ANNUAL REPORT 1981-'82

CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)
COCHIN-682029, INDIA

ANNUAL REPORT

1981-82

Central Institute of Fisheries Technology
(Indian Council of Agricultural Research)
MATSYAPURI P. O., COCHIN-682 029

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1. INTRODUCTION

The Institute has, during the year under report, re-structured the Research Programmes based on the developmental activities of the Centre and States in the field of fisheries technology as well as the needs of the Industry and rescheduled them for the financial year instead of the calendar year. It is heartening to note that some of the results of research were taken up almost immediately by developmental agencies for implementation while some other technologies developed by this Institute in the recent years enabled some of the small scale entrepreneurs to enter the export market and the traditional fishermen community to improve their economic condition.

Work carried out on the development of improved designs of lobster traps proved successful and resulted in an improved version which landed more catch in addition to longer service life as compared to traditional traps. Consequently, based on popular demand, about 200 lobster traps of CIFT design were got fabricated and distributed among traditional fishermen in Tamilnadu under a collaborative programme between CIFT, Marine Products Export Development Authority and the Government of Tamil Nadu. Similar collaborative programmes have also been proposed for implementation in Kerala State.

The water current meter to measure the amplitude and direction of water current in marine and estuarine waters has been designed, fabricated and tested successfully. Work is in progress on other electronic aids for exploitation of fishery resources. It is pertinent to mention here that 5 instruments developed earlier at this Institute have already been commercialised and 3 more have been proposed for commercialisation.

Work on diversified fishing methods and gear have brought out the efficacy of a 17 M. equal panel parachute trawl at Cochin, 32 M. large mesh size demersal trawl at Veraval (Gujarat), 23 M. high opening trawl

at Kakinada (Andhra Pradesh) and 10.3 M. unequal panel, large mesh mid water trawl at Panaji (Goa).

Work carried out by the Burla Research Centre on shore seines enabled the Orissa State Government to formulate a programme for rational exploitation of the fishery resources of Hirakud Reservoir.

Encouraging results have been obtained with some of the plant leaf extracts in the preservation of cured fish which has opened up a new area for innovative research in this field.

Work on textural and preservation aspects of dried fish enabled identification of cheap, indigenously available chemicals for improving the texture and preservation of dried fish.

Technologies have been worked out to get smoked prawns with increased shelf life and also to improve the yield of cutlets from minced meat.

Fish proteins, like fish oils, were found to have cholesterol lowering activity.

Methods have been worked out to improve the quality of wet cured oil sardines at the Calicut centre of this Institute.

Two serotypes of Salmonella (*S. muenchen* and *S. alachua*) and *Clostridium perfringens* were isolated from fresh silver pomfrets, lesser sardines and eels at Bombay, probably for the first time in this country.

High molecular weight, high density polythene film of 40 guage thickness was found to be a cheaper substitute for the conventional 100 gauge low density polythene film for use in frozen shrimp industry and several processors have taken to the new product on the recommendations of the Institute.

The technology developed and pilot plant fabricated for the production of chitosan from prawn shell waste were found to be suitable for production of end product, meeting the quality requirements of foreign buyers.

Studies on the idle capacity of fish processing plants in the country revealed an idle capacity of more than 70% on both east and west coasts in addition to identification of the various factors responsible for such a situation. These observations will be very helpful to the Industry as well as to the Governmental agencies to plan their future strategy in this regard.

Compilation and analysis of data collected on the economis of operation of mechanised boats in Kerala State revealed very interesting observations, which will be very useful for all concerned. The crucial factor

determining the ultimate profitability appears to be the number of fishing trips made in a year and this in turn is largely influenced by the fishing days lost in maintenance and repairs of the engine. Selection of a proper type of engine with optimum horse-power and relative freedom from repairs appears to be an important factor for the economic viability of mechanised fishing.

