



# ANNUAL REPORT 1984-85



**CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY**

(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)

MATSYAPURI P. O., COCHIN - 682029



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Compiled by: MARY THOMAS

Cover & Photography: K. BHASKARAN

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**Cover:** Drying of squid &  
A fisherman with indigenous lobster  
trap and CIFT designed trap



## 1. INTRODUCTION

The Institute continued to make steady progress in the research activities of the Scientific Divisions and in the transfer of technology programme during the year. Field demonstrations of the method of protection of fishing crafts like 'Thanguvallom' of Kerala using the newly developed chemical preservative had the expected impact; the expertise of the Institute was requisitioned to implement the programmes in several fishing villages as well.

Though trawling has established itself as a method of mechanised fishing in India, the design of the trawl plays a vital role in deciding the efficiency of the gear. Field trials carried out with a new two seam-high opening trawl hold out the possibility of introducing a more efficient fishing gear.

Extensive tests in the laboratories at Headquarters and the Research Centres confirmed the finding that the fishes and fish products of the East and West coasts of India do not contain toxic heavy metals and pesticide residues to any objectionable level. New products developed for the consumer markets in India and abroad include fish balls containing minced fish, potato, hydrogenated fat with spices, canned prawn curry of varied composition and taste and dried jelly fish, the last product being found acceptable by Japanese importers. A small solar dryer, inexpensive and simple in fabrication, was developed for drying fish upto 10 kg. per batch at about 48°C in 14 hours of daylight. A mechanical cooking device designed at the Institute has found application in prawn canning factories or wherever cooking of prawns is a pre-requisite for further processing.

Field trials have shown that a propeller nozzle developed for a 9.76 m. trawler increased the bollard pull of the engine by 30%. Two models of marine engines manufactured in the country were also type tested at the instance of the makers.

The flash light buoy developed for use along with gill nets is found to be highly advantageous in that it indicates the position of the net in the water at night thereby serving as a warning to boats plying nearby-saving both the costly net and the boat.

A few electronic instruments developed include (1) a moisture meter capable of measuring moisture in soil at several points at a time from remote centre and (2) solar radiation monitor capable of integrating the incident radiation over long duration of days and weeks continuously giving radiation in total. A 'Summer Institute' on 'Application of Indigenous Electronic Instruments for Fishing and Fisheries Research' of three weeks duration and the two 'Workshops' on 'Instrumentation for Fisheries and Environmental Investigations' conducted by the Institute were well attended.

Investigations on the economic efficiency of deep sea trawlers of L.O.A. 22 m and 23 m have shown that the 23 m class of vessels were economically viable for operation from the Vizag coast.

The Extension and training activities of the Institute were pursued and executed actively in tune with the research achievements of the Institute and the requirements of the expanding fishery industry of the country. Technical enquiries totalling about five hundred were replied promptly. Analytical and quality evaluation assistances in respect of fresh fish and processed fish products, water, ice, chemical preparations etc. were rendered promptly. Refresher training courses were conducted in selected topics of technological and economic advantage to the industry. Benefits of these courses were shared by nominees of processing factories, Government Departments, Universities and related institutions. Ad-hoc training was imparted to nominees of processing factories on specific requests. Field campaigns including demonstrations, film shows etc. were continued. Visitors were provided ample opportunities to familiarize with the activities of the Institute and the outcome of research and training in different disciplines.

(M.R. Nair)  
DIRECTOR

## 1.1. HISTORY

The Central Institute of Fisheries Technology, named at the time of its inception as Central Fisheries Technological Research Station, was set up following the recommendations of a high power Committee constituted by the Ministry of Food and Agriculture, Govt. of India, in 1954. It was started in 1957 at Cochin under the Department of Agriculture and the then Ministry of Food and Agriculture, with a small nucleus of staff for research work in fishing craft and gear. The Processing Division of the Institute was started in 1958 and the Extension, Information and Statistics Division in 1961. The Institute was given its present name in 1962. The administrative control of the Institute was brought under the Indian Council of Agricultural Research from 1st October, 1967.

The Institute is the only national Centre in the country where research investigations are undertaken in all disciplines of fishing and fish processing. Research Centres located at Veraval (Gujarat), Kakinada (Andhra Pradesh), Burla (Orissa), Bombay (Maharashtra), Panaji (Goa) and Calicut (Kerala) cater to the special regional needs.

## 1.2. ORGANISATION

The Director heads the Institute. All administrative and financial powers regarding research and management of the Institute are vested with him. He is assisted by a

Senior Administrative Officer, Administrative Officer and Asst. Administrative Officer for dealing with matters relating to general administration, an Accounts Officer and Asst. Accounts Officer for looking after the financial and accounting aspect as also internal audit of the Institute. One Technical Officer attends to the technical matters including those connected with research projects handled by the Institute at its Headquarters at Cochin and its Research Centres.

The various activities of the Institute including research work are carried out in the following divisions.

1. Craft Division
2. Gear Division
3. Biochemistry & Nutrition Division
4. Microbiology Division
5. Processing Division
6. Engineering Division
7. Electronics & Instrumentation Division
8. Extension, Information & Statistics Division

## 1.3. ADMINISTRATION

This Division deals with recruitment, service policy, discipline, staff welfare, land and building, procurement of stores, budget expenditure, settlement of claims, etc.



The Research Centres continued to function in rented buildings. Addresses of the Centres are given as Appendix I. List of staff under Scientific, Technical, Administrative, Auxiliary and Supporting categories as on 31-3-'85 is given as Appendix II.

#### 1.4. MANAGEMENT COMMITTEE

The Management Committee of the Institute functioned during the year under report with the following members:-

1. Director, C.I.F.T. : Chairman
2. Director of Fisheries, Kerala : Member
3. Director of Fisheries, Tamilnadu : Member
4. Director of Research, Kerala Agril. University : Member
5. Shri N. M. Shetty, Chairman & Managing Director, Hindustan Vegetable Oil Corporation, New Delhi : Member
6. Shri Y. P. Nishad, President, National Federation of Fishermen's Co-operatives, New Delhi : Member
7. Dr. P. N. Kaul, Scientist S-3, C.I.F.T. : Member
8. Shri P. Vasudeva Prabhu, Scientist S-3, C.I.F.T. : Member
9. Dr. K. Devadasan, Scientist S-3, C.I.F.T. : Member
10. Shri P. D. Antony, Scientist S-2, C.I.F.T. : Member

11. Asst. Director General (F) I.C.A.R. : Member
12. Accounts Officer, C.M.F.R.I. : Member
13. Admn. Officer, C.I.F.T. : Member Secretary

The Committee met 4 times during the year under report and transacted business.

#### 1.5. STAFF JOINT COUNCIL

On the expiry of the term of the Joint Council, elections were held on 20-2-84 for constituting the Joint Council, but due to certain administrative reasons, the Joint Council could not be constituted.

#### 1.6. MONITORING CELL

Monitoring Cell of the Institute met periodically during the year under report to consider progress in Plan expenditure, settlement of outstanding advances, procurement of stores, recruitment against vacancies and progress of the various construction works of the Institute.

#### 1.7. GRIEVANCE CELL

There are two Grievance Cells functioning— "The General Grievance Cell" dealing with individual grievances of staff coming under Class II and below and the other Grievance Cell dealing with grievances of officers of A.R.S. cadre and above.

The term of the General Grievance Cell expired on 1-1-84. Since, as per constitution, 4 members have to be nominated by the Institute Joint Council, re-constitution of the Cell is kept pending till constitution of the Institute Joint Council.



The Grievance Cell set up to deal with the grievance of officers of A.R.S. cadre and above functioned during the year under report with the following members:-

1. Director : Chairman
2. Dr. K. Gopakumar,  
Scientist S-3 : Member
3. Dr. T. K. Sivadas, S3 : Member
4. Dr. Jose Stephen, S2 : Member
5. Shri V. Vijayan, S1 : Member
6. Accounts Officer : Member
7. Admn. Officer : Member  
Secretary

The Cell met once during the year under report and considered grievances received from members. On expiry of the term of the present Cell, action is being taken to re-constitute the Cell.

## **1.8. TECHNICAL SECTION**

### **1.8.1. Compilation of Research Projects of the Institute**

The Institute's various research projects handled at the Headquarters and Research Centres were compiled for the year 1984-85 taking into consideration the review and recommendations of the Project Advisory Committee, Staff Research Council, suggestions of DDG (AS), ADG (F) and Director CIFT. The total number of projects during the period under report were 37, of which 28 were on-going and 9 were new projects. A brief summary of 9 projects completed during the year 83-84 were also given in the research project programmes of 84-85.

### **1.8.2. Project Review**

The on-going projects were reviewed at the Staff Research Council meeting, Project Advisory Committee meetings and other scientific meetings in the presence of DDG(AS).

A review report on the progress and achievements of the research work carried out under each project has been sent to Council in the stipulated time. The project leaders' files containing the Research project proposals, half yearly reports and annual reports of project leaders and associates pertaining to each project have been systematically maintained.

### **1.8.3. Preparation of Technical Reports**

Materials for the preparation of fortnightly and monthly reports were collected from each Division/Research Centre, compiled and sent to Council regularly for inclusion in the report to the Cabinet Secretariat. Similarly, quarterly reports for the Research highlights to be included in the meetings of the Governing body of ICAR were also sent to Council at the appropriate time.

### **1.8.4. Staff Research Council**

The progress of Research Projects was reviewed at the Staff Research Council meeting and recommendations suggested for follow-up action. All the Scientists at Headquarters and Scientists-in-Charge of Research Centres attended the meeting.

### **1.8.5. Publication of Technical Papers**

During the period, 54 research papers received from Scientists have been pro-

cessed and Director's approval for publication/presentation of 49 papers communicated to the authors.

#### **1.8.6. Five Yearly Assessment of ARS Scientists**

The assessment results in respect of 64 scientists eligible for five yearly assessment/reassessment for the periods ending 31-12-80|81 and '82 have been received from Council. Two S-3 Scientists were granted the next higher pay scale personal to them. Out of 18 S-2 Scientists, 15 got S-3 grade while out of 43 S-1 Scientists, 18 got promotion to S-2 grade and the only Scientist in the grade S got promoted to S-1 grade.

The assessment documents such as biodata and career information proformae, Five yearly assessment proformae, project files etc. of 51 scientists (2 S-3, 9 S-2 and 40 S-1) eligible for five yearly assessment/reassessment for the period ending 31-12-'83 have been scrutinised and forwarded to ASRB/Council in the stipulated time.

#### **1.8.7. Icar Regional Committee**

Material pertaining to review of progress of research projects, constraints and remedial measures, new technologies ready for transfer, salient major achievements, collaboration and liaison requirements, manpower training requirements, etc. for the past one year was prepared for inclusion in the agenda notes of the ICAR Regional Committees.

As follow up action on the 8th meeting of the ICAR Regional Committee No. 8 held at SBI Coimbatore, the post harvest technologies developed by the Institute are being compiled for bringing out the same as an Institute Special Bulletin.

#### **1.9. PROJECT ADVISORY COMMITTEE**

The Project Advisory Committee of the Institute met at the end of each quarter to review the progress of work in the research projects during the concerned period. Difficulties encountered by the Scientists in carrying out the research work were discussed and solutions suggested. Research proposals for the year were also discussed and approved by the Committee before submitting the same for approval to the Director. The major areas of work for the Institute during the VII Five Year Plan period were identified in the light of the recommendations of the QRT and the working group on fisheries.

#### **1.10. SCIENTIFIC TALK**

Scientific meetings were held regularly in which Scientists of the Institute and guest Scientists gave talks in their fields of specialisation. This provided a forum for free exchange of information, review of current status in specialised fields and in general, a stimulus for research. The programmes were arranged by Dr. K. Ravindran, Convener, Scientific Talks and the meetings were presided over by the Director of the Institute.



Particulars of the talks delivered are given below:-

<i>Date</i>	<i>Name of Speaker</i>	<i>Topic</i>
28-6-1984	Dr. P. K. Surendran, Scientist S-2	Microbial spoilage of tropical fish at low temperature.
3-8-1984	Shri P. K. Vijayan, Scientist S-1	Training on retort pouch processing of fish at TDRL, London.
19-9-1984	Dr. T. K. Sivadas, Scientist S-3	Instrumentation for Craft and Gear Research-points on methodology, range of application and limitations.
29-9-1984	Dr. K. T. Achaya, CSIR, Emeritus Scientist, Indian Oil Cake Project, Bangalore	Edible oil status in India.
28-1-1985	Dr. K. Gopakumar, Scientist S-3	Evaluation of retort pouched sardine.

### 1.11. LIBRARY

During the period under report, 390 new books were added to the collection and at present there are 5771 books and 2553 bound volumes of journals in the library.

A fortnightly publication entitled "Current Content on Fishery Technology" — a content page service of Current journals received at the Library — was started this year. This has been supported by a photocopying service. A library bulletin was also started during this year incorporating items such as new additions to the Library, conference alert news etc. A computerised catalogue of the books of the Library was also brought out this year.

More than 4000 documents were issued and about 7500 documents were consulted during this year from the Library.

A new Automatic Plain Paper Copier-Richo Dt: 5750R was installed in the Library section. 10600 Xerox copies were supplied from the Library during this year.

In addition to the Scientists & Technologists of the Institute, the Library is being utilised by the fish processing industries, University of Cochin, Kerala Agricultural University, Centre for Earth Sciences, Centre for Advanced Studies, Marine Products Export Development Authority, Export Inspection Agency and Central Marine Fisheries Research Institute.

### 1.12. COMMITTEES REPRESENTED BY THE INSTITUTE

Director served on the following scientific and allied bodies.

1. Chairman : National Committee on Cholera Problem in the Sea Food Industry.



2. Chairman : ISI, AFDC-27, Fish and Fishery Products Sectional Committee.
  3. Member : ISI, AFDC-36:9, Metallic Contaminants Sub Committee.
  4. Member : Scientific Panel for Fisheries Research, ICAR, New Delhi.
  5. Member : Task Force on Agro Processing and Post Harvest Technology and Environmental Committee, Govt. of Kerala.
  6. Member : Committee on Alienation of Discipline in Fishery Science in Agricultural Research Service.
  7. Member : Panel of Experts for hearing appeals (Export Inspection Agency).
  8. Member : Board of Directors, Kerala Fisheries Corporation.
  9. Member : Board of Studies, University of Cochin.
  10. Member : Board of Examiners, University of Agricultural Sciences, Bangalore.
  11. Adviser : UPSC Selection Committees.
  12. Member : Committee on Mechanization of Boats in the country.
  13. Member : CIFNET Consultative Committee.
  14. Member : IFP Consultative Committee.
  15. Member : Central Board of Fisheries.
  16. Member : Committee on Marine Based Industries, Govt. of Kerala.
  17. Member : Working Group for VII Plan proposals of Department of Agriculture (Fisheries).
  18. Member : Management Committee, Krishi Vigyan Kendra, CMFRI, Narakkal.
  19. Member : Resource Management Cell, Dept. of Fisheries, Kerala.
  20. Member : Standing Committee at Local Level of Training for harvest and post harvest technology, Ministry of Agriculture.
- The following Scientists also represented the Institute in various Committees.
1. *Dr. K. Gopakumar, Scientist S-3:*  
Member: Committee for technical scrutiny of applications received under Scheme for Extending Financial Assistance to Sea Food Processors for upgrading the efficiency of freezing units.
  2. *Shri R. Balasubramanyan, Scientist S-3:*
    - a) Member: ISI, MCPD-2, Indian Harbour Craft and Fishing Vessels Sectional Committee.
    - b) Member: Marine Corrosion Subcommittee of the CSIR.

- c) Member: Consultative Committee for FRP Technology of the National Council of Science and Technology.
- d) Member: Co-ordinating Committee of MPEDA, Cochin, to promote shark fishing.
- e) Member: Co-ordinating Committee of MPEDA, Cochin to promote lobster fishing.
- f) Member: Expert Committee for the acquisition of trawlers for the Tamil Nadu Fisheries Development Corporation Ltd., Madras.
- g) Member: Fisheries Resources Sub-Committee of National Consultation Meet on the Deep Sea Fans of the Bay of Bengal.
3. *Shri P. V. Prabhu, Scientist S-3:*  
Principal Member: ISI, AFDC-27:5, Fish Meal Sub-Committee.
4. *Shri P. Appukutta Panicker, Scientist S-3:*
- a) Member: Consultative Committee for Tuticorin, Vizhinjam and Cochin Base of Fishery Survey of India.
- b) Member: Working group of FORV 'Sagar Sampada'.
5. *Shri V. C. George, Scientist S-3:*
- a) CIFT Nominee: Co-ordination Committee of MPEDA on the Survey of Stake Nets in Kerala.
- b) CIFT Nominee: Inter-Institutional Infrastructural Facilities Evaluation Committee of ICAR Fisheries Institutes.
6. *Dr. K. Ravindran, Scientist S-3:*
- a) Subject Expert: Faculty of Marine Sciences, University of Cochin.
- b) Member: Marine Cargo Movement and Packaging Division Council. (MCPD of ISI).
- c) Member: Standing Working Committee on Marine Cargo Movement and Packaging (SWCMC of ISI).
7. *Dr. K. Devadasan, Scientist S-3:*  
Member: Council of Indian Science News Association, Calcutta.
8. *Shri H. Krishna Iyer, Scientist S-3:*  
Member: ISI, AFDC: 57, Expert Panel for Preparation of Draft Indian Standard and Methods for Sampling of Fish and Fisheries Products.
9. *Shri T. K. Govindan, Scientist S-3:*  
Member: Sub-Committee to Examine Amendments and Instructions for Fish and Fishery Products, Export Inspection Agency, Cochin.
10. *Shri T. S. G. Iyer, Scientist S-3:*  
Member: Panel of Experts for Approval of Factories under IPQC/MIPQC Scheme in Kerala region except Calicut.
11. *Shri S. Ayyappan Pillai, Scientist S-3:*
- a) Chairman: Expert Committee to assess the serviceability of equipment of N.I.O. Regional Centre, Cochin.



- b) Member: ISI, MCPD 3:7, Sub-Committee on Machinery for Dredgers, Tugs, Trawlers, Hoppers, Barges and Mechanised Fishing Boats.
- c) Member: National Committee of the International Institute of Refrigeration.
- d) Member: Advisory Committee for technical scrutiny of subsidy applications for installation of generating sets in seafood processing plants constituted by MPEDA.
- e) Member: Committee to study modernisation of sea food processing units constituted by MPEDA.
- f) Member: Panel for acquisition of refrigerator units by sea food processors constituted by MPEDA.
12. *Shri S. Gopalan Nayar, Tech. Officer, T-8.*  
Principal Member: ISI, TDC-42, Textile Materials for Fishing Net Purposes, Sectional Committee.
13. *Shri K. A. Sadanandan, Scientist S-2:*  
Member: Co-ordination Committee Federation Fisheries Co-operative Society, Hirakud Reservoir, Sambalpur.
14. *Shri K. K. Balachandran, Scientist S-2:*  
Principal Member: ISI, AFDC-27:1, Canned Fish Products, Sub-Committee.
15. *Dr. P. K. Surendran, Scientist S-2:*  
a) Subject Expert: Doctoral Committee, Cochin University.
- b) Supervising Guide: Ph.D. Degree, Faculty of Marine Sciences, Cochin University.
16. *Shri. Cyriac Mathen, Scientist S-2:*  
Member: Panel of Experts for Approval of Factories under IPQC/MIPQC system in Tamil Nadu region.
17. *Dr. Jose Stephen, Scientist S-2:*  
Supervising Guide: Ph.D. Degree in the University of Cochin.
18. *Sh. G. Narayanappa, Scientist S-2:*  
Member: Consultative Group set up to review work of Fishery Survey of India Bases at Madras, Calcutta, Visakhapatnam and Port Blair.
19. *Shri K. K. Solanki, Scientist S-2:*  
a) Member: ISI, AFDC-27, Fish and Fishery Products Sub-Committee.  
b) Member: Panel of Experts under IPQC/MIPQC Scheme of Export Inspection Agency, Bombay.
20. *Shri K. K. Kunjipalu, Scientist S-2:*  
Member: Consultative Group Meetings for Bombay and Porbander Bases of Fishery Survey of India.
21. *Dr. M. Arul James, Scientist S-2:*  
a) Member: State Level Committee for Co-ordination of Work on Marine Fisheries, Maharashtra.  
b) Member: Panel of Experts for IPQC/MIPQC Scheme for Fish and Fishery Products and IPQC scheme for Frozen Frog-legs for Madras Region.



