaeid prawns dominated the demersal fishery.

Crustacean resources

A remarkable feature was the increase in the penaeid prawn landings by 13.2%, the estimated catch being 186,000 t. The increase was mainly from the north-west caost. Kerala and Karnataka witnessed an increase of about 33-37%. A record catch of 12, 245 t of prawns were landed at Cochin and an equal amount at Sakthikulangara (Quilon). The lobster landings declined by 460 t when compared to last year.

Molluscan resources

The cephalopod landings accounted for 2.9% (64,000 t) during the year. The production from the south-west and north-west regions were 24,000 t and 30, 000 t respectively. The production of clams and gastropods in the Kakinada Bay was 3,500 t. The sacred chank landings (Nos.) at Tuticorin and Mandapam were 2 lakhs and 1.9 lakh respectively.

Environmental studies

Important environmental parameters have been collected from different centres. The 'Sea Truth' data collected during special cruises of FORV *Sagar Sampada* were utilised for validation with data from NRSA. Levels of heavy metal content in marine organisms have been studied. A resurvey of the damaged coral reefs at Mandapam showed that recolonisation was insignificant.

Physiology, nutrition and pathology

A breakthrough was achieved in the long term preservation of sperm motility of *Liza parsia* at -196^{0}C. Farm trials of compounded feed using *Penaeus indicus* were concluded during the period. At Ramudupalam (Nellore, A.P.) from 5 ha area 5202 kg (Head-on weight) was harvested after 120 to 150 days growth.

An Epizootic Ulcerative Syndrome caused by *Aeromonas* group of bacteria was noticed in the fresh water fishes of Kerala. Studies on the genetic stocks of Indian mackerel indicated difference between populations from Cochin, Calicut, Thottappally (Alappuzha), Wadge Bank and Mandapam.

Fishery economics

In Karnataka, the total investments on purse seiners stands at 28 crores of rupees and the overall income for these units stands at 29 crores of rupees. At Cochin, trawling was a profitable venture, since a surplus income of Rs. 93,000 was realised from an initial investment of Rs. 4 lakhs on a trawler (14 m & below).

Mariculture

In the prawn hatchery at Mandapam, 4.64 lakhs of postlarvae of *Penaeus semisulcatus* were produced and 4.42. lakhs were sea ranched and nearly 17,258 were farm grown. From the farm grown prawns, 6,342 were tagged and released in the Palk Bay during February '92. Two specimens have been recovered till March '92.

Edible oyster seeds from Tuticorin were trasferred to Pulicat, Kakinada and Karwar to study the feasibility of culture in these ares. At Pulicat, after 9 months the oysters attained an average length of 81 mm showing good prespects. At the other two centres the results were not encouraging.

A pilot project sponsored by NABARD to demostrate the economic feasibility of edible oyster farming was initiated at Tuticorin. The sea cucumber, *Holothuria atra* spawned under thermal stimulation and the larvae have been successfully reared.

Vessel based programme

Under the CMFRI cruise programme, FROV *Sagar Sampada* has undertaken five research cruises to survey the fishery resources and to collect environmental data off the west coast of India.

R.V. *Cadalmin* stationed at 7 centres monitored the environmental parameters in the inshore fishing grounds.

Education, Training and Transfer of Technology

Eight Senior Research Fellows were awarded the Ph.D Degree by the Cochin University of Science and Technology. All seven candidates of the 10th batch passed the M.Sc Mariculture Examination in First Class and those of the 11th and 12th batchs are currently undergoing the course.

Pearl culture has been carried out in the Valinokkam Bay in the Gulf of Manner. Twentyfive fishermen were trained in various aspects of pearl culture as part of the R & D efforts and transfer of technology for self employment and income generation.

Composite seafarming involving 8 candidate species have been initiated on a pilot scale at this centre, utilising the technologies developed by the Institute during the last two decades.

The Krishi Vigyan Kendra conducted 67 training courses and 1179 participants were trained. The Trainers' Training Centre organised 7 training courses for 77 participants.

Technology Mission for Marine Fisheries Development

The Institute has proposed a 'Technology Mission' for Marine Fisheries Development, similar to the one adopted successfully in the country for oilseeds, drinking water and communication. The main objectives are 1) - evaluating the resource position in the 50-200 m zone of the continental shelf; 2) - strengthening harvest technologies and infrastructure; 3) - post harvest technology and product development and 4) - effective marketing and distribution system for both domestic and export markets. The proposal is now under examination by the ICAR.

PSBRJames

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

COMMITTEES

MANAGEMENT COMMITTEE

1. The Director : Chairman
   Central Marine Fisheries
   Research Institute, Cochin.
2. Director of Fisheries, : Member
   Dept. of Fisheries and Ports,
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   Trivandrum (Kerala).
3. Director of Fisheries, : Member
   Dept. of Fisheries,
   Govt. of Tamil Nadu,
   Madras.
4. The Dean, : Member
   College of Fisheries,
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5. Shri Subey Singh, : Member
   Ex-SDM,
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   Sonepat Road, Rohtak (Haryana).
6. i) Dr.P.Vedavyasa Rao, : Member
   Principal Scientist,
   CMFRI, Mangalore.

   ii) Dr.K.Satyanarayana Rao, : Member
   Principal Scientist,
   CMFRI, Madras.

   iii) Dr. P.S. Kuriakose, : Member
   Scientist (S-3),
   CMFRI, Calicut.

   iv) Shri P.Sam Bennet, : Member
   Scientist (Selection Grade),
   CMFRI, Tuticorin.
7. Dr.K.Radhakrishna, : Member
   ADG (Marine Fisheries),
   ICAR, Krishi Bhavan,
   New Delhi.
8. Finance & Accounts Officer, : Member
   Central Institute of Fisheries
   Technology, Cochin.
9. Administrative Officer, : Member Secretary
   CMFRI, Cochin.

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1. Dr. P.S.B.R. James, --Chairman
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   Principal Scientist
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   Senior Scientist
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   Asst. Adm. Officer

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3. Shri M.P. Sivadasan, Tech.Asst. (T-I-3) --Member
4. Shri D. Sundararajan, Tech.Asst. (T-I-3) --Member

b) Administrative group

5. Shri S. Abdulla, Assistant --Member
6. Shri K.J. Mathew, Junior Clerk --Member
7. Shri K. Sadanandan, Junior Clerk --Member

c) Supporting group

8. Shri. A.P. Sebastian, S.S. Gr. III (Peon) : Member
9. Shri. T. Vijayakumar. S.S. Gr. II (Messenger) : Member
10. Shri. B. Zainudheen, S.S. Gr. II (Watchman) : Member

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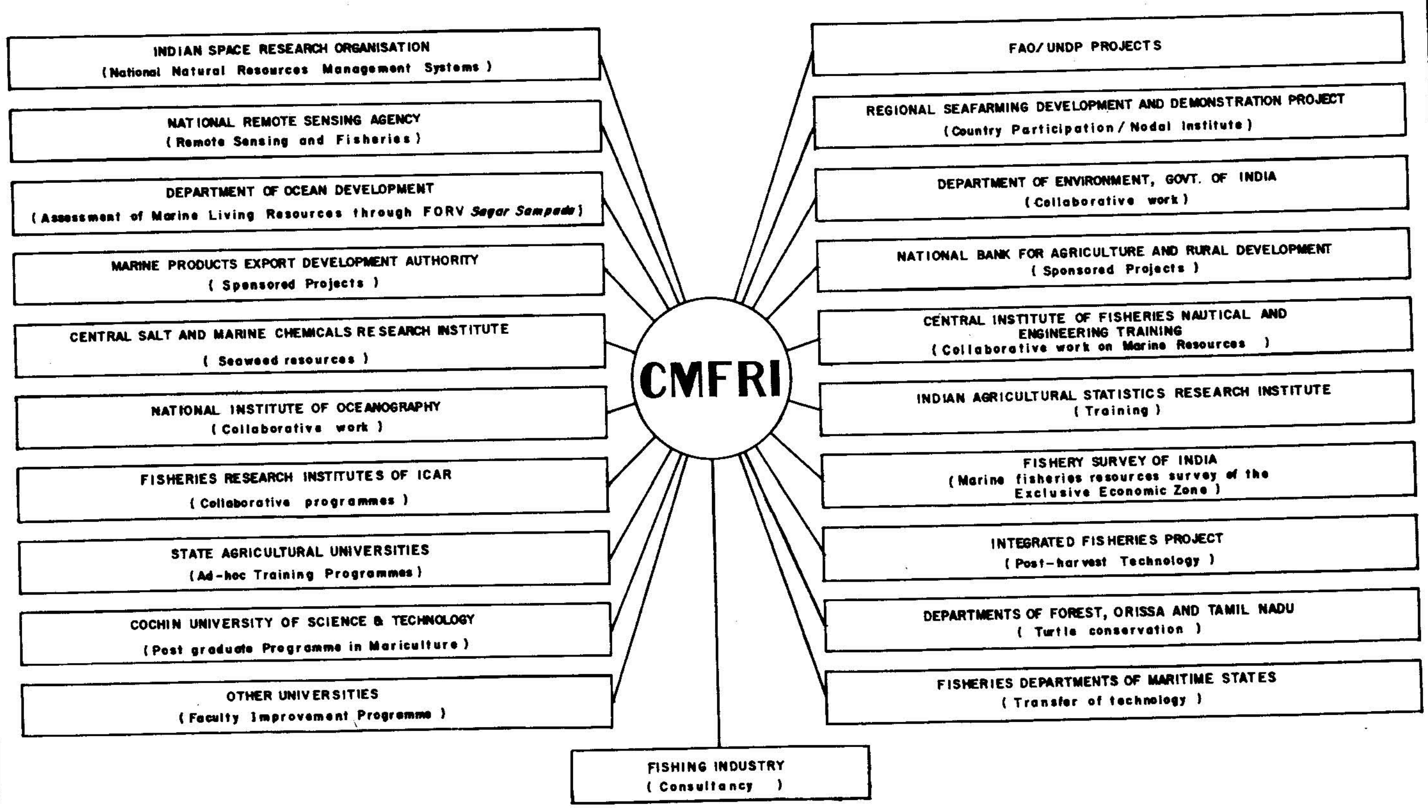
2. Dr. N. Neelakanta Pillai, Senior Scientist : Member
3. Shri. C. Muralidharan, Adm. Officer : Member
4. Shri. T.V. Asari, Sr. Finance & Accounts Officer : Member
5. Dr. A. Regunathan, Senior Scientist : Member
6. Shri. V.K. Suresh, Field Assistant (T-1) : Member
7. Shri. V.C. Subhash, Junior Clerk : Member
8. Shri. V.A. Surendran, Driver : Member
9. Shri. C.M. Rajappan, S.S.Gr. IV (LA) : Member
10. Shri. P.A. Naik, Asst. Adm. Officer : Member Secretary

Budget Expenditure statement for the year 1991 - 92
(Rs. in lakhs)

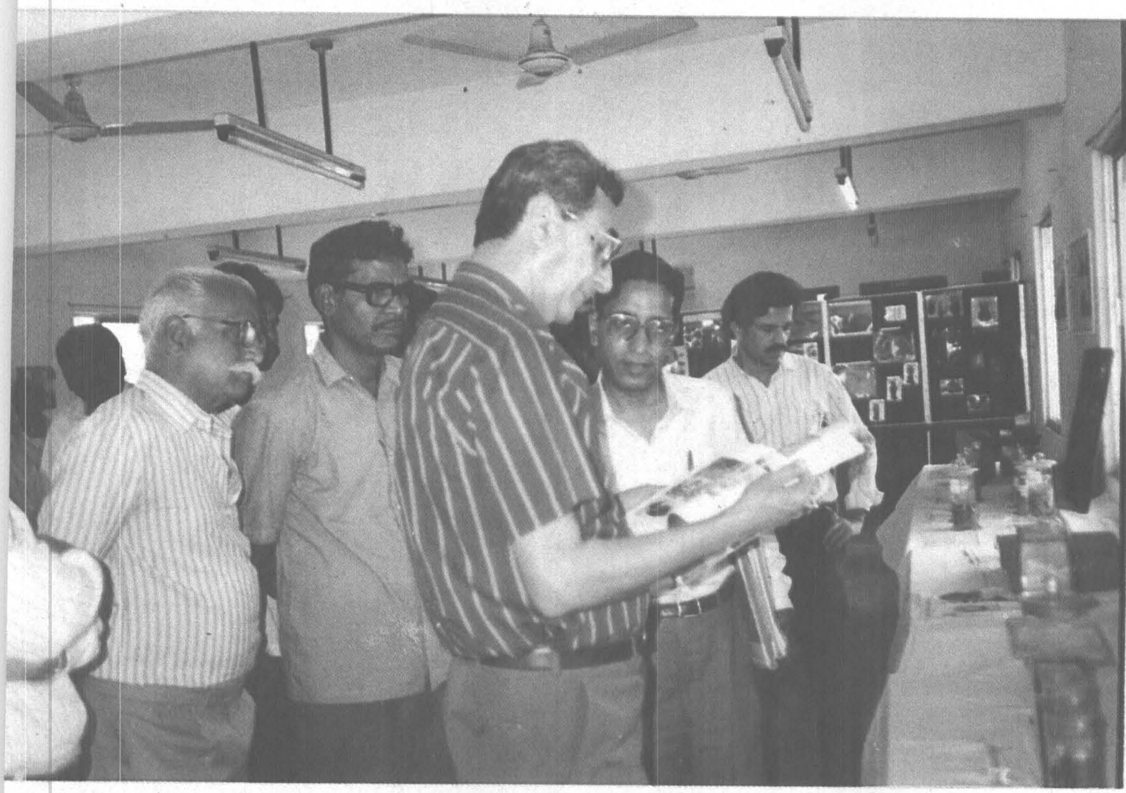
	Account Heads	Non-Plan		Plan	
		Budget Estimates for 1991-92	Expenditure	Budget Estimates for 1991-92	Expen-diture
1.	Establishment charges	386.25	361.16	–	–
2.	T.A.	11.00	8.34	7.00	7.00
3.	Other Charges				
4.	Equipments	38.75	66.77	46.70	35.68
5.	Fellowship/Scholar-ships/Awards	4.00	2.60	4.30	4.59
6.	Grant-in-aid	-	1.18	-	-
7.	Seminar & Conference	-	-	-	-
8.	Works	-	-	42.00	17.87
	Total	440.00	440.05	100.00	65.14

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE , COCHIN
(I C A R)

LINKAGES WITH OTHER ORGANISATIONS



D.G'.s VISIT



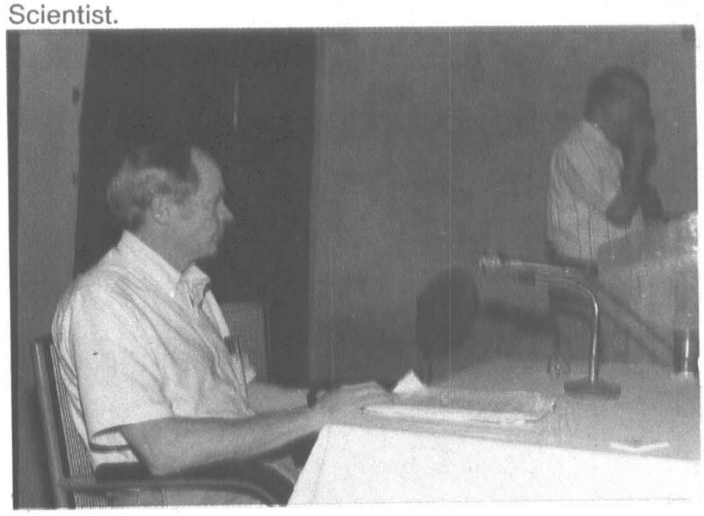
Dr. V.L. Chopra, Director General, ICAR visited the Madras Research Centre of the Institute on 4th February 1992.

TRAINING

A training on marine fisheries was given to the Officers of the Bank of Baroda by CMFRI from 26th November to 4th December 1991.

At the inaugural function Shri M.L. Pagaria, Senior Manager (Training), Bank of Baroda is introducing the participants.

Seated on the dias (from left) are Shri. R.R. Nair, Regional Manager, Bank of Baroda, Trivandrum; Dr. M. Sakthivel, Director, MPEDA, Cochin; Dr. P.S.B.R. James, Director, CMFRI, Cochin and Dr. A. Regunathan, Senior Scientist.



SEMINAR

Dr. Dean Parsons, National Marine Fisheries Service, Washington D.C. gave a seminar on Fishery Resources Assessment on 28th November 1991.

Dr. P.S.B.R. James, Director, CMFRI, Cochin is introducing Dr. Parsons to the audience.

PROGRESS OF RESEARCH

FISHERY RESOURCES ASSESSMENT DIVISION

MARINE FISH PRODUCTION IN INDIA DURING 1991

Marine fish production in India during 1991 has been provisionally estimated at 2.16 million tonnes. There has been no change in the total production compared to 1990. However, landings of major groups showed a different scenario. The production from west coast accounted for 71.8% (15,50,000 t) and east coast 27.2% (5,87,000 t). A reduction of 39,000 t was recorded in the west coast and an increase of the same order from east coast. Pelagic group of fishes formed 11, 60, 000 t (54%) and demersal group 10,00,000 t (46%). Among the commercially important fishes, oil sardine landings reduced by 84,000 t and mackerel by 70,000 t in 1991. However, penaeid prawn landings registered an increase of 22,000 t against the landings of 1990.

REGIONWISE PRODUCTION OF MARINE FISHES

North east region contributed 98,000 t to the total production and the landings reduced by 17,000 t (14.8%) compared to the estimate of 1990. Though, the total landings during 1991 declined by 17,000t, the landings of Hilsa shad increased by 13, 000t; from 14,000t of 1990 to 27,000t of 1991. The production of Bombay duck registered a reduction of 9,000t, from 13,000t to 4,000t. Pomfret landings also showed a reduction of 3,000t, from 8,000t of 1990 to 5,000t of 1991. The landings in the region accounted for 4.5% of the total production of India.

South-east region accounted for 22.7% of the total estimated landings in the country. The region recorded an increase of about 52,000t (11.9%) of marine fish production during 1991, compared to 1990. The production during 1991 was 4,89,000t. A remarkable feature noticed in this region was the production of oil sardine of 34,000t. The production of oil sardine during 1990 was about 38,000t and more or less the same state continued during 1991 also. Mackerel fishery showed a slight improvement of about 9000t, from 12,000t it increased to 21,000t in 1991. An increase was noticed in the landings of *Stolephorus* spp. by 7,000t, from 18,000t to 25,000t. A significant increase of 18,000t was seen in the landings of ribbon fishes from 7,000t to 25,000t in 1991. Among the commercially important groups, increase in landings were registered in the fishery of Hilsa shad by 7,000t and penaeid prawns by 1,000t.

Table-1

Regionwise production of marine fishes during 1991 (in tonnes)

Region	Annual production (in tonnes)	Percentage to all India production
North East (West Bengal & Orissa)	97,898	4.5
South East (Andhra Pradesh, Tamil Nadu & Pondicherry)	489,120	22.7
South West (Kerala, Karnataka & Goa)	796,436	36.9
North West (Maharashtra & Gujarat)	754,598	35.0

Besides Island Territories contributed 0.9% of total production.

With a substantial reduction of 1,11,000t, south-west region contributed 7,96,000t during 1991 and accounted for only 36.9% of the total marine fish production of the country. The reduction was primarily noticed in the landings of oil sardine, mackerel and perches. The landings of oil sardine in 1991 has been estimated at 1,42,000t showing a reduction of 80,000t compared to 1990; mackerel landings reduced by 75,000t, from 154,000t to 79,000t and perches reduced by 23,000t from 70,000 to 47,000t. However, increased production has been noticed in the catches of other sardines (13,000t), *Stolephorus* spp. (20,000t), carangids (36,000t) and penaeid prawns (19,000t). The estimated catch of penaeid prawns and *Stolephorus* spp. have been 73,000t and 57,000t respectively.

Marine fish production of the north-west region during 1991 has been estimated at 7,55,000t and an increase of 72,000t (10.5%) was noticed. Increase in the landings of *Coilia* spp., Bombay duck, ribbon fishes, penaeid prawns, non-penaeid prawns and cephalopods was noticed. However, landings of carangids and mackerel recorded slight reduction. The increase in the landings of *Coilia* spp. and *Thryssa* spp. has been 4,000t each. Bombay duck landings during 1991 has been 1,18,000t with an increase of 2,000t. An increase of 10,000t was recorded in the landings of ribbon fishes, from 47,000t to 57,000t. Penaeid prawn fishery showed an improvement of 6,000t, from 75,000t in 1990 to 81,000t in 1991. But a substantial increase of 29,000t was observed in the landings of non-penaeid prawns, from 76,000t to 105,000t. The estimate of carangids was 16,000t in 1991 which recorded a reduction of 2,000t. The reduction in the landings of mackerel was substantial (6,000t) from 18,000t to 12,000t. Oil sardine fishery witnessed a slight increase of 1,000t during 1991.

Pelagic group accounted for 54% of the total production and the demersal group 46%.

Table-2

Estimated landings (in tonnes) of pelagic fishes in India during 1990 and 1991

Name of fish	1990	1991*
CLUPEIDS		
Wolf herring	13409	14978
Oil sardine	260995	176887
Other sardines	77447	86362
Hilsa shad	14243	28895
Other shads	6096	13114
Anchovies	110	90
Coilia	31901	35254
Setipinna	1596	1391
Stolephorus	58682	85525
Thrissina	0	3
Thryssa	22423	34593
Other clupeids	46474	50138
BOMBAY DUCK	130234	123715
HALF BEAKS &FULL BEAKS	2503	2544
FLYING FISHES	941	5619
RIBBON FISHES	74301	91218
CARANGIDS		
Horse Mackerel	22121	19528
Scads	67958	102018
Leather-jackets	3160	3449
Other carangids	48548	43292
MACKERELS		
Indian mackerel	184380	113697
Other mackerels	22	17
SEER FISHES		
S. commersoni	15156	16233
S. guttatus	14598	19382
S. lineolatus	4	48
Acanthocybium spp.	83	578

Name of fish	1990	1991*
TUNNIES		0
E.affinis	32659	17773
Auxis spp.	6947	5447
K. pelamis	5012	4967
T. tonggol	951	3913
Other tunnies	6491	4702
BILL FISHES	1048	828
BARRACUDAS	11125	13790
MULLETS	9903	5323
UNICORN COD	253	1493
MISCELLANEOUS	42225	36421
PELAGIC TOTAL	1213999	1163223

* Provisional

Oil Sardine: Oil sardine formed 8.20% of the marine fish production of the country and accounted for 15.2% of the pelagic fish production. An estimated 1,77,000t of oil sardine was landed during 1991 which showed a reduction of 84,000t (32%). The reduction was mainly from south-west region (80,000t).

Mackerel: Mackerel formed 5.3% of the total marine fish production of the country and accounted for 9.8% of the pelagic resources. The estimated catch of mackerel was 1,14,000 t against 1,84,000t of 1990 which registered a decline of 70,000t (38%). The reduction of 75,000t was attributed to south-west region. South-west region registered a reduction of 1,11,000t of landings mainly due to poor landings of oil sardine and mackerel. Mackerel landings of south west region accounted for 10% of the total production in the region. South-east region recorded a slight improvement (9,000t) in the mackerel fishery.

***Stolephorus* spp.** *Stolephorus* spp. accounted for 4% of the total marine fish production of the country. With an estimate of 86,000t, it formed 5% of the total pelagic groups in 1991. The resource showed an increase of 27,000 t (45.7%). An increase of 20,000t was recorded in the south-west region which contributed 57,000t to the total production.

Bombay duck: Bombay duck landings accounted for 5.7% of the total marine fish production of the country. The estimated landings showed a reduction of 6,000t (5.03%) compared to the estimate of 1990. Bombay duck catches contributed 10.6% (1,24,000t) of the pelagic groups of fishes during 1991. The northwest region contributed 1,18,000t and registered an increase of 2,400t (4.6%) of total production of the region.

Carangids: Carangids accounted for 7.8% of the total marine fish production of the country. An increase of 26,000t (18.7%) was recorded in the landings of carangids during 1991. The estimate of 1,68,000t accounted for 14.5% of the pelagic groups. Among the different regions, south-west coast contributed 1,28,000t (76%) of the total carangids landings and recorded an increase of 36,000t (39.3%) during 1991. The carangids contributed 16% of the total landings of south-west region.

Ribbon fishes: Ribbon fishes accounted for 4.2% of the total production and 7.8% of the pelagic resources exploited during 1991. The estimated landings 91,000t registered an increase of 17,000t (22.8%) during 1991 compared to 1990. Of the total 91,000t, north-west region contributed 62% and south-east 27.6% and both the regions showed increase in production. The increase in south-east region was 18,000t and in north-west 9,000t.

Tunnies: The landings of tunnies accounted for 1.7% of the total production and 3.2% of pelagic groups during 1991, a reduction of 15,000t recorded from 52,000t in 1990 to 37,000t in 1991. The contribution of south-west region to the total tunnies production was 45% (16,000t) and recorded a decline of 19,000t in the region compared to 1990.

Table-3

Estimated landings (in tonnes) of demersal fishes in India during 1990 and 1991

Name of fish	1990	1991*
ELASMOBRANCHS		
Sharks	25013	27534
Skates	1631	1238
Rays	24046	17953
Eels	4852	6023
Catfishes	38230	34110
LIZARD FISHES	24840	28432
PERCHES		
Rock cods	4718	6287
Snappers	2746	2257
Pig-face breams	3855	5152
Threadfin breams	82644	64144
Other perches	26815	25785
GOATFISHES	21655	33442
THREADFINS	6882	6837
CROAKERS	119224	108394
SILVERBELLIES	53876	52832
BIG-JAWED JUMPER	8632	10581
POMFRETS		
Black pomfret	13214	13082
Silver pomfret	26244	24474
Chinese pomfret	404	97
FLATFISHES		
Halibut	2886	2695
Flounders	536	639
Soles	26465	34992
CRUSTACEANS		
Penaeid prawns	164580	186338
Non-penaeid prawns	79773	108812
Lobsters	2556	2094
Crabs	24243	29246
Stomatopods	65471	63468
Cephalopods	56237	63876
MISCELLANEOUS	36003	34354
DEMERSAL TOTAL	948271	995168

* Provisional

Catfishes: Catfishes accounted for 1.6% of total fish production and 3.4% of the demersal resources during 1991. The landings during 1991 has been estimated at 34,000 t which recorded a decrease of 4,000 t. North-west region contributed 18,600 t (54.6%) and north-east region 7,700 t (22.7%) of catfishes. The south-east region's contribution was 12.7%.