As a result of the training programme held under the lab-to-land programme on clam pickle technology, clam processing units have come up at Kundra and Perayam in Kerala State and these are now receiving orders even from other countries. Similarly, training programmes on the utilisation of mussel meat at and around Calicut enabled establishment of small scale mussel processing units in that area. Fisher-women belonging to the Badagara Taluk Matsya Pravarthaka Mahilasangham (Kerala State) were trained in trawl net fabrication as a result of which the Mahilasangham is able to fabricate and sell nets on a commercial scale thereby enabling the fishermen families to improve their economic condition. These are a few illustrations to indicate how the programmes of the Institute are contributing to the generation of rural employment and improvement of the economic conditions of fishermen.

C. C. Panduranga Rao
DIRECTOR

1.1. ORGANISATIONAL SET-UP

The Institute is headed by the Director with whom all administrative and financial powers regarding research and management of the Institute are vested. He is assisted by a Sr. 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 aspects as also internal audit of the Institute. One Junior Technical Officer attends to the technical matters including those connected with research projects handled by the Institute at its Headquarters at Cochin and Research Centres at Veraval (Gujarat), Kakinada (Andhra Pradesh), Burla (Orissa), Calicut (Kerala), Bombay (Maharashtra) and Panaji (Goa).

The research work is carried out by the following Research Divisions:-

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

Work under these Divisions is extended to the Research Centres as well, to tackle the problems facing the fishery industry of the respective region. Each Centre is under a Scientist who is designed as Scientist-in-Charge of that Research Centre. He carries out the co-ordination, supervision and periodical assessment of the progress of the different projects/ personnel attached to that Centre.

1.2. MANAGEMENT COMMITTEE

Two meetings of the Management Committee of the Institute were held during the period and important recommendations made.

1.3. STAFF JOINT COUNCIL

The Institute's Joint Council continued to function actively. One meeting was held during the year at which various matters on service conditions etc. concerning the employees were discussed.

1.4. MONITORING CELL

The Monitoring Cell of the Institute met five times during the year under report and considered the progress made in plan expenditure, procurement of stores, vacancy position, filling up of posts and construction work.

1.5. GRIEVANCE CELL

The Grievance Cell set up to consider the grievances of the Class I and above officers and the General Grievance Cell for all the other employees continued to function during the period. In all, three meetings of the latter were held and five cases considered. The former Cell met thrice and considered 12 cases.

1.6. PROJECT ADVISORY COMMITTEE

The Committee met 8 times during the year to evaluate the progress of work on the research projects handled at the headquarters and Research Centres. The recommendations for improving the quality and quantity of work were placed before the Staff Research Council from time to time. The Project Advisory Committee also prepared the draft research projects for 1982-83 for finalization by the Staff Research Council and subsequent approval by Institute Management Committee. The Committee met twice to give the final shape to the Sixth Plan EFC Memo of the Institute taking into account the comments of the Fisheries Division (Department of Agriculture) and Integrated Finance (Department of Agriculture) and of the Planning Commission.

1.7. ADMINISTRATION

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

The Research Centres continued to function in rented buildings. Addresses of the Research Centres are given as Appendix I. List of staff under Scientific, Technical, Administrative and Supporting categories as on 31-3-1982 is given as Appendix II.

Details of budget provision and actual expenditure are furnished as Appendix III.

1.8. TECHNICAL SECTION

The Section continued to assist the Director in collecting research material from the different Divisions at Headquarters and Research Centres

for preparation of technical notes and reports to be forwarded to the Council, scientific panel and other external agencies.

Forty technical papers presented by the Scientists were processed for approval for publication.

1.9. STAFF RESEARCH COUNCIL

The Council met twice to review the progress of various research programmes under implementation. Many useful recommendations that emerged from the discussions were implemented expeditiously.

1.10. AGRICULTURAL RESEARCH SERVICE

During the period, on the basis of the recommendations of the ASRB, seven out of twenty Scientists in the grade S, S-1 and S-2 who appeared for five yearly assessment, got merit promotion and 3 got advance increments. The documents in respect of six Scientists of grade S from the discipline of Fish and Fishery Science and seven Scientists of grades S, S-1 and S-2 from Fish Processing Technology were submitted to the Assessment Committee which met at CMFRI, Cochin on 19 and 21 January, 1982 for consideration. The results are yet to be announced.