22. *Shri H. N. Mhalathkar, Scientist S-2:*  
Member: Fifth Consultative Group Meeting of Mangalore Base of Exploratory Fisheries Project.
23. *Shri T. S. Unnikrishnan Nair, Scientist, S-2:*  
a) Alternate Member: ISI, AFDC-27:3, Dried Fish Products Sub-Committee.  
b) Member: IPQC Panel of Experts of Export Inspection Agency, Cochin.
24. *Sh. A. P. Valsan, Technical Officer:*  
Principal Member & Convener: ISI, AFDC-27:3, Dried Fish Products Sub-Committee.
25. *Shri V. N. Nambiar, Scientist S-1:*  
Member: Panel of Experts for IPQC/MIPQC scheme for Fish and Fishery Products and IPQC scheme for Frozen Frog-legs for Bombay Region.
26. *Shri K. N. Kartha, Scientist S-1:*  
Member: Technical Committee on Improvement of Dry Fish Production Base in India, constituted by MPEDA, Cochin.
27. *Dr. M. D. Varghese, Scientist S-1:*  
a) Subject Expert: Doctoral Committee, University of Cochin.  
b) Supervising Guide: Ph.D. Degree (Faculty of Marine Sciences), University of Cochin.
28. *Smt. K. Radhalekshmy, Asst. Tech. Officer, T5:*  
Alternate Member: ISI, TDC-42, Textile Materials for Fishing Net Purposes, Sectional Committee.
- 1.12 SYMPOSIA / SEMINARS / MEETINGS ATTENDED**
1. Shri A.K. Chattopadhyay, Scientist S-1 attended and presented paper at Symposium on 'Preservation & Supply of Fresh and Processed Foods', organised by Defence Food Research Laboratory at Mysore, 17-18 Oct. 1984.
  2. Shri V. C. George, Scientist S-3, participated in the Workshop on Brackish Water Prawn Farm Management, organised by Dept. of Fisheries, Kerala, at Cochin, May 2-3 1984. A paper was also presented at the Workshop.
  3. Dr. M. Arul James, Scientist S-2 and Shri V. Narayanan Nambiar, Scientist S-1, participated in the Quality Development training programme organised by the Export Inspection Agency at Bombay, Veraval and Goa. Lectures were given on the quality control aspects in seafood processing and microbial spoilage of sea foods.
  4. Dr. M. Arul James, Scientist S-2, and Shri V. Narayanan Nambiar, Scientist S-1 also participated in the demonstration/training programme on Peeling and Grading of Prawns organised by the Marine Products Export Development Authority at Ratnagiri. Lectures were given on hygiene in peeling sheds, quality control aspects in seafood processing and microbial spoilage of seafood.

5. Shri G. Narayanappa, Scientist S-2, attended the consultative group meetings of Fishery Survey of India, Madras Base in May 84 and Visakhapatnam Base in September 1984.
6. S/Shri Cyriac Mathen, & P. D. Antony Scientists S-2, attended Workshop on Marine Toxins in Bivalve Molluscs and General Consideration of Shellfish Sanitation, organised by CMFRI at Tuticorin, May 3-5, 1984.
7. Shri T. S. Gopalakrishna Iyer, Scientist S-3, participated in National Workshop on Identification and Serotyping of Salmonella and *Escherichia* strains at Kasauli (Himachal Pradesh) for eleven days from 23-5-1984.
8. Dr. K. Gopakumar, Dr. K. Ravindran and Shri V. C. George, Scientists S-3, attended the Seminar on Fisheries in Kerala, Review and Future, jointly organised by Dept. of Industrial Fisheries, University of Cochin and Dept. of Fisheries, Govt. of Kerala, July 6-7, 1984. Dr. Ravindran delivered the Keynote address on 'Fishing Craft of Kerala - Review and Future'. Shri George also presented a paper.
9. Dr. T. K. Sivadas, Scientist S-3, participated in the Seminar on Remote Sensing Techniques and its Application to Various Fields at Trivandrum, August 9, 1984. A paper was presented at the Seminar.
10. Dr. T. K. Sivadas, Scientist S-3 also participated in a group meeting conducted by CPCRI, Kasaragod of the Scientists of Regional Centres of CPCRI, CWRDM, Calicut and Rubber Research Institute, Kottayam to discuss some of the concepts and measurement techniques related to environmental studies.
11. Shri A. G. Gopalakrishna Pillai, Scientist S-2, attended and presented a paper at the Seminar on Better Utilization of Cashew Nut Shell Liquid organised by the Small Industries Service Institute and Mangalore Cashew Manufacturers' Association, Mangalore, Sept. 19, 1984.
12. Shri A. K. Chattopadhyay, Scientist S-1, attended and presented a paper at Symposium on 'Preservation & Supply of Fresh and Processed Foods', organised by Defence Food Research Laboratory at Mysore, Oct. 17-18, 1984.
13. Shri R. Balasubramanyan, Scientist S-3, attended the National Consultation Meet on the Deep Sea Fans of the Bay of Bengal organised by Earth and Atmospheric Division, Dept. of Science and Technology, Govt. of India, New Delhi, Oct. 26-27, 1984.
14. S/Shri T. K. Srinivasa Gopal, Scientist S-2 and K. P. Antony, Scientist S-1, attended Seminar on Recent Developments in Packaging for Exports, organised by Indian Institute of Packaging (Madras Region), Cochin, October 1984.
15. Dr. K. Ravindran, Scientist S-3, attended the 3rd International Symposium on Advances in Electro-chemical Science and Technology organised by Society for Advancement of Electro-chemical Science and Technology, Karaikudi, Dec. 10-14, 1984.



16. Shri M. R. Nair, Director, attended Workshop on Management of ICAR Institutes at National Academy of Agricultural Research Management, Hyderabad, Dec. 18-21, 1984.
17. Shri R. Balasubramanyan, Scientist S-3, attended the Symposium on Endangered Marine Animals and Marine Parks organised by the Marine Biological Association (India) at Cochin, Jan. 12-16, 1985.
18. Shri T. K. Srinivasa Gopal, Scientist S-2, attended National Symposium on Recent Developments in Food Packaging organised by Association of Food Scientists and Technologists (India), CFTRI, Mysore, January 1985.
19. Dr. P. N. Kaul, Scientist S-3, attended Seminar on Management of Agriculture and Rural Development Programmes at College of Agriculture, Nagpur, Feb. 6-9, 1985.
20. S/Shri T. S. Gopalakrishna Iyer, Scientist S-3 and T. S. Unnikrishnan Nair, Scientist S-2, attended and presented a paper at the Regional Seminar on Upgradation of Technology in Seafood Industry at Calcutta, Feb. 25-26, 1985.
21. Shri R. Balasubramanyan, Scientist S-3, attended Seminar on Motivation-cum-training on the Development of FRP Components organised by the Small Industries Service Institute, Govt. of India at Coimbatore, March 6-7, 1985. He spoke on the scope of utilisation of FRP in fishing boats.
22. Dr. P. K. Surendran, Scientist S-2, attended the National Seminar on Pollution Control and Environmental Management at National Environmental Research Institute, Nagpur, March 16-18, 1985. A paper was also presented at the Seminar.
23. Shri A. C. Joseph, Scientist S-2, attended the Fourth Consultative Group Meeting of Porbander Base of Fishery Survey of India at Veraval under the Chairmanship of Commissioner of Fisheries, Govt. of Gujarat, March 21, 1985.
24. Dr. T. K. Sivadas, Scientist S-3, attended and presented a paper at the International Seminar on Concepts and Techniques in Applied Climatology, Andhra University, Waltair, March 17-21, 1985.

### 1.13 FISHING CRUISES

The Scientists of the Institute are regularly taking part in the various fishing cruises on board the 71.5 m fisheries and oceanographic research vessel FORV SAGAR SAMPADA acquired by the Dept. of Ocean Development, Govt. of India under the Danish Assistance Programme and handed over to ICAR for research in fisheries and oceanography. Particulars of the various cruises undertaken during the year are given below.



<i>Particulars of cruise</i>	<i>Period</i>	<i>Scientists participated</i>
Trial Cruise I	9.1.'85-14.1.'85	Sh. P. A. Panicker, S-3 Dr. T. K. Sivadas, S-3 Sh. P. N. Joshi, S-1
Trial Cruise II	18.1.'85-25.1.'85	Sh. P. A. Perigreen, S3 Sh. K. V. Mohan Rajan, S-2
Trial Cruise III	29.1.'85-4.2.'85	Sh. V. C. George, S-3 Sh. N. A. George, Asst. Tech. Officer
1st Regular Cruise	8.2.'85-23.2.'85	Sh. P. A. Panicker, S-3 Sh. T. M. Sivan, Asst. Tech. Officer
2nd Regular Cruise	26.2.'85-13.3.'85	Sh. Cyriac Mathen, S-2 Sh. K. Sreedharan Namboodiri, S-2 Sh. T. K. Thankappan, S-2
3rd Regular Cruise Phase I	17.3.'85-4.4.'85	Sh. S. V. S. Rama Rao, S-2 Dr. M. D. Varghese, S-1 Sh. P. N. Joshi, S-1
Phase II	13.4.'85-18.4.'85	Sh. P. Madhavan, S-2 Sh. N. A. George, Asst. Tech. Officer

*Cruises on-board 'V. V. SARASWATHI' of CIFE, Bombay*

<i>Particulars of Cruise</i>	<i>Scientists participated</i>
XXXI Cruise for mid water trawling and shark long lining	Sh. V. C. George, S-3 Sh. K. K. Kunjipalu, S-2
XXXII Cruise for shark long line fishing Shark long line operation	Sh. P. George Mathai, S-1 Sh. N. Subramonia Pillai

**1.14 ICAR SPORTS**

The Institute participated in the 4th ICAR Sports Meet, (Zone V) hosted by the Central Tuber Crops Research Institute at Trivandrum during 24-29 September 1984. Sh. A. Vasanth Shenoy won the Badminton singles title and the CIFT team

comprising Shri Shenoy, Jose Kalathil, M. K. Kandoran, P. A. Uthup and C. R. Gokulan won the Badminton team Championship. In Football, CIFT was runner-up. Shri. C. D. Parameswaran bagged the first place in Long Jump and second place in Pole Vault.

### 1.15 DEGREE / AWARD

Sh. T. K. Sivadas, Scientist S-3, was awarded Ph.D. degree by the University of Cochin for his research work on the Development of a Composite Equipment for Coastal Fishery Hydrographic Investigations. The work was carried out under the guidance of Dr. C. T. Samuel, Dean, Dept. of Industrial Fisheries, University of Cochin.

### 1.16 FELLOWSHIP/TRAINING/DEPUTATION

Shri S. Kalaimani, Scientist S-1, attended a training course on Entomology of Storage Pests and Their Prevention at the Dept. of Entomology, Tamil Nadu Agricultural University, Coimbatore from 20-29 August 1984.

S|Shri Mahadeva Iyer and P. V. Prabhu, Scientists S-3, attended the course on Agricultural Research Management at NAARM, Hyderabad, from 18 September to 20 October 1984.

Shri S. Sanjeev, Scientist S-1, underwent training in phage typing of Staphylococci at the Dept. of Microbiology, Maulana Azad Medical College, New Delhi, during 18 September-5 October 1984.

Dr. M. Arul James, Scientist S-2 and Sh. V. Narayanan Nambiar, Scientist S-1, participated in the Quality Development training programme organised by the Export Inspection Agency at Bombay, Veraval and Goa. Lectures on quality control aspects and microbial spoilage of seafoods were also delivered.

S|Shri K. Sreedharan Namboodiri, Scientist S-2 and P. N. Joshi, Scientist S-1

were trained in acoustics in Denmark under the Danida Fellowship. They also participated in the maiden cruise of FORV 'Sagar Sampada' from Denmark to India during November-December 1985.

Dr. K. Ravindran, Scientist S-3, attended a three month training course from January 1985 on Ferrocement Fishing Vessel Construction organised by the Govt. of India in collaboration with FAO of the UN at Central Institute of Fisheries, Nautical and Engineering Training, Cochin.

### 1.17 VISITORS

As in the previous years, a number of people visited the Institute to acquaint themselves with the various activities of the Institute. These included Indian and Foreign dignitaries, students from educational institutions etc. Some of them were:

1. Dr. David Cooks, National Resource Adviser in Delhi Office of British Deputy High Commission.
2. ICAR Press Team.
3. Mr. M. H. Durand, Scientist of Orstom French Institute of International Co-op. Research for Development, Paris.
4. Mr. Pajot of BOBT-visited the Kakinada Research Centre of the Institute.

## 2. RESEARCH

### 2.1. HEADQUARTERS, COCHIN

#### 2.1.1. CRAFT DIVISION

##### SCIENTISTS ASSOCIATED

R. Balasubramanyan, Dr. K. Ravindran, Dr. N. Unnikrishnan Nair, A. G. Gopalakrishna Pillai.

- \* Shri P. R. G. Varma, Scientist S-2 was trained at the National Institute of Cholera and Enteric Diseases, Calcutta for a period of ten days in Feb. 1985 on the WHO technique for detection of cholera.



## CHIEF FINDINGS

Field trials on aluminium sheathed vessels, steel trawlers and marine structures have shown that the performance of mercury free anodes is on par with the specifications of anodes internationally accepted. Batch production of these anodes on a semi-pilot plant scale has been successfully carried out. The details of machinery flow chart and economics for the production on a pilot plant scale, upgradable to commercial scale, has been worked out.

The successful field demonstrations of chemical wood preservatives like creoscor, copper creosote and arsenical creosote, have generated considerable interest regarding their efficacy. More and more demands are being received from artisanal fishermen of different fishing villages for field demonstration of these preservatives on their crafts. The service life of the 'thanguvalloms' can now be enhanced to 3-4 years by the application of these preservatives.

Motorization of the 'thanguvalloms' has been a great success with two major alternatives to choose from, viz. inboard air cooled diesel engine and the Kerosene run out-board motor. Diesel engines are found to be more economical in the long run. Motorization has increased the fish landings three to four folds.

Studies on polymer impregnated ferrocement have shown that the first crack tensile stress is considerably higher in polymer impregnated ferrocement than in plain ferrocement and in ferrocement incorporated with fly ash. The enhancement in strength was four times in polymer impregnated ferrocement compared to ferrocement with fly ash and nearly three times in plain

ferrocement. The ultimate tensile stress increased with the volume fraction of reinforcement for all the three composites, but the increase was steeper in polymer impregnated ferrocement. Tests have demonstrated the feasibility of using polymer impregnated ferrocement in certain load bearing parts of the fishing craft.

The chemical wood preservatives based on fortified creosote have shown their efficacy in preventing biodeterioration in marine plywoods.

The diagnostic criteria for the stray current corrosion in steel fishing boats through remotely positioned welding generators were laid down and remedial measures evolved.

The toxic wood plastic composites, a new class of material innovated by the Institute, on extensive test in the marine fields, has brought to light that the composites can be put to specific use in areas where there is greater need for structural strength and where anti-fungal and anti-borer properties are required. FRP canoes can now replace the traditional wooden canoes. Complete technical know-how is now made available with close liaison between the builders and the end users.

## RESEARCH IN HAND

### Boat building materials

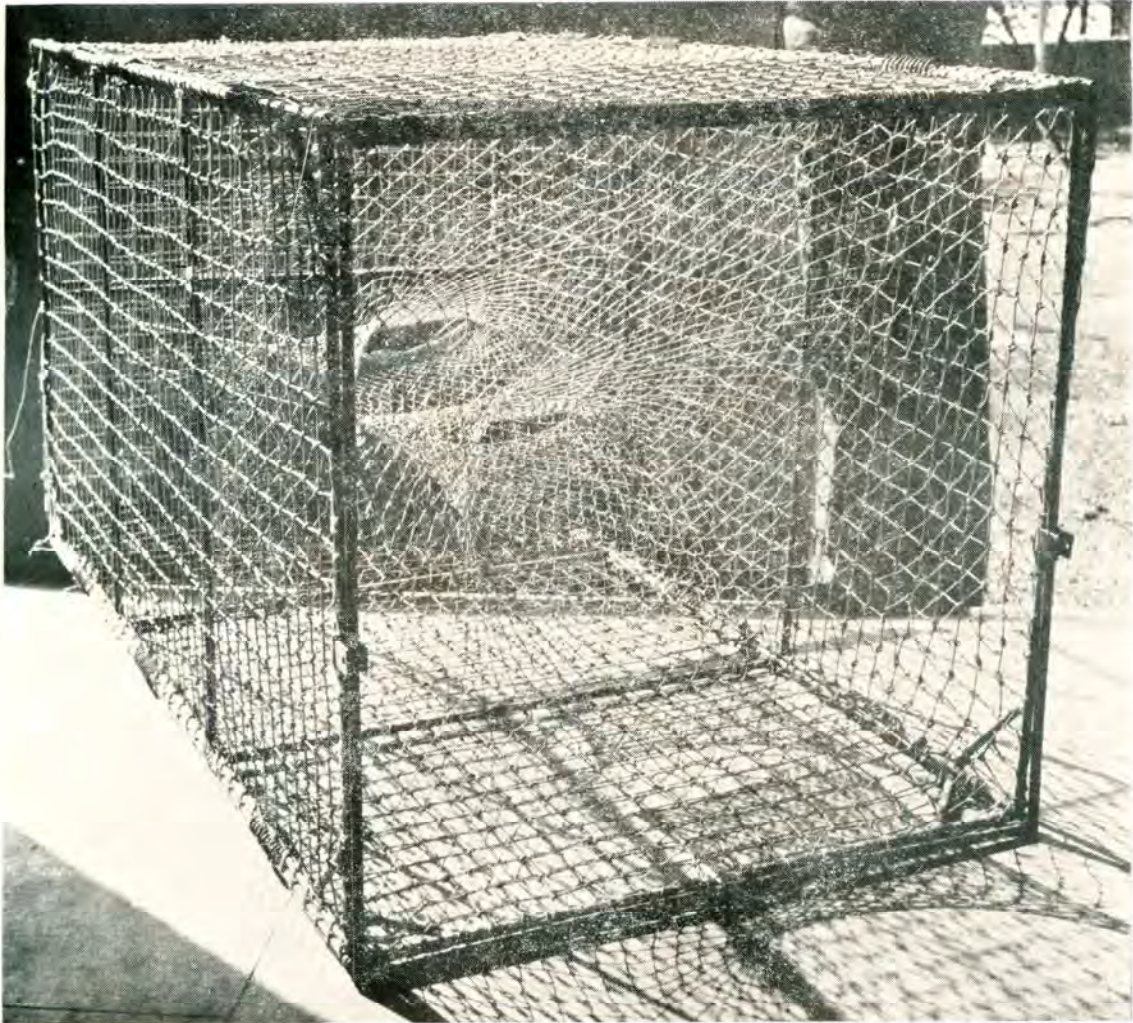
#### Fibreglass reinforced plastic

FRP boats constructed and operated at selected places were being monitored with reference to the construction practices and field performance.

#### Ferrocement

Studies were made on the mechanical strength properties of polymer impregnated





*Kalawa trap*



*Kalawa (Epinephelus sp.)*



ferrocement, ferrocement containing fly ash and plain ferrocement and their performance studied in the laboratory and field.

#### Marine ply-wood

The effect of fortified creosote on marine wood for preventing biodeterioration was evaluated.

#### Marine corrosion

Service trials on mercury free anodes were carried out.