Elasmobranchs: Elasmobranchs consisting of sharks, rays and skates contributed 1.9% of total production and 4.2% of the total demersal resources. The production during 1991 was 41,700 t which registered a decline of 9,000 t (17.5%). North-west region contributed maximum landings of 22,000 t (53.5%). North-east region contributed 8,800 t (21.1%) of the elasmobranch catch. The contribution of south-east region was 5,700 t (13.6%).

Perches: The estimated landings of perches has been 1,04,000 t during the period which recorded a decline of about 17,000 t compared to 1990. South-west coast showed a reduction of 23,000 t. South-west coast contributed 45.2%, south-east 29.0% and north-west region 22.9% of the total perch landings. Percentage contribution of perches to the total production of these three regions were 5.8, 6.1 and 3.1 respectively.

Croakers: Croakers accounted for 5.0% of total marine fish production and 10.9%

of demersal landings during 1991. The estimate of 1,08,000 t in 1991 recorded a decline of 11,000 t. South-west region contributed 51.8%, north-east 19.4% and north-west region 13.5% of the total croaker landings.

Silverbellies: Silverbellies accounted for 2.4% of total resources and 5.3% of demersal resources. An estimate of 53,000 t recorded during 1991 showed a reduction of 1,000 t compared to 1990. South-east region contributed 39,000 t (73.3%) and south-west 8,000 t (15.8%) of silverbellies catch and a decline of about 3,000 t was noticed in the south-east region.

Pomfrets: Pomfrets contributed 1.7% of total marine fish production of the country and 3.8% of demersal resources. An estimate of 38,000 t recorded in 1991 showed a slight decline of 2,000 t, compared to 1990. Maximum landings of 23,000 t was contributed by north-west region which showed a slight improvement of 2,000 t.

Penaeid prawns: A remarkable feature in marine fish production during 1991 was the increase in the landings of penaeid prawns. An estimated 186,000 t recorded during 1991 showed an increase of 22,000 t (13.2%), compared to 1990. Penaeid prawns accounted for 8.6% of total production and 18.7% of the demersal resources of the country during 1991. South-west region contributed 39.0% (73,000 t) and north-west 43.2% (81,000 t) of the total penaeid prawn production of the country. An increase of 19,000 t (34.5%) in the south-west region and 5,000 t (7.0%) in the north-west region were recorded during 1991. The contribution of south-east region was 30,000 t and that from north-east 3,000 t.

Non-penaeid prawns: The production of non-penaeid prawns during 1991 was 109,000 t which recorded an increase of 29,000 t (36.4%). Non-penaeid prawns accounted for 5.0% and 10.9% of total production of the country. North-west region alone contributed 105,000 t (96%) and an increase of 29,000 t was recorded in this region. The increase in the north-west region accounted for 38.2%. South-west region contributed 2.3% (3,000t) of non-penaeid prawn production and registered a slight increase. The contributions of north-east and south-west regions were 800 t and 300 t respectively.

Cephalopods: The cephalopod landings accounted for 2.9% (64,000 t) of the total production during 1991. An increase of 8,000 t (13.6%) was recorded during the period compared to 1990. The production from south-west and north-west regions respectively were 24,000 t and 30,000 t. North-west region recorded an increase of 9,000 t. A reduction of 2,000 t was recorded in the south-west region. South-east region contributed 10,000 t to the total production which registered an increase of 1,000 t.

Mechanized and Non-mechanized landings: The landings by mechanized units accounted for 84% of the total exploited resources of the country. Units having power for fishing and propulsion (trawl & purse seine units) accounted for 50% of the catch and propulsion alone 34%. Non-mechanized units recorded 16% of the landings. Compared to 1990, landings of units by fishing and propulsion (Category I) contributed a slight increase of 1% and recorded 10,70,000 t in 1991. Landings of units with mechanized propulsion (Category II) was 7,17,000 t which recorded a reduction of 2% in the catches. However, landings of non-mechanized units (Category III) registered an increase of 1% and recorded 369,000 t.

Effort expended by different types of units showed an increase of 2% in Category I and an estimated 18,55,000 units operated during 1991. The effort put in by Category II units showed an 8% increase while a reduction of 4% was noticed in Category III type.

Table 4 gives the percentage contribution of different Categories (I, II & III) of units to the total marine production of the country during 1990 and 1991.

Table 4. Percentage contribution of different categories of units

Region	1990			1991		
	I	II	III	I	II	III
North East	29.5	44.4	26.1	24.2	51.9	23.9
South East	47.0	6.6	46.4	46.8	11.2	42.0
South West	48.8	45.8	5.4	53.8	39.7	6.5
North West	55.7	40.0	4.3	51.5	39.2	9.3

I - Category I - Mechanized units (Fishing & Propulsion)

II - Category II - Mechanized units (Propulsion only)

III - Category III - Non-mechanized units

From table 4 it is clear that contribution of mechanized units from the west coast records above 90% and on the east coast about 70%. The contribution from non-mechanized units was relatively high on both north-east and south-east regions.

Table 5. Percentage contribution of three types of units in the regionwise production

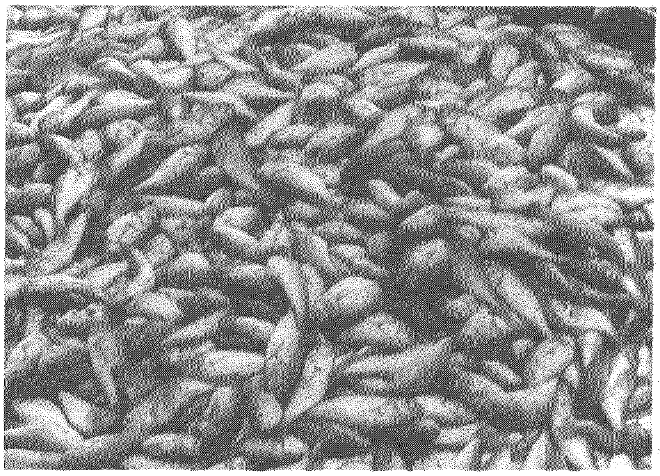
Region	1990			1991		
	I	II	III	I	II	III
North East	3.3	6.8	9.7	2.2	7.1	6.7
South East	19.8	3.9	65.7	21.4	7.6	58.6
South West	42.9	55.6	15.8	40.1	44.0	14.8
North West	34.0	33.7	8.8	36.3	41.3	19.9

I - Category I,II - Category II,III - Category III

BUMPER CATCH

Bumper catch of 'Karikkadi' prawns (*P. stylifera*) by shrimp trawlers at Fisheries Harbour, Cochin. An all time record catch of 12,245 t of prawns, mainly 'Karikkadi' was landed by the shrimp trawlers at this centre during the year.

Oil sardines landed by the pair trawlers at Rameswaram. During January-March 1992 the pair trawlers landed 6,800 t of oil sardine for the first time at this centre.



SOME UNDER-EXPLOITED RESOURCES

Fishes like threadfin breams (top), cat fishes (middle), mackerel (bottom), Indian bull's eye, blackruff, sharks, green eye, tunas and cephalopods have a potential of 1.4 million t in the 50-200/300m depth zone of the Indian EEZ and are under-exploited.

Table 5 shows the percentage contribution of four regions in the production of fishes by different Categories. South-west region contributed a maximum of 40.1% of the total production by trawlers and purse seiners (Category I) and also 44% of catches by propulsion units (Category II). The wide spread use of out-board units in the south-west region is primarily responsible for the increased production in this region under Category II. However, south-east coast still contributes maximum (58.1%) of the total non-mechanized production.

Table 6. Catch, effort and CPUE in 1990 and 1991

Region		1990			1991		
		A	B	C	A	B	C
North East	I	33828	102	331	23656	85	279
	II	50902	150	339	50821	151	337
	III	29826	638	47	23421	513	45
South East	I	205260	548	374	228822	594	385
	II	28904	452	64	54673	730	75
	III	202863	5469	37	205625	4845	42
South West	I	442917	851	521	428598	901	475
	II	415854	1297	321	315999	1137	278
	III	48958	1277	38	51839	1467	35
North West	I	351222	320	1099	388634	319	1219
	II	252023	913	276	295992	1022	290
	III	27066	368	73	69972	592	118

A: Catch in tonnes,

B: Effort ('000 operation),

C: CPUE (kg), I: Category I, II: Category II, III: Category III

CPUE under Category I indicated that only in the north-west there was improvement in the availability of fishes, whereas increase noticed in the south-east region under this category was marginal.

CPUE under Category II indicated that in the south-east region there was increase. The increased use of out-board units was primarily responsible for this enhancement of CPUE. Marginal increase in CPUE of units in category III was noticed in the north-west region.

PELAGIC FISHERIES DIVISION

Four gearwise research projects were carried out in the Pelagic Fisheries Division. They involved monitoring the landing s, species composition of the major groups caught, biology and population characteristics of the dominant species in gillnet (45 mm mesh and above), in dolnet, in purse seine and in pole and line.

Investigations on gillnet fisheries (PF/IP/1)

Investigations on the gillnet fishery resources were carried out at 9 research centres. Gill nets were operated almost throughout the year along the east and west coasts. The main fishery season varied in the different centres. The Saurashtra region continued to be the best region for gillnet fishing for the entire coast of India. Here, the traditional crafts with IBM and OBM are being replaced by FRP canoes of the same size of the traditional crafts. Among the four landing centres covered for study, Veraval accounted for 51.9% of the gillnet landings of this region followed by Mangrol 20%, Danleg 16.5% and Madhwad 11.6%. At Veraval, the effort input has gone up by 60% resulting in a two fold increase in the catch. More and more units were employing gillnets *(Jada Jaal)* of mesh size 140-280 mm. Further the extension of the operational range upto 35-75 m has resulted in drastic changes in the landing pattern. At Mangalore, the mesh size of the gillnets ranged from 80-135 mm and were operated in the 28-60 m depth zone. At Calicut and Cochin, gillnets with mesh size 110-130 mm and 70-130 mm respectively were used. At the former centre gillnets with mesh size 50-55 mm were losing importance due to poor mackerel catches. At Vizhinjam, gillnets were operated from motorised and non-motorised crafts. The mesh size of *Paruvalai, Podivalai* and bottom set gillnets at Tuticorin varied from 115-170 mm, 60-100 mm and 250-550 mm respectively.

The annual catch, catch rate (in parenthesis) and main fishery seasons at different centres were as follows: Veraval 12,804 t(265 kg), September-December and February-April; Mangalore 585 t (121 kg); Malpe 159 t (68 kg); Calicut 472 t(59 kg), May and August-January, Cochin 962 t (144 kg) July-September and Vizhinjam 2,432 t. At Tuticorin the *Paruvalai, Podivalai* and bottom set gillnets yielded 1,042 t (C/E 151 kg); 349 t (C/E 44 kg) and 318 t (C/E 121 kg) respectively. At Mandapam a threefold increase in the catch and twofold increase in the catch rate (105 kg) were recorded. At Madras the gillnets landed 469 t (C/E 335 kg) and the season was from January to July. At Visakhapatnam the fishery season was from September-October, December and February.

Seer fishes accounted for 8-11% of the gill net catches at centres on the Saurashtra coast, 54% at Mangalore, 65% at Malpe, 44% at Calicut, 11.7% at Cochin, 6% at Vizhinjam, 7% at Tuticorin, 52% at Madras and 18% at Visakhapatnam. Veraval recorded the highest landing of 1,400 t (C/E 28.9 kg), the fishery season being October-May. The catch, catch rates and the seasons were: Mangalore 315 t, (65.3 kg); Malpe 103 t, (44.3 kg); Calicut 207 t,(25.9 kg) May and August-January; Cochin 112 t,(16.8 kg), July-September; Vizhinjam 129.8 t; Tuticorin 73 t; Madras 243 t, (174.2 kg), January-July and Visakhapatnam 12 t, (1.2kg), September-October, December and February. At Veraval, *Scomberomorus guttatus* (53%) was the dominant species. Along the rest of the Indian coast, *S. commerson* followed by *S. guttatus* and stray specimens of *S. lineolatus* and *Acanthocybium solandri* formed the seer fish catch. *S. guttatus* of 12-82 cm and *S. commerson* of 28-138 cm in length were encountered in Veraval. At Mangalore, *S. commerson* of the size 40-125 cm with modes at 45,70 and 80 cm and *S. guttatus* 30-50 cm with mode at 45 cm were observed. At Calicut, the size of the King seer ranged from 40-110 cm with modes at 50-88 cm; Cochin 50-110 cm with modes at 60-85 cm; Mandapam 20-105 cm with modes at 30 and 95 cm; Pamban (Gulf of Mannar) 55-110 cm with modes at 65 and 90 cm; Palk Bay 15-45 cm and Madras 35-115 cm. Juveniles of this species (15-45 cm) were exploited at Mandapam and Pamban during June-September.

Tunas, though occurred along both the coasts of India, has emerged as a promising resource on the N.W. coast in recent years. The annual landings, percentage composition, catch rates and fishery season were as follows: Veraval 3,585 t, 5-28%, 8-70 kg, September-December and February-April; Mangalore 152 t, 26%, 82.9 kg, September-October; Malpe 11t, 7%, 4.8 kg, September-October; Calicut 184 t, 39%, 23 kg, May and August-January; Cochin 515 t, 53.5%, 77 kg, July- September; Vizhinjam 1,126 t, 52%, 46.9 kg, July-August; Tuticorin 416 t, 40%, 60.3 kg and Madras 112 t, 24%, 80.4 kg, January-July. Along the Veraval coast the tuna catch was mainly composed of *Thunnus tonggol* (57%) followed by *T. albacares, Euthynnus affinis* and *Auxis thazard.* Further south upto Vizhinjam *E. affinis* was the dominant species contributing to 35-79% of the tuna catch, followed by *A. thazard, Sarda orientalis* and *T. tonggol.* At Vizhinjam, in the non-motorised units and at Tuticorin, *A. thazard* dominated the catch. At Mandapam and Madras 99% of the tuna catch was constituted by *E. affinis.* There was a general increase in size of *T. tonggol* from north of Mangalore to Saurashtra region. At Veraval, the length range recorded were: *T. tonggol* 30-94 cm, *T. albacares* 54-148 cm, *E. affinis* 12-78 cm, *A. thazard* 20-48 cm and *K. pelamis* 51-73 cm. *E. affinis* occurred in the length range 28-68 cm with modes at 42 and 54 cm at Calicut; 36-58 cm with modes at 44-50 cm at Cochin; 20-56 cm at Vizhinjam and 24-60 cm at Madras. *A. thazard* of the size range 18-42 cm were exploited at Vizhinjam. At Tuticorin, the exploitation rate of *E. affinis* by *Paruvalai* indicated that both the sexes of this species were not exposed to any intense fishing pressure, whereas both sexes of *A. thazard* were exposed to over exploitation. A reduction in the effort input from the present level or an increase in the mesh size of *Paruvalai* has been recommended.

Mackerel *(Rastrelliger kanagurta)* catch by the gill nets were less than 1% at Mangalore and Calicut. At Cochin, the resource formed 5.7% (54.8 t, C/E 8.2 kg) and at Vizhinjam 17% (368 t). The main fishery season was during the monsoon months at both the centres. At Mandapam, bumper catch of 1,010 t of mackerel at a C/E of 64.5 kg was recorded forming 61.6% of the gillnet catch. The season was during September, November and February. At Visakhapatnam, mackerel formed 24.8 t at a C/E of 2.5 kg. The catch showed declining trends at Cochin and at Visakhapatnam. The size ranged from 115-290 mm at Vizhinjam, 170-270 mm with mode at 220 mm at Mandapam and 120-255 mm with mode at 220 mm at Visakhapatnam. Fish in the advanced stages of maturity was encountered mainly during February, April and August at Visakhapatnam though the spawning activity seemed to take place throughout the year. Sex ratio was equal. Juveniles of *R. faughni* were encountered in May and those with advanced stages of maturity during March.

Elasmobranchs dominated by sharks contributed to the gillnet landings all along the coast. At Veraval, *Carcharinus melanopterus* (42%), *Scoliodon laticaudus* (27%), *Rhizoprionodon acutus* and *Sphyrna lewini* constituted the catch. *S. laticaudus* was estimated to attain 317, 453, 548, 614 and 660 mm at the end of 1-5 years respectively. The steadiness in the catch rates of this group despite increase in fishing effort indicated scope for further exploitation. The value and demand for shark fins have increased tremendously during the past three years. In the Malpe-Mangalore region, elasmobranchs constituted 8% forming 59.5 t (C/E 8.3 kg). *C. limbatus* (49%), *S. lewini* (18%), *S. laticaudus* (12%), *C. macloti* (11%), *R. acutes* (8%) and others formed the fishery. The length range and the modal sizes for the first three species were 56-105 cm (modes 77 and 85 cm), 46-108 cm (modes 51 and 91 cm) and 36-76 cm (modes 53-59 cm) respectively. At Calicut, the resource contributed to 9% (42.5 t, C/E 5.3 kg) and the species supported were *C. melanopterus* (43%), *R. acutus* (19%), *S. lewini* (15%), *S. laticaudus* (11%) and others. The main species which constituted the fishery at Cochin were *R. acutus* (43%) and *R. oligolynx* (11%) and together they formed 12% (115 t, C/E 17.3 kg) in the gillnets. There has been an increase in the landings of elasmobranchs at Tuticorin (9%, 93.8 t and C/E 13.6 kg). The species recorded were *Loxodon macrorhinus* and *C. sorrah* among sharks and *Dasyatis bleekeri, D. uarnak* and *Amphotistius kuhli* among rays. At Mandapam, the resource constituted 10% at a C/E of 33 kg. Sharks formed 84% out of which *S. palasorrah* was the dominant species. The size ranged from 10-109 cm. At Madras, the catch, percentage and C/E were 46.9 kg, 10% and 33.5 kg respectively.

Carangids were mainly observed at Mangalore and Cochin forming 1% (9.6 t) and 4.3% (41.4 t)respectively. The fishery was a failure at Vizhinjam, as last year, 334 t (C/E 8 kg) of carangids were realised by the motorised crafts and 56 t (C/E 5.5 kg) by non-motorised crafts. At Cochin, carangids were mainly represented by *Alepes djedaba* (45%), *Megalaspis cordyla* (16%), *A. para* (17%) and others. The first two species occurred in the size range of 180-310 mm with dominant size at 191-270 mm and 211-340 mm with dominant size at 271-330 mm respectively. At Mangalore, carangid catches were significant only around September. *Chorinemus* spp. (30%) and *M. cordyla* (27%) were dominant species.

Catfishes formed a fishery only at Mangalore and Cochin. They constituted 4% (23.4 t, C/E 4.8 kg) at Mangalore and 6.9% (66.4 t, C/E 9.9 kg) at Cochin. Prior to 1986, catfishes contributed to a sizeable proportion in the gillnet catches at Mangalore and *Tachysurus tenuispinis* used to account for the bulk of the landings. But in recent years which were marked by poor catfish landings, *T. serratus* began to dominate. The species that contributed to the fishery were *T. serratus* (77.8%), *T. thalassinus* (18.5%) and *T. tenuispinis* (3.7%) at Mangalore and at Cochin their contributions amounted to 58%, 34% and 7% respectively. *T. serratus* ranged in length of 460-1090 mm and *T. thalassinus* 320-859 mm at Mangalore. At Cochin, *T. serratus, T. thalassinus* and *T. tenuispinis* had length ranging from 740-1100 mm; 240-840 mm; 360-500 m with modes at 840-1080 mm, 520-760 m and 460 mm respectively. During July-September, females of the first two species dominated the catches. Ripe females of both these species were abundant during August-October.

Pomfrets were mainly exploited at Veraval and towards south the catch was poor except at Cochin. *Pampus argenteus* continued to be an important item for export market. It accounted for 10-17% of the gill net catch (C/E 6-30 kg) at Veraval. The main fishery season was April-June and August-November. The length ranged from 100-290 mm and juveniles were caught throughout the year. June-September formed the breeding season. At Cochin, pomfrets contributed to 2.1% and 20.2 t (C/E 3.0 kg) of the gillnet catch. *Formio niger* of the size range 340-420 mm with modes at 360-390 mm was the dominant species.

Studies on the economics of operation of the drift gillnet units were carried out at Madras and Tuticorin. At the latter centre the gross annual income per unit was Rs. 1.03 lakhs realised from a catch of 11.5 t. The operational cost was Rs. 64,856 and the net operating income being Rs. 38,592. At Madras, the gillnet units were resorting to both one day and two days fishing trips. An income of Rs. 3.94 lakhs per year for one day fishing and Rs. 2.74 lakhs per year for two days fishing units were realised. The average operating cost was around Rs. 2.33 lakhs and Rs. 1.73 lakhs for these units respectively.

Investigations on dolnet fisheries (PF/IP/2)

Investigations were carried out on Bombay duck, *Coilia*, pomfret and non-penaeid prawn resources with particular reference to the composition of young fish in dolnet catches in the Saurashtra and Maharashtra region.

In Saurashtra, the estimated dolnet catch was 49518 t at a C/E of 163.9 kg/haul. Bombay duck formed 30513 t (61.6%,C/E 100.9 kg). The juveniles amounted to 282 t. At Bassein in Maharashtra, Bombay duck landings by dolnet was 1302 t (36.8%) at a C/E of 330 kg/unit. Low catch rate was observed in July-August and April.

An estimated 5708 t (C/E 18.8 kg) of *Coilia dussumieri* was realised by the dolnets in Saurashtra. The resource formed 11.5% of the dolnet catch. In Maharashtra 647 t (C/E 164 kg) of this resource was exploited by dolnets. In the Saurashtra and Maharashtra regions pomfrets formed 0.7% and 8.7% respectively, the catch being 338 t (C/E 1.1 kg) and 307 t.

The non-penaeid prawn catch in Saurashtra dropped from 3641 t in 1989-90 to 1892 t in 1991-92, mainly due to the drastic decline in the *Acetes* spp. in the dolnet catches. The catch of this resource declined from 3238 t in 1989-90 to 1515 t in 1991-92.

At New Ferry Wharf in Bombay, crustaceans formed 69.3% of the catch. The average catch rate was 68.9 kg/boat trip. The catch and catch rate of crustaceans increased by 32.7% and 5.6% respectively despite an increase (40.2%) in effort. The season for the fishery was from July-September with maximum landings in August when the highest catch rate of 237.9 kg/unit was recorded. The catch and catch rate (27.1 kg/unit) were lowest in January.

Dolnet fishery at Sassoon Dock was on a reduced scale. Monsoon conditions during July-September hampered fishing to some extent. Non-penaeid prawns were represented by *Acetes* spp. *(A. indicus, A. johni* and *A. japonicus). A. japonicus* was least abundant. Other non-penaeids were *Nematopalaemon tenuipes, Exhippolysmata ensirostris, Expalaemon styliferus* and *Leptochela aculeocaudata. E. styliferus* was present only during monsoon and *L. aculeocaudata* though constantly present, occurred in small percentage. The contribution by non-penaeid prawns in general amounted to 50% and that of *Acetes* spp. to non-penaeids was 80%.

Investigations on the purse seine fishery and its impact on resources (PF/IP/3)

Investigations on the purse seine fishery were carried out at Karwar, Mangalore (Bunder and Malpe) and Cochin.

A total of 35,257 t at a C/E of 1.3 t were landed by the purse seiners. Maximum catch was at Malpe (15,504 t) followed by Mangalore (14,214 t), Cochin (3,060 t) and Karwar (2,479 t). Highest catch rate was at Cochin (1.80 t), Malpe (1.75 t), Karwar (1.15 t) and Mangalore-Bunder (1.06 t). The overall catch decreased by 16.7% though the effort input has gone up by 7.8%. The catch decreased by 18.3% at Malpe, 15.7% at Mangalore and 29.6% at Karwar. Fishing operations were suspended during monsoon. The catch, effort, C/E and other details are given in Tables 1&2.

Fishing was carried out at two depths (11-20 m) and (21-40 m) at Mangalore (Bunder) and Malpe. At the former centre 80.7% of fishing was done in 11-20 m depth zone, whereas at Malpe 53.8% of the operations were in the deeper zone. Fishing was mainly in the 21-40 m zone at Karwar and Cochin.

Mackerel, *R. kanagurta* constituted 17 to 40% of purse seine catch at various centres. *Sardinella longiceps* comprising 61-74% dominated the sardine catch. *S. gibbosa* formed 15.7%, 9.2%,10.3% and 26.6% at Karwar, Mangalore, Malpe and Cochin respectively. *S. fimbriata* constituted 8.2% at Mangalore and 6.7% at Karwar. *S. dayi* occurred only at Karwar (22.4%), *S. brachysoma* at Mangalore (9.1%) and Malpe (14.8%). Tunas contributed 0.5-1.8% at various centres. *E. affinis* was the dominant species at Karwar (100%), Mangalore (76%), Malpe (96.1%) and Cochin (74.7%). *A. thazard* occurred in Mangalore, Malpe and Cochin. Catfishes were represented by *Tachysurus thalassinus* (53%) and *T. serratus* (47%) at Malpe. At Mangalore *T. thalassinus* constituted the fishery. The carangids formed 4.4-36.6% at various centres. *Decapterus resselli* contributed 54.9% at Mangalore and 64.5% at Malpe. *Alepes kalla* formed 15-18%. Whitebaits were observed at all centres and *Stolephorus devisi* formed 66-97%, except at Karwar. *S. bataviensis* was noticed at Mangalore (6.5%) and Cochin (32%). *S. macrops* occurred only at Cochin.