1.11. REGIONAL COMMITTEE

The Director continued to act as the Member Secretary of the ICAR Regional Committee No. 8. The fifth meeting of the Committee was held on 29-30th October 1981 at the Tamil Nadu Agricultural University, Coimbatore. The Chairman of the Committee, Dr. O. P. Gautam, Hon. Minister for Horticulture, Hon. Minister for Veterinary and Animal Husbandry from Government of Karnataka, Dy. Director General (AS), Asst. Director Generals of ICAR, Vice Chancellors of Agricultural Universities, Directors of ICAR Institutes, Representatives from Agricultural Universities and State Departments attended the meeting. Proceedings of the meeting, incorporating all major recommendations were also prepared in detail.

1.12. LIBRARY

During the year, 315 books and 184 bound volumes of journals were added to the Institute's Library, bringing the total to 4781 books and 2178 bound volumes.

One hundred and fifty seven journals, both Indian and foreign, were also subscribed to besides sixty journals received on exchange/gratis basis.

Indexing of current literature, compilation of bibliography on fishery technology, photo-copying service, ready reference service etc. were continued. In addition to the staff of the Institute, visitors from various Institutes, research scholars, students from Universities, technical personnel and industrialists from fishing and fish processing industries also utilised the library facilities. Inter-library loan facilities were maintained in collaboration with other Institutes, Colleges and Universities.

1.13. COMMITTEES REPRESENTED BY THE INSTITUTE

Director served on the following Scientific and allied bodies:

1.	*Member*	..	Scientific panel for Fisheries Research, ICAR.
2.	*Ex-Officio Member*	.. ..	Panel of Experts for the purpose of hearing appeals - Export Inspection Agency, Karnataka and Kerala.
3.	*Member*	..	Management Committee, Krishi Vigyan Kendra, CMFRI, Narakkal.
4.	*Member*	..	Fishery Advisory Committee, Kerala Agricultural University, Mannuthy.
5.	*Member*	..	Management Committee, Operational Research Project of CMFRI, Kovalam (Tamil Nadu)
6.	*Member*	..	Scientific Panel on Post Harvest Technology, ICAR.
7.	*Member*	..	Board of Directors, Kerala Fisheries Corporation, Kerala.
8.	*Member*	..	Board of Studies in Marine Sciences, University of Cochin.
9.	*Chairman*	..	Fish and Fish Products Sectional Committee, AFDC - 27 of Indian Standards Institution.

The following are the other Committees in which the Institute was represented:

1. *Shri M. R. Nair, Scientist* S-3 as:-
   (a) Alternate Member: ISI, AFDC - 27 Fish & Fisheries Products Sub-Committee.
   (b) Member: ISI, AFDC - 27:2 Frozen Fish Products Sub-Committee
   (c) Member: ISI AFDC - 36:9 Metallic Contaminants Sub-Committee
   (d) Member: Panel of Experts for hearing appeals against rejection of canned prawns, Export Inspection Agency, Cochin.

(e) Member: Panel of Experts for approval of processing units as required under the Export of frozen frog legs (Quality Control & Inspection Rules 1979).

2. *Shri R. Balasubramanyan,* Scientist S-3 as:-

(a) Member: Marine Corrosion Sub-Committee of the CSIR

(b) Alternate Member: ISI, MCPD - 2, Indian Harbour Craft and Fishing Vessels Sectional Committee

(c) Member: Consultative Committee for (FRP) Technology of the National Council of Science and Technology

(d) Member: ISI, MCPD - 21, Fishing Vessels Sectional Committee

(e) Member: Expert Committee for the Acquisition of Trawlers for the Tamil Nadu Fisheries Development Corporation Ltd., Madras