#### Toxic wood plastic composites (TWPC)

Wood plastic composites impregnated with biocides were tested for their strength retention and resistance to fungi, borers and foulers under field conditions. The sheer strength, compression strength and flexural behaviour of the TWPC were also studied.

#### RESEARCH CONTEMPLATED

1. Design development and construction of aluminium fishing craft for inshore waters
2. Development of a dual treatment preservative technology for boat building timbers
3. Cataloguing of the traditional fishing craft of India
4. Studies on craft materials with reference to marine corrosion, fouling, boring, bio-deterioration and marine coatings

#### 2.1.2. GEAR DIVISION

##### SCIENTISTS/TECHNICAL OFFICERS ASSOCIATED

P. A. Panicker, V. C. George, K. V. Mohan Rajan, K. N. Kartha, P. George

Mathai, T. P. George, B. Meenakumari, Dr. M. D. Varghese, A. C. Kuttappan, S. Gopalan Nayar, N. A. George, T. M. Sivan, K. Radhalakshmi.

#### CHIEF FINDINGS

*Field trials on the comparative efficiency of two seam and four seam high opening trawls have indicated a 50% better efficiency in the case of the former over the latter.*

*Experimental trial operations carried out with the prototype of Kalawa traps from MFV MATSYAKUMARI have given encouraging results.*

#### RESEARCH IN HAND

Evaluation of properties of polypropylene netting yarns and standardisation of twines in collaboration with Gujarat Filament Corporation and the GFCCA was initiated.

Preparation and evaluation of properties of combination twines and ropes made from polyethylene, polypropylene and polyamide were undertaken as also photo-degradation studies of netting materials under simulated conditions in the xenotest equipment.

Modelling and model testing of a 24 m. mid-water trawl is being carried out.

Design drawings of four panel, BOBP bulged belly, six seam and long wing trawls have been developed. Three designs of demersal trawls for operation from FORV SAGAR SAMPADA were also finalised and fabrication taken up. Models of the above gear are under preparation.

Studies have been initiated on the comparative performance of the long wing and BOBP shrimp trawls.

Studies were conducted on the behaviour studies of the fingerlings of *Chanos chanos* to HDPE 0.5 mm and 1.0 mm. twines. The frequency distribution was found to be normal.

#### RESEARCH CONTEMPLATED

1. Preparation of standard specification for polypropylene twines and combination twines
2. Introduction of netting materials other than nylon for different types of fishery
3. Formulation of test procedures for weather deterioration of netting materials
4. Preparation and testing of models of demersal trawls for EEZ and tank testing of mid-water trawl models
5. Efficiency studies of demersal and midwater trawls from bigger classes of vessels
6. Introduction of squid jigging and selectivity studies of hooks and baits for shark long lining
7. Development of traps for perches

#### 2.1.3. BIOCHEMISTRY & NUTRITION DIVISION

##### SCIENTISTS ASSOCIATED

Dr. P. G. Viswanathan Nair, Dr. K. Devadasan, P. D. Antony, Dr. Jose Stephen, Dr. M. K. Mukundan, A. G. Radhakrishnan, Dr. P. K. Surendran, Dr. P. T. Lakshmanan, K. Ammu, D. Imam Khasim Saheb.

##### CHIEF FINDINGS

*A stable mixture of lipases, proteases and carbohydrases prepared from the gut*

*contents of oil sardine gave 400 units lipase, 120 units carbohydrase and 2000 units protease activities per gram dry matter.*

*Chitosan, used along with carboxy methyl cellulose, could be used for immobilizing sardine lipase. But trypsin could not be retained under similar conditions, presumably due to its more easily denaturing nature.*

*Lipase enzyme, isolated from terrestrial strains of gram positive bacteria, showed maximum lipolytic activity after 48 hours at room temperature as well as at 37°C.*

*Prawn muscle had a lesser content of volatile carbonyls compared to oil sardine. Acetaldehyde alone accounted for more than 55% of the total carbonyls in prawns whereas in sardines, valeraldehyde, 3-heptanone, 2-heptanone etc. were the major constituents.*

*Free fatty acid induced protein denaturation showed some species based variations. The changes affected mostly the fibrillar proteins. In mackerel, after protein-f.f.a. inter-actions, a new faster moving protein band was visible in the electrophoretic pattern, which can be either due to increased molecular charge of the protein molecule as a result of fatty acid absorption, or due to molecular dissociation. The behaviour was not observed in other species of fishes.*

*Among the common fresh water carps, Rohu, *Labeo rohita*, was found to be the best, nutritionally, as assessed by the PER values.*

*Scromboid fishes had a high content of free histidine, the precursor of histamine,*



in the muscle. But storage for 4 hours at room temperature and for 4 days at refrigerated temperature did not result in any significant reduction in the content of histidine.

*Fishes and processed marine products from Cochin and Kakinada coast did not show objectionable levels of toxic heavy metals and pesticide residues in their muscle.*

#### RESEARCH IN HAND

Free fatty acid induced protein denaturation in fish muscle showed some species based variations. The sarcoplasmic proteins were relatively unaffected by free fatty acids, whereas fibrillar protein got rapidly insolubilized by f.f.a. Electrophoretic and gel filtration patterns before and after protein f.f.a. interactions did not suggest formation of any aggregates. In mackerel, after protein f.f.a. interaction, a new faster moving band was observed in the electrophoretic pattern which may be due to increased molecular charge or due to molecular dissociation. This was not observed in other species of fishes, prawns, squid etc.

Veleraldehyde, 3-heptanone and 2-heptanone were the major constituents in the hexane extractable carbonyls in oil sardine accounting for almost 60% of the total carbonyls. Other components were heptaldehyde, octaldehyde, octanone and heptyl methyl ketone. But in prawns, acetaldehyde alone accounted for more than 55% of the carbonyls. Formaldehyde, acetone and octanone were also present. Prawns had in general a lesser content of carbonyls compared to sardines.

Attempts made to prepare a stable mixture of lipase, protease and carbo-

hydrase from the gut contents of oil sardine gave a mixture with 400 units lipase, 120 units carbohydrase and 2000 units protease activities per gm. dry matter.

Chitosan could be used for immobilizing sardine lipase (50%) when used along with carboxymethyl cellulose (CMC). Without CMC the enzyme could not be retained. However, when trypsin was used for similar studies, chitosan was not found very useful, presumably due to easy denaturation of the enzyme.

Lipase isolated from terrestrial strains of gram positive bacteria showed maximum lipolytic activity after 48 hours, at room temperature as well as at 37°C.

Autolysis was generally found to be low in fresh water fishes. Coagulation characteristics of fish sarcoplasmic proteins in solution at different temperatures were studied as a function of pH, keeping the heating time constant. At each temperature, the insolubilization, changes in non-protein nitrogen content, -SH content, electrophoretic patterns etc. were followed.

Among the common fresh water carps, Rohu was found to be best, as far as nutritional quality of the proteins (as assessed by PER) was concerned.

Scombroid fishes had a high content of free histidine. But storage at room temperature upto 4 hours or at refrigerated temperature upto 4 days did not result in any significant production of histamine.

Fishes from Cochin and Kakinada and processed marine products of Cochin did not contain toxic heavy metals or pesticide residues above the safety limits.

#### RESEARCH CONTEMPLATED

1. Detailed studies on the biochemical composition of mollusca of commercial importance
2. Studies on toxic heavy metals, toxic amines, pesticide residue and biotoxins found in fresh fish and processed fishery products and aflatoxins in cured fishery products
3. Functional properties of fish proteins
4. Studies on hydrolytic enzymes of fish muscle
5. Volatile carbonyls from different fish species-isolation and identification
6. Pharmacologically active constituents of fish muscle- their isolation and activity studies
7. Protein-lipid interactions in fish muscle
8. Changes in fish muscle during heat treatment and its nutritional implications
9. Isolation of bacterial enzymes and study of their properties

#### 2.1.4. MICROBIOLOGY DIVISION

##### SCIENTISTS ASSOCIATED

K. Mahadeva Iyer, Dr. P. K. Surendran, Dr. M. Arul James, Nirmala Thampuram, K. V. Lalitha, S. Sanjeev, S. N. Nambiar, S. P. Damle, A. C. Joseph, H. K. Beri, S. S. Gupta.

##### CHIEF FINDINGS

*Of the various selective media tried for isolation of E. coli by direct plating method and their capacity to promote re-*

*covery of freeze injured cells, maximum recovery of the freeze injured cells was observed in a complete medium like Trypticase Soy Agar.*

*The occurrence of Clostridium perfringens in sardines, prawns and lactarius was observed by MPN method using lactose sulphite broth. The count, as in the previous year, was seen to be higher in the guts than in the skin or in the muscle of fishes.*

##### RESEARCH IN HAND

The nature of the bacterial flora on vral (*Ophiocephalus*), cuttle fish and oil sardine, was studied. The main groups of bacteria identified in vral were *Pseudomonas* (12%), *Alcaligenes* (12%), *Acinetobacter* (16%) and *Flavobacteria/Cytophaga* (6%). *Enterobacteriaceae*, mainly constituted by *Escherichia coli*, constituted nearly 22% of the bacterial flora, in addition to *Streptococci* (18%), *Staphylococci* (3%) and *Micrococci* (6%). During ice storage, *Streptococci* was detected even after eleven days, during which period, the major group of bacteria comprised of *Pseudomonas* (76%). In the case of cuttle fish, the gut carried a population of *Coliforms*, faecal *Streptococci* and *Staphylococci*.

Thirty five samples of fresh fish, frozen and dried fishery products collected from markets and cold storages in and around Cochin were also examined for presence of food poisoning organisms. *Staphylococcus aureus* was isolated from a majority of the products examined, while incidence of *Vibrio parahaemolyticus* was observed in frozen crab meat. However, all the samples were free from *Vibrio cholerae* and *Shigella*. The entero toxigenicity of *S. aureus* strains was studied em-



ploying Cellophane-over-Agar method and Optimum Sensitivity Plate (O.S.P.) method. Forty nine of the sixty seven strains were found to be enterotoxigenic and they produced enterotoxins A, B, C, D and E either singly or in combination, of which, toxins A, C and D were detected more often than the others.

The comparative performance of suspending fluids for enhancing the recovery of freeze-injured cells of *E. coli* in a selective medium is being studied.

#### RESEARCH CONTEMPLATED

1. Taxonomical studies in bacterial cultures isolated from fish including cultured fish
2. Improvements on existing methods for quantitative and qualitative determination of bacteria
3. Studies on the survival of salmonella serotypes in different fishery products
4. Survey on the occurrence of anaerobes in marine and brackish water fishes and their taxonomy
5. Studies on the conditions for toxin production on fish substrate and their control
6. Analysis and study of the various pathogens isolated from fish and fishery products and survey on their occurrence in fish and aquatic environs

#### 2.1.5. PROCESSING DIVISION

##### SCIENTISTS ASSOCIATED

Dr. K. Gopakumar, P. V. Prabhu, P. Madhavan, T. S. G. Iyer, T. K. Govindan, K. Mahadeva Iyer, Cyriac Mathen, K. K.

Balachandran, P. A. Perigreen, C. V. N. Rao, P. R. G. Varma, Dr. P. K. Surendran, A. Lekshmy Nair, Chinnamma George, P. K. Vijayan, T. K. Srinivasa Gopal, P. T. Mathew, K. G. Ramachandran Nair, Jose Joseph, A. V. Shenoy, P. Ravindranathan Nair, R. Thankamma, K. P. Antony, Nir-mala Thampuran, Francis Thomas, Dr. P. T. Lakshmanan, T. K. Thankappan.

#### CHIEF FINDINGS

*In order to impart a soft and firm texture to canned Rohu, its fillets, prior to canning, must be treated with brine containing 0.25% calcium chloride.*

*Presence of green peas in canned prawn curry makes the product unacceptable during long storage. Curry formulations made without green peas as per the process developed earlier and canned, remained well for over one year without any significant change either in the contents or the can interior.*

*Experiments carried out to determine the optimum tin coating required in fish cans have shown that provided the lacquering is perfect, a coating of 5.6 G.S.M. of tin is quite sufficient. However, since the cans are made out of lacquered tin plates, some irregularity invariably takes place on the lacquer film resulting in some exposure of the tin, which is likely to lead to product/container blackening.*

*Depuration of live mussels in sea-water yielded the best results as regards bacterial cleansing and removal of sand from the intestine.*

*Whole cuttle fish remained in good condition for 3 days when stored in crushed ice.*



Spices like cinnamon, clove and pepper improved the organoleptic quality of minced meat prepared from cat fish and horse mackerel. The spiced samples of minced fish recorded lower TBA values compared to the control samples.

A recipe has been worked out for preparation of fish balls using minced fish, potato, hydrogenated fat and spices.

*Psenes indicus* frozen immediately after catch, remained in good condition even after four months' storage at  $-23^{\circ}\text{C}$ .

PER values of squilla meat and sardine meal mixed in the ratio 1:3 was higher than the individual meals or meals mixed in other proportions.

A 10% increase in the carcass weight of broiler chicken was obtained when fed with 0.5% chitin incorporated diet.

A process was standardised for preparing squid/cuttle fish waste meal.

Dehydrated salt mince prepared out of lizard fish meat remained in good condition upto four months at room temperature.

Studies on the nutritional quality of red, white and whole meat from mackerel tuna (*Euthynnus affinis*) were completed. Determination of the PER of the smoked and dried red meat showed that in the initial stages, the diet intake was lower than that of casein. However, in course of time the difference tapered off and no ill effects were noticed. The PER in case of smoked and dried tuna ultimately became comparable to that of casein.

Bulk packages prepared out of corrugated 3-ply polypropylene boards lost flat crush strength and puncture resistance considerably, but retained bursting strength

even after four months of simulated commercial frozen storage conditions at  $-23^{\circ}\text{C}$ .

Five ply corrugated fibre board master cartons with normal flutings were superior to those with cross flutings with respect to bursting and compression strength, while the latter showed superiority in puncture resistance and flat crush strength.

Duplex board unit cartons with polythene coating on both sides were superior to conventional waxed ones.

Frozen storage studies on oil sardines showed that sealing the product in moisture vapour and oxygen proof films considerably improved their shelf life.

Salted and dried shark flesh dusted with 1% level calcium propionate and sodium benzoate and sealed in 200 g. polythene bags showed enhanced shelf life compared to controls.

Clams could be kept in live condition for 3 days at 18 to  $20^{\circ}\text{C}$  when held in horizontal position in individual compartments with aeration facilities.

*Vibrio cholerae* and *shigella* organisms were absent in all the samples of fish and fish products analysed.

## RESEARCH IN HAND

### Canning

Studies have shown that Rohu meat, on canning, becomes very soft. In order to overcome this problem several treatments of the fish fillets prior to canning were tried. Cold blanching in brine alone or in combination with different proportions of citric acid, acetic acid, alum and calcium chloride were attempted. After cold blanching, the fillets were either pre-cooked in

steam and canned in the conventional style using brine or oil as filling medium or directly packed in cans and processed without any additional medium. Control was made by packing untreated fish fillets with 2% solid salt sprinkled over it. From the observations made, it is seen that considering the overall appearance, taste and texture of the meat and clarity of the medium, best results were obtained by pre-treatment of the fillets in 10% brine containing 0.25% calcium chloride followed by processing without adding any liquid medium. Increasing the concentration of calcium chloride beyond 0.25% results in further improvement of the texture, but the other characteristics, especially flavour, get impaired. None of the other treatments yielded any desirable effect. Loss of flavour, toughening of the texture and adhesion of the meat to the can surface were the shortcomings observed. In treatments with citric/acetic acids, the texture also became quite fibrous. However, the can interior remained unaffected in all cases.

Unlacquered quarter dingley cans, though good for packing fillets, was found unsuitable as containers for fresh water fish, because in all types of packs, either blackening or corrosion or both was found to take place in the can interior. Round, SRL cans were therefore used for further studies.

A number of recipes were experimented for processing canned prawn curry. Though initially one containing green peas as one of the ingredients was quite tasty, on storage, the peas changed colour as well as developed an unpleasant taste. Storage studies of the canned curry samples were also continued. Beyond 13 months' storage, significant changes were observed,

especially in texture and flavour. However, no significant change was observed in the pH and consistency of the product. The interior of the cans also remained intact.

Trial consignments of the prawn curry were made by the Kerala Fisheries Corporation. The consumer acceptance of the product has been quite encouraging.

Studies were continued on the optimum tin coating required for cans. Cans with two internal tin coatings, viz. 5.6 grams per square metre (G.S.M.) and 11.2 GSM were used, the former as experimental cans and the other (now used in the industry) as control. When prawns were packed in the experimental cans, blackening was observed in some cases. Internal scratchings were seen at the places where blackening developed. Visibly perfect cans were then taken, and a few scratches made deliberately and prawns canned again. After a month's storage, it was observed that blackening took place in cans with scratches while the others remained intact. This probably indicates that when lacquering is perfect, 5.6 GSM tin coating is sufficient for fish cans.

Preliminary studies on canning clam and crab meat have shown the unsuitability of thin tin coatings for canning these commodities.

Studies were carried out on depuration of live mussels which is a pre-requisite to its processing. The different media tried were sea-water, brine, potable water, all three chlorinated at 5 ppm level and sea water alone at 2 ppm. level. Starvation in sea-water yielded the best results as regards removal of sand from the intestines as well as bacterial cleansing. Bacteriological analysis for total count, total coliforms, *E. coli*, total streptococci and coa-



gulase positive staphylococci were carried out before and after depuration. It was observed that there is 90% reduction in total count as a result of depuration.

#### *Freezing and frozen storage*

In order to study the storage characteristics, cuttle fish fillets, which comprised 33% of the whole fish, were frozen individually after wrapping in polythene and stored at  $-23^{\circ}\text{C}$ . The physical and sensory characteristics were good upto 4 months of storage and there were also no appreciable changes in chemical parameters. Studies are to be continued.

Attempts to separate the meat and prepare fresh frozen squilla have been partially successful.

#### *Dehydration*

Experiments have been initiated on the various aspects of dehydration of squid and the effect of antifungal agents on the dehydrated product.

The method worked out for dehydration of jelly fish was found to give a product comparable in properties to the product from Malaysia. Samples sent to Japan, through MPEDA, have also been accepted by the Japanese buyers.

Salted and dried shark flesh with low moisture content, treated with 1% level calcium propionate and sodium benzoate and sealed in 200 gauge polythene bags remained free from fungal attack even after 200 days. Organoleptic and chemical qualities did not reveal any drastic change during the period.

#### *Fish mince*

Studies were initiated on the effect of spices like cinnamon, clove and pepper to

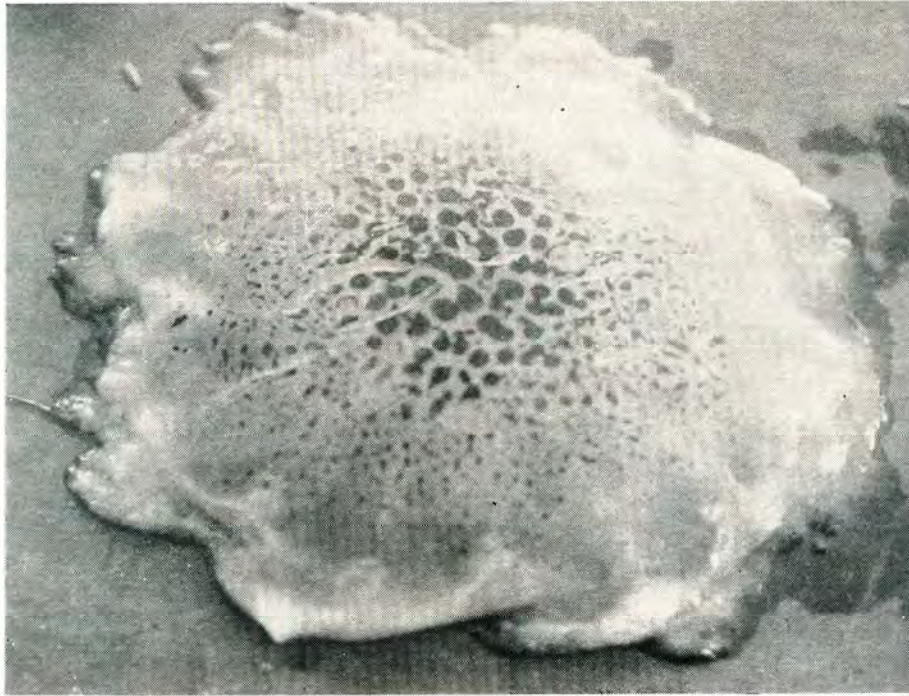
improve the quality of minces from cat fish and horse mackerel. The quantity of spices used was 0.1 and 0.2%. In general, the spices imparted the characteristic taste to the product which increased the organoleptic acceptability. In the case of cat fish mince, no significant difference in PV and FFA values were noticed after four months of frozen storage; but organoleptically the spiced samples were adjudged to be superior to the control samples. In the case of spiced horse mackerel mince, lower TBA values were recorded when compared to untreated mince during frozen storage for 2 months at  $-23^{\circ}\text{C}$ .