S. longiceps of the size range 84-204 mm (modes at 65, 105,110,135 180 mm) and 130-195 mm (mode 160 mm) were recorded at Mangalore and Cochin respectively. *S. gibbosa* occurred in the size range of 151-173 mm at Karwar, 75-180 mm at Mangalore and 110-140 mm at Cochin. The size range of mackerel recorded were 75-274 mm at Karwar, 55-275 mm at Mangalore and 185-285 mm at Cochin. *E. affinis* of the size range 300-415 mm, 240-680 mm and 380-520 mm were recorded at Karwar, Mangalore and Cochin respectively. The size range of *A. kalla* varied from 40-160 mm and that of *D. russelli* 60-215 mm at Mangalore. At the same centre *S. devisi* occurred in the length of 50-100 mm and at Cochin 70-95 mm.

In the oil sardines, males dominated at Karwar and females at Mangalore and Cochin. Fishes with gravid gonads amounted to 3.2% at Karwar, 6.5% at Mangalore and 21.4% at Cochin. *S. gibbosa* was in spent condition and comprised the entire adult catch at Karwar. Males were predominant in *S. dayi* at Karwar and in *S. fimbriata* at Mangalore. Mackerel catch was dominated by males at Karwar, Mangalore and Cochin. At Cochin, gravid fishes were observed during March and spent fishes during April and September. Fishes with gravid and spent gonads contributed to the fishery at Mangalore and Cochin, whereas at Karwar the adult catch consisted mainly of spent fishes. Among carangids males were dominant in *A. kalla* and females in *D. russelli.* Both gravid and spent fishes were encountered. Among whitebaits males were dominant at Mangalore and Cochin in species *S. devisi, S. bataviensis* and *S. macrops.*

The economics of operation for a purse seine unit was worked out at Cochin, Malpe, Karwar and Goa. At Cochin, for a purse seine unit, the average catch per day was 1.8 t, gross revenue Rs. 9200, operating cost Rs.4300, fixed cost Rs. 2100 and the average income Rs. 1800. At Malpe, the catch per day was 1.9 t, gross revenue Rs.7220, fixed cost Rs.2300, operating cost Rs.4230 and the net profit Rs.690. At Karwar, the catch per unit per day operation was 1.8 t, gross revenue Rs.4590, operating cost Rs.2560 and fixed cost Rs.2030 which resulted in no fishing surplus. However, the studies indicated that at this level the existing purse seine units can continue their operation without any loss. At Goa, the average catch of one tonne per day was only half of the quantity realised by purse seines at Cochin and Karnataka. The average gross revenue per unit was Rs.3800, operating cost Rs.2200 and the balance Rs.1600 was just sufficient to meet the fixed cost which indicated that the present level of exploitation by the purse seines had reached the optimum.

Though the purse seine units showed a grim picture at Karwar, the overall condition in Karnataka appeared to be bright. The state's investment on purse seine units amounted to Rs.28 crores and the gross income was Rs.29 crores during 1991. Out of these Rs.8 crores has been spent on fuel and the balance of Rs.21 crores was added to the income of the society indicating the recovery of the total investment in about 18 months in the form of income to the society.

Investigations on tuna fisheries and related aspects in Lakshadweep (PF/IP/4)

Investigations on tuna fisheries were carried out at Minicoy in Lakshadweep. An estimated 497 t of tuna was landed. The pole and line accounted for 97% of the catch and troll lines the rest at a C/E of 184 kg and 21 kg respectively. There has been a decline in the catch and effort employed for pole and line from 1124 t and 3915 units in 1989-90 through 782 t and 2522 units in 1990-91 to 483 t and 2626 units in 1991-92. This was on account of the scarcity of both tuna as well as live-bait in the respective fishing grounds. The main tuna fishery season also shifted from November-January (peak in December) during 1989-90 season, to October-November in 1990-91 and to only in January during 1991-92.

Katsuwonus pelamis (87%) was the dominant tuna caught by pole and line followed by *Thunnus albacares* (13%) and others. The composition of the latter was higher (44%) in troll line catches though *K. pelamis* continued to be the dominant species (56%) of tunas caught. *K. pelamis* of 20-68 cm length was caught, the dominant size being 48-61 cm. This species has been estimated to grow to 47 cm, 59 cm and 62 cm by the end of 1 to 3 years of age. During 1990-91, fish of the size group 60-63 cm (3rd year group) dominated the catch while during 1991-92 size group 48-51 cm (2nd year) dominated. However, there is no indication of any appreciable decrease in the abundance of fish as they grew from 48 cm to 62 cm. This would indicate the negligible fishing mortality inflicted on the stock and scope for increasing the exploitation rate on this species around the island. The high fluctuations in the availability of bait fish, particularly of the migrant caesionids, in the lagoon imposes limitations on the expansion of the traditional pole and line fishing for tuna in the island. Therefore, diversification of fishing methods, particularly introduction of night drift gill netting should receive serious consideration.

Table 1. Purse seine catch trends at different centres in comparison with those of the previous year (in units and tonnes)

Centre	Effort	Catch 1991-92	C/E	Effort	Catch 1990-91	C/E	Effort	Catch difference	C/E
Karwar	2150	2479	1.15	2858	3522	1.23	(-)708	(-)1043	(-)0.08
Malpe	8871	15504	1.75	7297	18980	2.60	(+)1574	(-)3476	(-)0.85
Mangalore	13436	14214	1.06	12795	16856	1.32	(+)641	(-)2642	(-)0.26
Cochin	1678	3060	1.82	1299	3052	2.35	(+)379	(+) 8	(-)0.53
Total	**26135**	**35257**	**1.35**	**24249**	**42410**	**1.75**	**(+)1886**	**(-)7153**	**(-)0.40**

Table 2. Catch (tonnes) of major resources landed by the purse seiners at different centres

Centres	*Sardinella*	Mackerel	Anchovies	Carangids	Tunas	Pomfrets	Catfishes	Prawns	Others	Total
Karwar	678	493	27	907	14	31	-	80	248	2478
Malpe	3639	6232	756	4133	249	95	12	23	365	15504
Mangalore	2898	2349	4818	3149	250	202	18	64	466	14214
Cochin	1491	1224	62	136	37	11	9	54	36	3060
Total	**8706**	**10298**	**5663**	**8325**	**550**	**339**	**39**	**221**	**1115**	**35256**
%	24.6	29.2	16.1	23.6	1.6	1.0	0.1	0.6	3.2	
Total 1990-91	**13905**	**13705**	**3519**	**7432**	**319**	**30**	**223**	-	**3277**	**42410**
%	32.8	32.3	8.3	17.5	0.8	0.1	0.5	-	7.7	

DEMERSAL FISHERIES DIVISION

Investigations on the resources exploited by small mechanised trawlers, 14 m & below (DF/IP/1)

The trawl landings amounted to 9.2 lakh t contributing 40% of the all India marine fish producttion during 1991. The catch increased by 0.5 lakh tonnes compared to last year. The contributions from east coast was 2.64 lakh t and west coast 6.54 lakh t (last year 2.39 and 6.32 lakh tonnes).

On the east coast silver bellies (34,320 t, 13%) followed by penaeid prawns and croakers (26,400 t, 10% each) perches (21,120 t, 8%), goat fishes and elasmobranchs(10,560 t, 4% each), ribbonfishes, carangids, cephalopods, crabs and lizard fishes (7,920 t, 3% each) contributed to the fishery. Penaeid prawns contributed to the maximum (117,720 t, 18%) on the west coast followed by stomatopods (58,860 t, 9%), croakers and threadfin breams (52,320 t, 8% each), cephalopods and non-penaeid prawns (45,780 t, 7% each), ribbon fishes (32,240 t, 6%), carangids (26,160 t, 4%), goat fishes and lizard fishes (19,620 t, 3% each) and elasmobranchs and crabs (13,080 t, 2% each).

Veraval: An estimated 67,300 units landed 97,000 t, (C/E 1500 kg) as against 69,000 units and 90,000 t in the previous year. Crustaceans constituted 50% (48,500 t) of the landings. Non-penaeids formed 35% of crustacean landings. The catch of prawns increased by 92%. *Parapenaeopsis stylifera* (44%), *Solenocera crassicornis* (22%), *P.hardwickii* (15%) and *Metapenaeopsis stridulans* constituted the fishery. *S. crassicornis* and *M. stridulans* are low deep water prawns. *Acetes* spp. dominated (99.9%) the non-penaied catch followed by *Exhyppolysmata ensirostris* and *Nematopalaemon tenuipes*. Among fishes mainly ribbon fishes (12%), croakers (11%), clupeids (6%), cephalopods (3%), perches (2%) and elasmobranchs (2%) contributed to the total landings. There was no trawling during June-August. Biological studies revealed that *Scoliodon laticaudus* (34.2%) and *Carcharinus melanoptera* (17%) dominated among sharks. The former had a size range of 22-60 cm. *Acetes* spp. was the main food item and sex ratio was equal.

Bombay: The trawl landing was 62,000 t, each at New Ferry Wharf (C/E 2.1 t) and Sasson Docks (C/E 2.7 t). The catch, C/E and effort increased by 42%, 14% and 24% respectively at the former centre. At Sasson Docks though the effort input decreased by 8%, increase in catch (58%) and C/E (53%) were noticed.

Penaeid prawns (17,000 t) dominated the catch at Ferry Wharf, followed by cephalopods (7700 t), sciaenids (5400 t), ribbon fishes (5300 t), catfishes (2800 t), nemipterids (2200 t), sharks (2000 t), other perches (1500 t) and lizardfishes and eels (4000 t each). Increase in catch observed with respect to the resources compared to last year were as follows: prawns 4000 t, cephalopods 800 t, ribbonfishes 2000 t, catfishes 1100 t, nemipterids 850 t, other perches 1000 t, lizardfishes 400 t and eels 600 t.

At Sassoon Docks, landings of cephalopods almost doubled and that of perches increased by 1000 t. Increase in catch of penaeid prawns (150 t) was marginal. Landings during monsoon (June-August) was 2900 t as against 1100 t in the previous year. Good showers, short duration of monsoon are supposed to have contributed to the better landings. Among rays, males were dominant in *Himantura zugui, H. bleekeri, H. walga* and females in *H. urnak, H. imbricata* and *Gymnura micrura.* Gravid females of *Trichiurus lepturus* were recorded in April-June. Fecundity varied from 4,955 to 61,935 eggs. In catfish, *Osteogeniosus militaris* females dominated and majority (70%) were in the resting stage.

Karwar: A total of 2800 t were landed by 1200 units and stomatopods forming 800 t (28%) followed by prawns 760 t, soles 670 t sciaenids 110 t, cephalopods and ribbonfishes 70 t each, constituted the catch. No catfishes were recorded during the year.

Mangalore: Trawl landings amounted to 29,000 t (C/E 34 kg/hr) in Mangalore Malpe region registering 7.4% increase over the previous year. As in Karwar, stomatopods (20%) dominated the catch followed by prawns and flat fishes (11% each), threadfin breams and cephalopods (7% each), carangids (4%) and lizardfishes (3%). The landings of prawns, crabs, *Nemipterus* spp. and anchovies increased by 1200 t, 140 t, 50 t and 90 t respectively. Decline in the catch of mackerel (260 t), cephalopods (20 t) and carangids (650 t) were noticed.

Among sharks, the size range of *R. acutes* and *S. laticaudus* were 50-98 cm and 36-76cm respectively. Peak spawning in *N. japonicus* was during November-December at Mangalore and December-January at Malpe.

Calicut: The estimated catch was 7500 t (C/E 270 kg) as against 2800 t (C/E 175 kg) in the previous year. No trawling was conducted from Puthiappa during the monsoon. The malabar sole, *Cynoglossus macrostomus* 1800 t (24%), carangids 510 t (6.8%) and *N. japonicus* 340 t (4.5%) contributed the fishery.

Among catfishes, the size range recorded were, *Tachysurus thalassinus* 68- 90 cm and *T.serratus* 84-98 cm. Females dominated and majority were in the developing stage (III-IV).

Cochin: The trawlers landed 23,500 t (C/E 400 kg) registering a decline in the catch by 4100 t and C/E by 60 kg compared to previous year. Landings increased with respect to threadfin breams, lizardfishes, sciaenids, elasmobranchs, whitebaits, barracudas, catfishes, prawns and cephalopods whereas the catch of flatfishes and carangids decreased. A remarkable increase mainly contributed by *P. stylifera*, resulted in an all time record catch of 12,245 t of prawns in the Cochin Fisheries Harbour as against the previous highest catch, of 8,854 t in 1988-89 by trawlers. There was a ban on monsoon trawling for 25 days from 15 July to 8 August '91.

An estimated 14,000 t of prawns were landed at Sakthikulangara as against 8800 t last year. *P. stylifera* and *M. dobsoni* were responsible for this increase. At Cochin and at Sakthikulangara *P. stylifera* occured in the size range of 36-120 mm with 71-95 mm and 71-85 mm forming the mainstay of the fisheries respectively. Spawning season was from May and December-March at Cochin and April-May and November-March at Sakthikulangara. *M. dobsoni* had a size range of 36-120 mm (mode 71-95 mm) at Cochin. Spawners were abundant during April, November-January and March.

Mandapam: The trawl landings at Rameswaram, Mandapam and Pamban were 13,400 t (C/E 275 kg), 5400 t (C/E 112 kg) and 4000 t (C/E 275 kg) respectively. The catch increased by 13.6% at Rameswaram irrespective of 5.4% decline in effort input. At Pamban the catch declined (4.8%) inspite of additional (59%) effort input. The catch and effort increased by 14.8% and 8.3% at Mandapam.

The oil sardine, emerged as a major fishery by pair trawlers at Rameswaram and Pamban during January to March. Bumper catch of catfish were also noted. A total of 6800 t (71%) of oil sardine and 365 t (4%) of catfishes were landed. Silverbellies (4300 t), penaeid prawns (2500 t), crabs (740 t) and elasmobranchs (560 t) were the other resources exploited. At Mandapam silver bellies (800 t), penaeid prawns (700 t), elasmobranchs (350 t), crabs (250 t), flatfishes (145 t) and sciaenids (135 t) constituted the fishery. At Pamban penaeid prawns (260 t) and silver bellies (2100 t) formed the fishery.

Oil sardine occured in the length range of 105-191 mm in the shrimp trawlers and 123-194 mm in the pair trawlers. Females and males dominated during January and February respectively and all specimens were in resting stage.

Visakhapatnam: The trawl landings at this centre was 5500 t which showed a decline of 570 t compared to previous year. Goatfishes (14%), penaeid prawns (9%), stomatpods (7%), sciaenids (6%), silverbellies, nemipterids and lizardfishes (5% each) contributed the fishery. The landings of sciaenids increased by 115 t whereas the catch declined by 40 t and 240 t with respect to threadfin breams and lizardfishes respectively.

Studies on the economics of operation of the small mechanised trawlers (14 m and below) were carried out at Goa, Cochin, Kakinada and Visakhapatnam. At Cochin, a sum of Rs.4 lakhs was invested on a trawler (30') which realised an annual income of Rs.7.05 lakhs. Of this about Rs.4.64 lakhs accounted for the operational cost and Rs. 1.47 lakhs towards fixed cost leaving a fishing surplus of around Rs. 93,000. The depreciation, interest on capital and insurance amounted to 37%, 40% and 13% respectively. The pay back period worked out to 2.41 years and the rate of return to capital was in the order of 39%. The study revealed that the trawler operation at Cochin Fisheries Harbour is still a profitable venture.

Results of the exploratory survey of the Indian EEZ by FORV *Sagar Sampada* (DF/IP/4)

Analyses of the results of 19 cruises (Nos. 78-96) were undertaken to study the distribution, abundance, species composition and biology of conventional and non-conventional finfishes, crustaceans and molluscs in the EEZ of India. Cruise Nos. 78,80,82 and 86 were in the seas around Lakshadweep. Special cruise (No. 87) was made to study the effect of oilslick and Cruise Nos. 88 to 93 were made to collect oceanographic data. Bottom trawling (Cruise Nos. 79, 81, 83, 84 and 85) in the depth range 51-100 m between Lat. $6^{0}30'$ - $15^{0}00'$ N and long. $70^{0}00'$ - $79^{0}00'$E have indicated good fishing grounds (catch rate upto 2 t/hr), off the south west coast during October '91. The major constituent was threadfin breams and *N.mesoprion* of the length range 13-23 cm dominated the catch. They were in partially spent stage. The Bull's eye, *Priacanthus* spp. showed a catch rate upto 1.5 t/hr from Sub-area 12-74/3E (Cruise Nos. 81, 83, 84 and 85).

Out of 35 hauls in the south west region only two yielded small quantities of prawns mainly *Metapenaeus monoceros* and *M. affinis* (depth 36 m) and *Solenocera choprai* (depth 96 m). Eleven IKMT samples from southwest and around Lakshadweep showed that the pelegic shrimp *Sergestes* spp. was found in offshore and oceanic regions whereas *Acetes* spp. occured in coastal waters.

The catch of cephalopods in the bottom trawling varied from 20-164 kg and mainly *Sepia pharaonis* (154-259 mm) formed 94% followed by *S. aculeata* and *Loligo duvauceli*.

Survey of the deep sea lobster (Cruise No.96) by bottom trawling during November-December in the depth zone 170-450 m (Lat. 8^0 - 13^0N) realised a total catch of 26 t, and mainly finfishes *(Epinnula, Chlorophthalmus)* 84%, crabs 8%, shrimps 7% and a negligible quantity of lobsters composed the catch. The shrimp catch (71-78 kg/hr) was higher from 151-300 m and lower (50 kg/hr) from 301-500 m depth zones. Important species were *Parapandalus spinipes* and *Metapenaeopsis coniger*. A total of 25.5 kg of lobster *Puerulus sewelli* (C/E 0.96 kg/hr) of the size range 5-20 cm was obtained from 201-300 m depth. Females were dominant and berried specimens formed 59%.

Studies on artificial reefs (DF/IP/5)

The project initiated during 1989-90 at Vizhinjam, Tuticorin and Minicoy was completed by this year. Used car tyres, granite stones, coconut tree pieces, bamboo poles and concrete modules were used for making reefs. At Vizhinjam, the reefs were built in the open sea (depth 30 m) by local artisanal fishermen, with the capital from certain voluntary organisations and with technical advice from CMFRI. The reefs at Minicoy were installed in a lagoon by CMFRI and Fisheries Dept., U.T. Lakshadweep. At Tuticorin, the reef was put up inside the breakwaters of the harbour. At Vizhinjam, fish aggregation in the reef was noticed during April-May and January-February. The congregation and species composition of fishes came down compared to the previous years. This was mainly due to the aging of reefs and also to the disturbance caused by fishing operations using light in the vicinity of the reefs.

At Tuticorin, the reef structures were observed to have visited by *Epinephelus* spp., *Lethrinus* spp. etc. At Minicoy, the reefs were mainly visited by *Lutianus kasmira*, *L.bengalensis*, *Abudefduf* spp.and *Dascyllus* spp. Stocks of *L. kasmira* appeared to have been staying in the reef throughout the year with new broods appearing. They were observed to feed on crustaceans, especially small crabs found in the reef. It is reported that reefs made of car tyres at 3 m depth can be used to aggregate such fishes for sport fishing by tourists.

Finfish seed production (DF/CUL/3)

From the natural wild state, fifteen live adults of seabass *Lates calcarifer* were collected from the Palk Bay and Gulf of Mannar and transported to the rearing tanks at Mandapam. The length-ranged from 47.5 cm (1 kg) to 93 cm (8 kg). Although oxygenation, exchange of the water and treatment by antibiotics were carried out during transportation, 13 specimens died within 1 to 134 days due to stresses caused by capture, transportation etc. Among three specimens collected from the culture ponds at Mandapam, only one (72 cm, 5.5 kg) survived. The specimens were fed with live food fishes such as *Chanos*, grey mullets, tilapia etc. Although five specimens were collected from Tuticorin during January (75-92 cm, weight 5-12 kg) and kept in floating cages for recovering from capture shock, all have died within 10 days. Culture of rotifer *Brachionus plicatilis* and microalga *Chlorella salina*, to be used as the food of the post larvae, have made good progress at Mandapam.

CRUSTACEAN FISHERIES DIVISION

Investigations on the artisanal fisheries (CF/IP/1)

The finfish and shellfish resources exploited by the various artisanal gears at the following centres along the Indian coasts were monitored for gear-wise catch composition, species distribution and biological parameters of dominant groups.

Karwar: The catch, C/E and percentage contribution of species landed by *Yendi* (shore seine) were: mackerel 1.3 t, 1,4 kg, 2.7%; oilsardine 1.1 t, 1.1 kg, 2.1%; lesser sardines 0.5 t, 0.5 kg 1% and tunas 0.2 t, 0.3%. Mackerel and oilsardine catch improved. Fishery season was from January to October. Mackerel occurred in the size range 130-270 mm and one year (90.6%) and 'O' year group supported the fishery. Oil sardine was supported by 65-191 mm group. Adults were in spent stage. *S.dayi* of the size range 130-158 mm constituted the lesser sardine catch. Tunas occurred in November and the sole constituent species was *E. affinis.*

Mangalore: Prawns in the inshore region was largely exploited by *Matabala* (minipurse seine) which yielded 88% of the prawn catch at Ullal, 99.9% at Panambur and 97% at Malpe. Other gears like *Kanthabala* (hand trawl) and *Kairampani* (shore seine) landed small quantities of prawns at Malpe. The entire catch was landed during the monson months. *Matabala* landed 0.3 t (C/E 3 kg) at Ullal, 229 t (127.3 kg) at Panambur and 54.2 t (51.2 kg) at Malpe. *P. indicus* and *M.dobsoni* respectively contributed 62.8% and 36.9% at Malpe and 5.2% and 94.8% at Panambur. Hand trawl and *Kairampani* were operated in the estuary at Bangare. The former, the most effective gear for juvenile prawn, landed 98% of the total prawn catch. Total prawn catch was 11.4 t against 5.7 t in the previous year. In the hand trawl *M. dobsoni* (89%) and *P. indicus* (11%) formed the catch. The size ranged from 33-53 mm and 58-98 mm respectively.

Calicut: Ring seines, driftnets and *Ayilachalavala* were the major gears. Stake nets were operated for exploiting juvenile prawns in Korapuzha estuary. The oil sardine and mackerel catch showed decline. The oilsardine catch amounted to 608 t (C/E 341 kg) against 3512 t (C/E 2.12 t) last year. Though *Chalavala* was operated in July and September the entire catch of oil sardine was obtained by ring seines. The length ranged from 73-193 mm (mode 130 mm). Indeterminates (49.3%) and immature fishes (49.3%) dominated the fishery. Estimated mackerel catch was 401 t against 1157 t last year. The species formed 98% (393 t, C/E 262.3 kg) in the ring seines and 1.9% in drift nets and 0.9% in *Ayilachalavala.* Maximum catch (217 t, C/E 171 kg) was during August and only immature fishes were caught. In the ring seine the size ranged from 155-265 mm with modes at 140, 245 mm in June, 140 mm in August and 170 mm in December.

Cochin: Ring seine was the major indigenous gear operated at Fort Cochin and mainly exploited mackerel, sardines, whitebaits, sciaenids and prawns. Mini trawls and gillnets were employed for prawns in the inshore region and stake nets in the backwaters. There was a decline in the landings of sardines and mackerel in the ring seines whereas the catch of prawns, sciaenids and whitebaits showed an increase. The extremely good 'Poovalan' (*M. dobsoni)* fishery in the 'chakara' (mud banks) at Ambalapuzha was exploited by the ring seinces. Mini trawlers registered a decline in prawn landings.

At Fort Cochin the ring seines landed 243 t (C/E 29.6 kg) against 530 t (C/E 9.5 kg) last year. Fishery season was in July-August and May. Mackerel of the size range 230-280 mm and 55-280 mm dominated the 1st and IInd quarters respectively. Pre-adults formed 58.5% followed by adults (35.5%) and gravid fishes 32.4%.

Sardine landings in ring seines declined by 85%, the estimated catch was 109 t (C/E 13.2 kg) *S. longiceps* constituted 99.6% followed by *S. gibbosa*. The season was during April, May amd March. Oil sardines occurred in the size range of 145-195 mm. Adults formed 38.1% and juveniles occurred in August. Males dominated. *S.gibbosa* was represented by adults of the size range 145-170 mm.

Whitebaits registered a five fold increase by landing 112 kg (C/E 13.6 kg) and were exploited mainly in July (96.2%) and August (3.8%). *Stolephorus macrops* (33.7%), *Encrasicholina devisi* (27.2%), *S. buccaneeri* (23.8%) and *S. bataviensis* (14.4%) constituted the fishery. The respective size range and modes were 50-70 mm (65 mm), 50-95 mm (60, 70 mm) 60-90 mm (75 mm) and 50-100 mm (55, 70 mm).

Ring seines landed 74.1 t (C/E 9 kg) of sciaenids rigstering 11% increasee over last year. The monsoon months were productive and 45.6 t were landed in August.

Dominant species and size range were: *Johnieops sina* 90-150 mm, *O.cuvieri* 140-230 mm and *O. ruber*.

The gillnets at Puthuvyppu landed 12.3 t (C/E 1.2 kg) of prawns, a 100% increase in catch and C/E over last year and the species contributed were *P. indicus* (98%) followed by *M. dobsoni* and *P. stylifera*. Monsoon months were productive and 83% of *P. indicus* was landed during the period. Premonsoon and postmonsoon was supported by smaller (81-120 mm) prawns and 130-150 mm occurred during the monsoon.

In the ring seines at Fort Cochin prawns occurred for a period of 10 days after the onset of S.W monsoon and the catch amounted to 105 t (C/E 61. 2 kg). A 100% increase over last year was recorded. 'Poovalan' (80%) of the size range 81-95 mm and 'Naran' 141-145 mm dominated the fishery. Females dominated. Spawners (32%) were noticed only in the former species.

A total of 1610 t (C/E 45.5 kg) of prawns were exploited by the ring seines during the mud bank ('chakara') season at Ambalapuzha and 'Poovalan' (80%) of the size range 81-90 mm dominated the catch among prawns. The catch increased by 1444 t (C/E 29.7 kg) compared to previous year. Highest catch (87.5%) was in June. Spawners constituted 40%. Except during monsoon the mini trawls were operated and yielded 18.9 t (C/E 2.1 kg), but registered a drastic decline of 308 t compared to last year. The season was from January to March when 84% of the catches were landed. *P. stylifera* and *M. dobsoni* occurred in equal quantities and mostly undersized prawns of 51-98 mm and 48-95 mm respectively were caught.