(f) Member: Co-ordinating Committee of MPEDA, Cochin to promote shark fishing

(g) Member: Co-ordinating Committee of MPEDA Cochin, to promote lobster fishing

3. *Dr. K. Gopakumar,* Scientist S-3 as:-

(a) Alternate Member: ISI, AFDC - 27:5, Fish Meal Sub-Committee

4. *Shri T. S. Gopalakrishna Iyer,* Scientist S-2 as:-

(a) Member: State Level Committee for the Co-ordination of work on marine fisheries, Maharashtra

(b) Member: Central Advisory Committee of the Exploratory Fishery Project

(c) Member: IPQC (Froglegs) panel of experts

5. *Shri K. K. Solanki,* Scientist S-2 as:-

(a) Member: ISI, AFDC - 27, Fish and Fishery Products Sub-Committee.

6. *Shri K. K. Balachandran,* Scientist S-2 as:-

(a) Member: ISI, AFDC - 27:1, Canned Fish Products Sub-Committee

7. *Dr. K. Ravindran,* Scientist S-2 as:-

(a) Member: Marine Cargo Movement and Packaging Division Council (MCPDC)

(b) Member: Standing Working Committee on Marine and Cargo Movement (SWCMC)

(c) Convener: 2nd ICAR Inter-Zone Athletic Meet, Cochin

(d) Subject Expert: Doctoral Committee, University of Cochin

8. *Shri P. V. Prabhu,* Scientist S-2 as:-

(a) Principal Member: ISI, AFDC - 27:5, Fish Meal Sub-Committee

(b) Alternate Member: ISI, AFDC - 27:2, Frozen Fish Products Sub-Committee

9. *Shri V. C. George,* Scientist S-2 as:-

(a) Member Secretary: Working Group to device ways and means of exploiting fishery resources of inland waters

(b) Member: Co-ordination Committee, Federation Fishermen Co-operative Society, Hirakud Reservoir, Sambalpur

(c) Institute Representative: All India Co-ordinated Project of CIFRI on the Ecology and Fisheries of Fresh Water Reservoirs

10. *Shri S. Ayyappan Pillai,* Scientist S-2 as:-

(a) Member: ISI, MCPD-3:7, Sub-Committee on Machinery for Dredgers, Tugs, Trawlers, Hoppers, Barges and Mechanised Fishing Boats

(b) Member: National Committee of the International Institute of Refrigeration

(c) Member: Kerala State Committee for the Evaluation of the Scheme of Mechanisation of Country Crafts

(d) Executive Committee Member: Indian Cryogenic Council, South Zone

11. *Shri K. Sreedharan Namboodiri,* Scientist S-2 as:-

(a) Member: ISI Sub-Committee MCPD - 21:2

12. *Shri S. Gopalan Nayar,* Jr. Fishery Scientist as:-

(a) Principal Member: ISI, TDC - 42, Textile Materials for Fishing Purposes, Sectional Committee

13. *Shri T. S. Unnikrishnan Nair,* Scientist S-1 as:-

(a) Alternate Member: ISI, AFDC - 27:3, Dried Fish Products Sub-Committee

14. *Shri A. P. Valsan,* Jr. Scientist as:-

(a) Principal Member and Convener: ISI, AFDC - 27:3 Dried Fish Products Sub-Committee

15. *Smt. K. Radhalekshmy,* Asst. Fishery Scientist as:-

(a) Alternate Member: ISI, TDC - 42, Textile Materials for Fishing Purposes, Sectional Committee.

1.14. SYMPOSIA/SEMINARS/WORKSHOPS ETC. ATTENDED

Shri T. K. Sivadas, Scientist S-2, attended the First Indian Conference in Ocean Engineering at Indian Institute of Technology, Madras during 18-20 Feb. 1981 and presented three technical papers. He also attended the All India Seminar on Status of Environmental Studies in India organised by the Centre for Earth Science Studies at Trivandrum, from 26-28 March 1981 and presented one technical paper. Shri Sivadas also presented a paper at the 2nd World Instrumentation Symposium organised by the Instrument Society of India at Bombay from 15-18 April 1981.