Of the several recipes tried for preparing fish balls using minced fish meat, the one which gave a satisfactory product involved cooked and minced meat from jew fish (75%) mixed with cooked potato (20%), hydrogenated fat (5%) and a little spice. Balls were made, rolled over maida and slightly fried in oil. The fish balls were preserved by canning in brine, oil and tomato sauce. The product had attractive colour, good taste and proper consistency.

Studies on dehydrated salt mince prepared from lizard fish have indicated that less initial moisture with high salt content would be the optimum conditions for enhanced storage life. At room temperature, the total bacterial count of the mince had not increased to any significant level.

Dehydrated salt mince was also prepared from a variety of Jew fish (*Sciaenid* sp.). The waste, after separation of the minced meat, could be utilised as animal feed. The salt mince cakes, after cooking and drying, were further analysed for microbial and chemical tests. Studies are in progress. Samples of the dried cake have also





*Jelly fish*



*Dried Jelly fish*



been kept at room temperature and at air-condition temperature for carrying out further storage studies.

Marine beef like samples were prepared from picked meat of Jew fish, mackerel and barracuda. No significant difference was noticed in the rehydration properties of the texturised meat from all the three species.

#### *Fish by products*

Utilization of cuttle fish waste by converting it into cuttle fish meal was experimented. Addition of alum to the brine used for hot blanching increased the water loss facilitating fast drying and thereby increasing the final yield of the product. Mincing the blanched material resulted in getting the dried material in granular form avoiding difficulty in pulverising after drying. Samples have been sent to commercial organisations for evaluation studies.

Nutritive value of meals prepared from fresh squilla or after demineralisation was determined. Squilla meals prepared by direct sun-drying of fresh squilla or by cooking squilla in (a) 1% acetic acid, (b) 7% acetic acid (c) water and auto-claving at 0.7 kg./sq. cm. for 30 mins., draining off the stick liquor and drying were used for the preparation of the test diets. PER evaluation of the various samples showed that the food intake in the initial two weeks was rather low during which period the weight gain was also low as compared to the casein control group. But during the third and fourth weeks, the rate of food intake increased. Ill-effects and mortality were not encountered in any of the test groups. Highest PER values were recorded for sample No. 1 followed by sample No. 5, which were comparable to

that of casein though slightly lower to it. In the other cases, the PER values were lower than that of casein.

The NPU of sardine meal and the PER of wafers prepared from tuna red meat and of Barracuda in the ratio 1:3 were determined. The food intake and growth rate were normal and ill-effects absent.

Investigations were continued on the separation and identification of the major constituents of frog and fresh water fish galls. Taurocholic acid and cholic acid were found present in the gall from frogs. But in the case of fresh water fish galls (Rohu and mrigal), the Thin Layer Chromatography (TLC) system showed a higher mobility than taurocholic acid or cholic acid. Hydrolysis and identification revealed that the bile of rohu and mrigal contains mainly taurine derivatives of lithocolic acid.

Encouraged by the rat feeding experiments with chitin the previous year, feeding experiments were conducted on poultry for broiler chicken in a local poultry farm with 0.5% chitin incorporated in the commercial diet. A significant (10%) increase in carcass weight was obtained. The results were confirmed with experiments conducted with several batches of chicks.

The influence of different parameters on the adsorption of mercury from solution by chitosan was studied and optimum conditions worked out for complete removal of mercury by chitosan. Direct addition of chitosan to the mercury solution and passing the solution through columns were the two methods adopted. In the case of column treatment, it was observed that 1 g. column can remove complete mercury from



5 litres of solution containing 10 ppm mercury in the form of mercury chloride.

Chitosan has also been found to be very effective for the clarification and removal of phosphorous from the effluent of phosphorous manufacturing plant. With a treatment below 5 ppm of chitosan it was found possible to flocculate the suspension and reduce the phosphorus content in the effluent to a concentration below the permitted level. In-plant experiments were conducted successfully and the process adopted.

Chitosan along with silica gel, was also used for the separation of amino acid in thin layer chromatography. The result has not been very encouraging.

#### *Fish speciality products*

Evaluation studies were carried out on the nutritional property of shrimp extract prepared from prawn shell waste by two methods, viz (1) by mincing in a cutter/blender, squeezing out the aqueous liquor through proper sieve, removal of shell residues by filtration through fine mesh and concentration of the filtrate using steam jacket, and (2) by hot extraction of the protein using 0.5% alkali, neutralisation of the extract to pH 7.0 and concentration of the extract. The concentrated extracts were freeze dried and the PER and NPU values determined. The nutritive quality of the protein powder isolated by mechanical means was found to be superior to the one isolated by the chemical method.

In order to find out a suitable direct use for the press juice from shell waste, attempts were made to prepare wafers incorporating the press juice with cooked prawn meat in varying proportions. Trials

conducted so far show that although the press juice alone is not suitable for preparation of wafers, a mixture of prawn meat and press juice gives a satisfactory product.

Attempts were made to prepare micro-fined powder of hygienically collected, cooked and dried shrimp head for human consumption. The prawn head after boiling in brine was dried at 60-70°C and pulverised to 0.6 mm. size. The product has good colour and flavour and can be easily mixed in curries giving characteristic prawn flavour. Treatment with acetic acid minimised the grittiness.

Studies were carried out on the comparative yield and composition of protein powders isolated from (1) whole squilla, (2) body portion of squilla and (3) head portion of squilla by (a) mincing and direct separation of press juice and (b) extraction of the protein using 0.5 percent alkali. Properties of the various protein powders and shell residues are being evaluated.

Separation of squilla protein using meat bone separator was tried. The process was found to be very effective for separating the press juice. Yield of the press liquor was 60% of the whole wet squilla.

#### *Packaging materials*

Duplex boards treated with wax-dendrite mixture showed an improvement to the extent of 15-20% in bursting strength, puncture resistance and ring stiffness at 15% level of the synthetic material in wax compared to normal waxed boards. Pattern of deterioration of physical properties at -23°C was seen to be similar in both the cases. The optimum temperature



for treatment of boards with the wax-dendrite mixture was seen to be about 80-90°C.

Frozen storage studies on sardines packed in 200 gauge LDPE and HDPE films, 40 gauge HM-HDPE films, 100 gauge HM-HDPE and PP films, cellophane/polythene laminates and MXXT cellophane showed that, while the control sample remained in acceptable condition only for two weeks, that packed in the first six films remained acceptable for the entire period of six weeks of operation. The sample packed in the last film was slightly inferior to that packed in the others.

#### *Handling and Transportation*

Studies on transportation of live clams showed that the clams could remain alive at ambient temperatures for 24 hours. When packed in polythene bags with water collected from the same habitat, oxygen bubbled through it till saturation, sealed and kept at 18 to 20°C, they remained alive for 4 days. Temperatures below 18 to 20°C were detrimental to the clams. Mortality was 50% in deputed clams in wet pack with oxygen at 18 to 20°C after 48 hours. When packed dry in polythene bags, the clams remained alive for 48 hours at 18 to 20°C. Packed in moulded pulp trays with aeration holes and held at 18 to 20°C, they remained alive for 3 days. Corrugated fibre-board master cartons of 3-ply and 53 cm x 35 cm x 30 cm size could hold 11 kg. of clams packed in pulp trays. Cost of packing worked out to Rs. 2.25/kg. for wet pack and Rs. 2.40/kg for dry pack. Yield of meat was 7.3 to 8% of the whole clams.

Studies were carried out on the ice storage characteristics of cuttle fish. Whole cuttle fish of average weight 500 g. were stored in ice and the changes in physical, organoleptic and biochemical characteristics observed periodically. After 3 days storage in ice, the samples, though moderately sweet and acceptable, developed slight yellow discoloration in the fillets near the belly portion. On the fifth day, the samples developed off-odours and the intensity of discoloration also increased.

#### *Quality control*

The dry matter content of commercially frozen raw shrimp was observed to be 14% and that of headless raw and headless raw frozen shrimp above 18%. The changes in the dry matter content of freshly peeled prawns in ice were also studied. When stored in ice there was an increase in weight by 8% and decrease in the dry matter by 1.5%.

Studies were continued on the effect of delayed icing on the quality and shelf life of fish. The initial readings of some species of fish tested using the Intelectron Fish Tester VI were shark, 85, Lactarius, 60, Bullseye, 61, Squid, 30. After 24 hours storage in ice the reading showed an increase, although after the first day the values again began to come down.

About 40 samples of prawns, tuna, crab meat and oysters were analysed for presence of heavy metals. As in the previous year, levels of metals like Hg, Pb, Cd, Cu, Zn, etc. were all below the permitted levels, although in some samples of canned crab meat, 'Cu' and 'Zn' contents were more.



#### RESEARCH CONTEMPLATED

1. Studies on canning fresh water fishes and optimum tin coating in fish cans
2. Solid loss taking place at different stages of canning and its prevention
3. Heat penetration studies and bacterial safety in canned fish
4. Freezing and storage of fatty fishes
5. Effect of spices on quality of frozen minced fish
6. Studies on consumer packages of chilled fish
7. Development of packages for dried fishery products and retort pouches from indigenous films
8. Transportation of live clams
9. Further studies on recovery and re-use of chitosan saturated with mercury
10. Effect of antifungal agents on dehydrated squid
11. Isolation of bulk quantity of squilla protein

#### SCIENTISTS ASSOCIATED

S. Ayyappan Pillai, P. K. Chakraborty, K. Sreedharan Namboodiri, P. N. Joshi.

#### 2.1.6. ENGINEERING DIVISION

##### CHIEF FINDINGS

*The solar tent dryer developed by the Institute recorded an average temperature of 48°C, a rise of 18-20°C over room temperature. Fish could be dried in 14 day-*

*light hours in this simple, inexpensive, dismantlable polythene dryer. The cost of a unit of 10 kg. capacity works out to Rs. 250|-.*

*Quality smoked products from sardine and clam meat were obtained using the electro-thermal smoke kiln. Attempts were made on the electro deposition of smoke on the fish surface by an electronic device.*

*Detailed design drawings were developed of a commercial model mechanical cooking device for cooking prawns. The device is meant for cooking and cooling prawns under pressure, reducing the loss of weight during the cooking process. The device consists of a pressure chamber, a steam supply system for cooking prawns, a compressed air system for pressurising and a water pump for cooling the system.*

*A propeller nozzle was developed and fitted to a 9.76 m. (32 ft.) trawler fitted with a 47.5 H.P. engine and 31" x 27" size propeller. Trials carried out indicated an increase in bollard pull of 30%.*

#### RESEARCH IN HAND

Modifications are being effected in the existing design of the solar tent dryer.

Fabrication was undertaken of the bio-gas generator based on the design developed earlier and experimental trials on the production of bio-gas from water hyacinth carried out.

Fabrication was also undertaken of the commercial model of the cooking device for prawns and trials initiated for standardisation of the design. Fabrication and trial runs were also carried out with the prawn washing machine for standardisation of the same.



*The electro-thermal smoke Kiln for production of quality smoked products*



Trial runs were continued with the deep freezer for attaining a temperature of  $-40^{\circ}\text{C}$ .

A Kaplan propeller and a slotted blade propeller have been developed. Trials with these propellers have to be carried out.

#### Testing of Marine Engines

During the year under report, two engines of M/s. H.T.C. Diesel Engines Pvt. Ltd., Bombay were subjected to type testing and their suitability for installation on fishing vessels studied. Details of the engines tested are given below.

H.T.C. VC-16, water cooled engine  
H.T.C. ISFS-8, water cooled engine

#### RESEARCH CONTEMPLATED

1. Development of electronic propulsion for small mechanised fishing vessels
2. Design and development of a commercial smoke kiln based on electro-thermal principle
3. Further modification of deep freezer to attain  $-40^{\circ}\text{C}$ .

#### 2.1.7. ELECTRONICS AND INSTRUMENTATION DIVISION

##### SCIENTISTS ASSOCIATED

T. K. Sivadas, K. Ramakrishnan, K. Vijayabharathi.

##### CHIEF FINDINGS

###### (a) "Flash Light Buoys"

"Flash light buoys" have been developed for operation along with gill nets, for the safety of the nets and the boats

passing by. This equipment was developed at the request of the Karnataka State Fisheries and Indo-Danish Fisheries Project, Karwar and was handed over to the Indo-Danish Fisheries Project for their trials.

The equipment operated on 9V dry cells flashes light during night. A few of these small and portable flash buoys attached to the gill nets indicate the positions of the nets during night and warn boats against the danger, thereby not only saving the costly nets but also avoiding damage to the boats.

###### (b) Moisture meter

The Moisture meter developed at CIFT was further modified for measurement of moisture in soil with additional facility for remote measurement at several points at a time. This technique is found to be more advantageous and free from the operational limitations of the conventional Gypsum block method. One unit of the equipment was handed over to CPCRI, Kasaragod at their request.

###### (c) Solar Radiation Monitor

The "Solar radiation monitor" developed as part of the "Environmental Data Acquisition System" is found to have several advantages over the conventional radiation measurement techniques, namely (1) it is free from the cosine error (2) it has got remote sensing facility with a long cable, more than 500 metres long (3) it integrates the incident radiation over long duration of days and weeks continuously giving total radiation. Several remote operated sensors can be used in series to give the average radiation in the shade of plants.

## RESEARCH IN HAND

Some of the instruments developed at the Institute were operated in marine conditions for the benefit of students of educational institutions and other research organisations. Some of the instruments were also supplied to the Research Centres of the Institute for their regular operations.

### *Low cost fish finder*

Further tests on the performance of the transmitter circuit were continued. Development of the receiver circuit is in progress.

### *Buoy telemetry system*

Testing and standardisation of various sensors were continued to evaluate their accuracy and performance under different environmental field conditions.

### *S.O.S. Transmitter*

Development of a S.O.S. transmitter for the safety of fishermen operating country crafts as well as mechanised boats has been initiated.

A Summer Institute on 'Application of Indigenous Electronic Instruments for Fishing and Fisheries Research' was conducted from 17th May to 7th June 1984. Twenty three participants from 19 Institutes participated. The objective of the Summer Institute was to acquaint the scientists, teachers, research workers and subject matter specialists with the advancements in indigenous instrumentation techniques developed at CIFT and their applications to numerous fisheries and related environmental programmes being handled by different departments in the country, so

that they can plan their schemes based on the indigenously available technology.

The Division conducted two workshops in Instrumentation for Fisheries and Environmental Investigations during the month of December 1984 for imparting training to the teachers and research workers in the respective fields for adopting new instrumentation technologies developed at CIFT.

The Workshop organised in A.V.V.M. Shri Pushpam College, Poondi, was attended by 78 participants from 21 educational Institutions of Bharathidasa University and other nearby departments.

The Workshop organised at Vellalar College, Erode was attended by 44 participants belonging to several colleges of Bharathiar University and other organisations, namely, Salem Institute of Experimental Biology, Salem and Centre for Environmental Research and Action, Coimbatore.

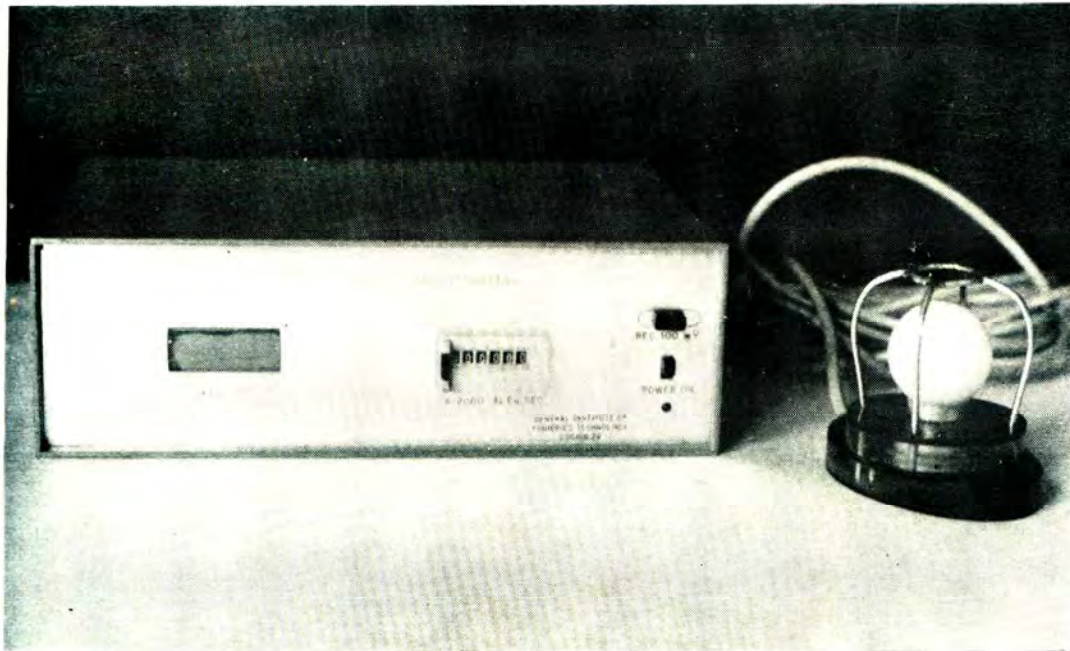
The division also participated in an exhibition on the occasion of the Seminar on Investment Opportunities in Prawn Farming at Cochin on 2nd January 1985 conducted by MPEDA, Cochin and demonstrated the various uses of instruments developed by CIFT.