The stake nets mainly exploited juvenile prawns in Cochin backwaters. At Thevara, 69.2 t (C/E 4.2 kg) were landed in the last quarter. *M. dobsoni* 92.7%, *M. monoceros* 4.5% and *P. indicus* 2.3% of the size range 36-80 mm, 61-90 mm and 91-125 mm constituted the fishery.

Vizhinjam: The artisanal gears landed 4193 t and were contributed by hooks and lines (motorised) 57%, boat seines 21.5%, hooks and lines (non-motorised) 8.5%, *Kochuvala* 6.7%, *Chalavala* 2.8%, *Netholivala* 2.1%, shore seines 0.5% and *Kolachivala* 0.1%

Tunas amounted to 1203 t of which 99.9% was from hooks and lines. Motorised hooks and lines landed 88.7% of total tunas. *A. rochei* (66.7%), *E. affinis* (15.4%), *A. thazard* (9.9%) and *K. pelamis* (5.2%) formed the fishery. The same pattern of species composition was noticed in the non-mechanised hooks and lines. The occurrence of *K. pelamis* in good quantities in the former gear during December-March was significant. The size range was 16-32 cm for *A. rochei* and 22-72 cm for *E. affinis*.

Mackerel catch was 83.1 t of which hooks and lines motorised and non-motorised contributed 79.1% and 12.5% respectively, shore-seines 5.1% and boat seines 0.2%. A decline of 29.4 t was noticed. Mackerel occurred in the size range of 145-274 mm.

The whitebait catch increased by 111 t compared to previous year, the estimated catch being 297.5 t and were contributed by boat seines 67.2 %, *Netholivala* 30% and shore seines 2.3%. Fishery season was in May and August - November. The boat seines landed *Encrasicholina devisi* (47.1%,) *S. waitei* (25.6%) and *S. andhraensis* (13.7%). The former species dominated the catch in *Netholivala* and shore seines.

The artisanal gears landed 521 t of perches against 201 t during last year. Mechanised and non-mechanised hooks and lines contributed 81.3% and 13.7% respectively, and the rest of the catch came from seine nets and gillnets. Nemipterids (36.4%) lethrinids (30.6%) and serranids (19.7%) constituted the fishery. At Kadiapattinam 328 t of perches were landed mainly during April-May, August and February by the hand lines (56.3%) long lines (33%) and traps (9.2%). Lethrinids like *L. lentjan, L. microdon, L. crocineus* formed the fishery.

Motorised hooks and lines landed 226 t of cephalopods accounting for 73.7% of the total cephalopod catch. *Sepia pharaonis* (74%) and squids formed the catch.

Tuticorin: Bottom set gillnets, prawn gillnets and *Thallumadi* were the artisanal gears. *Thallumadi* and prawn gillnets mainly exploited prawns. The former gear landed 44.2 t (C/E 3.9 kg). *P. semisulcatus* (91.3%), *P. indicus* and *M. burkenroadi* constituted the fishery with peak landings during July, August and November-December. The size of the former ranged from 51-181 mm and majority of them were immature.

The prawn gillnets yielded 17 t of *P. indicus* mainly during June, July, September and November. Length ranged from 103-224 mm and mature females formed 61% in June and 41% in November.

Bottom set gillnets yielded 257 t of crabs (C/E 13 kg) registering a three fold increase over last year. *Portunus pelagicus* (99.6%) and *Scylla serrata* constituted the fishery. Good landings were in October, November and March. In the former species males 95-175 mm (mode 133 mm) and females 75-165 mm (mode 128 mm) represented the catch. Berried females formed 30.8% and 22.6% respectively in September and February. The lobsters mainly *Panulirus ornatus, P.homarus* and *P. versicolor* constituted 1.5 t at this centre.

Mandapam: The *Chooda vala* landed 280 t (C/E 28.5 kg) and 401 t (48.5 kg) of lesser sardines at Mandapam and Pamban respectively. The catch declined by 43% at the former centre. *S. albella* forming 70-72% dominated the catch followed by *S. gibbosa. S. albella* of the size range 65-160 mm and 85-150 mm formed the fishery at Mandapam and Pamban respectively. The latter species occurred in the size range of 90-155 mm.

The sole prawn constituent of *Thalluvalai* fishery was composed of juveniles of *P. semisulcatus.* The combined catch from Chinnapalam, Devipatanam and Vedalai was 22.5 t, the contribution from each centre being 7 t (C/E 0.2 kg), 10.2 t (0.5 kg) and 5.3 t (0.6 kg) respectively. Size range of males at the respective centres were 86-116 mm, 93-102 mm, 81-112 mm and females 92-113 mm, 79-110 mm and 89-119 mm.

Lobsters *P. ornatus* (80%) of the size range 228-265 mm and *P. homarus* 185-345 mm formed 1.3 t at Vedalai during April May.

Madras: Stake nets, cast nets and drag nets were employed for fishing juvenile prawns in Ennore estuary. The former gear landed 640 t (C/E 92.8 kg) against 118 t in the previous year. Fishery season was from October-March and *M. dobsoni* (31.3%), *M. monoceros* (25.4%), *P. indicus* (24.6%), *P. semisulcatus* (11.4%) and *P. monodon* (7.1%) supported the fishery. Cast nets and drag nets landed 1.9 t and 1.3 t respectively. *P. indicus* supported the cast net fishery while *M. monoceros* (41%) *P. indicus* (30.6%) and *M. dobsoni* (28.4%) formed the drag net catch.

Gillnets landed 3.5 t (C/E 1.1 kg) of lobsters at Kovalam against 3.6 t in the last year. Good catches were obtained in August and March. *P. homarus* (67.6%), *P. ornatus* (17.3%), *P. versicolor* (10.8%) and *P.homarus* occurred in the size range of 181-190 mm and females 121-380 mm. Berried ones occurred during July-August.

The *Edavala* operations landed 1281 t (C/E 474 kg) oil sardine of the size range 95-145 mm mainly during July-September. The catch declined to the tune of 319 t compared to previous year.

Visakhapatnam: Fish landings by artisanal gears amounted to 168t, a decline of 20t was noticed. Ribbon fishes in boat seines, lesser sardines in gillnets and whitebaits in shore seines dominated the catch.

Boat seines landed 6.9 t (C/E 2.9 kg) of oil sardine mainly during October and April. The catch has declined. In the gillnets oil sardine occurred sporadically. The size ranged from 40-170 mm (modes 70-85 mm and 120-145 mm). Adults were in spent resting stage.

The estimated catch of mackerel was 11.5

t and mainly occurred during March, August and November-January. Gillnets 55%, boat seines 42% and shore seines shared the catch. *R. kanagurta* formed 78% and *R. faughni* the rest. The size ranged from 45-190 mm and 80-150 mm respectively. Indeterminates and preadults dominated.

Puri: Gillnets at Pentakota (Puri) landed 109.2 t (C/E 0.54 kg) during the year as against 88.4 t (0.3 kg) in the previous year. Nearly 94% of the landings took place in September and November. The fishery was constituted by *P. indicus* (92%), followed by *Metapenaeus affinis* (5%), *P. merguiensis* (2%) and *P. monodon* (1%).

Bamboo traps employed mainly for juvenile prawns at Jadpur in Chilka Lake landed 59.8 t of prawns (0.04 kg/trap) as against 54.4 t, (0.03 kg/trap) in the previous year. Landings were better during October to March. *P. monodon* (3%), *M. monoceros* (28%), *P. indicus* (25%) and *M. dobsoni* (13%) constituted the fishery. *P. monodon* occurred in the size range of 65-245 mm and 125-205 mm supported the fishery. *P. indicus* of the size range 53-148 mm were recorded and 93-123 mm size dominated the catch. In *M. monoceros*, size ranged between 38-118 mm with 58-93 mm size classes supporting the fishery.

Studies on the economics of ring seine fishery were carried out at Calicut, Fort Cochin, Alleppey and Neendakara. The average initial investment on a unit ranged from Rs. 2.20 lakhs to Rs. 2.75 lakhs and that of the net from Rs. 1.10 to Rs. 1.20 lakhs.

Sea ranching of marine prawns (CF/CUL/1.1.7)

During the period under report, 17 hatchery runs were carried out for the large scale seed production of the green tiger prawn *Penaeus semisulcatus* at Mandapam Camp. Of the 57 spawners used for the trial runs, 36% spawned only partially under laboratory conditions. A total of 464,000 postlarvae (PL 10-47) were reared under laboratory conditions. Of this, 441,750 were released into the Palk Bay. The remaining 22,250 seed were stocked in the departmental ponds for conducting farming experiments.

Laboratory produced postlarvae of *P. semisulcatus* were further reared under controlled conditions. From these, 5 females (Av. TL 143 mm) and 4 males (Av. TL 132 mm) were transferred to a maturation tank with biological filter. The pH of the water was maintained at 8-8.2. They were fed *adlibitum* with clam meat and polychaetes. Within 20-25 days the ovary developed to stage IV, and one of them spawned partially. Thus laboratory produced PL-I have grown and attained maturity under controlled conditions without eyestalk ablation.

A total of 17,258 postlarvae of *P. semisulcatus* (TL 12.6-17.0 mm) were stocked in 4 different ponds and reared for 65 days. After an average growth of 1.6 mm per day during the first 30 days the growth was reduced. The average growth for 65 days was 0.85 mm per day.

During February 1992, a batch of 6342 (last year 2964) lab reared and farm grown *P. semisulcatus* (TL 41-90 mm) were tagged and released into the sea at Palk Bay. Two tagged prawns were recovered so far, one after 20 days and another after 37 days of release. They showed an average growth of 1.5 mm per day.

During the 2 years of experiments the average growth rate of seed of *P. semisulcatus* in the farm was 1.5-1.6 mm per day during the first 30 days of farming. The growth rate gradually declined during the next 2 months of farming. The mean size attained after 113 days of farming was 95.8 mm (TL) with an average weight of 7g. The farm grown prawn of 61-70 mm average size, when tagged and released into the sea, showed an immediate spurt in growth. In the sea, an average growth of 1.5 mm per day was observed during the next 20-30 days.

The studies during the last two years clearly showed that the prawns reared under laboratory conditions and grown in the farm, when released in the sea, were able to survive and migrate to the fishing grounds and get recruited to the commercial fishery. This indicated the importance of sea ranching of this species in the Palk Bay as a measure of increasing production.

MOLLUSCAN FISHERIES DIVISION

Studies on clam, mussel and gastropod resources (MOL/RE/2)

The clam and gastropod production in Kakinada Bay was 3500 t. Clams accounted for 50% of shellfish production and was mainly contributed by (92%) *Anadara granosa*. The estimated standing stock of this species was 9129 t. Clams mainly *A. granosa, Katalysia opima* and *Meretrix meretrix* supported a limited fishery in Pulicat Lake. The estimated standing stock was 314 t of *M. casta* in 76 ha in Muthukadu and 41 t of *A. granosa* in Ennore estuary.

At Nettur, near Cochin, 574 t of black clam *Villorita cyprinoides* was fished. The catches were high during July-September with an average monthly production of 125 t. This was mainly due to heavy recruitment which occurred once in 10-12 years. At Chellanam 117 t was landed. At Murukkumpadam 2186 t of *Sunetta scripta* consisting of mainly empty shells (live clams 5-10%) was exploited. Nearly 59 t of green mussel, *Perna viridis*, was landed at Fort Cochin and Vypeen Island. On the granite rocks along the sea coast from Pallithode to Munambam dense settlement of brown mussel, *Perna indica* was seen. They were harvested in some places in Vypeen Island. As a fishery it was recorded for the first time. Clam landings declined by 41 t in Mulki and was constituted by *M. casta*. A standing stock of 9 t of green mussel has been recorded in the Mulki Estuary in January '92. The brown mussel production in Vizhinjam-Colachel-Enayam coast was 814 t.

The sacred chank production in Tuticorin was 199,312 chanks showing an increase of 34% as against previous year. Full size chanks accounted for 60%. At Rameswaram-Mandapam-Kannirajapuram 194, 496 chanks were exploited as against 80, 200 chanks last year and 84% were full size. At Tuticorin 646 and at Mandapam 652 chanks were tagged and released, the recovery being 1.1% and 2.8% respectively. The growth rate was slow which indicated a long life span. Egg capsules of sacred chank collected from Mandapam area and reared in the laboratory, released baby chanks after 33 days. Their growth has been monitored.

Development of hatchery technology for experimental/mass production of the seed of clams, mussels, edible oyster and pearl oysters and sea ranching of clams and pearl oysters (MF/CUL/4)

In the hatchery-based seed production system at Tuticorin, forty batches of oysters *Crassostrea madrasensis* were conditioned for breeding. There was spat falls from fifteen spawnings. Rate of setting varied from 0.4% and larvae were reared for 17 to 27 days. The spat grew to 5-7 mm in a week and were transferred to nursery on the 10th day.

From ten spawnings, 277,240 spats of pearl oyster, *Pinctada fucata* were produced. After a growth of 3-5 mm in two months they were transferred to the pearl farm.

Out of 5 pearl oysters injected with (0.2ml) human chorionic gonadotropin

(HCG) two males and two females spawned after 15 and 20 minutes respectively. Fertilisation and development was normal. Two batches of clams *Paphia malabarica* and *K. opima* were conditioned for breeding. In one of the attempts, thermal stimulation yielded 17.3 million eggs out of which 1.54 million larvae were produced. They survived for three days. The growth and survival rates of hatchery produced *P. malabarica* (1989-90 batch) reared in suspended cage at Tuticorin Bay was not satisfactory suggesting unsuitability of the area for sea ranching of clams. The green mussel, *P. viridis* was bred at Calicut. 1200 seeds produced were further reared in the inshore waters. Suitable food was *Chromulina*. The modified Walne medium gave good growth of micoalgae.

Selection of suitable sites for oyster culture (MF/CUL/8)

The feasibility of oyster culture at Pulicat, Kakinada and Karwar has been investigated. In Pulicat Lake spat fall started by end of June and continued till July. Average settlement was 11 spat/tile, the maximum being 33 spat/tile. Two periods of active growth during July-October and January-March were noticed in the 9896 spats suspended in cages. After nine months the average growth was 81 mm (maximum 108 mm). Harvesting of oysters cultured in the lake during last year yielded 11,975 oysters (28 kg meat). Survival rate was 40%. Maturation in the natural population of *C.madrasensis* took place during June-September and November-April.

Hatchery produced oyster seeds from Tuticorin have been transferred to Pulicat, Kakinada and Karwar in February '92. The oyster seed with initial size of 8 mm cultured on shell rens by rack method grew to a size of 20 mm at Pulicat and Kakinada.

Semi-commercial production of edible oyster (MF/CUL/9)

A pilot project sponsored by NABARD to demonstrate the economic feasibility of oyster farming was taken up at Tuticorin. 3,220 shell strings were prepared from 17,800 shells bearing spat and suspended in 20 racks in the nursery. From nursery 1,725 strings with seed oysters were transferred to farm and grown from 21 racks. The average weight (kg) of one oyster string with spat increased form 0.5 (0 months) to 7.9 (12 months). The survival rate was 91.4% (2 months) to 57.3% (12 months). The average weight of one oyster was 6.34 g in the second month and 157.2 g after 12 months.

Upgradation, location testing and transfer of technology of pearl culture (MF/CUL/10)

The Valinokkam Bay (in the Gulf of Mannar) in the Ramanathapuram District of Tamil Nadu, was selected for pearl culture. The Bay provided ideal conditions. The project which started in 1991 created an awareness among fishermen in the area about the importance of pearl culture and the possibilities for fishermen to produce cultured pearls using technology developed by CMFRI. Nucleus implantations in 15,340 pearl oysters with single, double and triple impantations carried out were 8592,6729 and 19 respectively. The twenty five fishermen who were associated with the project actively participated in the construction and maintenance of culture rafts, preparation of cages and in taking care of the oysters. They were acquainted with techniques of nucleus implantation. This project has become a model for the involvement of rural population in the R & D efforts and transfer of technology for employment and income generation.

Composite Sea farming

After successful pearl oyster farming and pearl culture and also after conducting several training programmes in pearl culture at Tuticorin, the latest being in collaboration with FAO/UNDP Regional Sea Farming Development and Demonstration Project, Bangkok, the Institute has initiated a R & D project on composite sea farming at Valinokkam. This involves several candidate species such as pearl oyster, edible oyster, mussels, clams, sea bass, prawns, sea cucumber and sea weeds. Sea farming technologies have been developed by the Institute during the last two decades. The main objective has been to scale up the operation of these technologies on a pilot scale for upgradation, location testing, to work out the production potential, the rate of growth in a new environment, to propagate and extend such technologies to other areas. The local fishermen are actively associated in these sea farming activities so as to equip themselves with requisite skills. This approach helps them to take sea farming activity on their own leading to employment and income generation.

FISHERY ENVIRONMENT MANAGEMENT DIVISION

During the year 1991-92, the Fishery Environment Management Division was engaged in 9 Research Projects of the Institute. Out of these 2 projects were FORV *Sagar Sampada* oriented; one each *Cadalmin* and Mobile Laboratory based and remaining were dealing with Remote Sensing, Marine Pollution, Sea-cucumber culture, resources monitoring and related environmental parameters.

Investigations on environmental parameters in inshore waters in relation to fisheries (FEM/ES/1)

Cochin: The fluctuations in temperature, salinity and dissolved oxygen content of the 10m, 20m and 30m depth zones off Cochin showed the following features.

At the surface, the temperature was around 31^{0}C during April-May but decreased during June and remained below 28^{0}C till September. A slight increase recorded in October, kept the temperature around 29^{0}C in November. However, December and January recorded perceptible changes to bring the temperature below 29^{0}C prior to a steady increase to restore values to 30^{0}C and above in March. At the bottom, the temperature was 29^{0}C during April-May, decreased with time to less than 24^0/24^{0}C in the 20m and 30m depth zones in September. A steady increase was recorded during the rest of the period as to register 29^0/30^{0}C in March.

The region off Cochin was more or less vertically homogeneous during April-May with salinity values well above 34 ppt except at the surface in the 10m depth zone (31.61%o). While the salinity of the 10m depth zone underwent drastic changes with low salinity between 20 and 30 ppt persisting during June-August but disappearing thereafter, the rest of the region remained high saline, above 30 ppt, till March.

The dissolved oxygen content of the surface remained well above 3 ml/l. But that of the bottom went down to 1-2 ml/l betwen June and September. Though the fluctuations in oxygen content were erratic during the rest of the period, the values recorded in March were close to those recorded during the previous April.

The values of photosynthetic pigments of the water column of the inshore area indicated that during the first quarter (April-June), the values of chlorophyll *a* were found to be low to moderate levels (surface - 2.13 to 5.90 mg/m^3, bottom - 2.93 to 4.80 mg/m^3); in the second quarter (July-Sept.) high values of chlorophyll *a* were observed (surface - 4.49 to 10.80 mg/m^3, bottom - 2.0 to 6.0 mg/m^3) while during the 3rd and 4th quarter low to moderate levels of values were observed (surface - 1.60 to 2.67 mg/m^3, bottom - 2.20 to 5.58 mg/m^3). The values of phaeopigments indicated low to moderate levels during the first and second quarter (2.57 to 4.00 mg/m^3) while very low values were observed during the 3rd and 4th quarters (0.36 to 3.00 mg/m^3).

The monthly mean values of zooplankton biomass by displacement volume and numerical abundance of the various groups and larval forms were estimated per 100 m^3 of water filtered and zooplanktons such as cladocera, copepods, larval decapods, lucifers, chaetognaths, siphonophores and fish eggs and larvae occurred more frequently in large numbers at one time or the other during the period.

The mean biomass value 39.0 ml/100m^3 recorded at the 30 m depth zone in October was the highest and the least 1.3 ml/100m^3 in April. The numerical abundance of the major holo and meroplankters was remarkably high during September-October and the maximum was attained during October in the 20-30 m depth zone. The number of copepods, cladocerans, appendicularians, doliolids, chaetognaths, siphonophores, euphausids, larval polychaetes, fish eggs and larvae observed in October and lucifers and larval decapods in June were the highest.

Total number and total biomass of bacteria from water and sediment samples collected from 2 fixed stations were investigated during the period. In brackishwater, the average bacteria ranged from 0.3 x 10^9/gm to 9.7 x 10^9/gm of sediment. In offshore station (20-25 m depth) the range was 0.32 x 10^9/gm to 3.10 x 10^9/gm. In surface brackish water, the range varied from 1.68 x 10^6/ml to 6.2 x 10^6/ml whereas in seawater, it was 0.8 x 10^6/ml to 7.2 x 10^6/ml.

Microbial production reached 20.8/ug to 436/ug C gm^{-1} in brackish water sediment whereas, it as 11/ug to 35/ug C gm^{-1} in seawater. High microbial production in sediments will provide much of the food for benthic fauna especially for species which directly ingest sediments.

Mangalore: During the year, seawater samples were collected weekly from 10m and 20m depth stations off Mangalore and analysed for the estimation of various environmental parameters. The temperature of the water column showed steady level during the first and second quarters, while slight reduction was noticed during the third quarter and in 4th quarter, again the water temperature showed slightly high values (above 30^{0}C). The values of salinity showed a steady increase from January to March (above 34 %o) and in other months, especially during southwest monsoon, the salinity values indicated less than 30%o. Among the nutrients, the values of nitrite and phosphate showed low to negligible values (0.03 to 0.24/ug at/l) while nitrates and silicates indicated low to moderate values (0.54 to 14.70/ug at/l). The primary production rates were found to be moderate in February--March (305-495 mgC/m^3/day) and slightly high in January (465-582 mgC/m^3/day).

Mandapam: Water samples were collected in 10, 20 and 30 m depth stations in the Gulf of Mannar and Palk Bay regions. The hydrological data indicated that the maximum surface water temperature was observed in April (33^{0}C) and minimum in January (26^{0}C). The salinity values were found to be high during September (36.44%o) and low in January (32.46%o). The values of dissolved oxygen content was indicated high during January (4.04 ml/l) and minimum in December (2.15 ml/l). Among the nutrients, the phosphate concentration ranged from 0.03 to 0.25/ug at/l during July was found to be the maximum and in other months, negligible to nil values were noted. Similarly, the nitrogenous compounds ranged from 0.25 to 2.75/ug at/l during April and September and in other months, negligible values were noted.

The zooplankton biomass ranged from 2.8 to 9.0 ml in the Gulf of Mannar area, while it was 5.1 to 6.0 ml in Palk Bay region.

Environmental ecology of coastal zone and mapping of potential sites for seafarming (FEM/ES/5)

During the year, field surveys were conducted in October-November 1991, January and March 1992 utilising the Mobile Laboratory to study the ecology of coastal water bodies along the Kerala coast from Kasaragod to Kayamkulam covering stations from eight estuarine systems, *viz.* Chandragiri, Nileshwar, Mopla Bay, Murat, Thanneermukkom, Andhakaranazhi, Thottappally and Kayamkulam. Hydrographic and productivity values were found to be high during March in these estuarine systems. During March, surface water temperature was found to be high ($>33^0$C) at Thanneermukkom and Andhakaranazhi while at other estuaries, it varied from 29 to 32^0C. Salinity reached almost marine conditions during high tide at Mopla Bay, Nileshwar, Chandragiri, Kayamkulam and Andhakaranazhi while Thanneermukkom water had 10-12 ppt. Dissolved oxygen content was maximum at Thanneermukkom (4.1 ml/l to 4.7 ml/l). In the northern estuaries it ranged from 3 to 4 ml/l while at Kayamkulam, it varied from 2.0 to 3.5 ml/l in the diurnal survey.

Highest mean net primary productivity was estimated at Andhakaranazhi (2.9 gC/m^3/day) and the minimum at Thanneermukkom (0.4 gC/m^3/day) in the south, while along the northern estuaries, the mean values ranged between 0.30 to 0.63 gC/m^3/day. The zooplankton samples collected from these estuaries indicated that the displacement volume and species composition differed from estuary to estuary.

Monitoring marine pollution in relation to protection of living resources (FEM/MP/1).

Cochin: 18 field trips on board *Cadalmin* and CIFT vessels covering four stations (estuary to the inshore area) were conducted during the period. Samples from surface and bottom, and data on eight water quality parameters such as temperature, pH, salinity, dissolved oxygen content, nutrients, Chlorophyll *a* and phaeo-pigments were collected.

During the months of May and June low dissolved oxygen and higher salinity levels were noticed in the coastal area indicating the phenomenon of upwelling. The values of salinity ranged from 1.05 to 26.90% at the surface, while at the bottom, 31.98 to 34.86%o; dissolved oxygen content ranged from 3.98 to 4.63 ml/l at the surface and 1.02 to 1.92 ml/l at the bottom. Dissolved oxygen levels were rather low (2.46 - 3.30 ml/l) in the estuarine area during April and May and Ammonia were high upto 77.99/ug at/l.

In the biological samples analysed, metal levels were comparatively higher in the crabs and bivalves, but within standard limits recommended for seafood - Sediment analyses showed higher levels of lead contents in the inshore areas (range : 30.62 to 44 ppm). Other than the analyses of samples collected under project work, more than 1000 water samples collected on board FORV *Sagar Sampada* were analysed for nutrients in the Marine Pollution Laboratory.

Karwar: Mercury monitoring in seawater, sediment and biota near a caustic soda plant were completed. From the data collected 1987-92, biomagnification and bioconcentration factor BCF of mercury in the biota were calculated. Mercury level in the seawater from the impact area was 1.85 ppb., while in the crustaceans it was 10 ppb and in mackerels 30 ppb, mussels 85 ppb and oysters 200 ppb. This shows that biomagnification of mercury in the tissues of bivalves is higher than in other organisms and plants.

Higher concentration factor was obtained for oysters followed by mussels and seaweeds. The BCF followed the pattern such as oysters, mussels, seaweeds, mackerel, crab, prawn, squid and sardine.