Shri P. V. Prabhu, Scientist S-2, attended the Seminar on Aquaculture in Kerala with special reference to crabs and prawns at the University of Calicut on 8th June 1981. Shri Prabhu was also deputed for participation in the Food Drying Workshop at Edmonton, Canada, under the IDRC Project from 6-10 July 1981 in which a paper was presented by him.

Shri S. Ayyappan Pillai, Scientist S-2, attended the Seminar on Science and Technology, Education and Research in Kerala organised by Kerala Sastra Sahitya Parishat in collaboration with the Institution of Engineers (I) and sponsored by the Kerala State Committee on Science and Technology at Cochin on 2nd and 3rd August 1981.

Kum. B. Meenakumari & Smt. A. Lekshmy Nair, Scientists S-1, attended the International Conference of Women Engineers and Scientists organised by Indian Women Scientists' Association (IWSA), Bombay, from 8-12 Sept. 1981.

S|Shri G. Narayanappa, Scientist S-2 and D. Imam Khasim Saheb, Scientist S-1 attended the IVth Workshop of All India Co-ordinated Research Project on Brackish Water Fish Farming at Kakinada, from 24-25 October, 1981.

Shri M. K. Kandoran, Scientist S-2, participated in the Seminar/Training Course in Inland Fisheries organised by Fish Farmers Development Agency, Palghat at Malampuzha on 26 October 1981. A detailed talk on handling, preservation, packing and transportation of fish was given for the benefit of the fish farmers who attended the programme, as also a general idea of the different types of fishing gear in use in the country.

Dr. P. N. Kaul, Scientist S-3, participated in the National Seminar on the Challenges of Extension in Eighties organised by the Indian Society of

Extension Education at Indian Agricultural Research Institute, New Delhi from 26-28 November, 1981 and presented a technical paper.

Dr. K. Ravindran, S|Shri S. Ayyappan Pillai Scientist S-2 and K. N. Kartha, Scientist S-1, attended the Seminar on Future Prospects of Fisheries Industry in India organised by the Industrial Fisheries Association of Department of Industrial Fisheries, Cochin University from 30 November to 4 December 1981.

S|Shri V. C. George, Scientist S-2 and A. A. Khan, Scientist S-1, attended the Seminar on Inland Fishing at Ukhai Reservoir, Gujarat on 12 and 13 December 1981 and presented three technical papers.

S|Shri S. M. S. Abuthahir Ali, Scientist S-1 and P. Madhavan, Scientist S-2 attended the National Seminar on Polymeric Materials and their Engineering Applications at Trivandrum from 28 to 29 December 1981. The Seminar was sponsored by the College of Engineering, Trivandrum in co-operation with National and International Organisations. One paper from the Institute was presented at the Seminar.

1.15. FELLOWSHIP/TRAINING/DEPUTATION

Shri P. Appukutta Panicker, Scientist S-2 who was deputed for advanced Post Graduate Diploma course in Fisheries Management at the Grimsby College of Technology, U.K. under the Colombo Plan for a period of one year from September 1980, returned after completion of the course during July 1981.

Shri Jose Joseph, Scientist S-1, was nominated for award of Norwegian Government Fellowship for undergoing a diploma course in fish and fishery technology at the University of Trodhein for a period of one year from 15 August 1981.

S|Shri T. K. Srinivasa Gopal and K. P. Antony Scientists S-1, attended the training programme on Developments in Packaging organised by the Indian Institute of Packaging at Bangalore from 29 to 31 December 1981.

Shri K. Bhaskaran, Photographer-cum-Artist attended the 3rd Colour Photographic Training Course at Indian Agricultural Research Institute, New Delhi from 1 to 31 March 1982.

Seventeen Scientists of the S-1 cadre attended the Agricultural Research Management and Orientation course in 5 batches at the National Academy of Agricultural Research Management, Hyderabad.