## 2.2. VERAVAL RESEARCH CENTRE

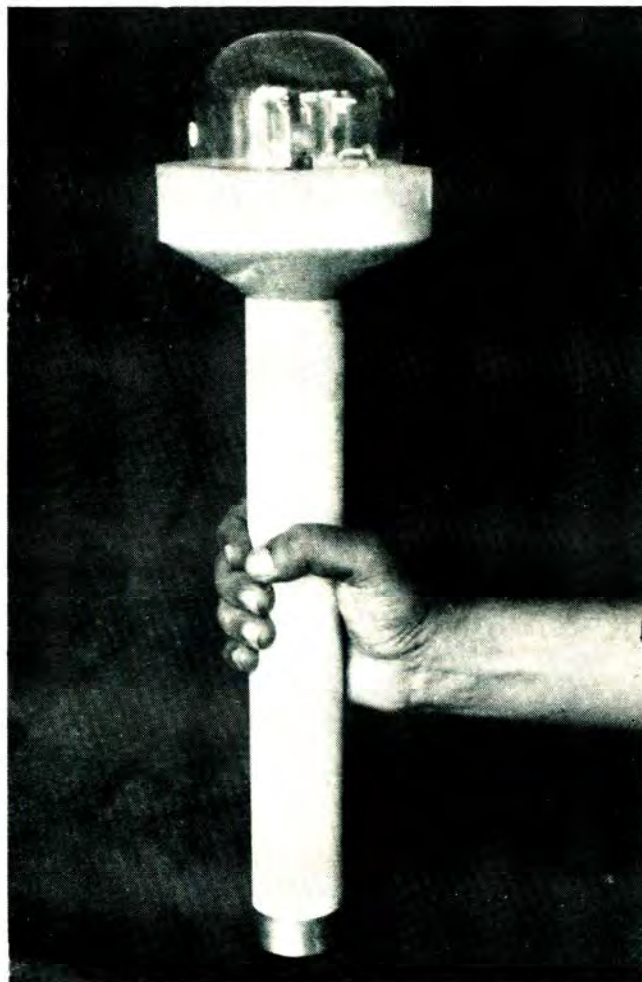
### SCIENTISTS ASSOCIATED

K. K. Kunjipalu, K. K. Solanki, N. Subramonia Pillai, M. R. Boopendranath, A. C. Joseph, Anil Agarwal, M. R. Raghunath,





*The solar radiation monitor and indicator*



*The flash light buoy developed for operation with gill nets.*



*Sh. T. K. Sivadas, Scientist S-3, explains the working of some of the equipments displayed in connection with the Summer Institute on 'Application of Indigenous Electronic Equipments for Fishing and Fisheries Research'.*



## CHIEF FINDINGS

*The effectiveness of attachment of sail kite in improving the trawl gear performance has been confirmed in a 25 m. high opening trawl. Both the trawls, rigged with sail kite showed increase in total catch, with marked increase in catch of Ribbon fish, eel, squid and Lactarius.*

*Comparative studies of a 25 m (six seam) high opening trawl, 25 m. large mesh demersal trawl and 25.60 m. high opening BOBP trawl have shown that better catch rates are obtained with the 25 m. high opening trawl and the 25 m large mesh demersal trawl than with the BOBP design. Results confirm the earlier findings that high opening trawls with large mesh in the forepart and with more than four panels are more efficient for the better exploitation of the demersal and semi-pelagic fish resources.*

*Yellow coloured gill nets introduced off the coast have been a success for hilsa and pomfret fish.*

*A chemical treatment has been developed for improving the colour of shark fillets.*

*A simple physical method has been found effective in removing filth from Sand Lobster Tails (SLT).*

*A modified freezing method was developed to avoid blood stain discolouration of frozen pomfret.*

*Methods have also been developed for preparation of canned fish minces mixed with vegetables.*

*Refrigerated storage can reduce the rate of browning of dried squids. Skin-on*

*squids are more prone to browning than skinless squids during drying.*

## RESEARCH IN HAND

Studies were carried out with gill nets fabricated out of newer materials like HDPE monofilament and multifilament. Comparative efficiency studies were also carried out on the different types of gill nets fabricated out of different materials and with different types of mounting. Six of the twelve units studied were with improved method of mounting and six with local method of mounting.

A chemical treatment has been developed to improve the colour of shark fillets. This method has also been effective in removing the urea content from shark muscle to some extent.

The problem of blackening of whole cooked lobsters was studied in detail. Cooking of dead lobsters and use of impure salt for cooking were found to be the main reasons for this problem. Another major technical problem noticed in the processing of Sand Lobster Tails (SLT) meant for export to the United States was the presence of filth in the form of sand even after repeated washing in water. Brushing the abdominal portion of the individual pieces followed by pressure washing could solve the problem to some extent.

Blood stain discolouration of frozen pomfrets owing to oozing out of blood through the mouth and gills of the fish due to pressure in contact freezers is a major problem faced by the industry. A modified freezing method in which the freezer plates are tightly pressed only after the partial freezing of fish has been found effective in avoiding the blood stain discolouration.

Treatment with a dilute solution of citric acid has also been found effective in removing the blood stains already formed to a great extent.

Canning trials were carried out with different fish minces, vegetables and spices, using brine, ground nut oil and tomato juice as filling media. A dry or semi-dry pack with masala curry was seen to be much better than a pack with more liquid medium.

The rate of drying of skinless squids was greater than that of skin-on type. Squids treated with polyphosphate took more time for drying compared to the control sample. Skin-on squids were more prone to browning than the skinless samples. Refrigerated storage, however, considerably reduced the rate of browning of the dried squids.

Studies were continued on the incidence and isolation of pathogenic organisms in fresh and processed fish and fishery products. While coliforms were present in sixteen of the seventy two samples of different varieties of fresh fish analysed, other pathogenic organisms like *Salmonella*, *Vibrio para-haemolyticus*, *V. cholerae* and *Shigella* were absent in all the samples. Commercial frozen fishery products were found free of contamination with *V. cholerae*.

#### RESEARCH CONTEMPLATED

1. Studies on bridles and rigging of trawls
2. Studies on effect of different types of mounting of gill nets
3. Design and development of demersal and high opening fish trawls for medium size trawlers
4. Studies on commercial freezing of shark fillet and ghol fillet with special emphasis on drip loss

5. Canning of fish and shellfish mince with vegetables
6. Standardisation of process variables of squid drying

#### Technical Assistance

A total of 275 samples of products comprising fish meal, dried fish, frozen fishery products, water and ice were analysed and the results communicated to the concerned organisations.

The Centre participated in the Agricultural Fair conducted by the Gujarat Agricultural University at Junagadh in early 1984.

### 2.3. KAKINADA RESEARCH CENTRE

#### SCIENTISTS ASSOCIATED

G. Narayanappa, S. V. S. Rama Rao, A. V. V. Satyanarayana, D. Immam Khasim Saheb, Sib Sankar Gupta, Subrata Basu, R. Chakraborty, R. Mangayya Naidu.

#### CHIEF FINDINGS

*Further studies have confirmed that trawling against the current is more profitable with higher catch rate when compared to trawling along and across the current direction.*

*Operation of mid-water trawls in in-shore waters have not given any encouraging results.*

*Design and operation of bag nets with stakes for prawns as well as multimeshed gill nets for fishing in general have been standardised.*

*Studies on the biochemical composition of fish and shell fish have shown the cadmium content to be more in the liver tissues*



of tuna and sail fish caught from the Vizag coast. The zinc content in the fish and shell fish of this region was also observed to be more.

*Treatment of cured and sun dried fish with sodium tripolyphosphate has shown to control the growth of red halophiles.*

*Psenus sp. stored at  $-18^{\circ}\text{C}$  remained in acceptable condition even after one year.*

*Live fish transported from Andhra by lorry reach their destination in a good condition, if the water is changed on the way. The damage to the container is also less when transported by lorry than by rail.*

#### RESEARCH IN HAND

#### RESEARCH IN HAND

In order to evolve a trawl gear involving fuel economy, designs were worked out for big mesh trawls and rope trawls.

Most of the salted fish samples collected from the retail outlets and whole sale markets of Andhra Pradesh showed high levels of total volatile nitrogen (TVM), moisture and sand content, while some showed presence of staphylococci and coliforms. Total bacterial count in all the cases was in the range of  $10^4$ /gm.

Experimental containers were fabricated incorporating certain changes in the traditionally used containers for transportation of live air-breathing fish.

Studies have been initiated on effect of neem leaves, smoke liberated from neem leaves and effect of campher on control of insect infestation in cured fish.

Preparation of isinglass in the powder form, as is at present used in the breweries, has been taken up.

Analysis of market samples of fish showed complete absence of pathogens like *Salmonella* and *Vibriopana haemolyticus*. A few samples showed presence of coagulase positive *Staphylococci*.

#### RESEARCH CONTEMPLATED

1. Comparative evaluation of different trawl designs for effecting reduction in fuel consumption
2. Studies on resistance of different components of a trawl system
3. Modifications/improvements, if any needed, to existing boat seines being operated off the coast
4. Analysis of pesticide residues in fish and shell fish
5. Effect of sodium tripolyphosphate on the pathogenic bacteria encountered in cured fish products
6. Study on modified atmosphere storage of fish

#### 2.4. BURLA RESEARCH CENTRE

#### SCIENTISTS ASSOCIATED

K. A. Sadanandan, A. A. Khan, T. Joseph Mathai, M. Mukundan, J. Sita Rama Rao, S. K. Bhattacharyya, J. K. Bandyopadhyay, A. K. Chattopadhyay, Percy Dawson.

#### CHIEF FINDINGS

*Field trials conducted in Derjang Reservoir with improved fishing gear and local gear revealed the superiority of the former over the latter.*

*Trawling operations with the 12 m. mid-water trawl in combination with vertical*

curved otter boards have shown the technique to be effective for harvesting the fishery resources of reservoirs.

Pickled products prepared from low cost fresh water fish using the juice of citrus fruit, *C. reticulata* and pulp of green mango remained in acceptable condition at room temperature for six and six and half months respectively.

Studies were completed on the comparative effect of addition of black pepper and sodium benzoate on the microbial qualities of pickled products prepared from fresh water fish using the juice extracted from *C. reticulata*. The total bacterial count (TBC) and total mold count (TMC) of the control sample were found to be higher than those of the other two samples. Black pepper was shown to exhibit more anti-bacterial property than sodium benzoate, whereas sodium benzoate showed better anti-fungal property. However, the organoleptic scoring of the control sample was found to be slightly higher than that of the other two products.

A pickled product has also been developed from fresh water molluscs using acetic acid and other ingredients.

Studies were also completed on the keeping qualities of *Labeo fimbriatus* and *Catla catla* inside the freezer cabinet of a household refrigerator, taking into account the physical, biochemical, bacteriological and organoleptic changes. Glazed samples of *L. fimbriatus* had better storage life than control samples (39 and 30 days respectively).

*Catla catla* could be stored for 24 days in an acceptable condition without glazing.

The total bacterial count before and after storage of both the species was also noted.

#### RESEARCH IN HAND

Experiments were continued with the 12 m. mid-water trawl. The catch comprised mainly of smaller size group of *G. chapra* and *R. cotio*. An 8.5 m. equal panel mid-water trawl has been designed and made ready for experimental purposes.

Gill nets were operated in surface and column regions to study the spatial distribution of *C. catla*. Preliminary observations show that the nets operated in the column regions yielded better catch of *C. catla*.

Studies were continued on development of pickled products from *Rita chrysea*, a low cost fresh fish, using the juice of *C. reticulata* as a partial replacement of acetic acid. The studies were conducted taking into consideration the changes in chemical, microbiological and organoleptic qualities. The product could be stored in acceptable condition upto six months at room temperature.

Storage studies were also conducted of pickled products prepared from *Chela bacaila*, another low cost fresh fish, using the pulp extracted from raw and cooked green mango as a partial replacement of acetic acid. The product could be stored at room temperature in an acceptable condition for six and half months.

Studies were continued on the presence of certain pathogenic organisms in market samples of smoke dried products. The *Salmonella spp.* and *Staphylococcus coagulase* positive organisms were absent in all the samples. *Streptococcus faecalis* content



varied from  $1.85 \times 10^2$  to  $6.66 \times 10^6$  per gram sample and *Escherichia coli* from nil to  $5.19 \times 10^4$  per gram sample.

Survey on the quantum of smoked fish products produced in and around Sambalpur district have shown that the products comprised mainly of *G. chapra*, followed by *Puntius* sp., prawns, *E. cotio* and a few other species in that order. The 'Chalisukha' practice of smoke drying accounted for production of 93% of the smoked fish and 'Pooal dhora', 7%.

Fresh *G. chapra* smoked in the laboratory by the traditional method was found to be acceptable even after three months of storage.

Survey has been initiated on the mode of transportation of iced fish to different centres.

#### RESEARCH CONTEMPLATED

1. Experimental field trials with the 8.5 m. mid-water trawl
2. Effect of coloured lights in fishing operations
3. Development of effective substitutes for nylon multifilament in fabrication of gill nets
4. Development of consumer products from minced meat of low cost fresh water fish
5. Designing of a cheap smoke kiln
6. Preliminary studies on transportation of live fish
7. Further studies on smoking and smoke-drying of fish

## 2.5 BOMBAY RESEARCH CENTRE

### SCIENTISTS ASSOCIATED

Dr. M. Arul James, A. P. Valsan, V. Narayanan Nambiar, S. P. Damle, D. K. Garg.

### CHIEF FINDINGS

*Good quality, low fat soup powder has been prepared using whole jawala prawns. The product can be kept upto four months without development of rancidity and other deteriorative changes.*

*Studies were completed on the use of black, low density polythene sheets for producing better quality dried jawala. The relatively high surface drying temperature provided by the black LDP sheets ensures shorter drying period. Contamination with sand and filth is totally controlled, considerably improving the quality of the final product. Breakages while drying is also reduced appreciably, resulting in improved yield. Since the sheets are re-usable, the whole process is very economical. The economics and cost of this new material have also been worked out.*

*The proximate composition, microbial profile, percentage of edible portion and offal of six different commercially less utilized fishes of Maharashtra have been determined.*

### RESEARCH IN HAND

Non-penaeid prawns as such are of low fat content, but the soup powder made from these prawns in combination with ordinary ingredients was found to develop undesirable rancid odour within a short time owing to high levels of fat content, to the order

of 17.7%. This high level of fat content, it is assumed, may be due to the fat added for frying the ingredients, especially onions. Investigations have shown that if dehydrated onions can be used instead of raw onions, the quantity of fat required for frying can be considerably reduced. The soup powder prepared using dehydrated onions was found to contain very low fat content and hence could be stored for up to 4 months without the development of rancid odour, after which rancidity started developing and gradually increased. The maximum shelf life of soup powder from the jawala prawns can therefore be reckoned as four months.

About 30% of the marine landings in Maharashtra is composed of fishes like carangids, perches, eels, flat fishes and threadfins. At present, these fishes are either utilised fresh or converted into fish meal. This rich source of protein can be better utilised by evolving new preservation techniques or converting them into various speciality products thereby increasing the economic returns of the fishermen. Preliminary studies were carried out on the landing pattern of these fishes to identify the species which require further studies. Based on these, six different species, viz. Groupers, Eel, Sole, Barracuda, Saurida and Snappers were selected. The length-weight relationship, yield of edible portion, protein content, proximate composition and microbial profile of these fishes were studied. It was observed that in all cases, about 55-60% of the body weight could be obtained as edible portion by careful dressing. The offal was found to contain 45-55% protein on dry weight basis which can be utilized for incorporation in poultry feed and fish feed.

Studies have also been taken up on the feasibility of freezing and frozen storage of

'Chorbombil', a locally common fish belonging to the *Saurida spp.*

The general microflora of Horse mackerel (*Megalaspis cordyla*) was studied. Fifty percent of the strains were of gram-positive type, the majority of them being positive *Cocci*, while a good majority of the gram negative strains were found to be of the *Pseudomonas-Achromobacter* group. A few *Vibrio* and *Enterobacteriaceae* were also observed.

Studies were carried out on the bacteriological quality of fresh fish from landing centres with a view to identify the source of contamination. Samples of fresh fish, water and ice collected from the landing centres were examined for bacteriological parameters like total bacterial count, counts of *E. coli*, faecal *Streptococci*, Coagulase positive *Staphylococci* and incidence of pathogens like *Salmonella*, *Vibrio parahaemolyticus* and *Clostridium perfringens*. Sixty eight samples of fresh fish belonging to 21 different commonly available species, 22 samples of water from the landing centres used for washing the fish and the landing platforms and 22 samples of ice used at the landing centres were analysed. About 15% of the fish samples showed total bacterial counts of more than  $1.0 \times 10^5$  per gram and 40% of the samples had faecal *Streptococci* counts more than 1000 per gram. Coagulase positive *Staphylococci* and *E. coli* were detected in a few samples. Pathogens like *Salmonella*, *Vibrio parahaemolyticus* and *Clostridium perfringens* were also detected in a few samples. Water and ice samples were found to be highly contaminated. Pathogens like *Salmonella*, *V. parahaemolyticus* and *C. perfringens* were observed in a few samples of water and ice, thereby indicating that the major sources of contamina-



tion of fish at landing centres were the water and ice used there.

#### RESEARCH CONTEMPLATED

1. Further studies on the various aspects of preservation and utilisation of commercially less utilised fishes of Maharashtra
2. Further studies on the sources of contamination of fresh fish

#### GENERAL

Dr. M. Arul James, Scientist S2 and Shri A. P. Valsan, Technical Officer, visited the Satpati area of Maharashtra at the request of M/s. Konkan Sea Foods in order to study the problems faced by the fish processors, and offer technical advice to them.

Shri A. P. Valsan, Technical Officer, visited Veraval and Porbander to conduct demonstration/training programmes on the use of calcium propionate in preservation of cured fish.

## 2.6 CALICUT RESEARCH CENTRE

#### SCIENTISTS ASSOCIATED

T. S. Unnikrishnan Nair, V. Muraleedharan, K. George Joseph, N. Kalaimani.

#### RESEARCH IN HAND

Confirmatory experiments were conducted with the marinades prepared from mussel meat to check their quality on storage. The meat was observed to become a little tarnished on storage for about four months. In order to check whether this was due to keeping the sample in sunlight, one of the samples was kept away from sunlight. Periodical observation showed no

particular change in both. But the sample kept in darkness recorded slightly higher total bacterial count while organoleptically both were equally acceptable.

Using the conventionally used commercial choola, about half a ton of mussel shell waste was converted into lime and the same used for demonstration of white-washing at the premises of the Matsya Pravarthaka Mahila Sangam, at Badagara, where it was well appreciated. Experiments are to be undertaken to study the quality parameters of the product as a building material.

Studies have been initiated on the seasonal variation in the yield and composition of wild-grown mussels, with special reference to size of the shell-on mussels, yield of meat, proximate composition and bacteriological quality.

In order to confirm the efficacy of calcium propionate as a preservative for dry cured fish, samples of cured shark and mackerel were dusted with the chemical in the recommended dosage and stored for evaluation studies. The samples remained in good condition for more than three months. Detailed organoleptic and taste panel studies of treated fishes like silver belly, cat fish, shark, anchovies and sole are also being carried out.

Studies were initiated on the preservative effects of certain natural preservatives in cured fishery products. Dusting of the dry powders of *Withania somnifera* and *Asparagus racemosus* on the product did not yield any successful result, nor did dipping the fish in the aqueous extracts of the two. However, the aqueous extracts of *Phyllanthus niruri* at high concentrations (above 15% W/v) had some effect on the

taste and appearance of the product. Aqueous extracts of *Ocimum sanctum* at high concentrations (above 10% W/v) were more effective.

Studies were also carried out on the action of the different natural preservatives on test organisms using the pad-plate method. While extracts of *P. niruri* did not show any inhibitory action against the organisms, 4 out of 7 of the organisms showed sensitivity towards *O. sanctum*. Of the concentrations of 1%, 2%, 4% and 10% used, the latter two were most effective. Extracts of *Piper betle* did not have any effect on the test organisms.

Studies on the use of 'Vayambu' (*Acorus calamus*) as a preservative against insect attack in dried fish products showed that the samples of dried silver belly stored over 'Vayambu' were affected with 'red' after 25 days of storage, though no insect was noticed even after 40 days.

Dried mussel meat stored in air tight (wax-sealed) glass containers remained free of insect infestation even after 10 months. Studies were also continued on the storage of the dried mussel meat in sealed polythene bags. The product, stored in polythene bags of thickness 100, 200, 300 and 400 gauge, were found to be free from insects after 6, 6, 6 and 10 months respectively.

Commercial samples of dried anchovies (dried upto moisture levels of 10% and 20%) packed in 200 and 300 gauge polythene bags, remained free of insect attack till 10 months.

Mites collected from infested mussel meat by the 'Berlese funnel' method were preserved for future identification by experts.

#### RESEARCH CONTEMPLATED

1. Preparation of unsalted and hard dried products from non-fatty fishes
2. Use of different containers for pickle and wet curing of fish
3. Study of optimum factors like time of storage, moisture and other chemical factors and their relation to infestation
4. Identification of the common insects responsible for infestation
5. Survey of curing sheds, dry fish/fish meal godown and major markets for study of the extent of insect infestation

#### GENERAL

Necessary guidance was given to a representative of M/s. Bafakyh Export House, Calicut, on the preparation, preservation and storage of different cured fish products. Practical demonstration was conducted on the processing aspects of dry cured shark and mussels.