Tuticorin: The regular monitoring of hydrographic characteristics revealed that there is certain apparent adverse influence on the physical characters of the Bay water mainly due to the discharge of hot water. The ambient water temperature showed a range of 28.2^{0}C in June to 36.3^{0}C in September.

The biological assay conducted using water collected from three areas (Dyke, Bay and inshore) also confirmed the influence of pollution in the Bay waters. The bioassay conducted using *P. indicus* showed that compared to pollution free water, the survival rate was only 50% in the Dyke water areas, indicating the effect of stress.

Resources assessment of seaweeds and their culture (FEM/SW/1)

Seaweed culture work at Minicoy

During the year, *Gracilaria edulis* culture was continued in Minicoy lagoon. In the first quarter, the culture operations suffered a set back because of heavy grazing by herbivorous streaked spinefoot *Siganus javus* and probably by the turtles in the lagoon. The same phenomenon was noticed in the natural beds also at both the sites.

Natural growth of *G. edulis* introduced in Minicoy lagoon was measured using quadrats. The harvestable biomass of *G. edulis* in Navodaya School site ranged from nil to 300 g/m^2 and was calculated to be 15 kg in an area of 2000 m^2 and in Fisheries jetty site the wet biomass was 3 kg in 2000 m^2 area ranging from nil to 125 g/m^2. Higher depth and flow of water at Navodaya School site than at Fisheries jetty is considered responsible for favouring the vegetation at Navodaya School site.

To overcome grazing problem and to obtain uninterrupted yield of *G. edulis*, a new method was adopted by deploying cage made of wooden reepers and covering by net webbings to prevent the grazers. The fronds were introduced in the twists of coir ropes (1.5 m x 4) and tied inside the cage and kept floating vertically in the lagoon. 1 kg of seed material can be introduced in 4 coir ropes in single cage. The results were encouraging.

During January 1992, *G. edulis* cultured inside a cage covered with net gave good result and yield was found to be 10 fold to the seed material introduced. In the lagoon culture of *G. edulis* tied to coral rocks showed steady growth near the Fisheries jetty site.

Seaweed resources of Tamilnadu coast

Data obtained on the deep water seaweed resources survey from Kilakkarai to Dhanushkodi (Sector IV) during December 1990 to January 1991 were computed and report was prepared. The identification of algae and sea grass collected in this survey was confirmed. Totally 29 species of marine algae (8 species of green, 8 species of brown, 12 species of red and one species of blue-green algae) and one species of seagrass, *Cymodocea serrulata* were recorded in this region. The total standing crop of all seaweeds in 514 km^2 area surveyed was estimated at 18162.5 tons (wet weight).

All the data collected in the deep water seaweed resources survey from Dhanushkodi to Kanyakumari (Sector I to IV) during 1986-91 were also computed. A total number of 100 algal species were encountered in the deep waters at the depths ranging from 5.0 to 22.0 m. The total estimated standing crop (wet weight) from 1863 km^2 area was 75372.5 t. The quantitative analysis of economically important seaweeds encountered in the four sectors revealed the feasibility of exploitation of *Sargassum* from Mandapam to Kilakkarai and Tuticorin, *Hypnea* from Mandapam to Vembar and *Gracilaria* from Vembar to Nellatanni Tivu regions.

Seaweed culture work at Mandapam

Cultivation of the agar yielding red alga *Gracilaria edulis* was carried out from April 1991 to March 1992 in five number of Tuflite tanks (75x50x50 cm size) (250 litres capacity) which were arranged in three tiers at different heights under a thatched shed in outdoor condition. Running seawater with gravitational flow was maintained in the tank. The optimum quantity of 100 gm seed material was introduced in each tank. The experiment was carried out from February 1991 to first week of May. The plant reached maximum biomass of 420 gm (320% increase) and 575 gm (475% increase) after 40 to 70 days growth respectively, from 100 gm of seed material introduced.

In the experiment conducted during July to September the plants *(G. edulis)* were treated with 100 mg of NPK fertilizer at weekly interval by putting it in slotted polythene bags and suspended in each tank. In this experiment, maximum increase in biomass 300 gm (200% increase) was obtained after 45 days' growth.

In the experiment conducted during November and December 1991, the plants of *G. edulis* were treated with 400, 500,600,700 and 800 mg of NPK fertilizer every week. Maximum increase in biomass of 160, 160, 140 and 190 gm was obtained after 21 days growth with 400, 500,600 and 700 mg of fertilizer respectively. In the tank treated with 800 mg of fertilizer, the maximum increase in weight of plants was found to be 170 gm after 45 days of culture.

Preliminary survey of Valinokkam Bay

Preliminary survey of Valinokkam Bay, Gulf of Mannar, in Ramanathapuram District of Tamil Nadu was made during January 1992, with a view to study the flora occurring there and its suitability for undertaking seaweed cultivation. Totally 31 species of seaweeds were found growing in this region. The preliminary observations including the hydrographic conditions revealed the possitility of seaweed cultivation alongwith other cultivable species under Integrated Seafarming Project at Valinokkam Bay.

Fishery oceanography of the offshore regions of the Indian EEZ (FORV/SS/1)

A 28 day research cruise was undertaken on board FORV *Sagar Sampada* from 2nd to 29th July 1991 for collection of meteorological, oceanographic and biological data from 44 stations located in the Arabian Sea between Cape Comorin and Goa (upto Long. 68°30'E) mainly to observe the environmental conditions prevailing during the peak of south west monsoon.

Sea surface temperature varied between 25°C and 29.5°C and salinity values ranged from 30.46ppt to 37.53 ppt. Dissolved oxygen content varied between 3.19 ml/l to 4.52 ml/l. The main thermocline was observed between 20 m and 100 m. Among the nutrients, phosphate concentration at surface levels varied between 0.10 and 1.83 /ug at/l. Nitrite nitrogen concentration at surface levels varied between nil and 0.47 /ug at/l. Chlorophyll *a* at surface levels varied between nil and 4.54 mg/m^3 and phaeo-pigments between nil and 10.68 mg/m^3.

Detailed analysis of oceanographic data collected during the above cruise revealed the existance of upwelling between Lat. 08°30'N (Trivandrum) and 11°30'N (Off Calicut) near the coast. In this area, the 23°C isotherm was found at comparatively shallower depths (18-25 m), the movement of which on the vertical plane can be taken as an indication for upwelling and sinking as the case may be. The present study also confirmed that the movement of 23°C isotherm can be taken as an indicator for the commencement, intensification and cessation of the process of upwelling along the south-west coast of India which was first revealed from a detailed analysis of similar data collected by the erstwhile Pelagic Fishery Project observed off Trivandrum.

The same stations were covered during October 1991 to study the possible variations in the above mentioned parameters during post monsoon season.

Investigations on zooplankton and components of DSL of the EEZ of India (FORV/SS/3)

A total of 251 zooplankton samples collected during 12 cruises of FORV *Sagar Sampada* from the EEZ of the south west coast of India were sorted out. Samples of cruise 87 were collected during the special Gulf Cruise conducted for investigating the oil slick during the Gulf War of 1991.

The zooplankton collected during the Gulf Cruise was separately studied for undertaking the effect of oil slick on the plankton community. The study yielded no positive evidence as to any adverse effect of oil on the plankton at the time of observation.

The zooplankton collected from the north-east, south-east and from the Andaman & Nicobar Islands were subjected to detailed studies for their abundance, distribution and seasonal variations.

At Mangalore, the work on penaeid larvae and copepods progressed. Fortyone samples from the Bay of Bengal were analysed for decapods in general and penaeid larvae in particular and the numerical counts were taken for the quantitative distribution of various groups such as penaeid prawns, aristaeids, sergestids, lucifers, caridians and anomurans. The area between lat. 7° and 8°N was the richest for the larval forms of these groups.

Copepods contained in 137 samples were analysed for their species composition and distribution. While 88% of the material was constituted by the calanoid copepods, the rest was composed of cyclopoid copepods. A total of 33 species were encountered in the samples of which 28 were calanoids and 5 cyclopoids.

RING SEINE

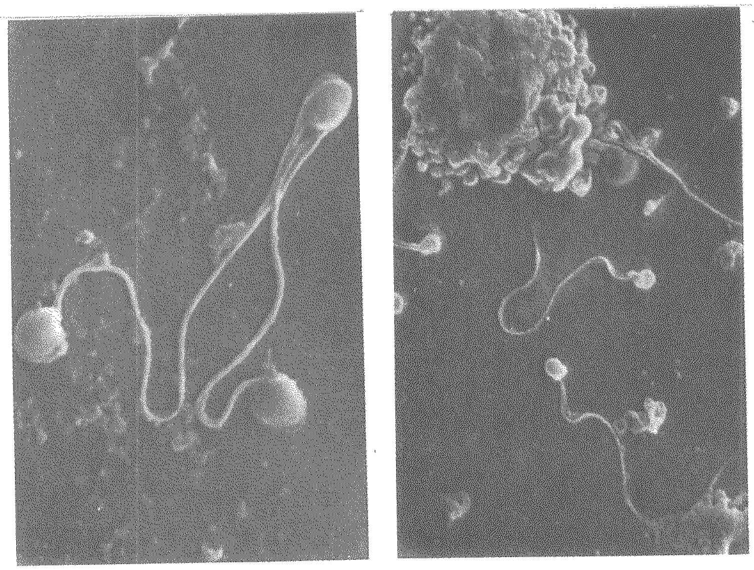
The ring seine, the simulative type of purse seine. They are operated in the in-shore waters along Kerala and Karnataka coasts.

WHITE SARDINE

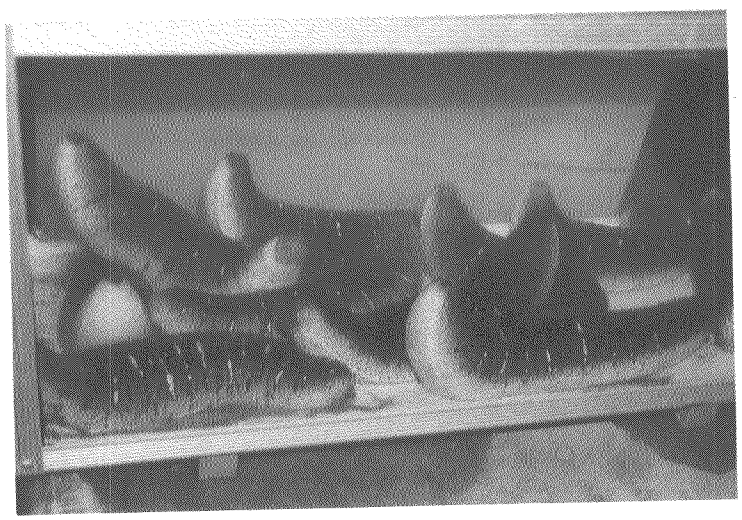
ESCUALOSA THORACATA

from the Ring Seine at Fort Cochin.

BREAKTHROUGH



SEM image of sperms of mullet *Liza parsia* (x 5000) (left) and Indian whiting *Sillago sihama* (x 2500) (right). A breakthrough was achieved in the long-term preservation of sperm motility of *L. parsia at* – 196^{0}C.



Holothuria scabra spawning in the hatchery. This sea cucumber has been induced to spawn for the first time, the larvae have been successfully reared.

Application of remote sensing technology in marine fisheries (FEM/RS/1)

Under the collaborative project on Remote Sensing, SST distribution charts were regularly recieved from the NRSA. To verify and validate this data sea-truth information have been collected during the cruises of *Sagar Sampada*, in July, October and April. Chlorophyll concentrations have been also collected at each 1^0 station in the EEZ from latitude 7^0 - 15^0N. The NRSA was also supplying charts indicating potential fishery areas and this information was being passed on to downstream end users on experimental basis. Also the feed back information collected by the project scientists are being studied. For the MARSIS system at CMFRI, one image analyser has been acquired and installed.

Breeding, seed production and sea ranching of the sea-cucumber, *Holothuria scabra* (FEM/CUL/2)

During the year under report, *Holothuria scabra* spawned on two occasions, one in December 1991 and the other in Feb. 1992. About 5000 juveniles were produced from the first spawning. After three months, some of the juveniles reached a length of 45 mm. About 90% of the juveniles were 5-10 mm in length and only 10% reached a length of 30-45 mm. For the first two months, the juveniles were fed with algal extract of *Sargassum* sp. The algae were finely ground into a paste in a mixe and then filtered in 40 micron sieve and the extract was poured into the tank where the juveniles were kept. After 2 months 80 micron sieve is used for filtration of the algal extract. After 3 months the juveniles were fed with fine sand collected from the natural habitat. This was mixed with algal powder. Algae like *Sargassum* sp. were first sun dried and then kept in the oven for complete drying. Then this was finely ground to a powder and mixed with fine sand. This was daily sprinkled in the tanks having the juveniles. The juveniles were found to feed well on the algal extract and also on the sand mixed with algal powder. Only a few of them developed into Auricularia larvae, in the second spawning and they failed to settle to the bottom of the tank.

During the month of September 1992, specimens of *Holothuria atra* were found to be ripe.When these specimens were brought to the laboratory and kept in buckets containing seawater collected from the sump, they spawned. The seawater in the sump had always a higher temparature than seawater outside. *Holothuria atra* spawned for the first time in the hatchery and during this month, the spawning took place on eight occasions. About 50,000 Auricularia were produced, some of them transformed into pentactula stage and finally failed to settle at the bottom of the tank.

Investigations on coral reef ecosystem (FEM/EE/1)

Re-survey of the reefs around Mandapam such as Manauli Island, Hare Island, Crusadi Island and Pamban was carried out with a view to assess the recolonisation of corals after extensive damage to the biota due to quarrying. The results indicated that recolonisation was insignificant even after 20 years where removal was total.

Some work on the bacteriological assemblage on corals from Manauli Island was done. Marine aerobic bacteria from corals, sponges and Alcyonarians were qualitatively and quantitatively assessed. Occurrence of *Escherischia coli* was found predominant in *Acropora*.

PHYSIOLOGY, NUTRITION AND PATHOLOGY DIVISION

PHYSIOLOGY

Studies on cryopreservation and its influence on storage and viability of gametes of certain cultivable marine fishes (PNP/43)

A breakthrough was achieved in long term preservation of sperm motility of fish *Liza parsia* at - 196^0 C using DMSO and glycerine as cryoprotectants alongwith other suitable diluents. By this method sperm motility could be preserved with great success for a period of 4 months till the reporting period. Further experiments are being continued on motility and viability of sperms preserved for a period of one year and more. Work on cryopreservation of sperms of other fishes like *Sillago* sp. *Gerres* sp. and *Mugil cephalus* is also being done.

Endocrinological factors influencing maturation of selected species of finfishes and prawns (PNP/39)

The protein concentration in the eyestalks of mature and late mature female specimens of *M. dobsoni* was 6 folds higher when compared with the values obtained from eyestalks of immature females and mature males of the species. Electrophoretic studies revealed four bands in both the maturing and late maturing eyestalk extract samples whereas only one band was observed in the eyestalk extracts of immature female and mature male specimens. The protein concentration of thoracic ganglia extraxts from mature female specimens of *P. stylifera* was found to be 2.5 folds higher when compared with the values of eyestalk extracts from mature female specimens. The electrophoretic pattern observed in the eyestalk extracts of mature specimens were similar to the observations made in the samples of *M. dobsoni.* But the thoracic ganglia extracts from mature *P. stylifera* revealed a single band which was absent in immature specimens.

Thin layer chromatography technique was used for identification of Dopamine from eyestalk and thoracic ganglia extracts obtained from *M. dobsoni* samples in different maturity stages. The intensity of the colour due to Dopamine was found to be more in the samples of eyestalk, brain and thoracic ganglia of mature female species of *M. dobsoni* compared to the immature and male specimens.

NUTRITION

Farm trials of compounded feeds developed for prawns (PNP/35)

Farm trials of compounded feed using *P. indicus* were concluded during September 1991. The total head-on weight of prawns harvested from 5 ha after 120 to 150 days growth period was 5202 Kg (3770 Kg headless) with a FCR of 1.78.

Studies on environmental changes during one entire crop made in 6 ponds at Ramudupalem exhibited maximum diel variations of 7.94 ml O_2/l (8.52 ml O_2/l the maximum at 1600 hrs and 0.56 ml O_2/l - minimum at 0400 hrs) in dissolved oxygen levels. Maximum variation recorded in the case of pH was 1.19 (9.45-maximum at 1200 hrs and 8.26 minimum at 0400 hrs). Levels of Ammonia in the ponds ranged between trace to 1.71 mg at N/l. Maximum diel variation was 1.23 mg at N/l. Phosphate levels varied between 0.024 and 2.523 ug at P/l in all the ponds. Salinity did not vary considerably and the maximum variation recorded was 2.15‰. Atmospheric temperature showed a maximum diel variation of 7.7°C (maximum 35.2°C and minimum 26.5°C). Soil pH varied between 6.85 and 9.02 and there was no appreciable variation throughout the culture period. Common species of phytoplankters recorded at 0600 and 1800 hrs were *Biddulphia, Gyrosigma, Pleurosigma, Nitzchia, Chaetoceros, Navicula, Amphipora, Peridinium*, etc., while common zooplankters were copepods, copepodites, copepod nauplii, rotifer and mysids.

Composite culture of carps and *P. mondon* carried out using low saline waters yielded success as 920 kg of head-on prawn (average wt. 34g/prawn) was harvested after 75 days in the first crop and 770 kg of head-on prawn (25-38 g) was harvested after 80 days of rearing in the second crop.

The effect of food particle size and feeding level on the growth of *P. indicus* post larvae was studied in a six week laboratory experiment. A feed using prawn meal, fish meal, groundnut oil cake, soyabean meal, cod liver oil and groundnut oil (2:1), cholesterol, vitamins and minerals was compounded. The pelleted feed was dried, crumbled and sieved to obtain particle sizes of 100, 150 and 200 microns. The selected feeding levels were 20, 25, 30 and 35% of the body weight. Statistical analysis of growth data did not show any significant difference between the selected feeding levels or particle sizes.

In order to determine the digestibility potential of proteins and carbohydrates, proteolytic and amylase activity was estimated in the digestive tract of *M. dobsoni* juveniles. Enzyme extract showed a relative activity of 82.00 and specific activity of 9.46 for protease and relative activity of 8.10 and specific activity of 0.934 for amylase. Activity of carboxypeptidase A was estimated using hippuryl-l-phenyl alanine as substrate gave a relative activity of 0.245 units and specific activity of 0.028.

PATHOLOGY

Disease investigation and disease control in culture systems (PNP/37)

An outbreak of Epizootic Ulcerative Syndrome was encountered in fresh water fishes of Kerala State. Fresh water fishes of Kuttanadu, Trichur, Alwaye, Wynad and Palghat areas were affected with the disease. Gross morphological and histological alterations of this disease were recorded. Microbiological studies revealed the role played by *Aeromonas* group of bacteria. Though the disease was suspected to be of viral orgin it was found that *Aeromonas salmonicida* and *A. hydrophila* were responsible for development of symptoms and lesions of diseases.

Soft prawn syndromes in *P. indicus* and *P. monodon* were studied. Bacterical isolations were made. It was found that *Aeromonas salmonicida* and *A. hydrophila* were responsible for development of symptoms and lesions of diseases.

GENETICS

Indentification of genetic stocks in Indian Mackerel *(Rastrelliger kanagurta)* (PNP/41)

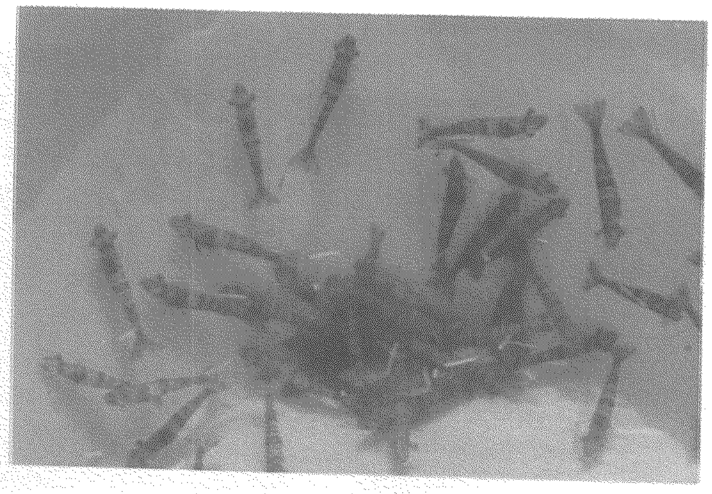
A series of experiments were conducted to standardise electrophoretic conditions required for separation and resolution of banding patterns of selected enzyme systems in different tissues of Indian mackerel, *R. kanagurta.* Tissues showing better zymorgram patterns were then compared in sample populations of mackerel to detect intraspecies biochemical genetic polymorphism in the species. The enzymes Alcohol dehydrogenase (ADH) and Xanthine dehydrogenase (XDH) in liver tissue were satisfactorily resolved using tris-citric and tris-versene buffer systems respectively. Sorbitol dehydrogenase (SDH) in eye lens and muscle peroxidase (PO) were resolved in phosphate-citric and borate buffer systems respectively. The zymogram patterns observed in these enzyme systems appeared to be controlled by one or two loci.

The first electrophoretic screening of Alcohol dehydrogenase (ADH), Sorbitol dehydrogenase (SDH), Xanthine dehydrogenase (XDH) and Peroxidase (PO) in sample populations of Indian mackerel revealed intraspecies polymorphism. A comparison of allelic frequencies at the polymorphic loci in populations from Cochin, Calicut, Thottapally, Mandapam and Wadge Bank indicated differences in their values between populations.

TAGGING

Tagged prawns *Penaeus semisulcatus* being released into the Palk Bay.

6,342 farm grown prawns were tagged during February '92.



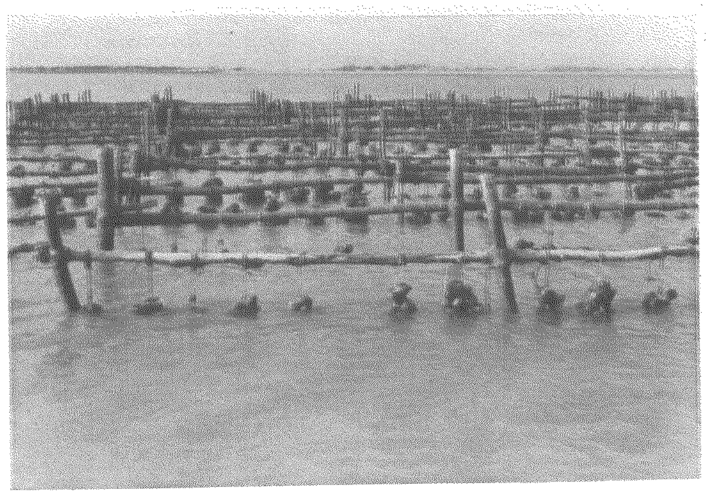
HARVESTED PRAWN

Hatchery produced and farm grown prawn, *P. semisulcatus*.

At Mandapam, from the prawn hatchery, nearly 17,000 post-larvae were stocked in the fish farm. They were harvested during February '92.

SEAWEED CULTURE AT MINICOY

Harvesting of *Gracilaria edulis* from culture nets introduced in the Minicoy lagoon.



PILOT PROJECT

Edible oyster culture by rack-and-ren method under the NABARD – aided project at Tuticorin.

ERADICATION OF PREDATORS

Trainees at KVK, Narakkal, eradicating predators from a pond by ammonia treatment.

TRANSFER OF TECHNOLOGY

Prawn seeds being acclimatised before stocking in culture pond at Narakkal fishermen colony as part of the village adoption programme of the Institute for transfer of culture technology.

FISHERY ECONOMICS AND EXTENSION DIVISION

The Division carried out research and extension activities under five projects. Case studies on fishery economics have been carried out under four mega projects and the economics of operation of the gillnets, purse seines, trawls and artisanal gears at selected centres were worked out during the period.

Studies on the feasibility of transfer of fish/prawn culture technologies in selected coastal villages (FE & E/23)

The fishermen colony in Narakkal Panchayat was adopted for transfer of fish/prawn culture technology. In the first phase, farm families having owned/leased water areas ranging from 25 cents to 100 cents were selected for transfer of prawn culture technology. Seeds of *P. indicus* were stocked. Though mortality was observed in few farms, a growth of 86-145 mm for a period of 3 months was registered (28.3 mm/month). A total yield of 226 kg of prawns valued at Rs. 14,981 was harvested from 3.18 acres. An investment of Rs. 8,273 during the first phase generated an income of Rs. 14,981 leaving a surplus of Rs. 6,702 for a period of 3 months. If the investment had been put to proper use immediately, the income in the observed order of production would have trebled for the year.

In the second phase, an area of 4.5 ha was utilised for transfer of technologies and was stocked with 3,15, 600 seeds of *P. indicus*. Six of the farm families out of a total of 18 were provided with sluices for farms. Monitoring of the biological parameters of cultured prawns showed a growth rate per day of 1.5 mm, 1.3 mm and 1.1 mm respectively in a period of 80 days (Average growth 1.3 mm/day).

Training programme on marine fisheries

The Central Marine Fisheries Research Institute in collaboration with the Bank of Baroda Staff College, Baroda, organised a nine day training programme between 26th November and 4th December 1991 on marine fisheries. 25 Officers from the Bank of Baroda serving the coastal districts of Gujarat, Maharashtra, Goa, Karnataka, Kerala, Pondicherry, Tamil Nadu, Andhra Pradesh and Orissa participated in the training programme.

The Division has received visitors from 35 outside agencies and catered to their needs in the form of organising lectures, screening films, etc. An 'Open House' was organised as part of the National Science Week celebrations.

LIBRARY AND DOCUMENTATION SECTION

During the year, 103 books and 2190 issues of journals were added to the library at Headquarters. Essential books and periodicals were also acquired for the libraries at the Mandapam Regional Centre and at all the Research Centres. Inter library collaboration and inter library loan of books and periodicals were continued. Reference facilities were provided to visiting scientists, scholars and students of various Universities, Institutions etc. from within and outside the country.

The mimeographed "Current Awareness Service" was continued to be issued. The library also stocks, distributes and sells the Institute's publications.