1.16. DOCTORATE AWARD

The University of Kerala awarded Ph.D. degree in the faculty of Science to Shri P. K. Surendran, S-1, Microbiology Division for his thesis entitled 'Chemical Preservatives in Relation to Control of Microbial Changes in Fishery Products.' He conducted his research under the guidance of Dr. K. Gopakumar, Head, Processing Division.

1.17. CONSULTANCY SERVICE

Consultancy service was undertaken by the Institute for installation of a Coastal Oceanographic Data Acquisition System (CODAS) for Centre for Earth Science Studies, Trivandrum for monitoring data related to oceanographical, geological and meteorological studies.

S|Shri S. Ayyappan Pillai, Scientist S-2 and P. A. Perigreen, Scientist S-1 conducted an inplant study of M|s Karthika Marine Industries (P) Ltd., Cochin under the modernisation programme of marine products processing industry undertaken by the Small Industries Service Institute, Trichur. A report based on the survey, was prepared and submitted to the SISI.

1.18. VISITORS

The visitors to the Institute during the period include:-

1. *Mr. A. T. Marriott,* Grimsby College of Technology
2. *Mr. Zee Quiay,* 19 D Towlinson Road, Singapore
3. *Shri Mohammed Husain Baloch,* Hon'ble Dy. Minister of Law, Justice and Fisheries, Government of Gujarat
4. *Dr. Willimann,* Economist, Bay of Bengal, Small Scale Fisheries Project of the FAO at Madras
5. *Dr. R. K. Baisya,* Project Manager, Corn Products Co. (India) Ltd., Bombay
6. *Mrs. Miriam Weissburg,* Scientific and Technological Councillor at Mexican Embassy in India
7. Fisheries Extension Officer, Government of Orissa
8. *Shri Rao Birendra Singh,* the Hon'ble Minister for Agriculture and Rural Reconstruction, accompanied by *Dr. O. P. Gautam,* Director General, ICAR
9. *Mr. Palasathiran,* Mg. Director, Ceynor Devt. Foundation, Sri Lanka
10. *Mr. J. P. Trozde,* Chief, Fisheries Development Planning Service, FAO, Rome

11. FAO Mission including *Dr. Tracoadee* and *Dr. Iyengar*
12. *Mr. K. K. Gurung,* Field Officer, Cabinet Secretariat, New Delhi
13. *Mr. D. A. S. Gnanadoss,* FAO, UNDP, Lagos
14. *Mr. L. O. Abuah,* Fisheries Division, Benin City, Nigeria
15. *Mr. A. A. Akiwai,* Fisheries Division Manager, Abeokuta, Nigeria
16. *Mr. E. O. E. Odiong,* Fisheries Division, Calabar, Nigeria
17. *Mr. A. A. Aderonamu,* Fed. Dept. of Fisheries, Lagos, Nigeria
18. *Dr. M. A. Haleen,* Central Food Technological Research Institute, Mysore
19. *Mr. Peter Gurtner,* FAO, Rome
20. *Mr. M. Shahidullah,* Dy. Director (Marine Fisheries Dept.) Chittagong, Bangladesh
21. *Mr. Myint Soe* and *Mr. Tin Mynit,* C|o. Peoples' Pearl and Fishery Corporation, Rangoon, Burma
22. Group of Journalists escorted by *Shri S. K. Sharma,* Public Relations Officer, ICAR

1.19 OBITUARY

Shri Korah Eapen, Scientist S-1 attached to the Engineering Division, died of sudden illness on 23 January 1981. He is survived by his wife.

Shri M. John, Technician in the Electronics and Instrumentation Division passed away due to heart attack on 21 August 1981. He is survived by his wife, a son and a daughter.

Shri N. L. Chorwadi, S. S. Gr.-I, Veraval Research Centre died of long illness on 12 January, 1982.

Shri C. S. Govindan, S.S. Gr.-III of the Biochemistry and Nutrition Division died on 9 February 1982. He is survived by his wife and two daughters.