Technical assistance was given to a local fish meal trader on the utilization of fish for preparation of fish meal and manure and on the extraction of sardine oil.

Training was imparted to two persons on the practical aspects of fish curing.

Seven samples of water from fish ponds, four of the pond-bed, and two each of water and ice collected from fish processing plants were analysed and reports furnished to the parties.

In order to assess the curing losses and suggest improved methods of utilisation of dried fish, extensive survey was conducted of the fish curing yards and dry fish



godowns of Quilon, Vizhinjom, Kanyakumari and Tuticorin. Samples of dried fish were collected from these centres and subject to chemical analysis.

## 2.7 GOA RESEARCH CENTRE

### SCIENTISTS ASSOCIATED

H. N. Mhalathkar, M. Syed Abbas, V. Vijayan, R. S. Manohardoss.

### CHIEF FINDINGS

*Comparative fishing trials with a 10.3 m large mesh unequal panel mid-water trawl operated at different speeds have shown that the net landed better catches when operated at 1200 rpm.*

*A 20 m bridle length was found most suitable for a 15 m. bulged belly trawl.*

### RESEARCH IN HAND

The 15 m. bulged belly trawl, fitted with tapering jibs in combination with flat rectangular otter boards continued to give better results when compared to the net with straight jibs. More data are to be collected for confirming the observations.

Fishing operations were also continued with the 15 m. bulged belly trawl fitted with 5.0 cm. and 6.0 cm. mesh separator panels in the aft belly of the trawl to assess the effectiveness of both the separator panels.

On the basis of a survey conducted of the local marine gill nets and methods of operation in the different fishing villages in and around Goa, a design was developed of a multi-mesh gill net. Steps are under way for procuring the different materials required for fabrication of the net.

Survey was completed of the different fishing villages for selecting a suitable site for erection and operation of the Chinese dip net. Based on the survey, it has been decided to operate the net from Gudem-Siolim in North Goa. Steps are being taken for erection of the gear.

### RESEARCH CONTEMPLATED

1. Completion of studies on effect of tapering jibs on bottom trawls
2. Extensive field trials with the 10.3 m. unequal panel mid-water trawl with varied riggings to study its efficiency in aimed fishing
3. Introduction of the Chinese dip net in the Goan waters
4. Operation of the multi-meshed gill nets for capture of shoaling fishes

### 3. EXTENSION, INFORMATION & STATISTICS DIVISION

#### PERSONNEL ASSOCIATED

Dr. P. N. Kaul, M. K. Kandoran, K. Krishna Rao, H. Krishna Iyer, A. K. Kesavan Nair, P. N. R. Kaimal, G. R. Unnithan, P. Srinivasa Rao, S. Balasubramaniam, V. Annamalai, Mary Thomas, R. G. Nair.

#### EXTENSION AND INFORMATION

##### *Replies to technical queries*

More than three hundred and fifty queries were received during the year from those connected with the fishing and fish processing industry.

Comments were offered on the suitability of squid and cuttle fish for the production of fish meal, on the use of tunnel dryer for drying the surplus fish caught in

the various parts of the country and on the economics of setting up a fish meal plant.

Information was furnished on quality changes and shelf life of certain fishes on storage at ambient temperature and in ice, on handling and transportation of fish, on thaw drip loss and its prevention, on the quality of packages/pouches suitable for the various fishery products.

Details were also provided on methods of canning and freezing various fish and shell fish, extraction of sardine oil and shark liver oil, preparation of beche-de-mer and by-products and speciality products like chitosan, shark fin rays, fish soup powder, fish wafers and fish pickles.

On the fishing craft and gear side, comments were offered on use of purse seines and long lines along Kanyakumari coast, use of Xenon lamps for fish luring, suitability of FRP boats for operation along Orissa coast and on the feasibility of introduction of new craft and gear designs along Karnataka coast.

Information was also provided on the design aspects of long lines for sharks and fishes, the aquatic weed harvester for removal of floating and submerged aquatic weeds, on preservatives developed for protection of wooden fishing boats, on the use of cashew nut shell liquid for preparation of marine paints and the various electronic equipments developed at the Institute.

Viability reports on operation of the lobster trap were also furnished to certain interested parties.

#### *Publications*

Three issues of the publication, Fish Technology Newsletter, viz. Vol. III, Nos. 11 and 12 and Vol. IV, No. 1, were

brought out during the period. In addition, a few technical pamphlets as listed below, were also brought out in association with Scientists from other Divisions.

1. Fabrication of modern fishing gear. (Lab-to-Land handout)
2. Preparation of clam meat pickle (Lab-to-Land handout)
3. Preservation of traditional fishing craft (Lab-to-Land handout)
4. Filleting and freezing of fish.
5. Common spoilage in processed fish.
6. Chitosan - an industrial chemical from prawn shells.

#### *Supply of designs and publications*

A number of designs of drawings and publications were issued during the year to those who requested for the same. Particulars are shown below.

Designs	Number issued
Tunnel dryer	7
Rotary drum dryer	8
Lobster trap	2
Long line for sharks and fishes	2
Otter board	4
36 ft. trawler	2 sets
50 ft. combination vessel	3 sets
<i>Publications</i>	
Special Bulletin-I - An account of the inland fishing gear and methods of India	1
Special Bulletin 8 - Abstracts of CIFT publications, 1957-80	32
Special Bulletin-9 - Indigenous marine fishing gear and methods of India-I-Karnataka State	12
Quality control in fish processing	134





*Joint pavilion of CIFT and three other ICAR Institutes located in Kerala at the Cochin '84 Exhibition*



*Inside the CIFT Pavilion at the exhibition held at Polio Home Campus, Trivandrum*



### *Exhibitions and Film shows*

The Institute participated in about half a dozen exhibitions. These include the Cochin '84 Exhibition held at Cochin from 6th March to 30th April 1984, the AHARA '85-FOOD EXPO at Delhi from 25 January to 3 February, 1985, that held by the Indian Navy at Home for Handicapped (Polio) Children at Trivandrum during 16-18 February 1985 and the Exhibition held in connection with the Diamond Jubilee celebrations of National Dairy Research Institute, Karnal from 21 September to 20 October 1984. Exhibits including samples of fish products, photographs and charts were also sent for display at the India-International Trade Fair held at New Delhi in November 1984 and at the Exhibition conducted by the District Science Centre, Tirunelveli.

Film shows were held for the benefit of State Fisheries Depts, educational institutions and others connected with the fishery industry.

## **4. STATISTICS**

### *CHIEF FINDINGS*

*Data collected on the effect of the size of trawl net on the returns indicate that larger nets on an average give higher return than the smaller ones.*

*Suitable methodologies were developed for comparing the efficiencies of two or more trawl nets or gill nets.*

*On the basis of the economics of operation of fishing boats already worked out and the potential and sustainable yields collected from sources, the optimum number of fishing trawlers to be operated along Kerala coast was estimated to be 2510 against the present 2476 boats.*

## **RESEARCH IN HAND**

*Data collected on the effect of the size of trawl net on the returns indicate that larger nets, on an average, give higher returns than the smaller ones. The nets were operated from mechanised boats of the size range 30'-32', and the data were collected from Cochin Fisheries Harbour for trawl nets of size 50', 60' and 80'. While the average income for 50' and 60' nets was of the order of Rs. 1300 per trip, the corresponding figures for 80' net was Rs. 1500|-.*

Competing parametric and non-parametric tests were applied to six sets of data. On comparing the performance of these methods, the following approach appeared to be suitable for comparing the efficiency of fishing gears; Wilcoxon matched-signed-rank test found suitable for comparing the efficiency of two trawl nets or two gill nets. When the efficiency of more than two trawl nets is to be compared, Friedman's test and usual ANOVA may be tried first. If either of these tests brings out the difference, there is no need to conduct further tests. If these tests are not found to be sensitive for the data in hand and if the probability for an observed difference is close to the significance level, then the combination procedure (that is application of Tukey's test, outlier elimination and power transformation) may be applied because the combination procedure may bring out the difference, if any, in this case. When the efficiency of more than two gill nets is to be compared, Friedman's test and usual ANOVA may be used. Friedman's test helps to confirm the results. Chisquare test, based on the distribution of the data, was also found to be useful when data on number of fish caught by gill nets are used.



Data pertaining to the number of trawlers operated, their area of operation, the infrastructural facilities and other utility services available in the different fishing bases along Kerala Coast, were collected and analysed. On the basis of the economics of operation of fishing boats already worked out and the potential and sustainable yields collected from different sources, the optimum number of fishing trawlers to be operated along Kerala coast was estimated to be 2510 against the present 2476 boats. This estimate was arrived at under the assumption that the annual number of fishing trips per boat is 180 and the profit over capital cost is 15%. From the estimated figures it can be safely concluded that there is not much scope for increasing the number of trawlers along Kerala Coast.

#### RESEARCH CONTEMPLATED

1. Optimum number of fishing boats for a viable fishing base/harbour
2. Economic aspect of boat/net combination on fishing

3. Design of experiments, analysis and interpretation of data for research projects of the Institute

#### 5. LAB-TO-LAND PROGRAMMES

Under phase II of the Lab to Land Programmes, twenty five adopted fishermen families of Puthuyyppu fishing village (Ernakulam District) were trained in the application of improved chemical preservatives for traditional craft. The training-cum-demonstration programmes on the application of improved preservatives and the supply of required preservatives to the adopted families were undertaken during 1984.

The Lab-to-Land programme, phase-III was initiated during the period and one hundred farm families were allotted to Central Institute of Fisheries Technology, Cochin. The villages selected for the programme are (1) Puthiyappa (Kozhikode Dt.), (2) Vaikom (Kottayam Dt.) and (3) Chowara (Trivandrum Dt.).

The technologies selected and number of fishermen families covered by each technology are as follows.

<i>Village</i>	<i>Enterprise/Technology</i>	<i>No. of families</i>
1. Puthiyappa	Fabrication of high opening trawl nets	35
2. Vaikom	Handling and processing of clam meat	15
3. Chowara	Lobster fishing with modern traps	50

Bench mark surveys were undertaken of the 35 families at Puthiyappa and 15 families at Vaikom.

Under the clam meat processing programme, the improved methods for handling, processing and packing clam meat were demonstrated to the selected 15 parti-

cipants. Fifteen improved hearths developed by CIFT for cooking clams were fabricated under the Lab-to-Land programme and supplied to the selected families to save fuel cost. As a result of these programmes, the income of the adopted families has been increased substantially.



*Application of improved preservative on an indigenous craft*

*Improved hearth developed for cooking stoves*





## 6. TRAINING / DEMONSTRATION

Training course at Goa on handling and preservation of fish on board fishing vessels-jointly organised by MPEDA and CIFT. Scientist associated: Sh. A. P. Val-san, Technical Officer.

Demonstration programme on use of sodium metabisulphite to control black spot in raw prawn - jointly organised by MPEDA and CIFT, 10 & 11 Oct. 1984. Scientist associated: Shri Francis Thomas, Scientist S-1.

Demonstration programmes held at Veraval and Porbander on preparation of quality dried fish in November 1984.

Demonstration on use of new chlorine test paper held at Bombay - jointly organised by CIFT and MPEDA. Scientist associated: Sh. A. C. Joseph, Scientist S-1: Number of participants, nine.

Group training on detection of *Vibrio cholerae* in fishery products - arranged for technologists of processing establishments under the MIPQC system. Scientists associated: S/Sh. P. R. G. Varma, Scientist S-2 and T. S. G. Iyer, Scientist S-3: Number of trainees, eighteen.

Demonstration - cum - training programme in peeling and grading of shrimp-organised at Ratnagiri by MPEDA in collaboration with CIFT. Scientists associated: Dr. M. Arul James, Scientist S-2 and V. Narayanan Nambiar, Scientist S-1.

Demonstration on preparation of speciality products like fish wafers, pickles and fish soup powder at the request of the Krishi Vigyan Kendra of CMFRI, 25-27 February 1985, at Narakkal. Scientists associated: S/Shri K. K. Balachandran, M. K. Kandoran, Scientists S-2, P. K. Vijayan, Smt. R. Thankamma and Mary Thomas, Scientists S-1.

### AD-HOC TRAINING IMPARTED

Subject/Area	Place	Duration	No. of trainees
Methods of analysis in quality control of seafoods	Cochin	1 month	6
		3 weeks	1
		2 weeks	2
Bacteriological analysis of fish and fishery products	Cochin	18 days	1
		10 days	1
Bacteriological assay of vitamins	Cochin	12 days	1
Microbiological aspects of quality control in seafoods with emphasis on analytical methods of <i>Vibrio cholerae</i>	Cochin	19 days	2
Production of fish wafers, fish soup powder, pickles and extraction of shark fin rays	Cochin	4 days	5

Besides the above, a two weeks training on quality control of fish and fish products was given to two trainees from PDR Yemen. Training was also imparted to a FAO Fellow from Yemen in processing dried shark for a period of two and half months from Feb. 1985.

Two Namibian scholars underwent a training course at the Institute on fish processing technology for a period of one year from 8 September 1983. The training was sponsored by the FAO, Rome.

Training in Quality control aspects was also imparted to a scholar from Rangoon, Burma.

One trainee from the Dept. of Fisheries, Chilanga, Zambia, reported for training in fish processing technology for a period of nine months from January 1985.

An FAO trainee of the Federal Dept. of Fisheries, Lagos, Nigeria, reported for a three months training programme in Craft and Gear technology from 18 March 1985.

## 7. ANALYSIS OF MATERIALS/ PRODUCTS

Products and raw materials, processed /manufactured indigenously were tested on request and results of analysis intimated to the concerned parties with suggestions for improvement wherever necessary. Particulars of materials/products tested are given below.

<i>Materials/products</i>	<i>No. of samples</i>
Frozen fish and shell fish products	720
Canned fish and shell fish products	9

<i>Materials/products</i>	<i>No. of samples</i>
Dried fish and shell fish products	26
Freeze dried prawns	4
Fresh fish - whole	1
Fresh fish - fillets	1
Fish by-products	18
Oils	2
Fish speciality products	1
Detergent	1
Packaging materials	7
Water	70
Ice	45
Fishing craft materials	16
Fishing gear materials	36
Marine engines	2

## *Information seeking behaviour in Fisheries Technology*

(Dr. P. N. Kaul, Mary Thomas)

During the period Jan. 1983-Dec. 1983, 382 technical queries were received. The largest number (13.09%) were received in January followed by September (12.04%), February and April (11.52% each). The number of queries received declined from 13.09% in January to 6.02% in May rising to 12.04% in September and declining to 2.62% in December. It appears that less number of queries are received during the fishing season. The largest number of queries were regarding publications (19.11%) followed by training (10.73%), analysis of fishery products (9.69%), by-products (8.12%), fishing craft (7.85%). The queries from foreign countries were 1.57%. Among the Indian States, some of the top ones are Kerala (24.87%), Delhi (16.75%), Tamil Nadu (12.57%) and Maharashtra (8.90%). It appears that technical queries are more



from maritime States than from inland fishing States. Complete replies were sent for 90.31%, partial replies for 9.42% and there was no satisfactory reply for 0.26% of the queries. The average number of days taken in replying was 27.75 with S.D. of 18.53.

## 8. "ADOPTION OF INNOVATIONS DEVELOPED AT CIFT"

### SCIENTISTS ASSOCIATED

Dr. P. N. Kaul, M. K. Kandoran, H. Krishna Iyer, A. K. Kesavan Nair, S. Balasubramaniam, Mary Thomas, G. R. Desai.

Studies on the adoption of eight improved fish curing practices revealed that the mean adoption index of progressive centre was 28.35 and that of less progressive centre was 26.85 and there was no significant difference between the two. Total investment made for the curing yard was significantly associated with adoption, and accounted for 22% of the variance in adoption index. Length of experience in fish curing was negatively related to adoption. The distance of the curing yard from the house and size of the curing yard were each positively associated with adoption. These four independent variables together explained 28% of the variance in adoption index. Newspaper subscribers and radio-owners each had higher mean adoption indices than non-subscribers and non-owners respectively. Discriminant analysis of the improved practices showed that it was possible to discriminate between adopters and non-adopters on the basis of four quantitative variables in all cases except one practice. Scalogram analysis of the data on adoption indicated unidimensionality of the variable. The effect of radio ownership on adoption appeared to be marked by

newspaper subscription and there was no interaction between the two factors.

The adoption of five recommended practices among traditional fishermen in Kerala revealed an average adoption index of 40.75 with a standard deviation of 4.97. About 94% of the adopters were in the medium category. The total investment and the total income were positively significantly associated with adoption index. The type of wood material used for building the boat showed significant differences in adoption. Those using 'chini' had the highest adoption index, whereas those using 'aini' had the lowest. With regard to the sources of information, the mean adoption indices in respect of newspaper readers and private agencies were higher than the other sources combined in each case. In the case of friends and relatives, the mean adoption index of other sources combined was higher. Total investment and total income explained 16% of the variance in adoption index. The various reasons given by the fishermen for the non-adoption of various technologies were also recorded.

The adoption of nine innovations by mechanised fishermen in Kerala and Karnataka was also studied. In Kerala, the mean adoption index was 42.29 with a standard deviation of 5.16. The total investment of the individual, total income, number of boats owned, number of nets and number of fishing days per year, were all positively correlated with adoption. Analysis of the technological variables showed that cost of painting of the boat per year, cost of engine, and average operating hours of engine per day were positively correlated with adoption, whereas repair cost of boat and engine per year were found to be negatively correlated with adoption. It was indicated that personal sources of information

were more conducive to adoption than impersonal sources.

A similar study in Karnataka revealed the mean adoption index to be 33.56. Subsidiary occupation and number of fishing days were each positively associated with adoption. Total investment was negatively associated with adoption.

Studies on the adoption of CIFT boat designs have shown that 40% of the fishing boats in Bombay area, 82% of the boats in Goa area, and 90% boats in Karnataka are based on CIFT designs. The fishing boats made in Bombay area are Bassein type, CIFT and Satpati type, modified forms of these three designs, and also combinations of CIFT and Satpati designs. In North Karnataka, almost all the boats are made without sheathing at present. In Kerala, the maximum number of boats built (39%), were of 25' OAL whereas in Karnataka, the maximum number of boats built (47%), were of 32' OAL.

Studies on adoption of improved lobster trap of CIFT design showed that these traps were well accepted by the fishermen. The durability of the CIFT-designed trap was at least 3 years while the traditional trap lasts only for 1 to 3 weeks. In terms of lobster catch, the CIFT designed trap is two to three times more efficient than the traditional trap. The analysis of the data are in progress. Studies on the adoption of recommended quality control practices, effectiveness of training programmes, and on training needs of traditional fishermen, are in progress.

## 9. PUBLICATIONS

1. Antony, K. P., Chinnamma George & Govindan, T. K. - The effect of chemical treatment and packaging on

keeping qualities of salted and dried mackerel - *Perfectpac*, 24(1): 17, 1984.