The following publications were brought out during the year.

1. CMFRI Special Publication No. 49.
2. CMFRI Newsletter Nos. 49,50,51,52 &53.
3. Marine Fisheries Information Service T & E Series Nos. 107, 108, 109, 110, 111 and 112.
4. Research Highlights 1990-91.
5. Brochures on Activities and achievements of the Research Centres at the following places.
   a) Visakhapatnam
   b) Minicoy
   c) Bombay
   d) Tuticorin
   e) Madras
6. CMFRI Annual Report 1990-91.

TECHNOLOGY MISSION FOR MARINE FISHERIES DEVELOPMENT

The Institute has proposed a 'Technology Mission for Marine Fisheries Development'. The concept of the mission is similar to the one adopted successfully in this country for oilseeds, drinking water and communication.

The Mission proposed includes the following components:

1. Evaluating the resource position in the 50-200 m zone of the continental shelf;
2. Strengthening harvesting technologies and infrastructure;
3. Post harvest technology and product development; and
4. Effective marketing and distribution systems for both domestic and export markets.

The proposal is now under examination by the ICAR.

POST-GRADUATE PROGRAMME IN MARICULTURE

Ph.D. Programme:

Eight Senior Research Fellows were awarded Ph.D. Degrees by the Cochin University of Science and Technology for their work on:

1. Studies on the pathobiology of penaeid larvae and postlarvae...... A.Sait Shahul Hameed.
2. Studies on some aspects of the reproductive physiology of the female grey mullet *Mugil cephalus* ...... A. Gopalakrishnan.
3. Studies on the haemolymph of *Penaeus indicus* H. Milne Edwards...... P. Laxmi Latha.
4. Population biology and ecology of *Artemia* from salinas of southeast coast of India...... Joslet Mathew.
5. Nature and ecological significance of nutrient regeneration in different prawn culture fields...... K.K. Joshi.
6. Some observations on the ecology and biochemical aspects of the seaweeds of Kerala coast...... Saji Susan Mathew.
7. Studies on the reproductive physiology of *Lates calcarifer* (Bloch)...... Kuldeep Kumar Lal.
8. Studies on coral reefs of Lakshadweep...... V.R. Suresh.

Two more Senior Research Fellows have submitted their Ph.D. theses to the Cochin University of Science and Technology for adjudication. Twenty three Senior Research Fellows are progressing in their research work.

M.Sc. Programme:

All the seven Junior Research Fellows of the 10th batch who have appeared for the M.Sc. Degree Final Semester Examination held in November 1991 have passed in first class, one with distinction. At present 20 Junior Research Fellows are progressing in their studies.

The Mariculture Degree holders are in great demand and are booked by private firms even while they are doing the course. It is understood that four of them are appointed in the 'AQUASTRIDE', Madras. Also eight persons who have undergone the Mariculture Course were selected for Agricultural Research Service during the period.

KRISHI VIGYAN KENDRA

Courses conducted under K.V.K., Narakkal

Sl. No.	Subject	Short term training (Below one month)			Long term training (Above one month)			Total	
		No. of courses	No.of trainees		No.of courses	No. of trainess		Cour-ses	Parti-cipants
			Males	Females		Males	Females		
1.	Fisheries	26	101	327	-	-	-	26	428
2.	Live stock production	19	9	441	-	-	-	19	450
3.	Crop production	3	24	17	-	-	-	3	41
4.	Home science	19	-	260	-	-	-	19	260
	Total	**67**	**134**	**845**	-	-	-	**67**	**1179**

The type of trainers trained were, practicing farmers (64), youths (70) and farm women (1045).

Demonstration of various aspects of farming and other aspects were also taken up by the Kendra. The different aspects concerned were as follows:

Sl. No.	Item of Demonstration	No.	Area	No. of participants
1.	Prawn seed collection	3	Surf region and canals in Vypeen island.	33
2.	Eradication of predators from the culture field	2	0.2 ha	29
3.	Fish processing	4	N.A.	71
4.	Fruit preservation	4	-	55
5.	Making hay box	1	-	20
6.	Garment making	1	-	6
7.	Vegetable cultivation	2	KVK Campus	29
	Total	**17**		**243**

Apart from the regular training programme, the Kendra provided training to the farmers sponsored by the Brackishwater Fish Farmers Development Agency on prawn farming. Training courses were conducted for officials of the Nationalised and Scheduled Banks on prawn farming to enlighten them on the scientific and cost-benefit aspect so as to enable them to evaluate the projects submitted by the farmers for financial assistance. Students of the Vocational Higher Secondary Schools of Narakkal and Kadamakudi were given exposure to the practical aspects of prawn and fish farming. The various training programmes have greatly benefited the farmers by the adoption of new technologies. High returns have attracted more and more fishermen to scientific farming to cater to the increasing demand for prawn seed. Some of the trained farmers are employed in prawn farms. During the period five villages and a total of 237 farm families have been surveyed to know the type of training they required. The KVK has been advocating the feasibility of taking up three harvests of prawns in an year by proper management practices. A production of around 3500 kg/ha of tiger prawn valued at Rs. 7 lakhs can be harvested. Under a separate Research Project of the Institute, 18 farmers of Narakkal village were identified to study the feasibility of transfer of fish/prawn culture technologies in hitherto unutilised canal system in coastal villages.

Training achievements of the Trainers' Training Centre

Sl. No.	Name of the subject	Duration (days)	No.of training conducted	No. of persons trained
1.	Prawn farming	5	1	10
2.	Prawn farming	10	2	21
3.	Hatchery production of prawn seeds	10	1	13
4.	Seaweed culture and utilisation	5	1	19
5.	Seaweed culture and utilisation	10	1	9
6.	Post harvest technology in fisheries	10	1	5
	Total		**7**	**77**

Trainees included the State Government and Union Territory Officials (39), Bank Officials (10), other organisations and individuals (28).

The extension activities taken up by the KVK/TTC

Sl. No.	Subject	No.	No. of participants
1.	Film shows	27	3500
2.	Radio talk	6	–
3.	Prawn harvest	3	150
4.	Prawn seed conditioning	1	65
5.	Women in Agriculture Day	1	75

Centre-wise list of Scientists and the Code Numbers of Projects in which the Scientist is Project Leader or Associate

Centre/ Name of the Scientist	Designation	Project Codes
COCHIN		
Dr.P.S.B.R.James	Director	
Shri K.V. Narayana Rao	PS	PF/IP/3, CF/IP/1
Dr. K. Alagaraja	PS	FSS/FRA/1.3, FSS/FRA/ST.1, DF/IP/1,FEM/RS/1.1
Shri M.S. Rajagopalan	PS	FEM/ES/1,/FEM/ES/5, FEM/RS/1.1
Dr. A. Noble	PS	PF/IP/1, PF/IP/3, CF/IP/1
Shri D. Sadananda Rao	PS	FEM/ES/5
Shri G. Subbaraju	PS	FEM/RS/1.1
Dr. P. Bensam	PS	DF/IP/4
Dr. C.S. Gopinadha Pillai	PS	FEM/EE/1
Dr. A.D. Diwan	S(S-3)	PNP/43
Shri D.B.S. Sehara	S(SG)	DF/IP/1
Dr. C. Suseelan	S(SG)	DF/IP/1,DF/IP/4
Dr. V. Kunjukrishna Pillai	S(SG)	FEM/MP/1
Dr. K.J. Mathew	S(SG)	FORV/SS/3
Dr.K. Rengarajan	S(SG)	FORV/SS/3
Dr.(Ms.) S. Sivakami	S(SG)	PF/IP/1,DF/IP/4
Shri G.S. Daniel Selvaraj	S(SG)	FEM/ES/1, FEM/ES/5
Shri K. Narayana Kurup	S(SG)	FSS/FRA/1.1, FSS/FRA/1.3, PF/IP/3
Shri G. Nandakumar	S(SG)	DF/IP/1, CF/IP/1
Ms. Mary K. Manissery	S(SG)	CF/IP/1
Shri N. Surendranatha Kurup	S(SG)	DF/IP/1,CF/IP/1
Dr. A. Regunathan	S(SG)	FE&E/23
Dr. N. Gopinatha Menon	(SG)	PF/IP/1, DF/IP/1,FORV/SS/3
Shri K. Balan	S(SG)	FSS/FRA/1.3,FSS/FRA/ST.1, CF/IP/1
Dr.(Ms.) V. Chandrika	S(SG)	FEM/ES/1
Dr. K.S.Scariah	S(SG)	FSS/FRA/ST.1,FSS/FRA/1.19, DF/IP/1
Dr. C.P. Gopinathan	S(SG)	FEM/ES/1, FEM/MP/1
Shri K.G. Girijavallabhan	S(SG)	FEM/ES/1
Shri R. Sathiadhas	S(SG)	PF/IP/1
Shri K.V. Somasekharan Nair	S(SG)	DF/IP/1, DF/IP/4, CF/IP/1, FEM/RS/1.1

Shri K.K.P. Panikkar	S(SG)	PF/IP/3
Dr.N. Gopalakrishna Pillai	S(SG)	PF/IP/1, PF/IP/3, FEM/RS/1.1
Shri K.N. Rajan	S(SG)	DF/IP/1,DF/IP/4, CF/IP/1
Shri M. Srinath	S(SG)	FSS/FRA/1.3, FSS/FRA/ST. 1, PF/IP/4,FEM/RS/1.1
Shri P.C. Thomas	S(SG)	PNP/41
Dr. K.C. George	S(SG)	PNP/37
Dr. M.K. George	S(SG)	PNP/41
Shri R.N. Misra	S(SG)	FEM/ES/5,FEM/MP/1
Shri K. Prabhakaran Nair	S(SG)	DF/IP/4, FORV/SS/3
Shri P.E. Sampson Manickam	S(SG)	DF/IP/1
Shri K.R. Manmadan Nair	S(SG)	DF/IP/1, DF/IP/4
Ms. Krishna Srinath	S(SG)	On study leave
Shri S. Muthusamy	S(S-2)	FEM/ES/1
Ms. Grace Mathew	S(S-2)	PF/IP/1,DF/IP/1,DF/IP/4
Ms. T.S. Naomi	S	FEM/ES/1, FORV/SS/3
Ms.K. Vijayalakshmi	S	FSS/FRA/ST.1, FSS/FRA/1.19, PF/IP/2
Ms. Jancy Gupta	S	FE&E/23
Dr. Mohan K. Zachariah	S	PNP/39
Dr. N. Sridhar	S	PNP/39
Ms. Prathibha Rohit	S	PF/IP/3,DF/IP/1,CF/IP/1
Ms. V.Kripa	S	DF/IP/1,MF/RE/2
Dr.(Ms.)M.K. Sanhotra	S	PNP/35
Dr. A.K. Pandey	S	PNP/39
Dr. Naresh Kumar Varma	S	PNP/41
Dr. I.D. Gupta	S	PNP/41
Shri T.V. Sathianandan	S	FSS/FRA/1.3, FSS/FRA/ST.1, PF/IP/1, CF/IP/1, FEM/RS/1.1
Shri P. Vijayagopal	S	PNP/35
Ms. M.P. Molly	S	FEM/ES/1, FEM/ES/5

MANDAPAM CAMP

Shri. R. Marichamy	PS	DF/CUL/3
Dr. N. Neelakanta Pillai	S(SG)	CF/CUL/1.1.7
Dr. N. Kaliaperumal	S(SG)	FEM/SW/1
Shri A.A. Jayaprakash	S(SG)	PF/IP/1, DF/IP/1, CF/IP/1
Shri P. Livingston	S(SG)	PF/IP/1,DF/IP/1
Shri A. Raju	S(SG)	DF/CUL/3
Shri A.P. Lipton	S(SG)	DF/IP/1, MF/RE/2
Dr. P Nammalwar	S(SG)	DF/CUL/3
Dr. E.V. Radhakrishnan	S(SG)	CF/CUL/1.1.7
Shri S. Krishna Pillai	S(S-2)	FEM/ES/1

Dr. P. Jayashankar	S	DF/IP/1,DF/CUL/3
Ms. Reeta Jayashankar	S	FEM/ES/1, FEM/SW/1
Shri G. Maheshwarudu	S	DF/IP 1, CF/IP/1, CF/CUL/1.1.7

VERAVAL

Dr. Alexander Kurian	S(SG)	PF/IP/1, PF/IP/2, DF/IP/1
Dr.E. Vivekanandan	S(SG)	PF/IP/1, DF/IP/1
Shri K.P. Said Koya	S	PF/IP/1
Shri K.K. Philipose	S	PF/IP/2, DF/IP/1

BOMBAY

Dr.(Ms.) P.V. Kagwade	PS	DF/IP/1
Dr. Kuber Vidyasagar	S(SG)	DF/IP/1
Dr. S.K. Chakraborthy	S(SG)	DF/IP/1
Shri K.S. Sundaram	S(SG)	DF/IP/1
Shri M. Zaffar Khan	S(SG)	PF/IP/1, PF/IP/2, DF/IP/1
Dr. V.D. Deshmukh	S(SG)	PF/IP/2, DF/IP/1
Shri S.G. Raje	S(SG)	DF/IP/1
Shri M. Aravindakshan	S	PF/IP/2, DF/IP/1
Dr. V.V. Singh	S	FEM/ES/1

KARWAR

Shri G.G. Annigeri	PS	PF/IP/3, CF/IP/1
Dr. V.S. Kakati	S(SG)	DF/IP/1, CF/IP/1, FORV/SS/3
Shri V. Gandhi	S(SG)	PF/IP/3, DF/IP/1
Dr. P.K. Krishna Kumar	S	FEM/ES/1, FEM/MP/1
Dr. P.K. Asokan	S	DF/IP/1, MF/RE/2, MF/CUL/8

MANGALORE

DR. P.V. Rao	PS	FORV/SS/3
Dr. P.P. Pillai	PS	PF/IP/1, PF/IP/3, FORV/SS/3
Shri K.K. Sukumaran	S(SG)	DF/IP/1, CF/IP/1
Shri G.M. Kulkarni	S	PF/IP/1, PF/IP/3, DF/IP/1
Shri P.U. Zachariah	S	PF/IP/1, PF/IP/3, DF/IP/1
Dr. Sunil Kumar Mohamed	S	DF/IP/1, MF/RE/2

CALICUT

Dr. V. Narayana Pillai	PS	FEM/ES/1, FEM/RS/1.1, FORV/SS/1
Shri M. Kumaran	PS	DF/IP/1, CF/IP/1
Dr. R.S. Lal Mohan	PS	PF/IP/1, DF/IP/1
Dr. P.S. Kuriakose	S(S-3)	MF/CUL/4
Shri G.P. Kumaraswamy Achary	S(SG)	MF/CUL/4, FORV/SS/3
Shri K.K. Appukuttan	S(SG)	MF/CUL/4
Shri M. Sivadas	S	PF/IP/1, DF/IP/1, CF/IP/1
Shri C.V. Mathew	S	FEM/ES/1, FEM/ES/5
Shri M. Feroz Khan	S	PF/IP/1, DF/IP/1, CF/IP/1
Ms. P.T. Sarada	S	DF/IP/1, CF/IP/1

VIZHINJAM

Dr. P.A. Thomas	S(SG)	FEM/ES/1
Dr. S. Lazarus	S(SG)	DF/IP/5, CF/IP/1
Ms. Rani Mary George	S(SG)	On study leave
Shri G. Gopakumar	S(SG)	PF/IP/1, CF/IP/1
Dr. N. Ramachandran	S(S-2)	CF/IP/1, MF/RE/2
Ms. S. Jasmine	S	FEM/ES/1

TUTICORIN

Dr. K.A. Narasimham	PS	MF/CUL/4
Dr. M. Peer Mohamed	PS	FEM/MP/1
Dr. A.C.C. Victor	S(SG)	MF/CUL/4, MF/CUL/10
Shri A. Chellam	S(SG)	On study leave
Shri S. Dharmaraj	S(SG)	MF/CUL/4, MF/CUL/10
Shri M.E. Rajapandian	S(SG)	MF/CUL/4, MF/CUL/9
Shri P. Muthiah	S(SG)	MF/CUL/4, MF/CUL/9
Shri K. Ramadoss	S(SG)	MF/RE/2
Shri P. Sam Bennet	S(SG)	DF/IP/1, CF/IP/1
Shri K.M.S. Ameer Hamsa	S(SG)	PF/IP/1, DF/IP/1
Dr. H. Mohamed Kasim	S(SG)	PF/IP/1, DF/IP/1
Dr. D.B. James	S(SG)	FEM/CUL/2
Dr. M. Rajamani	S(SG)	DF/IP/1, DF/IP/5, CF/IP/1
Dr. D.C.V. Easterson	S(SG)	On study leave
Shri D. Kandasamy	S(SG)	PNP/35, FEM/MP/1
Shri T.S. Velayudhan	S(SG)	MF/CUL/4, MF/CUL/10
Shri D. Sivalingam	S(S-2)	DF/IP/1, MF/CUL/4
Shri V.S. Rengasamy	S(S-2)	DF/IP/1
Ms. Rani Palanisamy	S	MF/CUL/4, MF/CUL/9

MADRAS

Dr. K. Satyanarayana Rao	PS	MF/CUL/8
Shri N.S. Radhakrishnan	S(SG)	DF/IP/1, CF/IP/1
Shri R. Thiagarajan	S(SG)	PF/IP/1, DF/IP/1
Dr. P. Devadoss	S(SG)	PF/IP/1, DF/IP/1, CF/IP/1
Shri J.C. Gnanamuttu	S(SG)	DF/IP/1, CF/IP/1
Shri G. Mohanraj	S(SG)	DF/IP/1, CF/IP/1
Shri R. Sarvesan	S(SG)	On study leave
Dr. P.V. Sreenivasan	S(SG)	MF/RE/2, MF/CUL/8
Shri M. Vijayakumaran	S(SG)	PNP/35
Shri M. Rajagopalan	S(SG)	FEM/ES/1, FEM/ES/5
Dr. R. Paul Raj	S(SG)	PNP/35
Shri M.M. Meiyappan	S(SG)	DF/IP/1, FORV/SS/3
Shri S. Srinivasarengan	S(S-2)	DF/IP/1,CF/IP/1
Shri V. Thangaraj Subramanian	S(S-2)	DF/IP/1, CF/IP/1
Shri P. Natarajan	S(S-2)	MF/RE/2, MF/CUL/8

KAKINADA

Dr. V. Sriramachandra Murty	S(SG)	DF/IP/1
Shri C. Muthiah	S(SG)	On study leave
Dr. G. Syda Rao	S(SG)	DF/IP/1, MF/RE/2, MF/CUL/8
Dr. (Ms.) S. Lalitha Devi	S(SG)	On study leave
Dr. P.N. Radhakrishnan Nair	S(SG)	DF/IP/1

VISAKHAPATNAM

Dr. G. Luther	PS	PF/IP/1, CF/IP/1
Dr. T. Appa Rao	PS	DF/IP/1
Shri S. Reuben	S(S-3)	DF/IP/1, CF/IP/1
Dr. G. Sudhakara Rao	S(SG)	DF/IP/1, CF/IP/1, CF/IP/2
Shri Y. Appanna Sastry	S(SG)	DF/IP/1
Shri G. Radhakrishnan	S	DF/IP/1
Shri K. Vijayakumaran	S	FEM/ES/1, FEM/RS/1.1

MINICOY

Dr. V.S.K. Chennubhotla	PS	FEM/SW/1
Shri T.M. Yohannan	S(SG)	PF/IP/4, DF/IP/5
Shri Pon Siraimeetan	S(SG)	On study leave
Dr. P. Kaladharan	S	FEM/ES/1, FEM/SW/1

KVK/TTC, NARAKKAL

Dr. M.M. Thomas	PS	Extension & Training, FE&E/23
Dr. D. Noble	S(SG)	Extension & Training

HEADS OF DIVISIONS

1.	Fishery Resources Assessment Division	--	Dr.K.Alagaraja, Principal Scientist
2.	Pelagic Fisheries Division	--	Dr. G. Luther, Principal Scientist
3.	Demersal Fisheries Division	--	Dr.P. Bensam, Principal Scientist
4.	Crustacean Fisheries Division	--	Dr. N. Nelakanta Pillai, Senior Scientist
5.	Molluscan Fisheries Division	--	Dr. K. Satyanarayana Rao, Principal Scientist
6.	Fishery Environment Management Division	--	Shri D. Sadananda Rao, Principal Scientist
7.	Physiology, Nutrition and Pathology Division	--	Dr. M. Peer Mohamed, Principal Scientist
8.	Fishery Economics and Extension Division	--	Dr. A. Regunathan, Senior Scientist

DEPUTATIONS

Smt V. Kripa, Scientist and **Shri A. Devendra Gandhi,** Technical Assistant (T.II.3) participated in a training course on "Breeding and culture of Scallops and Sea cucumber" organised by NACA, China from 24 May - 25 June 1991.

Dr. P. Parameswaran Pillai, Principal Scientist participated in the Workshop on Stock Assessment of Yellowfin Tuna in the Indian Ocean at Colombo from 7-12 October 1991.

Dr. P.S.B.R. James, Director, attended the 5th Meeting of the National Co-ordination of Seafarming Development and Demonstration Project at Bangkok from 5-8 November 1991.

Shri R. Marichamy, Principal Scientist, attended the Seminar on Mud Crab Culture and Trade at Surat Thani, Thailand from 5-8 November 1991, organised by Bay of Bengal Programme.

Dr. V. Kunjukrishna Pillai, Senior Scientist attended the Workshop on Cleaner Fishery Harbours at Penang from 9-11 December 1991 organised by Bay of Bengal Programme.

Dr. P.K. Krishnakumar, Scientist was deputed to Seattle, Washington, USA to avail Biotechnology Overseas Scholarship Award 1991-92.

FISHERIES EXPERT COMMITTEE

Dr. K. Alagaraja, Principal Scientist and **Dr. C. Suseelan,** Senior Scientist of the Institute served as members of the Fisheries Expert Committee, constituted by the Government of Kerala to advice on the problem of ban on monsoon trawling along the Kerala coast. The committee submitted its report on 31 May 1991.

ENGAGEMENTS

Dr.P.S.B.R. James, Director, attended the following:

The cruise programme and priorities committee meeting for finalising the cruise programmes for FORV *Sagar Sampada* and FORV *Sagar Kanya* at New Delhi, 6 May '91.

The meeting of the group constituted for finalising FORV *Sagar Sampada* cruise programmes for 1991-92 at National Institute of Oceanography, Goa, 20 June '91.

The Workshop on Mathematical Modelling of the Ocean at National Aeronautical Laboratory, Bangalore, 25 June '91.

Meeting of the Standing Committee at ISRO Headquarters, Bangalore, 26 June '91.

Meeting with the Hon'ble Minister of State for Agriculture and Co-operation Shri Mullappally Ramachandran at Cannanore, 5 July '91.

Meeting of EFC/PIC documents for the year 1991-92 at ICAR Headquarters, 25-26 July '91

The Kendriya Vidyalaya Management Committee meeting at Mandapam Camp, 22 August '91.

Discussion with Secretary/Director/Advisor, Department of Fisheries, Orissa, regarding status of marine fisheries in the State and inspection of the possible sites for breeding of seabass, 8-11 September'91.

Group discussion-cum-National Consultation on the ICAR Personal Policies for Scientists at NAARM, Hyderabad, 24-25 October '91

5th National Coordination meeting of the Sea Farming Project at Bangkok, 5-8 November '91.

Seminar on strategies for development of fisheries in Andhra Pradesh, organised by A.P. Agricultural Ministry, Kakinada, 30-31 January '91.

Meeting and discussion with Dr.Chen Foo Yan on Environmentally linked aquaculture projects, New Delhi 18 February '92.

Meeting with Director General, ICAR to discuss personal policy for scientists. New Delhi, 9 March '92.

Dr. G. Luther, Principal Scientist, **Shri. S. Reuben,** Scientist S-3 and **Dr. G. Sudhakara Rao,** Senior Scientist participated in the decinnary celebration of *Fishing Chimes* at Visakhapatnam, 6 June 1991.

Dr.K.A. Narasimham, Principal Scientist, **Dr.D.B. James** and **Dr. A.C.C. Victor,** Senior Scientists participated in the National Workshop on "Promotion of marine pisciculture and allied activities among fisherfolk integrated with poverty alleviation programmes" jointly organised by the Fisheries College, Tuticorin, CMFRI and the Department of Rural Development, Ministry of Agriculture, Govt. of India, New Delhi, 26-27 June '91.

Dr. P.P. Pillai, Principal Scientist attended the Workshop on "Stock Assessment of yellowfin tuna in the Indian Ocean" at Colombo, 7-12 October '91.

Dr.K.C. George, Senior Scientist participated in the discussion on "Fish disease outbreak in Kerala". This programme was telecasted by Thiruvananthapuram Doordarshan, 10 October '91.

Dr.K.A. Narasimham, Principal Scientist attended the Workshop on " Industrial Development of Tuticorin Region" held at V.O. Chidambaram College, Tuticorin, 26 October '91.

Shri R. Marichamy, Principal Scientist participated in the Regional Seminar on 'Mud Crab Fattening' held at Surat Thani, Thailand. He presented the paper "Experiments on larval rearing and seed production of the mud crab, *Scylla serrata,*" 5-8 November '91.

Dr.K. Rengarajan, Senior Scientist and **Dr. N. Sridhar,** Scientist, attended the 8th National Training Programme in Electron Microscopy for Biological and Biomedical applications for scientific personnel of AIIMS, New Delhi, 12 November to 3 December '91.

Dr.N. Kaliaperumal, Senior Scientist and **Smt. Reeta Jayasankar,** Scientist attended the meeting on " Seaweed resources of India and present status of seaweed exploitation" organised by MPEDA at NIO, Dona Paula, Goa, 23 November '91.

Shri G.P. Kumaraswamy Achari, Scientist (S.G.) and **Dr.N. Kaliaperumal,** Senior Scientist participated in the " All India Symposium on Algal Resources, their management, biology, chemistry and utilisation", organised by University of Kerala at Thiruvananthapuram, 25-27 November '91.