1.20. GENERAL

S|Shri P. A. Perigreen, A. Vasanth Shenoy, Scientists S-1 and R. Chakraborthy, Scientist S-2, conducted a training programme on Diversified Products from Fish at Calcutta from 23rd to 25th September and at Puri from 28th to 30th September 1981. The programmes were organised by the Marine Products Export Development Authority.

A month long Summer Institute on 'Non-Traditional Diversified Fish Products and By-Products' sponsored by the ICAR was held at the Institute from 27 April to 26 May 1981.

At the request of the Director, ICAR Research Complex for the North Eastern Hill Region, Shillong, S|Shri K. S. Namboodiri, Scientist S-2 and A. A. Khan, Scientist S-1, visited Shillong during August 1981 and studied the problems relating to fishing in the Barapani reservoir. The Scientists offered technical guidance for the successful operation of FRP fishing vessels fitted with out-board engines. Ways and means for the judicious exploitation of the reservoir were also recommended.

2. LAB-TO-LAND PROGRAMMES

A one month long training programme on Fabrication of Modern Fishing Gear was organised at Veraval, Gujarat in collaboration with the Gujarat State Fisheries Department from 21 September 1981 for the benefit of the fisherwomen of the area. The course, intended to impart technical know-how on modern trawl gear fabrication included 1) interpretation of design drawings 2) estimation of netting materials and 3) cutting, tailoring and assembling, including rigging. Nineteen numbers of the 'Kharawa' (fishermen) community participated in this course.

A follow-up of the training imparted earlier to fisherwomen belonging to the Badagara Taluk Matsya Pravarthaka Mahilasangham in fabrication of improved trawl gear has shown that the Mahilasangham has started fabrication and sale of nets both on a commercial scale on orders obtained from the Government and other agencies.

As a follow-up of the training on processing of clam meat held at Kundara, Quilon, in July 1979, interviews were held with beneficiaries of the programme and their views recorded. Those interviewed included a manufacturer and exporter of clam pickle, who has started manufacture of this product as per CIFT technology. Another beneficiary is a youth who has established a clam processing unit at Perayam, Near Kumbalam, Quilon District in Kerala, which processes 100 Kg of clam meat every day, providing employment to 45 people including women, in and around the area.

3. ICAR SPORTS

The 2nd ICAR Inter-Zone Athletic Meet was held at Cochin on 6th and 7th March 1981. Over one hundred and forty three athletes, including 15 women from thirty ICAR Institutes and ICAR Headquarters took part in this two day Meet. These were the winners of the six zonal tournaments conducted during the previous year at Central Soil Salinity Research Institute, Karnal, Indian Agricultural Research Institute, New

Delhi, Central Institute for Cotton Research, Nagpur, Sugarcane Breeding Institute, Coimbatore, Indian Veterinary Research Institute, Izatnagar, and Central Rice Research Institute, Cuttack.

Shri Tejpal Singh of National Dairy Research Institute (NDRI), Karnal and Smt. Sunanda of Central Plantation Crops Research Institute (CPCRI) Kasargod, were adjudged athletic men's champion and women's champion respectively.

Zone IV, consisting of Indian Institute of Horticultural Research, Bangalore, Central Institute of Fisheries Technology, Cochin, Central Marine Fisheries Research Institute, Cochin and Central Plantation Crops Research Institute, Kasargod topped the list with 58 points for men and women taken together.

The G. K. Kuriyan Memorial Rolling Trophy instituted by the Staff of CIFT, in memory of late Shri G. K. Kuriyan, Director of CIFT, was bagged by the National Dairy Research Institute, Karnal.

Prof. Dr. M. V. Pylee, Vice-Chancellor, University of Cochin, inaugurated the Meet. Shri Philipose Thomas, District Collector, Ernakulam, was the Guest of Honour. Smt. Phlipose Thomas distributed the prizes.

Dr. C. C. Panduranga Rao, Director, Central Institute of Fisheries Technology was Chairman of the Organising Committee and Dr. K. Ravindran, Convener of the Athletic Meet.