2. Antony, K. P., Sreenivasa Gopal, T. K., Perigreen, P. A., Arul James, M. & Govindan, T. K. - Retortable flexible package for heat processed prawns in brine from indigenous synthetic films - *Fish Technol. Newsletter*, III (12): 11, 1984.
3. Balasubramaniam, S., & Kaul, P. N. - Adoption of improved practices by fish trawler owners in Kerala - *Ind. J. Ext. Edn.*, 20(3 & 4): 35, 1984.
4. Bandyopadhyay, J. K., Chattopadhyay, A. K. & Bhattacharyya, S. K. - A glimpse of technological research on inland fish processing - Paper presented at the Seminar on Fresh Water Fisheries and Rural Development organised by the Director of Fisheries, Orissa and Revenue Divisional Commissioner, Sambalpur, Rourkela, 6-7 April, 1984.
5. Chakraborty, P. K. - Solar drying in conjunction with artificial drying of fish - a feasible proposition - *Seaf. Exp. Jour.*, XVI (8): 1984.
6. Chattopadhyay, A. K. - Preservation of low cost fresh water fish utilising a cheap variety of citrus fruit (*C. reticulata*) by making pickled products - Paper presented at Symp. on Preservation and Supply of Fresh and Processed Foods, Mysore 17-18 Oct., 1984.
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8. *George, V. C.* - Harvesting of cultured prawn - Paper presented at the Workshop on Brackish Water Prawn Farm Management, Cochin, 2-3 May, 1984.
9. *George, V. C.* - Fishing gear of Kerala - Paper presented at Seminar on Fisheries in Kerala - Review and Future, Cochin, 6-7 July, 1984.
10. *George, V. C.* - Inland fishing gear - Paper presented at the All India Institute for College Teachers on Indian Fisheries, Cochin, 1-21 Aug., 1984.
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12. *Gopakumar, K.* - Diversified products for export - Paper presented at the Seminar on Upgradation of Technology and Quality Control in the Seafood Industry, Calcutta, 25-26 Feb. 1985.
13. *Gopakumar, K.* - Improved methods of processing and preservation of dried fish - Paper presented at the Seminar on Quality Development of Dried Fish, Tuticorin, Tamilnadu, 1 Feb. 1985.
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16. *Gopakumar, K., Vasanth Shenoy, A., Thankamma, R. & Ravindranathan Nair, P.* - Instant foods from fish - Paper presented at the Seminar on Latest Innovations in Instant Foods, organised by Small Industries Service Institute (Govt. of India), Madras, 22 Nov., 1984.
17. *Gopal, T. K. Srinivasa* - Studies on the storage life of cod fillets using controlled atmosphere packing - Paper presented at National Symposium on Recent Developments in Food Packaging, organised by Association of Food Scientists and Technologists (India), CFTRI, Mysore, 17-18, Jan., 1985.
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48. Pillai, A. G. Gopalakrishna - Effect of sulphide on corrosion of copper in seawater - *Fish. Technol.*, 22(1): 35, 1985.
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  60. Thampuran Nirmala, Krishna Iyer, H. & Mahadeva Iyer, K. - Selection of suitable diluents for bacteriological examination of fishery products - *Fish. Technol.* 22(1): 40, 1985.
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  63. Thomas Francis - Need for hygiene and sanitation in fishing vessels - Course note for Training Programme on Safe Use of Sodium Metabisulphite to Control Black Spot in Raw Shrimp at Visakhapatnam, 10 & 11 Oct., 1984.
  64. Unnithan, G. R. & Krishna Rao, K. - Mathematical models for minimising costs - *Seaf. Exp. Jour.* XVI (4): 27, 1984.
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1. Feasibility reports:
    - a) Production of fish soup powder. (A. Vasanth Shenoy, P. Madhavan, R. Thankamma, P. V. Prabhu & Dr. K. Gopakumar).
    - b) Production of shark fin rays. (P. Madhavan, K. G. Ramachandran Nair, & P. V. Prabhu).
    - c) Production of fish wafers. (A. Vasanth Shenoy, P. Madhavan, R. Thankamma, P. V. Prabhu & Dr. K. Gopakumar).
  2. Annual Report 1980 - Hindi
  3. Matsya Technology Samachar - III (10).



## 10. APPENDICES

### APPENDIX - 1

#### HEADQUARTERS:

#### CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY

Willingdon Island, Matsyapuri, P.O.

COCHIN-682029, KERALA

TLX No. 0885-440

Telephone Office No. 6845 (10 lines)

Director (Per.) No. 6880

(Res.) No. 31034

Telegram : MATSYAODYOGIKI OR  
FISHTECH, COCHIN

#### DIRECTOR

Shri M. Rajendranathan Nair

from 12-9-1984

Dr. C. C. Panduranga Rao upto

11-9-84.

#### *Scientists-in-Charge*

- |  |    |                         |
|--|----|-------------------------|
| 1. Craft Division                                  | .. | Shri R. Balasubramanian |
| 2. Gear Division                                   | .. | Shri P. A. Panicker     |
| 3. Biochemistry and Nutrition Division             | .. | Dr. K. Devadasan        |
| 4. Microbiology Division                           | .. | Shri K. Mahadeva Iyer   |
| 5. Processing Division                             | .. | Dr. K. Gopakumar        |
| 6. Engineering Division                            | .. | Shri S. Ayyappan Pillai |
| 7. Electronics & Instrumentation<br>Division       | .. | Dr. T. K. Sivadas       |
| 8. Extension, Information & Statistics<br>Division | .. | Shri M. K. Kandoran     |

RESEARCH CENTRES

Sl. No.	Place	Address	Telephone No.	Telegram	Scientist-in-Charge
1	2	3	4	5	6
1.	VERAVAL	Research Centre of CIFT, Bunder Road, Veraval-362265, Gujarat.	297	MATSYAOUDDYOGIKI	Shri K. K. Solanki
2.	KAKINADA	Research Centre of CIFT, D. No. 54-2-9, Yesuvari Street, Jagannaikpur, Kakinada-533002, Andhra Pradesh	4436	MATSYAOUDDYOGIKI	Dr. C. C. Panduranga Rao
3.	BURLA	Research Centre of CIFT, Burla-768017, Sambalpur Dist, Orissa	19	MATSYAOUDDYOGIKI	Shri A. A. Khan
4.	BOMBAY	Research Centre of CIFT, 162-B.P.T. Godown, Sassoon Dock, Colaba, Bombay-400005, Maharashtra.	213892	FISHPROCESS (FT)	Dr. M. Arul James
5.	CALICUT	Research Centre of CIFT, Beach Road, West Hill, Calicut-673005, Kerala.	76607	CARE 'CADALMIN'	Shri T. S. Unnikrishnan Nair
6.	GOA	Research Centre of CIFT, 2nd Floor, "Shanta", 18th June Road, St. Inez., Panaji-403001, Goa.	5905	MATSYAOUDDYOGIKI	Shri H. N. Mhalathkar



## APPENDIX - II

*List of Personnel in CIFT as on 31-3-1985*

### SCIENTIFIC PERSONNEL

#### *DIRECTOR*

Shri M. RAJENDRANATHAN NAIR

#### *Scientist S-3*

- |                            |                                  |
|----------------------------|----------------------------------|
| 1. Dr. K. Gopakumar        | 9. Shri T. S. Gopalakrishna Iyer |
| 2. Shri R. Balasubramanian | 10. Dr. K. Devadasan             |
| 3. Dr. P. N. Kaul          | 11. Shri P. Madhavan             |
| 4. Dr. T. K. Govindan      | 12. Shri P. Appukutta Panicker   |
| 5. Shri P. V. Prabhu       | 13. Dr. T. K. Sivadas            |
| 6. Shri K. Mahadeva Iyer   | 14. Shri H. Krishna Iyer         |
| 7. Dr. K. Ravindran        | 15. Shri S. Ayyappan Pillai      |
| 8. Shri V. C. George       |                                  |

#### *Scientist S-2*

- |                                  |                                     |
|----------------------------------|-------------------------------------|
| 1. Shri C. V. Narasimha Rao      | 14. Dr. P. K. Surendran             |
| 2. Shri K. K. Balachandran       | 15. Shri K. G. Ramachandran Nair    |
| 3. Shri K. Sreedharan Namboodiri | 16. Shri P. T. Mathew               |
| 4. Shri P. D. Antony             | 17. Dr. Jose Stephen                |
| 5. Shri P. K. Chakraborty        | 18. Dr. P. G. Viswanathan Nair      |
| 6. Shri M. K. Kandoran           | 19. Shri A. G. Gopalakrishna Pillai |
| 7. Shri K. Krishna Rao           | 20. Dr. N. Unnikrishnan Nair        |
| 8. Shri P. A. Perigreen          | 21. Smt. A. Lakshmy Nair            |
| 9. Shri A. K. Kesavan Nair       | 22. Shri T. K. Srinivasa Gopal      |
| 10. Shri K. A. Sadanandan        | 23. Dr. M. K. Mukundan              |
| 11. Shri P. R. Girija Varma      | 24. Shri K. V. Mohan Rajan          |
| 12. Shri A. G. Radhakrishnan     | 25. Shri Cyriac Mathen              |
| 13. Smt. Chinnamma George        |                                     |

#### *Scientist S-1*

- |                         |                           |
|-------------------------|---------------------------|
| 1. Shri P. N. R. Kaimal | 3. Shri A. Vasanth Shenoy |
| 2. Smt. Mary Thomas     | 4. Shri P. N. Joshi       |

*Scientist S-1*

- |                                  |                                 |
|----------------------------------|---------------------------------|
| 5. Shri K. N. Kartha             | 18. Shri S. Sanjeev             |
| 6. Shri P. George Mathai         | 19. Dr. P. T. Lakshmanan        |
| 7. Shri T. P. George             | 20. Smt. K. V. Lalitha          |
| 8. Shri P. K. Vijayan            | 21. Shri P. Ravindranathan Nair |
| 9. Shri K. Ramakrishnan          | 22. Shri S. Balasubramaniam     |
| 10. Smt. Vijayabharathy          | 23. Shri K. P. Antony           |
| 11. Shri Jose Joseph             | 24. Dr. M. D. Varghese          |
| 12. Shri T. K. Thankappan        | 25. Smt. R. Thankamma           |
| 13. Smt. Nirmala Thampuran       | 26. Shri V. Annamalai           |
| 14. Kum. B. Meenakumari          | 27. Shri A. C. Kuttappan        |
| 15. Shri Francis Thomas          | 28. Shri A. Ramachandran        |
| 16. Shri G. Rajagopalan Unnithan | 29. Shri T. V. Sankar           |
| 17. Smt. K. Ammu                 | 30. Shri M. M. Prasad           |

**TECHNICAL PERSONNEL**

*Technician T-7*

- |                              |                             |
|------------------------------|-----------------------------|
| 1. Shri K. S. Ganesan        | .. Workshop Engineer        |
| 2. Shri K. J. Francis Xavier | .. Skipper                  |
| 3. Shri S. Gopalan Nayar     | .. Technical Officer (Fish) |
| 4. Smt. P. J. Cecily         | .. Jr. Technical Officer    |

*Technician T-6*

- |                             |                                   |
|-----------------------------|-----------------------------------|
| 1. Shri K. C. Purushothaman | .. Editor-cum-Information Officer |
|-----------------------------|-----------------------------------|

*Technician T-5*

- |                             |                                   |
|-----------------------------|-----------------------------------|
| 1. Shri T. M. Sivan         | .. Asst. Technical Officer (Fish) |
| 2. Smt. K. Radhalakshmy     | .. Asst. Technical Officer (Fish) |
| 3. Shri N. A. George        | .. Asst. Technical Officer (Fish) |
| 4. Shri M. S. Rajan         | .. Fishing Mate                   |
| 5. Shri N. Sriharshan       | .. Engineer                       |
| 6. Shri V. K. Ibrahim       | .. Head Draughtsman               |
| 7. Smt. T. T. Annamma       | .. Sr. Technical Assistant        |
| 8. Shri K. Vasudevan Nair   | .. Sr. Technical Assistant        |
| 9. Smt. Annamma Mathew      | .. Sr. Technical Assistant        |
| 10. Shri K. Bhaskaran       | .. Photographer-cum-Artist        |
| 11. Shri Varghese Paul      | .. Technical Assistant            |
| 12. Shri C. Chandrasekharan | .. Superintendent (E & M)         |
| 13. Shri N. Vareethiah      | .. Glass Blower                   |
| 14. Shri G. Mohanan         | .. Artist                         |
| 15. Shri O. Subramanian     | .. Sr. Welder                     |



*Technician T-4*

- |                           |                          |
|---------------------------|--------------------------|
| 1. Shri P. Ravindranathan | .. Librarian             |
| 2. Shri K. K. Poulose     | .. Instrument Technician |
| 3. Shri T. K. Sayed Ali   | .. Technical Assistant   |
| 4. Shri A. Kassim Kunju   | .. Technical Assistant   |

*Technician T-II-3*

- |                                 |                                     |
|---------------------------------|-------------------------------------|
| 1. Shri P. Sadanandan           | .. Technical Assistant              |
| 2. Shri Thomas J. Mammoottil    | .. Technical Assistant              |
| 3. Shri M. K. Sasidharan        | .. Technical Assistant              |
| 4. Shri P. T. Sebastian         | .. Technical Assistant              |
| 5. Shri V. Gasper               | .. Technical Assistant              |
| 6. Shri P. A. Alias             | .. Superintendent (Instrumentation) |
| 7. Shri M. L. Anslem            | .. Sr. Draughtsman                  |
| 8. Shri M. Abdul Sathar         | .. Media Supervisor                 |
| 9. Shri B. Anandan              | .. Foundry Assistant                |
| 10. Shri R. Gopalakrishnan Nair | .. Computer                         |
| 11. Shri G. Ramadas Kurup       | .. Instrument Maker                 |

*Technician T-I-3*

- |                              |                           |
|------------------------------|---------------------------|
| 1. Shri M. U. Vijayan        | .. Senior Mechanic        |
| 2. Shri T. K. David          | .. Fitter                 |
| 3. Shri K. J. Augustine      | .. Sr. Turner             |
| 4. Shri A. K. Jaisingh       | .. Bosun                  |
| 5. Shri T. S. Bhaskara Menon | .. Sr. Mechanic           |
| 6. Shri K. E. Mani           | .. Sr. Mechanic           |
| 7. Shri P. M. Joseph         | .. Machinist              |
| 8. Shri A. K. Dharaneedharan | .. Media Assistant        |
| 9. Shri K. K. Subramanian    | .. Engine Driver          |
| 10. Shri V. V. Johni         | .. Sr. Field Assistant    |
| 11. Shri V. K. Ramachandran  | .. Sr. Lab. Assistant     |
| 12. Shri E. K. Balakrishnan  | .. Draughtsman            |
| 13. Shri G. Ratnakaran Nair  | .. Refrigeration Mechanic |
| 14. Shri M. M. Devassya      | .. Jr. Library Assistant  |
| 15. Smt. K. Sarasamma        | .. Draughtsman            |
| 16. Shri Shanmugavel         | .. Refrigeration Mechanic |
| 17. Shri C. Rajendran        | .. Refrigeration Mechanic |
| 18. Shri Jose Kalathil       | .. Refrigeration Mechanic |
| 19. Shri K. V. Madhavan      | .. Electrician            |
| 20. Shri K. K. Pappukutty    | .. Driver (Launch)        |
| 21. Shri T. Gopalakrishnan   | .. Metal Worker           |
| 22. Shri P. A. John          | .. Cockswain              |

*Technician T-2*

1. Shri P. K. Damodaran	.. Sr. Lab. Assistant
2. Shri Shaju A. Averah	.. Draughtsman
3. Shri N. R. Gopan Nair	.. Refrigeration Mechanic
4. Shri P. A. Joshi Augustine	.. Refrigeration Mechanic
5. Shri C. C. Sivan	.. Welder-cum-Blacksmith
6. Shri K. B. Thilakan	.. Jr. Lab. Assistant
7. Shri T. N. Manibhadran	.. Tindal
8. Shri T. K. Vasudevan	.. Jr. Lab. Assistant
9. Shri T. K. Aravindakshan	.. Jr. Lab. Assistant
10. Shri T. K. Bhaskaran	.. Jr. Lab. Assistant
11. Shri P. N. Sudhakaran	.. Net Making Supervisor
12. Smt. K. K. Sumathy	.. Jr. Lab. Assistant

*Technician T-1*

1. Shri O. M. Samuel	.. Jr. Lab. Assistant
2. Shri V. V. John	.. Jr. Lab. Assistant
3. Shri A. A. Kunjappan	.. Field Assistant
4. Shri K. K. Narayanan	.. Boilerman
5. Kum. G. Usha Rani	.. Jr. Lab. Assistant
6. Kum. K. G. Sasikala	.. Jr. Lab. Assistant
7. Smt. V. C. Mary	.. Jr. Lab. Assistant
8. Kum. K. P. Leelamma	.. Jr. Lab. Assistant
9. Shri C. R. Gokulan	.. Jr. Lab. Assistant
10. Shri P. S. Raman Nampoothiri	.. Jr. Lab. Assistant
11. Shri Mathew A. K.	.. Electrician
12. Shri Viswambharan P. T.	.. Electrician
13. Shri Tommy Robello	.. Boilerman

**ADMINISTRATIVE PERSONNEL**

Sr. Administrative Officer	.. Vacant
Administrative Officer	.. Shri P. James Abraham
Asst. Administrative Officer	.. Shri Varghese Paul
Accounts Officer	.. Shri K. T. Abubacker
Asst. Accounts Officer	.. Shri S. P. Nair

*Superintendent*

1. Shri P. J. Joseph	4. Shri P. A. Uthup
2. Shri S. Sadanandan	5. Shri M. George Joseph
3. Smt. T. N. Ambujakshy Amma	6. Shri S. Naveenchandra Prabhu



*Senior Stenographer*

Shri K. J. Thomas

*Assistant*

1. Smt. K. A. Devaky
2. Smt. Nafeesa Ali
3. Shri A. George Joseph
4. Shri T. M. Padmanabhan
5. Smt. N. K. Sulochana
6. Shri R. Anil Kumar
7. Smt. T. K. Sarala
8. Shri R. S. Shanmugan
9. Shri A. L. John
10. Shri T. Gurumoorthy
11. Smt. Alice M. Joseph

*Stenographer*

1. Smt. Mariamma Sadanandan
2. Shri K. Ravindran
3. Smt. N. K. Saraswathy
4. Smt. R. Vasantha

*Senior Clerk*

1. Shri M. Gopalakrishnan
2. Shri M. T. Joseph
3. Shri V. N. Rajasekharan Nair
4. Shri P. Vijayan
5. Shri A. K. Venugopal
6. Shri M. J. Sebastian
7. Smt. Annamma Varghese
8. Smt. C. G. Marykutty
9. Smt. M. S. Susanna
10. Smt. N. Prabhavathy Amma
11. Shri C. Ravindran Nair
12. Smt. K. R. Gita Rani
13. Shri T. M. Ramraj
14. Shri G. Somappan
15. Shri K. Bhaskaran
16. Smt. M. Jully
17. Shri Y. Philipose
18. Smt. M. A. Prasanna
19. Shri R. Viswanathan

*Jr. Stenographer*

1. Shri P. K. Raghu
2. Kum. S. Kamalamma
3. Kum. V. P. Vijayakumari
4. Kum. N. Leena
5. Shri K. V. Mathai

*Junior Clerk*

- |                            |                                |
|----------------------------|--------------------------------|
| 1. Shri V. R. Kesavan      | 14. Shri K. K. Sasi            |
| 2. Smt. K. A. Nazeem       | 15. Shri P. Padmanabhan        |
| 3. Shri P. K. Sreedharan   | 16. Smt. A. R. Kamalam         |
| 4. Smt. K. Gracy           | 17. Smt. T. K. Shyma           |
| 5. Shri P. V. Venugopalan  | 18. Smt. T. D. Usheem          |
| 6. Shri K. P. Velayudhan   | 19. Kum. V. S. Aleyamma        |
| 7. Smt. T. K. Susannamma   | 20. Shri V. S. Ambasuthan      |
| 8. Smt. P. C. Kamalakshy   | 21. Shri A. P. Gopalan         |
| 9. Shri K. Rajappan Pillai | 22. Kum. G. N. Sarada          |
| 10. Smt. N. I. Mary        | 23. Shri S. Radhakrishnan Nair |
| 11. Shri P. K. Thomas      | 24. Shri K. B. Sabukuttan      |
| 12. Kum. P. K. Thankamma   | 25. Smt. P. A. Sathy           |
| 13. Smt. A. A. Cousallia   |                                |