Dr.M. Peer Mohamed, Principal Scientist, participated in a training course on Information, Management and Research Communication in Agriculture" held at NAARM, Hyderabad, 26 November to 6 December '91.

Dr.G. Luther, Principal Scientist attended the Workshop on "Satellite Remote Sensing in Marine Fisheries", organised jointly by Department of Fisheries, Government of Andhra Pradesh, Fishery Survey of India and Association of Indian Fishing Industry of Visakhapatnam, 27 November '91.

Dr.A.D. Diwan, Principal Scientist and **Shri A. Nandakumar,** Technical Assistant, participated in the "Second Congress of the Asia and Oceanic Society for Comparative Endocrinology" organised by Indian Society of General and Comparative Endocrinology and Department of Zoology, Delhi University and presented a paper "Studies on short term preservation of sperm motility of a cultivable marine fish *Liza parsia* (Hamilton), 3-6 December '91.

Shri V. Kunjukrishna Pillai, Senior Scientist attended a Workshop on "Cleaner Fishing Harbours" at Penang, 9-11 December '91.

Dr.G. Sudhakara Rao, Senior Scientist attended the Seminar on "Agricultural Potential of North Coastal Districts of Andhra Pradesh", organised by Andhra Pradesh Agricultural

University at Srikakulam and presented a paper "An assessment of prawn fishery resources off Visakhapatnam", 27-28 December '91.

Dr.A.P. Lipton, Senior Scientist attended the International Conference on Food Resources, Production and Processing Technology organised by Institute of Artemia Research and Training (Madurai Kamaraj University) at Nagarcoil, 28-30 December '91.

Dr.K.A. Narasimham, Principal Scientist gave a talk on "Coastal Aquaculture" at a function organised by Zoology Association of St.Mary's College, Tuticorin, 17 January '92. Also attended the inaugural function of the Aquaculture Training Programme conducted by the Fisheries College and Research Institute Tuticorin and gave the felicitation address, 21 January '92.

Dr.G. Luther, Principal Scientist; **Shri S. Reuben,** Scientist S-3; **Dr.G. Sudhakara Rao,** Senior Scientist and **Shri Y. Appanna Sastry,** Scientist (S.G.) attended the Seminar on "Strategies for development of Fisheries in Andhra Pradesh" at Kakinada, 30-31 January, 1992.

Dr.N. Kaliaperumal, Senior Scientist attended the meeting of seaweed, seashell, *Beche-de-mer* suppliers, utilizers and exports, organised by the MPEDA at Madras, 18 February '92.

Dr.D.B. James, Senior Scientist, participated as faculty member in the training programme for fishermen on improved methods of handling and processing of sea cucumbers for export at Irupalakudy (Palk Bay), jointly organised by MPEDA, CMFRI and Department of Fisheries, Govt. of Tamil Nadu, 19-25 February '92.

Dr.G. Luther, Principal Scientist and **Dr.G. Sudhakara Rao,** Senior Scientist attended the III Zonal meeting of the Southern States held at Visakhapatnam, 21 February '92.

Dr.K.A. Narasimham, Principal Scientist, **Dr.A.C.C. Victor,** Senior Scientist, **S/Shri S. Dharmaraj, M.E. Rajapandian, K. Ramadoss, D. Sivalingam, T.S. Velayudhan,** Scientists (S.G.) and **Smt. Rani Palaniswamy,** Scientist, participated in the National Seminar on Prawn Seed and the National Workshop on the impact of Coastal Aquaculture on Environment, held at Fisheries College and Research Institute, Tuticorin, 25-26 February '92.

Dr.K. Satyanarayana Rao, Principal Scientist served as a Member, Academic Council of Tamil Nadu Veterenary and Animal Sciences, Madras. He gave an invited lecture on "Recent Trends in Marine Fisheries in India at the Presidency College, Madras.

Dr.M.M. Thomas, Officer-in-charge, Krishi Vigyan Kendra, Narakkal attended the following:

1. Meetings organised by MPEDA on prawn farming
2. Monthly workshops of Kerala State Agricultural Extension Programme.

Dr. D. Noble, Senior Scientist attended the KVK revised meeting at Gandhigram.

VISITORS

Cochin

Dr. S.S. Ahluwalia, Director (International Co-operation)Ministry of Agriculture, New Delhi.

Dr. S.C. Pathak, Deputy Manager, NABARD, Bombay.

Dr. Subba Rao, Director (Research), Andhra Agricultural University.

Dr. Dean Parsons, National Marine Fisheries Service, Maryland.

Japanese Delegation on Joint venture promotion group, consisting of Mr. Iwao Mizuishi, Expert; Mr. Takeshi Wakamatsu, Expert; Mr. Junzo Ohmori, Adviser and Mr. Kanae Bito, Adviser.

Mandapam Camp

The Parliamentary Committee consisting of 7 members.

Dr. K. Abdul Azeez, Deputy Commissioner, Commercial taxes, Madurai.

Dr. B.S. Attri, Additional Director, Ministry of Environment and Forests, New Delhi.

Dr. E.G. Silas, Vice Chancellor, Kerala Agricultural University, Trichur, Kerala.

Dr. S. Shanmuga Sundaram, Dean, Veterinary College and Research Institute, Veterinary and Animal Sciences University, Namakkal.

Dr. M. Devaraj, Dean; Dr. N. Sukumaran and Shri M. Justin, Fisheries College and Research Insitute, Tuticorin.

Veraval

Prof. P.V. Subba Rao and Ms. Ujjwala Gadre with students CIFE, Bombay.

Dr. K. Radhakrishna, Assistant Director General (MF), ICAR; Dr. Gopal K. Saxena, Scientist, CIFE, Bombay and Shri K. Venkateswaran, Scientist, CFETC (CIFE), Kakinada.

Dr. K. Gopakumar, Director, CIFT, Kochi; Shri R.P. Gupta, Director (Hindi), ICAR, New Delhi; Smt. Sheela, P.J., Assistant Director (O.L.), CMFRI and Smt. Jessy Joseph, Assistant Director (O.L.), CIFT, Kochi.

Tuticorin

Shri S.P. Elangovan, IAS, Secretary, Dept. of Rural Development, Govt. of Tamil Nadu, Madras.

Shri A.K. Agarwal, Deputy Commissioner, Dept. of Rural Development, Govt. of India, New Delhi.

Shri K.N. Shrivastava, IAS, Director, Ministry of Steel and Mines, Govt. of India, New Delhi.

Smt. K. Ratna Prabha, Collector, Raichur, Karnataka.

Dr. D. Vincent (with trainees), MPEDA, Prawn Farming Complex, Vallarpadam, Kochi.

Prof. T.M. Sankaran, Dr. Madhusoodana Kurup, Smt.Mallika (with students), College of Fisheries, Kerala Agricultural University, Kochi.

Shri R. Poornalingam, Commissioner of Fisheries, Tamil Nadu Fisheries Dept., Madras.

Dr. Y. Venkateswarulu, Scientist, IICT, Hyderabad with 5 Junior Research Fellows.

Mrs. Shyamala Thiagarajan, CIRI, Madras.

Dr. A. Ramasamy, Asst. Director (PF), Vigella, England.

Dr. M.T. Mulgir, Lecturer, Science College, Nanded,Maharashtra.

Dr. T.A. Balakrishnan, Reader in Zoology, Vijaya College, Bangalore.

Shri Harpreet Singh, IAS (P) LBS, NAA, Mussoorie (U.P.).

Shri T.M. Koya, Superintendent of Fisheries, Andamans.

Dr. E.G. Silas, Vice-Chancellor, Kerala Agricultural University, Trichur, Kerala.

Dr. M.D.K. Kuthalingam, Vice-Chancellor, Madurai Kamaraj University, Madurai.

Dr. M. Devaraj, Dean, Fisheries College, Tuticorin.

Lt. C.J. Panicker, Lt. D.K. Swain and Lt. M. Kumar, I.N.S., T.I.R., Kochi.

Dr.(Ms.) Rajammal P. Devadas, Vice-Chancellor, Avinashilingam Deemed University, Coimbatore.

S/Shri S.K. Choudhary, D.K. Pattrick, J. Sasta and B. Pande, O.A.S., B.F.D.A., Cuttack.

Shri Ibrahim Babu, Asst. Director, MPEDA, Alibag (with trainees).

Madras

Dr. V.L. Chopra, Director-General, I.C.A.R and Secretary, Department of Agriculture Research and Education, Government of India.

Dr. K. Radhakrishna, Assistant Director General (MF), ICAR.

Visakhapatnam

Dr. K. Radhakrishna, Assistant Director General (MF), ICAR.

Shri L.M. Chuaungo, IAS, Managing Director, Gujarat Fisheries Development Corporation, Ahmedabad.

Mr. Per.J. Sparre and Rolf Willana, FAO, Rome, Italy.

Dr. Marcel Giudicelli, FAO, Rome, Italy.

Minicoy

S/Shri P. Saikoya, Kalikagoth Moosa, M.P. and Cheriya Koya, Councillors to the Administrator, U.T. of Lakshadweep.

Dr. Vishnu Potti, Director, Forensic Science Laboratory, Thiruvananthapuram.

Justice R.L. Gupta, Delhi High Court and Justice Chopra, Rajasthan High Court.

PUBLICATIONS

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Centre-wise list of Technical/Administrative/Auxiliary/ Supporting staff as on 31st March 1992

(Not a gradation list)

CMFRI-Headquarters, Cochin

Technical Staff

T-7

Shri S. Natarajan, - *Field Officer*
„ G. Balakrishnan - *Field Officer*
„ P.R. Leopold - *Skipper*
„ P.K. Velayudhan - *Mate*

T-6

Field Officers

Shri Varghese Philipose
„ V. Rajendran

T-5

Technical Officers

Shri K.C. Yohannan
„ M. Ayyappan Pillai
„ V.K. Balachandran
„ K.N. Gopalakrishnan
„ P. Karunakaran Nair
„ Varghese Jacob
„ G. Krishnankutty Nair
„ P.Sivaraman
Ms.K.S.Leela Bhai
„ V.P. Annam
Shri P.M. Aboobaker
„ R. Reghu
Ms. C. Nalini
Shri V. Suresh
„ P. Raghavan - *Photography*
„ B. Ramesh - *Bosun*

T-4

Senior Technical Assistants

Shri A.A. Thankappan
Shri N.P. Kunhikrishnan
Ms. Geetha Antony
Shri K. Thulasidas
„ K.L.K. Kesavan - *Sr. Artist*
„ Nirmal Mathew - *Bosun*

T-II-3

Technical Assistants

Shri Joseph Andrews
Ms. A. Kanagam
Shri. A. Kanakkan
„ S. Haja Najeemuddin
„ C.J. Prasad
„ A. Nandakumar
Ms. P.L. Ammini
Shri K. Balachandran
„ V.A. Narayanan Kutty
„ N.B. Gopalakrisha Menon -*Bosun*
Ms. S. Girija Kumari - *Library Asst.*

T-I-3

Shri. K. Ramadoss Gandhi
„ K. Chellappan
Ms. K.K. Valsala
Shri Mathew Joseph
„ M.N. Kesavan Elayathu
„ L.R. Khambadkar
„ J. Narayanaswamy
„ M.P. Sivadasan
„ C.K. Dandapani - *Serang*
„ T.R. Sreekumaran - *Oilman*
„ C.D. Davis - *Motor Driver*
„ S. Yadavaiah - *Motor Driver*
„ K. Chacko - *Projector Operator*

Shri M.A. Vincent - *Driver (Boat)*

Punch Card Operators

Shri K.P. George
„ M.B. Seynudeen
„ P.P. Pavithran
Ms. M.R. Beena
Ms. P.T. Mani
Shri M. Ramachandran
„ K. Anandan
Ms. Latha Khambadkar

Junior Library Assistants

Ms. P. Geetha
„ K. Ramani
Shri. V. Mohan
„ M. Abdul Nizar - *Jr. Tech. Asst.*
„ K.K. Sankaran - *Artist*

Motor Drivers

Shri K.J. Mathew
„ M.N. Appukuttan Nair
„ K.K. Soman

Senior Deckhands

Shri P. Bhaskaran
„ K.P. Vijayan
„ M.K. Gopalakrishnan
„ K.S. Leon
„ K.C. Devassy
„ P.D. Chidambaram - *Oilman-cum-Deckhand*
„ K. Raju - *Cook*

T.1

Field Assistants

Shri R. Anil Kumar
„ P.K. Baby
Ms. K.P. Salini
Shri K.M. Venugopalan
„ K. Solomon
Shri K.N. Pushkaran
„ V.R. Arunachalam
„ Thomas Kuruvilla
„ K.C. Pradeep Kumar
Ms. P.K. Seetha
Shri V.K. Suresh
„ A. Udayakumar
Ms. T.N. Anandalakshmy
Shri C. Unnikrishnan
„ G. Sampath Kumar
„ G. Subbaraman - *Punch Card Operator*
Ms. P.M. Geetha - *Museum Assistant*
Shri K.K. Bose - *Driver (Boat)*

Administrative Staff

Shri T.V. Asari - *Sr.Finance & Accounts Officer*
„ K.U.K. Menon - *Asst. Finance & Accounts Officer*
„ C. Muralidharan - *Admn. Officer*
„ P. Aithappa Naik - *Asst. Admn. Officer*
„ S.R. Narayanan - *Asst. Admn.Officer*
Ms. P.J. Sheela - *Asst.Director (Official language)*

Superintendents

Shri S. Subramanian
„ R. Kuppuswamy
„ V. Chemmutty
„ J.M. Vaz
„ P.J. Davis
„ P. Ganeshan
Ms. T.K. Ponnamma
„ M.A. Seetha - *Sr. Stenographer*

Assistants

Shri K. Nagarajan
„ M.J. John
„ A. Narayanaswamy
„ S. Abdulla
„ K.L.K. Padmanabhan
„ M. Ganapathy

Ms. P.V. Mary
Shri K. Arumugham
„ M. Velu
„ N. Govindan
„ T.N. Padmanabha Kurup

Stenographers

Shri K.M. Surendran
Ms. D. Geetha
Shri C. Yohannan
Ms. A.K. Omana

Junior Stenographers

Ms. N. Ambika
„ N.R. Latha Devi
„ K.V. Sajitha
Shri R. Chandrakesa Shenoy
Ms. K.J. Malathi Devi
„ N. Yesodha
Shri C.G. Thomas
„ C.N. Chandrasekharan
Ms.V.K. Sobha

Senior Clerks

Ms.T.Madhavi
Shri V.V.Lakshminarayanan
„ V.P.Unnikrishnan
Ms.P.K.Sridevi
shri V.Chandrasekharan
Ms.A.Ranjini
„ K.M.Annamma
„ M.O.Leela
Shri V. Mohanan
Ms. K. Vijayalakshmi
„ K.C. Karthiayini
Shri A.P. Balakrishnan
„ M.K. Abdulla
„ Thomas Joy
Ms. M. Suseela
„ K.C. Girija
„ Alice Valuran

Ms. M.M. Teresakutty
„ Christina Joseph
„ K. Santha
„ A.K. Kunjipennu
„ N.K. Suseela
„ G. Ambika
Shri K.J. Mathew
„ P.M. Bhaskaran
Ms. N.S. Sarala
„ P.S. Sumathy
„ M.G. Chandramathy
Shri C.K. Sivadas
„ K. Baburajan
„ V.C. Antony
Ms I.M. Baby Rajalakshmi
Ms. V. Parukutty
Shri M. Balaraman
„ K. Ramadasan
Ms. K. Kousallia
Shri Benny Mathew
„ V.C. Subash
Ms. V. Jayalakshmi
Shri K. Sadananadan
„ Augustus Julin Raj
„ P.V. Devassy
Ms.N.G. Supriya
„ P.K. Many
Ms. G. Ponnamma
„ N.M. Ponnamma
Shri M.J. Tomy Prince - *Telephone*
Ms. K. Balamani - *Hindi*

Auxiliary Staff

Ms. E.K. Uma - *Sr. Hindi Translator*
„ E. Sasikala - *Hindi Translator*

Drivers for light vehicles

Shri M.B. Xavier
„ V.A. Surendran
„ A. Rajan
„ M.R. Bharathan - *Deckhand*

Shri Ravindran Andi - *Deckhand*
„ M. Krishnan - *Binder*
„ N. Ravindranathan Nair - *Sr. Gestetner Operator*

Supporting Staff

SSG-IV

Lab. Attendants

Shri P.A. Vasudevan
„ K.P. Joseph
„ P.A. Vasu - *Fieldman*
„ M.K. Peethambaran - *Fieldman*
„ T.A. John - *Khalasi*
Ms. N. Leela - *Daftry*

SSG-III

Shri K.S. Vaidyalingam - *Fieldman*
„ M.L. Antony - *Lab. Attendant*
„ A.P. Sebastian - *Peon*

SSG-II

Shri T.A. Vijayan
„ N.T. Velappan

Watchmen

Shri B. Zainudheen
„ E.F. Francis
„ K. Ganesan
„ C. Chandran
„ G. Mithralal
„ G. Vijayan
„ P.K. Achuthan

Messengers

Ms. R. Devalakshmi
Shri T. Sreedharan
„ A. Gopinathan
„ K.C. Hezhakiel
„ T. Vijayakumar
„ T.M. Abdul Azeez

Safaiwalas

Shri K. Velayudhan
Ms. K.K. Kalliani
Shri C.O. Viswambaran
Ms. B. Savithri

SSG I

Watchmen

Shri. K. Velayudham
Shri K.T. Rajappan
„ E.J. James
„ V.T. Ravi
„ P.K. Ravindran
„ P.K. Chellappan
„ K.C. Rajappan

Messengers

Shri M.P. Mohandas
„ D. Prakasan
„ R. Ravindranathan Nair
„ V.A. Kuttappan
„ T.I Soman
Ms. Pennamma Joseph
Shri N.K. Harshan
Ms. R.M. Sarasamma
Shri V. Krishnan
„ P.V. Gopalan
„ S. Mohanan - *Lift Operator*
„ T.K. Antony - *Lift Operater*
„ K.G. Radhakrishnan Nair - *Helper*
„ V.H. Venu - *Binder*
„ N.V. Thambi - *Lab. Attendant*
„ S. Narayanan Achari - *Lab. Attendant*
Ms. J. Sudha Devi- *Cane Weaver*

Fieldmen

Shri P.B. Jeevaraj
„ P.S. Allocious
„ P.V. Joy
„ V.K. Aravindakshan
„ M.K. Anil Kumar

Safaiwalas

Shri P.D. Karunakaran
„ N.P. Mohanan
„ V. C. Gopi
„ B. Babu
Ms. A.Letha
Shri N.K. Shanmughan

Gardeners

Shri T. Lawrence
„ K.C. Jayaprasad

Chavakkad Field Centre

Shri K.G. Baby - *Field Asst.*

Quilon Field Centre

Shri Babu Philip - *Tech. Officer*
„ S.B. Chandrangathan - *Tech.Officer*

Alleppey Field Centre

Shri A.Y. Jacob - *Field Asst.*

Mandapam Regional Centre

Technical Staff

T-7

Shri B.S. Ramachandrudu - *Farm Engineer*
T-5

Technical Officers

Shri S. Kalimuthu
„ M. Badrudeen
„ C. Kasinathan - *Curator*
T-4
Shri P. Thankappan - *Foreman*
T-II-3

Technical Assistants

Dr. K. Muniyandi
Shri A. Ganapathy
„ S. Palanichamy
„ V. Edwin Joseph - *Lib. Asst.*

Shri T.K. Sudhakaran - *Bosum*
T-I-3

Technical Assistants

Shri. J.R. Ramalingam
„ M. Najmuddin
„ M.R. Arputharaj
„ M. Bose
„ A. Ramakrishnan
„ Md. Jaffar - *Driver (Boat)*
„ K. Muniyandi - *Artist*
„ P. Muniasamy - *Deckhand*
„ O. Muthukaruppan - *Motor Driver*
„ R. Marimuthu - *Painter-cum-Polisher*
„ S. Mohideen Meerasa - *Sr. Deckand*

T-2

Shri R. Subramanian - *Jr.Tech.Asst.*
„ M. Ebrahim - *Sr. Deckhand*
„ T.P. Haridasan - *Carpenter*
„ M. Rengan - *Cook (Boat)*

T-1

Shri N. Ramamurthy - *Museum Asst.*
„ R. Sekhar - *Deckhand*
„ A. Gandhi - *Field Asst.*
„ V. Sethuraman - *Field Asst.*
„ Sanjay Kumar Dana - *Mechanic*
„ A. Srinivasan - *Driver (light vehicles)*

Administrative Staff

Shri A. Sethubhaskaran - *Asst.Admn. Officer*
„ M. Ramakrishnan - *Supdt.*
„ V.M. Mariappan - *Asst.*
„ A. Kajendran - *Asst.*

Senior Clerks

Shri K. Margathavadivelu
„ S. Nagarajan
„ V. Chandran
„ P. Selvaraj
Ms.N.Gomathy - *Jr. Steno.*

Junior Clerks

Shri A. Yagappan
„ N. Natarajan
„ S. Muthumari
Ms.S.Parisa
„ M. Rameshwari

Supporting Staff

SSG - IV

Laboratory Attendants

Shri S. Mohamed Yousuff
„ K. Muthuramalingam
„ M. Chinnasamy
„ A. Raman - *Fieldman*

SSG III

Laboratory Attendants

Shri S. Muthuramalingam
„ M. Ibrahimsa
„ K. Gopalakrishnan
„ A. Muniasamy

Fieldmen

Shri A. Subramanian
„ S. Mani
„ R. Nagan
„ S. Pitchai - *Daftry*

Watchmen

Shri R. Sonai
„ K. Muthiah
„ M. Ramu
„ P. Kuruppiah

Safaiwalas

Shri R. Sevugan
„ M. Muthu
„ V. Santhanam
„ K. Kuruvan
„ A. Mari

Shri R. Alagan

SSG-II

Shri M. Athimoolam - *Cook*

Watchmen

Shri K. Muniasamy
„ M. Govindaraj
„ G. Saivadurai
„ K. Vellayan
„ P. Ramu
„ S. Arulsamy

Safaiwalas

Shri L. Sathan
„ G. Ankaiah
Ms. J. Kondamma
Shri K. Gurusamy
„ S. Nagammal
„ R. Sonaimuthu
„ K. Subramanian
„ S. Arumugham
„ S. Murugan
„ N. Nagamuthu
„ A. Palanichamy - *Messenger*

SSG-I

Laboratory Attendants

Shri S. Muruga Boopathy
„ N. Ramakrishnan
„ C. Ramadas
„ E. Natarajan
„ A. Yesudhas
„ K. Jeekanantham
„ M. Bareen Mohamed
„ S.M. Seeni
„ K.U. Raman - *Khalasi*
„ A. Susai - *Khansama*

Fieldmen

Shri M. Kuberaganeshan
„ K. Thangavel

Shri N. Boominathan
„ S.M. Sikkender Batcha
„ T. Thangarajan - *Oilman*
„ Y. Balu - *Oilman*
„ M. Shahul Hameed - *Messenger*
„ S. Kannadoss - *Messenger*
„ J. Padmanathan - *Lascar*
„ B. Thangaraj - *Lascar*
„ K. Govindan - *Khansama*
„ J. Hameed Sultan - *Pump Driver*
„ G.K. Rajan - *Pump Driver*
„ B. Ramesh - *Daftry*

Watchmen

Shri S. Balakrishnan
„ V. Alagan
„ N. Rajavelu

Safaiwalas

Shri V. Narasimmabharathi
„ U. Rajendran
„ S. Murugan

Nagapattinam Field Centre

Technical Assistants

Shri V. Sivasamy
„ V. Thanapathi
„ R. Somu

Pattukottai Field Centre

Shri K. Muthiah - *Tech. Asst.*
„ N. Vaithanathan - *Tech. Asst.*
„ K. Palani - *Jr.Tech. Asst.*
„ A. Kumar - *Jr. Tech. Asst.*

Veraval Research Centre

Technical Staff

T-I-3
Technical Assistants
Shri Y.D. Savaria
„ H.K. Dhokia
Shri B.P. Thumber

T-2

Shri M.S. Zala - *Jr.Tech.Asst.*

T-1

Field Assistants

Shri Ladani Amruthalal Arjanbhai
„ B.A. Ponchabhai
„ P.J. Premji
„ J.D. Vanvi
„ G.N. Chudasama - *Motor Driver*

Administrative Staff

Shri J.N. Jambudiya - *Jr. Clerk*

Supporting Staff
SSG-II
Watchmen

Shri Asiri Abu Bin Mehsan
„ I.M. Waghela
„ H.M. Bhint - *Messenger*

SSG-I

Shri M.K. Makvana - *Fieldman*
Shri Makanasomapitha - *Watchman*

Rander Field Centre

Shri B.V. Makadia - *Jr. Tech. Asst.*

Bombay Research Centre

Technical Staff

T-I-3

Technical Assistants

Shri K.B. Waghmare
„ J.L. Oza
„ C.J. Josekutty

T-2

Junior Technical Assistants

Shri A.D. Sawant

Shri J.D. Sarang
„ R. Dias Johny
„ B.B. Chavan
„ P.S. Gadankush - *Motor Driver*

T-1

Field Assistants

Shri A.Y. Mistry
„ B.G. Kalbate
„ Jayadev S. Hotagi
„ Thankur Das

Administrative Staff

Shri B. Vijayakumar - *Assistant*
Ms. P.V. Shanbhag - *Sr. Clerk*
Shri M.R. Wadadekar - *Sr. Clerk*
„ Rama D. Medar - *Jr. Steno.*
Ms. Ashlesha - *Jr. Clerk*

Supporting Staff

SSG-IV

Shri B.T. Talpade - *Lab. Attendant*
„ R.B. Bhangare - *Fieldman*

SSG II

Shri K.G. Tawade - *Watchman*

SSG-I

Watchmen

Shri B.D. Jangam
„ S.M. Tandel
„ M.P. Jadav
„ Kakwana Sona Pitta
Ms. V.V. Kharalia - *Safaiwala*
Shri P.S. Selvi - *Messenger*
Ms. Rajani Sakharam Tambe - *Messenger*
Shri K.K. Baiker - *Fieldman*

Janjira Murud Field Centre

Shri D.G. Jadhav - *Jr. Tech. Asst.*
„ K. Suresh Naik - *Field Asst.*

Dahanu Field Centre

Shri S.D. Kamble - *Field Asst.*
„ Suresh Krishnaras Kamble - *Field Asst.*

Ratnagiri Field Centre

Shri B.N. Katkar - *Jr.Tech.Asst.*
„ David Dattatray Sawant - *Field Asst.*

Malvan Field Centre

Shri Kishore Reghunath Mainkar - *Field Asst.*
„ Bharamus Melinmani - *Field Asst.*

Karwar Research Centre

Technical Staff

T-I-3

Technical Assistants

Shri C.K. Dinesh
„ N. Chennappa Gowda

T-2

Shri T.B. Harikantra - *Jr. Tech. Asst.*
„ V. Varadaiah - *Motor Driver*

T-1

Field Assistants

Shri V.M. Dhareshwar
„ U.V. Arghekar
„ Satyanarayana V.Pai
„ K.C. Pandurangachar
„ M.M. Bhaskaran
„ Narayana G. Vydya

Administrative Staff

Shri G.K. Kudalkar - *Asst.*
„ Y.H. Gamanagatti - *Sr. Clerk*

Junior Clerks

Shri Gangadhar B. Naik
„ Ganesh R. Nadig

Supporting Staff

SSG-IV

Shri G.M. Korar - *Fieldman*

SSG-II

Shri M.P.Harikantra - *Oilman*
„ M.E. Durgekar - *Lascar*

Watchmen

Shri L.K. Suvarna
„ M.R. Kotharkar
„ M.B. Kotharkar

SSG-I

Ms. Somi M. Harijan - *Safaiwala*
Shri Chandrakant G.Ulvekar - *Fieldman*

Watchmen

Shri Jhimmappa B. Gonda
„ Somayya S. Gonda
„ H.C. Naik
„ C.N. Jeglekar - *Messenger*

Goa Field Centre

Shri Ramesh B. Kamble - *Field Asst.*
„ Prakash C. Shetty - *Field Asst.*
„ Subash K. Naik-SSG I

Mangalore Research Centre

Technical Staff

T-I-3

Technical Assistants

Shri G. Subramanya Bhat
Ms. Alli C. Gupta
Ms. Uma S. Bhat
Shri B. Sridharan
„ D. Nagaraja

T-2

Junior Technical Assistants

Shri S. Kemparaju
Shri Y. Muniyappa

T-1

Field Assistants

Shri V. Lingappa
„ C. Purandhara
„ H.S. Mahadevaswamy
„ C.H. Vamana Naik
„ R. Appaya Naik
„ H. Vasu Serang (T-2)

Administrative Staff

Shri Balakrishna Naik - *Asst.*
„ K.M. Abdulla - *Sr.Clerk*
„ K. Rama Naik - *Sr. Clerk*
Ms. Martha R. Mascarenhas - *Jr. Clerk*

Auxiliary Staff

Shri P. Narayana Naik - *Driver (light vehicles)*

Supporting Staff

SSG-II

Shri U.B. Sadashiva - *Lascar*
„ Mohan S. Puthran - *Oilman*

Watchmen

Shri Ramanna Sapaliga
„ A. Keshava
„ D. Gangadhara Gowda

SSG-I

Shri U. Purandara Shetty - *Lab. Attendant*
Ms. Padmavathy - *Safaiwala*
Shri M. Radhakrishnan - *Messenger*

Bhatkal Field Centre

Shri Maruthi Sankar Naik - *Jr.Tech.Asst.*
„ Ganesh Bhatkal - *Field Asst.*

Calicut Research Centre

Technical Staff

T-5

Technical Officers

Shri K. Nandakumaran
„ K.K. Balasubramanian
„ K. Soman
Ms. S. Lakshmi
„ K. Koumudi Menon

T-4

Senior Technical Assistants

Shri C.K. Krishnan
„ T. Girijavallabhan

T-I-3

Technical Assistants

Shri K.P. Vishwanathan
„ P. Swarnalatha
Ms. V.K. Janaki

T-2

Junior Technical Assistants

Shri V.G. Surendranathan
Ms. Lalitha Sekharan

Administrative Staff

Shri B.D. Puthran - *Asst.*
Ms. P. Subhadra - *Sr. Clerk*
„ C. Kamalakshi - *Sr. Clerk*
Shri R. Sreenivasan - *Jr. Clerk*
Ms. K.P. Shylaja - *Jr. Clerk*

Auxiliary Staff

Drivers for light vehicles

Shri B.K. Velukutty
„ P. Harshakumar

Supporting Staff

SSG-IV

Shri K. Janardhanan - *Fieldman*

SSG-III

Laboratory Attendants

Shri V.K. Krishnankutty
„ M. Ramadasan
„ K. Kumaran -*Fieldman*

SSG-II

Shri K.E.J. Victor -*Watchman*
„ K. Chekkutty -*Watchman*

SSG-I

Ms. P. Renuka - *Lab. Attendant*
Shri B. Raju - *Lab Attendant*
„ P.K. Suresh Babu-*Watchman*
„ A. Sivadasan - *Watchman*
„ M.K. Chandran - *Safaiwala*
„ Palaniappan - *Safaiwala*

Fieldmen

Shri Thirumangalath Koman
„ P. Dasan
„ T.P. Renil Kumar

Cannanore Field Centre

Shri. K. Chandran -*Tech. Asst*
„ K.C. Purushothaman -*Field Asst.*

Vizhinjam Research Centre

Technical Staff

T-5

Technical Officers

Shir K. Ramachandran Nair
„ P.S. Sadasiva Sarma
„ R. Bhaskaran Achari
„ Jacob Jerald Joel
„ S.G. Vincent
„ K. Ramakrishnan Nair

Shri T.G. Vijaya Warrier

T-4

Shri R. Vasanthkumar - *Sr. Tech. Asst.*

T-II-3

Shri Thomas Teles - *Bosun*

T-I-3

Technical Assistants

Shri A.K. Velayudhan
„ K.T. Thomas
Ms. T.A. Omana
Shri V.M. Alwaris - *Sr. Deckhand*
T-2
Shri S. Ramachandran Nair - *Motor Driver*
„ K.C. Gopalan - *Cook*

Senior Deckhands

Shri P.M. Hariharan
„ V.P. Bensiger
„ P. Hilary

T-1

Shri K. Sasidharan Pillai - *Field Asst.*

Administrative Staff

Senior Clerks

Shri M. Abdul Salam Sahib
„ S. Erishikesan

Junior Clerks

Shri C. Johnson
„ M. Regunathan

Supporting Staff

SSG-IV

Laboratory Attendants

Shri J. Anselam
„ C.M. Rajappan
„ V. Sasidharan Pillai

SSG-III

Shri A. Ayyappadas - *Peon*
„ K. Chandran - *Safaiwala*
SSG-II
Shri S. Antony - *Messenger*

Watchmen

Shri V. Vishnunathan
„ R. Madhusudhan Nair
„ V. Kochunarayanan Nair

SSG-I

Shri B. Prabhakaran - *Messenger*

Tuticorin Research Centre

Technical Staff

T-6

Shri A. Bastian Fernando - *Field. Officer*
T-5

Technical Officers

Shri C.T. Rajan
„ R. Gurusamy
T-4

Shri P. Feroz Khan - *Bosun*

Senior Technical Assistants

Shri A. A.P. Mudaliar
„ T.S. Balasubramanian
T-II-3

Technical Assistants

Shri J.X. Rodrigo
„ A.D. Gandhi
„ N. Palanisamy

T-I-3

Technical Assistants

Shri D. Sundararajan
„ O.M.M.J. Habeeb Mohamed

Shri M. Selvaraj
„ M. Manickaraja
„ G. Arumugham
„ K. Srinivasagam
„ S. Rajapackiam

Skin Divers

Shri A. Dasman Fernando
„ F. Soosai V. Rayan

T-2

Shri M. Enose - *Jr.Tech.Asst.*
„ P. Muthikrishnan - *Skin Diver*
„ N. Jesuraj - *Skin Diver*
„ Xavier Mohandoss - *Motor Driver*
„ E. Shivanandam - *Boat Cook*

T-1

Shri R. Ponniah - *Electrician*
„ K. Alagirisamy - *Motor Driver*

Field Assistants

Shri K. Shamugasundaram
„ S. Mohamed Sathakathullah
„ R. Athipandian
Shri K. Jayabalan
„ K. Paul Sigarmony

Deckhands

Shri D. Bosco Fernando
„ S. Enasteen
„ R. Arockiasamy
„ D. Anandan

Administrative Staff

Shri N. Rajamunisamy - *Supdt.*
„ D. Ganajebamani - *Asst.*

Senior Clerks

Shri S. Jayachandran
Shri B. Bavanandam
„ S. Antony George Ratnam
Ms. S. Leelavathi - *Jr.Stenographer*

Junior Clerks

Ms. Kamala Venkataraman
Shri M. Samuthiram
Ms. S. Sarada
„ C. Rajeswari

Auxiliary Staff

Shri S.K. Gurusamy - *Driver (light vehicles)*

Supporting Staff

SSG-IV

Shri A. Francis - *Lab.Attendant*

SSG-III

Shri M. Ramadoss - *Lab.Attendant*
„ D. Motcham - *Daftry*

SSG-II

Watchmen

Shri S. Mani
„ M. Alfred
„ M. Thangavelu
„ K. Thangaraja
„ P. Muthumalai
„ V. Samayamuthu
Ms.S. Daisy - *Safaiwala*
Shri R. Uchimahali - *Fieldman*

SSG-I

Shri K. John James - *Gardener*
„ S. Alagesan - *Fieldman*

Shri I. Syed Sadiq - *Lab.Attendant*
„ V. Muniasamy - *Lab.Attendant*

Fieldmen

Shri W. Satyawan Neelraj
„ K. Muthuvel
„ P. Kandan
„ M. Sankaran
„ G.S. Rayappan
„ I. Ravindran
„ S. Ganesan

Safaiwalas

Shri P. Villiam
„ K. Kadarkarai
„ M. Mariappan

Watchmen

Shri N. Asokumar
„ M. Shanmughavelu

Kanyakumari Field Centre

Shri N. Retnasamy - *Tech.Officer*
„ I.P. Ebenezer - *Sr. Tech.Asst.*
„ A. Prosper - *Jr.Tech.Asst.*

Madras Research Centre

Technical Staff

T-6
Shri P.K. Mahadevan Pillai - *Field Officer*

T-5

Technical Officers

Shri S. Kandasamy
Shri M. Mohamed Sultan
„ A.C. Sekhar
„ S.K. Balakumar

T-4

Senior Technical Assistants

Shri P. Ramadoss
„ K.S. Krishnan

T-II-3
Shri T.N. Sukumaran - *Bosun*

Technical Assistants

Shri S. Palanichamy
Dr.R. Thangavelu
„ V. Selvaraj

T-I-3

Shri L. Jayashankaran
„ H. Kader Batcha
„ S. Subramani
„ S. Seetharaman
„ Hameed Batcha
„ C. Manimaran
„ G. Sreenivasan
„ P. Poovannan
„ K. Shahul Hameed
„ S. Chandrasekhar
„ G. Natarajan - *Motor Driver*
„ K. Pandi - *Motor Driver*

T-2

Junior Technical Assistants

Shri P. Thirumulu
„ S. Mohan
„ A. Ahmed Kamal Bhasha
„ V.S. Gopal
„ K. Ratnakumar - *Motor Driver*
„ D. Padmanabhan - *Boat Driver*
Shri Voli Mohamed - Boat Cook

Senior Deckhands

Shri K. Parasuraman

Shri C. Manibal

T-1

Shri A. Vairamani - *Field Asst.*

Administrative Staff

Assistants

Shri K.M. Karuppiah
„ S. Mangalam

Senior Clerks

Shri S.K. Murali
„ S. Balasubramanian
Ms. M. Parvathy
„ G. Abitha
„ Rosy Joachin - *Jr. Steno*

Junior Clerks

Ms. A.B. Lalitha
„ P. Thankaleelal

Auxiliary Staff

Deckhands

Shri Joseph Xavier
„ S. Selvanidhi

Supporting Staff

SSG-IV

Shri M. Vellayan - *Lab.Attendant*

SSG-II

Shri M. Ravindran - *Messenger*
„ G. Vijayarangam - *Safaiwala*

Watchmen

Shri R. Anandha Jyothi
Shri A. Janagiraman
„ G. Chekkrapani

SSG-I

Shri S. Yuvarajan - *Lab.Attendant*

Shri P. Selvaraj - *Safaiwala*
Ms. Aiyali Devi - *Peon*

Messengers

Shri M. Anbu
„ S. Rajan

Watchmen

Shri T. Nagalingam
„ S. Inbamani

Fieldmen

Shri T. Manoharan
„'quad R. Sundar
„ R. Vasu

Cuddalore Field Centre

T-I-3

Technical Assistants

Shri A. Srinivasan
„ T. Dhandapani
„ M. Radhakrishnan
„ M. Manivasagam - *Jr.Tech.Asst.*

Pondicherry Field Centre

Shri L. Chidambaram - *Tech.Asst.*

Mahabalipuram Field Centre

Shri S. Manivasagam - *Tech.Officer*

Ongole Field Centre

Shri K.V.S. Seshagiri Rao - *Tech. Officer*
„ A. Hanumantha Rao - *Sr. Tech. Asst*

Nellore Field Centre

Shri G.C. Lakshmaiah - *Tech.Officer*
„ G. Sudhakar - *Field Asst.*

Kovalam Field Centre

Shri S. Sankaralingam - *Jr.Tech.Asst.*

SSG-II

Shri D. Pakkiri - *Watchman*

SSG-I

Shri M.P. Chandrasekhar - *Watchman*

Kakinada Research Centre

Technical Staff

T-4

Shri P. Ramalingam - *Sr.Tech.Asst.*

T-II-3

Technical Assistants

Shri K. Ramasomuyagulu
„ K. Dhanaraju

T-2

Shri K. Dharma Rao - *Motor Driver*
„ Ch. Ellithathayya - *Jr.Tech.Asst.*

T-1

Field Assistants

Shri T. Nageswara Rao
„ N. Nurayya
„ P. Venkata Ramana
„ Vasamsetty Abbulu

Administrative Staff

Shri S. Suryanarayana Murthy - *Sr.Clerk*
„ S. Appa Rao - *Jr.Clerk*

Supporting Staff

SSG-III

Shri K. Narasimhamurthy - *Lab. Attendant*

„ R.V.S. Subramanyan - *Watchman*

SSG-I

Shri S. Tatabhai - *Messenger*
„ K. Satyanarayanan - *Watchman*
„ G. Sainyadhipathy - *Watchman*

Machilipatnam Field Centre

Shri T. Chandrasekhara Rao - *Tech.Asst.*

Narasapur Field Centre

Shri P. Ananda Rao - *Sr.Tech.Asst.*

Visakhapatnam Research Centre

Technical Staff

T-5

Shri C.V. Seshagiri Rao - *Tech.Officer*

T-II-3

Technical Assistants

Shri K. Chittibabu
„ K. Diwakar
„ U. Alagamalai - *Bosun*

T-I-3

Shri J.B. Varma
„ S. Satya Rao
„ M. Chandrasekhar
„ A.K. Unnikrishnan - *Boat Cook*

T-2

Junior Technical Assistants

Shri K. Narayana Rao
„ M.S. Sumithrudu
„ M. Prasad Rao

Shri P.A. Reghu - *Oilman-cum-Deckhand*

T-I

Field Assistants

Shri S. Chandrasekhar
„ P. Achayya
„ R.V.D. Prabhakar
„ P. Pasupathi Rao - *Motor Driver*

Deckhands

Shri S. Ganeshan
„ P.Md. Abdul Moheedu

Administrative Staff

Shri R. Appa Rao - *Asst.*
„ Shanti Prasad - *Sr.Clerk*
Ms. B. Gowri - *Jr. Clerk*

Auxiliary Staff

Shri S. Doraipandian - *Driver (light vehicle)*

Supporting Staff

SSG-III

Shri V. Mohana Rao - *Lab.Attendant*
SSG-II

Shri Rajan - *Peon*

Watchmen

Shri R. Kanakaraju
„ V. Demudu
„ P. Krishna Rao
„ L. Appa Rao - *Messenger*

SSG-I

Shri R. Dalayya - *Safaiwala*

Contai Field Centre

Shri S.S. Dan - *Field Officer*
„ Pulin Behari Dey - *Jr.Tech.Asst.*

Field Assistants

Shri Sapan Kumar Ghosh
„ Bijoy Krishna Burman
„ Swapan Kumarkar
„ Prasanta Kumar Das - *SSG-I*

Puri Field Centre

Shri P.V. Krishna Rao - *Tech.Asst.*
„ Sukdev Bar - *Jr.Tech.Asst.*
„ S. Hemasundara Rao - *Field Asst.*

Gopalpur Field Centre

Shri K. Narayana Rao - *Tech.Asst.*
„ Satchidananda Naik - *Field Asst.*

Palasa Field Centre

Shri V. Achutha Rao - *Tech.Asst.*

Srikakulam Field Centre

Shri N.P. Chandra Kumar - *Field Asst.*

Minicoy Research centre

Technical Staff

Shri Anasukoya - *Field Asst.*

Ministerial Staff

Ms. M. Safayabi - *Jr. Clerk*

Supporting Staff

SSG-III

Laboratory Attendants

Shri C. Mohammed Koya
„ K. Kunjukunju
„ P.I. Koya - *Watchman*
SSG-II

Watchmen

Shri O. Ismail
„ N. Pookoya

Krishi Vigyan Kendra/Trainers' Training Centre

Technical Staff

Field Officers

Shri K. Asokakumaran Unnithan
Dr. P.K. Martin Thompson
Shri K.N. Rasachandra Kartha

Technical Officers

Shri A.N. Mohanan
„ P. Radhakrishnan
Ms. P. Sreelatha - *Training Asst.*

T-2

Motor Drivers

Shri C.S. Xavier
„ P.J. Sebastian

Administrative Staff

Shri C. Balamamundinathan - *Asst.*
„ C.D. Manoharan - *Jr. Steno*
Ms. P.K. Anitha - *Jr. steno.*
Shri N.K. Mohanan - *Jr.Clerk*

Supporting Staff

SSG-III

Fieldmen

Shri K.P. John
„ N.K. Asokan

SSG-II

Shri K.N. Balan - *Fieldman*

SSG-I

Shri K.G. Bhaskaran Nair - *Messenger*
Ms. Chinnamma Anjelo - *Safaiwala*

Regional/Research Centres of CMFRI and their Officers-in-Charge

Mandapam Regional Centre of CMFRI, Marine Fisheries P.O., Mandapam Camp - 623 520, Tamil Nadu. Phone: 443 & 456	Shri R.Marichamy, Principal Scientist
Veraval Research Centre of CMFRI, Opposite Octroi Naka, Talala Road, Veraval - 362 265 Gujarat.Phone : 20065	Dr. Alexander Kurian, Senior Scientist
Bombay Research Centre of CMFRI, 148, Army & Navy Building, 2nd Floor, M.G. Road, Bombay - 400 023. Maharashtra Phone : 245260	Dr. Kuber Vidyasagar, Senior Scientist
Karwar Research Centre of CMFRI, Post Box No.5, Karwar, Uttara Kanara Karnataka. Phone : 6471	Shri G.G. Annigeri, Principal Scientist
Mangalore Research Centre of CMFRI, Post Box No. 244, Bolar, Mangalore - 575 001, Dakshina Kanara, Karnataka. Phone : 24152	Dr.P.V. Vedavyasa Rao, Principal Scientist
Calicut Research Centre of CMFRI, West Hill.P.O., Calicut - 673 005, Kerala. Phone : 50377	Dr.V. Narayana Pillai, Principal Scientist
Vizhinjam Research Centre of CMFRI, Vizhinjam P.O., Trivandrum - 695 521 Kerala. Phone : 224	Dr.P.A. Thomas, Senior Scientist
Tuticorin Research Centre of CMFRI, 90, North Beach Road, Tuticorin - 628 001, Tamil Nadu. Phone : 20274	Dr.M. Peer Mohamed Principal Scientist

Madras Research Centre of CMFRI,
68/1, 4th Floor,
Greams Road, Madras - 600 006,
Tamil Nadu.
Phone :

Dr.K. Satyanarayana Rao,
Principal Scientist

Kakinada Research Centre of CMFRI,
Door No. 8-14-38,
Red Cross Street, Gandhi Nagar,
Kakinada - 533 004.
Andhra Pradesh.
Phone : 76231

Dr.V. Sriramachandra Murthy,
Senior Scientist

Visakhapatnam Research Centre of CMFRI,
Andhra University P.O.,
Visakhapatnam - 530 003.
Andhra Pradesh.
Phone : 55793

Dr.G. Luther,
Principal Scientist

Minicoy Research Centre of CMFRI,
Minicoy, U.T. of Lakshadweep,
Phone : 228

Dr.V.S.K. Chennubhotla,
Principal Scientist

Other units of CMFRI attatched to the Headquarters, Cochin

Krishi Vigyan Kendra of CMFRI,
Prawn Culture Farm,
Narakkal - 682 505.
Ernakulam Dist.,
Kerala.
Phone : 482

Dr.M.M. Thomas,
Principal Scientist

Field Lab of CMFRI,
Cochin Fisheries Harbour,
Thoppumpady,
Cochin - 682 005
Kerala.
Phone : 26092

Shri K.V. Somasekharan Nair,
Scientist(Selection Grade)

Vessel Management Cell of CMFRI,
Fine Arts Avenue,
Cochin - 682 016
Kerala.
Phone : 369819

Shri K.G. Girijavallabhan,
Scientist(Selection Grade)

Address List of Field Centres
(Arranged alphabetically)

Alleppey Field Centre of CMFRI,
Geetha Building, Kalarcode,
Alleppey - 688 003,
Kerala.

Bhatkal Field Centre of CMFRI,
Room No. 72, Municipal Rest House,
Near Old Bus Stand, Bhatkal - 581 320,
Uttara Kanara, Karnataka.

Cannanore Field Centre of CMFRI,
Ayikara Police Station Building,
Cannanore - 670 017,
Kerala.

Chavakkad Field Centre of CMFRI,
Chavakkad - 680 506,
Trichur District, Kerala.

Contai Field Centre of CMFRI,
Thanapukur Par, Contai - 721 401,
Midnapur District, West Bengal.
Phone : 254

Cuddalore Field Centre of CMFRI,
No. 106, Irusappa Chetty Street,
Cuddalore Port - 697 003,
South Arcot District,
Tamil Nadu.

Dahanu Field Centre of CMFRI,
Kirtane Bulgalow, Mangailwada,
Dahanu, Thana District,
Maharashtra.

Gopalpur Field Centre of CMFRI,
Door No. 44, Big Street,
Gopalpur-on-sea P.O.,
Ganjam District, Orissa.

Goa Field Centre of CMFRI
Daulat, III Floor, 18th June Road,
Panaji, Goa.
Phone : 5995

Jamnagar Field Centre of CMFRI,
Milan Chambers, Khodiyar Colony,
Aerodrome Road,
Jamnagar - 361 006,
Gujarat.

Janjira Murud Field Centre of CMFRI,
14/3, Ground Floor, Bazar Peth Road,
Janjira Murud - 402 401,Raigad District,
Maharashtra.

Kanyakumari Field Centre of CMFRI,
Kanyakumari - 629 702, Tamil Nadu.

Kovalam Field Laboratory of CMFRI,
Kovalam - 603 112,
Chengulpet District, Tamil Nadu.
Phone : 52

Machilipatnam Field Centre of CMFRI,
17/299, Sidimbi Agraharam Lane,
Chilakalapudi - 521 002,
Machilipatnam, Andhra Pradesh.

Mahabalipuram Field Centre of CMFRI,
Door No. 251, West Raja Street,
Mahabalipuram - 603 104,
Chengulpet District,
Tamil Nadu.

Malvan Field Centre of CMFRI,
Municipal House No. 2799/3,
Dawoolwada, Malvan - 416 606,
Sindhudurga District,
Maharashtra.

Narasapur Field Centre of CMFRI,
Door No. 9-2-64, Church Road,
Narasapur - 534 275,
West Godavari District,
Andhra pradesh.

Nagapattinam Field Centre of CMFRI,
C/o Inspector of Fisheries,
Salt Road, Nagapattinam - 611 001,
Thanjavur District, Tamil Nadu.

Nellore Field Centre of CMFRI,
Room No. 14, Municipal Buildings,
Near A.C,Bubba Reddy Statue,
Trunk Road, Nellore - 524 001,
Andhra Pradesh.

Ongole Field Centre of CMFRI,
No. 49, A.P. Housing Colony,
Manidipakam, Ongole - 523 002,
Prakasam District,
Andhra Pradesh.

Palasa Field Centre of CMFRI,
Viswanatham Hospital Road,
S. Kotta Street,
Palasa - 532 221,
Srikakulam,
Andhra Pradesh.

Pattukottai Field Centre of CMFRI,
Room No. 23, Periaswamy Building,
187/A, Big Bazar Street,
Pattukottai - 614 601, Tanjore Dist.,
Tamil Nadu.

Pondicherry Field Centre of CMFRI,
C/o Office of the Dy. Director of
Fisheries (HQ), 49 B,V.O.C. Street,
Pondicherry - 605 001.

Puri Field Centre of CMFRI,
Santikeenja Lane,
Near Hotel Sea 'n Sand,
Chakrathirtha Road, Puri - 752 002,
Orissa.

Quilon Field Centre of CMFRI,
Municipal Stadium Building,
Ward No. VIII, Door No. 737,
Quilon, Kerala.

Rander Field Centre of CMFRI,
3/213, Bandaniwad, "Devikrupa",
Ist Floor, Randarai Ward, Rander,
Surat - 395 005, Gujarat.

Ratnagiri Field Centre of CMFRI,
Building No. 3615, Devchand Nivas,
Lower Lane, Ratnagiri - 415 612,
Maharashtra.

Srikakulam Field Centre of CMFRI,
Door No. 8-15-68, Ring Road,
Near Head Post Office,
Srikakulam - 532 002,
Andhra Pradesh.