*Telephone Operator-cum-Receptionist*

Shri P. Bahulayan

**AUXILIARY PERSONNEL**

- |                                |                       |
|--------------------------------|-----------------------|
| 1. Shri V. S. Augustine        | .. Sr. Carpenter      |
| 2. Shri Philip Durom           | .. Sr. Carpenter      |
| 3. Shri Joseph Paul            | .. Carpenter          |
| 4. Shri A. Gopalakrishnan Nair | .. Staff Car Driver   |
| 5. Shri P. P. Poulose          | .. Staff Car Driver   |
| 6. Shri M. G. Narayanan Nair   | .. Driver             |
| 7. Shri V. P. Raphel           | .. Driver             |
| 8. Shri T. Neelakantan         | .. Projector Operator |
| 9. Shri C. C. Gandhi           | .. Plant Attendant    |
| 10. Shri N. C. Bhaskaran       | .. Plant Attendant    |
| 11. Shri K. R. Kesavan         | .. Plant Attendant    |
| 12. Shri K. K. Lakshmanan      | .. Deck hand          |
| 13. Shri T. Balan              | .. Deck hand          |
| 14. Shri P. K. Pushpangadan    | .. Deck hand          |
| 15. Shri T. K. Dasan           | .. Deck hand          |
| 16. Shri T. K. Bava            | .. Deck hand          |
| 17. Shri E. K. Chinnappan      | .. Deck hand          |
| 18. Shri M. K. Asokan          | .. Deck hand          |
| 19. Shri D. G. Rao             | .. Deck hand          |
| 20. Shri E. R. Krishnan        | .. Cook               |
| 21. Shri M. Sankara Panicker   | .. Carpenter          |
| 22. Shri G. Jyothi Kumar       | .. Driver             |
| 23. Shri V. A. Sudhakaran      | .. Plumber            |



## SUPPORTING STAFF

### *Supporting Staff Grade-IV*

1. Shri K. K. Radhakrishnan
2. Shri O. C. Lonan
3. Shri O. A. Krishnan
4. Shri E. S. Balachandra Pai

### *Supporting Staff Grade-III*

1. Shri E. S. Sreedharan
2. Shri P. A. Thomas
3. Shri K. Balakrishna Pillai
4. Shri P. J. George
5. Shri P. C. Sukumaran
6. Shri A. G. Vasu
7. Shri C. A. Subran
8. Shri K. K. Appachan
9. Shri K. X. Joseph
10. Shri T. T. Das
11. Shri M. K. Thevan
12. Shri P. M. Pakeer Mohammed

### *Supporting Staff Grade-II*

1. Shri K. Raghavan
2. Shri K. K. Madhavan
3. Shri S. Rajan
4. Shri T. V. Manoharan
5. Shri T. T. Velayudhan
6. Shri C. A. Krishnan
7. Shri P. A. Shanmughan
8. Shri K. N. Mukundan
9. Shri P. Gopalakrishnan
10. Shri P. D. George
11. Shri K. B. Bhaskaran
12. Shri K. K. Karthikeyan
13. Shri K. A. Kunjan

### *Supporting Staff Grade-I*

1. Shri T. T. Thankappan
2. Shri P. R. Unnikrishna Panicker
3. Shri R. Chellappan
4. Shri T. Kochukuttan Nair
5. Shri A. R. John
6. Shri C. N. Raghavan
7. Shri A. Ravindran Nair
8. Shri P. N. Sukumaran Nair
9. Smt. P. L. Roselly
10. Shri T. K. Rajappan
11. Shri K. N. Velayudhan Kutty
12. Shri T. G. John
13. Shri O. K. Xavier
14. Shri T. Mathai
15. Shri P. T. Anthappan
16. Shri T. K. Viswanathan
17. Shri P. A. Sivan
18. Kum. C. G. Radhamony
19. Shri P. K. Somasekharan Nair
20. Shri N. Krishnan
21. Shri C. D. Parameswaran
22. Shri V. T. Sadanandan
23. Shri P. V. Narayanan
24. Shri T. S. Lawrance
25. Shri P. P. George
26. Shri A. V. Chandrasekharan
27. Shri P. V. Raju
28. Shri M. Shanmughavelu
29. Shri E. Damodaran
30. Shri M. M. Radhakrishnan
31. Shri K. K. Karthikeyan

## VERAVAL RESEARCH CENTRE

### SCIENTIFIC PERSONNEL

#### Scientist S-2

1. Shri K. K. Solanki .. Scientist-in-Charge
2. Shri A. C. Joseph
3. Shri K. K. Kunjipalu

#### Scientist S-1

1. Shri N. Subramonia Pillai
2. Shri H. K. Beri
3. Shri M. R. Boopendranath
4. Shri M. R. Raghunath
5. Shri Anil Agarwal

### TECHNICAL STAFF

1. Shri M. S. Fernando .. T-7 (Skipper)
2. Shri G. P. Vaghela .. T-II-3 (Tech. Asst.)
3. Shri J. B. Paradwa .. T-II-3 (Tech. Asst.)
4. Shri D. K. Ukhabhai .. T-II-3 (Tech. Asst.)
5. Shri S. R. Jethwa .. T-I-3 (Sr. Mechanic)
6. Shri Mohammed Jaffar .. T-I-3 (Engine Driver)
7. Shri N. J. Tandal .. T-I-3 (Driver-Launch)
8. Shri M. M. Vara .. T-2 (Sr. Field Asst.)
9. Shri M. K. Kuttikrishnan Nair .. T-2 (Sr. Field Asst.)
10. Shri K. U. Sheikh .. T-1 (Jr. Lab. Asst.)
11. Shri D. R. Aparnathi .. T-1 (Jr. Lab. Asst.)
12. Shri A. P. Joshi .. T-1 (Tindal)

### ADMINISTRATIVE STAFF

1. Shri P. Vasudevan .. Assistant
2. Shri Veersingh .. Jr. Clerk
3. Shri S. B. Purohit .. Jr. Clerk
4. Shri K. N. Karunakaran .. Jr. Stenographer
5. Shri M. M. Damodara .. Jr. Clerk

### AUXILIARY POSTS

1. Shri G. B. Tandel .. Deck hand
2. Shri H. M. Kotiya .. Deck hand
3. Shri G. R. Bhogte .. Deck hand
4. Shri Malam Bachu Sidi .. Deck hand
5. Shri G. L. Tandel .. Cook



## SUPPORTING STAFF

1. Shri S. M. S. Yadav .. S.S. Gr. III
2. Shri P. A. Abdul Rahman .. S.S. Gr. III
3. Shri K. K. C. Fofandi .. S.S. Gr. II
4. Shri G. M. Vaghela .. S.S. Gr. II
5. Shri K. A. Masani .. S.S. Gr. II
6. Shri N. N. Goswami .. S.S. Gr. II
7. Shri Harbhajan .. S.S. Gr. I
8. Shri B. M. A. Khoker .. S.S. Gr. I
9. Shri D. P. Parmar .. S.S. Gr. I
10. Shri D. B. Chudasama .. S.S. Gr. I
11. Shri K. J. Damer .. S.S. Gr. I
12. Smt. Chandrika C. Tank .. S.S. Gr. I
13. Shri P. N. Chudasama .. S.S. Gr. I
14. Shri H. V. Punjera .. S.S. Gr. I

## KAKINADA RESEARCH CENTRE

### SCIENTIFIC PERSONNEL

#### *Scientist S-3*

1. Dr. C. C. Panduranga Rao .. Scientist-in-Charge

#### *Scientist S-2*

1. Shri G. Narayanappa
2. Shri Sibsankar Gupta
3. Shri S. V. S. Rama Rao

#### *Scientist S-1*

1. Shri Subrata Basu
2. Shri D. Immam Khasim Sahib
3. Shri R. Mangayya Naidu
4. Shri Rupshankar Chakraborty

### TECHNICAL STAFF

1. Shri A. V. V. Satynarayana .. Technical Officer - Fish (T-7)
2. Shri A. Veeranjeyulu .. Technical Asst. (T-II-3)
3. Shri Srihari Babu .. Technical Asst. (T-II-3)
4. Shri V. V. Ramakrishna .. Technical Asst. (T-II-3)
5. Shri K. V. Baladasan .. Engine Driver (T-I-3)
6. Shri Laxmanadu .. Bosun (T-I-3)
7. Shri Veera Raju .. Tindal (T-I-3)
8. Shri N. Babu Rao .. Sr. Field Asst. (T-2)
9. Shri B. Ramaiah .. Jr. Lab. Asst. (T-2)
10. Shri Prakash Rao .. Driver - Launch (T-1)
11. Shri N. Venkata Rao .. Field Asst. (T-1)
12. Shri K. V. S. S. Kusuma Harnath .. Jr. Lab. Asst. (T-1)

### ADMINISTRATIVE STAFF

- |                          |                     |
|--------------------------|---------------------|
| 1. Shri N. Venugopal     | .. Senior Clerk     |
| 2. Smt. Satyanarayanamma | .. Jr. Stenographer |
| 3. Ch. Satyanarayana     | .. Junior Clerk     |
| 4. Kum. B. Hemalatha     | .. Junior Clerk     |
| 5. Shri Nirmala Raju     | .. Junior Clerk     |

### AUXILIARY STAFF

- |                           |              |
|---------------------------|--------------|
| 1. Shri K. Sarangadharadu | .. Deck hand |
| 2. Shri Karri Gangaraju   | .. Deck hand |
| 3. Shri G. Subba Rao      | .. Cook      |

### SUPPORTING STAFF

- |                             |                |
|-----------------------------|----------------|
| 1. Shri B. Suryaprakash Rao | .. S.S. G. IV  |
| 2. Shri Koppada Gandhi      | .. S.S. G. IV  |
| 3. Shri Thirupathi Rao      | .. S.S. G. III |
| 4. Shri N. Gnanaranjana Rao | .. S.S. G. III |
| 5. Shri C. Kamaraju         | .. S.S. G. II  |
| 6. Shri V. Kamaraju         | .. S.S. G. II  |
| 7. Shri K. Kameswara Rao    | .. S.S. G. II  |
| 8. Shri Melladi Perraju     | .. S.S. G. II  |
| 9. Shri C. Chinna Rao       | .. S.S. G. II  |
| 10. Shri O. Heman           | .. S.S. G. II  |
| 11. Shri Vasipilli Yelliah  | .. S.S. G. I   |
| 12. Shri K. Appa Rao        | .. S.S. G. I   |
| 13. Shri B. Sivanadham      | .. S.S. G. I   |
| 14. Shri S. Chakram         | .. S.S. G. I   |
| 15. Shri S. Appa Rao        | .. S.S. G. I   |
| 16. Shri Ranga Swamy        | .. S.S. G. I   |
| 17. Shri V. Venkata Ramana  | .. S.S. G. I   |

### BURLA RESEARCH CENTRE

#### SCIENTIFIC PERSONNEL

##### *Scientist S-2*

- |                          |                        |
|--------------------------|------------------------|
| 1. Shri Anwar Ahmed Khan | .. Scientist-in-Charge |
| 2. Shri Joseph Mathai    |                        |

### **Scientist S-1**

- |                              |                             |
|------------------------------|-----------------------------|
| 1. Shri M. Mukundan          | 4. Shri S. K. Bhattacharya  |
| 2. Shri Percy Dawson         | 5. Shri A. K. Chathopadhyay |
| 3. Shri J. K. Bandhyopadhyay | 6. Shri J. Sitarama Rao     |

### **TECHNICAL STAFF**

- |                           |                             |
|---------------------------|-----------------------------|
| 1. Shri Baikunta Pradhan  | .. Technical Asst. (T-II-3) |
| 2. Shri Gurudas Ram       | .. Tindal (T-I-3)           |
| 3. Shri P. M. Pattanayak  | .. Sr. Lab. Asst. (T-I-3)   |
| 4. Shri Radhu Pandey      | .. Driver - Launch (T-1)    |
| 5. Shri Sathrugan Kumara  | .. Tindal (T-1)             |
| 6. Shri Damodar Rout      | .. Jr. Lab. Asst. (T-1)     |
| 7. Shri Ashok Kumar Naik  | .. Mechanic (T-1)           |
| 8. Shri Rabinarayan Sahoo | .. Driver - Launch (T-1)    |

### **ADMINISTRATIVE STAFF**

- |                               |                 |
|-------------------------------|-----------------|
| 1. Shri Jatindra Kumar Mishra | .. Assistant    |
| 2. Shri G. C. Adhikari        | .. Junior Clerk |
| 3. Shri Udekar Pande          | .. Junior Clerk |

### **AUXILIARY STAFF**

- |                         |           |
|-------------------------|-----------|
| 1. Shri Narasingh Panda | .. Driver |
|-------------------------|-----------|

### **SUPPORTING STAFF**

- |                                |                |
|--------------------------------|----------------|
| 1. Shri Ganjendra Karali       | .. SS. G. IV   |
| 2. Shri K. C. Mehar            | .. S.S. G. III |
| 3. Shri Laba Nag               | .. S.S. G. III |
| 4. Shri G. C. Mehar            | .. S.S. G. II  |
| 5. Shri Rathan Chand           | .. S.S. G. II  |
| 6. Shri Sathrugan Seth         | .. S.S. G. II  |
| 7. Shri K. C. Nayak            | .. S.S. G. II  |
| 8. Shri Kirtan Kisan           | .. S.S. G. II  |
| 9. Shri S. C. Mehar            | .. S.S. G. II  |
| 10. Shri Badrinarain Guru      | .. S.S. G. I   |
| 11. Shri Thomas Topno          | .. S.S. G. I   |
| 12. Shri Jaisingh Oram         | .. S.S. G. I   |
| 13. Shri Satyanarayan Mirdha   | .. S.S. G. I   |
| 14. Shri P. K. Bhangaraj       | .. S.S. G. I   |
| 15. Shri Premlal Pande         | .. S.S. G. I   |
| 16. Shri Dibyalochan Patanayak | .. S.S. G. I   |
| 17. Shri Godabari Mahanandia   | .. S.S. G. I   |
| 18. Shri Surajananda Dishri    | .. S.S. G. I   |



## GOA RESEARCH CENTRE

### SCIENTIFIC PERSONNEL

#### *Scientist S-2*

1. Shri H. N. Mhalathkar .. Scientist-in-Charge

#### *Scientist S-1*

1. Shri R. S. Manohardoss
  2. Shri V. Vijayan
  3. Shri Sayed Abbas
- as:

### TECHNICAL STAFF

1. Shri A. B. Varghes .. Bosum (T-I-3)
2. Shri Koruthu George .. Engine Driver (T-2)

### ADMINISTRATIVE STAFF

1. Shri A. B. Rodrigues .. Senior Clerk
2. Shri S. K. Bhabarde .. Junior Clerk

### AUXILIARY STAFF

1. Shri M. Venkateswara Rao .. Driver

### SUPPORTING STAFF

1. Shri D. D. Naik .. S.S. G. III
2. Shri R. D. Padnekar .. S.S. G. II
3. Shri Vasudeva G. Kubal .. S.S. G. II
4. Shri Menino Souza .. S.S. G. II
5. Shri P. S. Morajkar .. S.S. G. II
6. Shri C. B. Shiredhkar .. S.S. G. II
7. Shri V. P. Halnekar .. S.S. G. I
8. Shri Gopixenkar Chodankar .. S.S. G. I
9. Shri Chandrakanth Kolvalkar .. S.S. G. I

## BOMBAY RESEARCH CENTRE

### SCIENTIFIC PERSONNEL

#### *Scientist S-2*

1. Dr. M. Arul James .. Scientist-in-Charge

*Scientist S-1*

1. Shri V. Narayanan Nambiar
2. Shri S. P. Damle
3. Shri Dinesh Kumar Garg

**TECHNICAL STAFF**

1. Shri A. P. Valsan .. Technical Officer - Fish (T-7)
2. Shri N. M. Vasu .. Technical Assistant (T-II-3)

**ADMINISTRATIVE STAFF**

1. Shri Milind S. Bhatkar .. Assistant
2. Shri Y. N. Mhadgut .. Senior Clerk
3. Shri K. Shirishkar .. Junior Clerk

**AUXILIARY STAFF**

1. Shri B. B. Pinjari .. Driver

**SUPPORTING STAFF**

1. Shri S. S. Salvi .. S.S. G. IV
2. Shri A. T. Waghmare .. S.S. G. III
3. Shri B. S. Tambe .. S.S. G. II
4. Shri B. N. Ghare .. S.S. G. I
5. Shri Vinod S. Salvi .. S.S. G. I

**CALICUT RESEARCH CENTRE**

**SCIENTIFIC PERSONNEL**

*Scientist S-2*

1. Shri T. S. Unnikrishnan Nair .. Scientist-in-Charge

*Scientist S-1*

1. Shri V. Muraleedharan
2. Shri N. Kalaimani
3. Shri George Joseph

**TECHNICAL STAFF**

1. Shri T. John .. Technical Assistant (T-II-3)
2. Shri V. Gopalakrishna Pillai .. Technical Assistant (T-II-3)
3. Smt. M. K. Sreelekha .. Junior Lab. Asst. (T-1)
4. Smt. Tara Karupalli .. Junior Lab. Asst. (T-1)

#### ADMINISTRATIVE STAFF

1. Shri M. Ravindran .. Senior Clerk
2. Shri M. Balan Nambiar .. Senior Clerk

#### SUPPORTING STAFF

1. Shri E. Gangadharan Nair .. S.S. G. III
2. Shri C. M. Gopalan .. S.S. G. III
3. Shri K. K. Lakshmanan .. S.S. G. I

#### ON DEPUTATION

<i>Sl. No.</i>	<i>Name</i>	<i>Deputation with</i>	<i>Designation</i>
1.	Sh. P. Sulochanan, Scientist S-2	Fisheries Survey of India Kandla Base, Block No. 80 262, Kutch.	Deputy Director
2.	Shri Y. Sreekrishna, Scientist S-2	Central Institute of Fisheries Education, P.B. No. 7392, Kakori Camp, J.P. Road, Bombay-61.	Professor (Fisheries Technology)
3.	Sh. R. Rajendran, Scientist S-1	CIFNET, Cochin-16.	Instructor (Craft & Gear)
4.	Dr. M. Shahul Hameed, Scientist S-1	University of Cochin	Reader
5.	Sh. C. Hridayanathan, Scientist 'S'	University of Cochin	Lecturer
6.	Dr. G. Jagatheesan	Tamil Nadu Agricultural University, Coimbatore.	Associate Professor (Fish Technology)
7.	Sh. K. Gopalakrishnan, Scientist S-1	Fisheries Survey of India, Bombay.	Deputy Director



APPENDIX III

FINANCE

*Details of budget provision and actual expenditure during the year 1984-85*

<i>PLAN</i>	<i>Budget Provision Rs.</i>	<i>Annual Expenditure Rs.</i>
Salary of Officers	5,500.00	5,487.85
Salary of Establishment	1,11,900.00	1,11,832.04
Dearness Allowance	1,87,600.00	1,87,564.00
H.R.A.	24800.00	24,738.30
Interim Relief	18,400.00	18,393.70
Bonus	6,100.00	6,046.20
Overtime Allowance	2,500.00	—
City Compensatory Allowance	3,300.00	3,209.15
Other Allowances & Honoraria	2,900.00	2,870.25
Travelling Expenses	2,30,000.00	2,29,910.99
Other Charges	56,57,000.00	54,52,167.21
<b>TOTAL</b>	<b>62,50,000.00</b>	<b>60,42,219.69</b>
<i>NON PLAN</i>		
Salary of Officers	19,13,800.00	19,13,742.64
Salary of Establishment	13,51,600.00	13,51,531.24
Dearness Allowance	41,43,200.00	41,43,173.75
Interim Relief	3,18,800.00	3,18,760.35
Bonus	1,17,400.00	1,17,354.95
Overtime Allowance	31,000.00	26,518.25
House Rent Allowance	3,67,900.00	3,67,843.81
City Compensatory Allowance	32,300.00	32,299.90
Other Allowances & Honoraria	1,52,200.00	1,52,182.39
Travelling Expenses	70,000.00	69,843.80
Leave Salary Contribution	—	—
Pension & P.F. Contribution	500.00	360.00
Other Charges	13,33,900.00	13,33,356.65
Grant-in-aid, Contribution etc.	43,400.00	43,307.85
<b>TOTAL</b>	<b>98,76,000.00</b>	<b>98,70,275.58</b>