4. PROGRESS OF RESEARCH

4.1. DEHYDRATION AND SMOKING:

CHIEF FINDINGS

Investigations for improving the quality of wet cured sardines have shown the quality of the product from which self brine was removed and replaced with fresh saturated brine to be better than that of the control sample where the self brine was left as such. Comparative study of drying efficiencies of different drying surfaces revealed that palmyrah leaf mat and stretched net surface were as efficient in terms of rate of drying as cement platform and aluminium tray. Even though there was considerable difference in moisture and sand content between sundried fish samples and those dried in mechanical drier, there was no significant difference in total bacterial count and total halophilic count between the two sets of samples.

Studies on salt penetration and optimum salt to fish ratio showed that for small and medium size ribbon fish curing for 18 *hours with* 1 : 5 *salt to fish ratio and for big size fish* 1 : 4 *salt to fish ratio would be sufficient.*

The smoked prawns processed by traditional Jithaka process when packed in polyethylene bags remained in good condition even after a storage period of five months at room temperature. Studies on sun dried and smoke dried market samples showed that they had no uniformity in moisture content and had varying storage lives ranging from 4 *to* 150 *days. Being unhygienically processed, most of the market samples were found to have high total bacteriological count and insect infestation.*

RESEARCH IN HAND

Investigations for improving the quality of wet cured sardines were continued at the Calicut Centre. A series of experiments with larger quantities of sardines were taken up during the year. It is proposed to conduct the experiments on a pilot scale under commercial condition. This has much significance as wet curing is one of the major types of curing adopted for sardine and mackerel in this region.

A few experiments were conducted to explore the possibility of refining commercially dry cured samples of fish affected with fungus and red halophiles into good, organoleptically acceptable ones by some treatment or other. A fairly large quantity of dry cured fish was purchased from the local market and divided at random into five portions viz. 1) The control sample kept as such (2) washed well in potable water and dried (3) washed well in potable water, dipped in saturated brine for five minutes and dried (4) washed well in potable water, dipped in sodium propionate solution and dried and (5) washed in potable water and dried with preservative mixture containing sodium propionate. The treated samples were dried to more or less the same moisture levels. All the samples were kept for storage study. It has been observed that all the samples other than control did not show any sign of red attack or fungus in festation after one and a half months. The control sample has been heavily infested with red halophiles and fungus. The studies are being continued.

Experiments to study the effectiveness of betel leaf extract as an antioxidant in the curing of fatty fish were carried out. Bacteriological studies showed appreciable reduction in standard plate count of the products treated with the extract. On storage also, the plate counts were found to remain at a low level in contrast to the control samples which showed further increase. It is also proposed to extend the studies to the wet curing of sardine.

In Kakinada, studies to prevent the spoilage of brine during repeated curing of batches of fish in the same brine showed that simple chlorination of the 20% brine to different levels of chlorine using bleaching liquor masked the off odour. Further work is in progress. A cheaper chemical was found to be efficacious in improving the texture of the dried fish after rehydration. To improve the traditional Jithaka smoking process an experimental smoking kiln using locally available materials was constructed and further work is in progress.

At the Burla Centre, storage studies of market samples of sun dried and smoke dried fresh water fishes were carried out. Changes occurring in the chemical parameters and total bacteriological load with storage were recorded. Attempts were made to improve the quality of the traditionally sun dried *Gudusia chapra* with pretreatment.

A survey of the quality of dried, non-penaeid prawn available in three main fish markets in Bombay was conducted and organoleptical, physical, biochemical and bacteriological indices were studied. Many of the samples analysed were sub-standard in quality. Studies on the improvement of the existing methods of sun-drying non-penaeid prawns were taken up. A laboratory model of solar drier has been designed and fabricated. Though this model gave good results for drying big fishes, it required some modifications for drying non-penaeid shrimps and this part of the work is under progress.

Research Contemplated

1. Further studies to improve the processing conditions of sundrying adopting easy and cheaper methods of sanitation and hygiene.
2. Further studies on the improvement of textural qaulity of sundried fish using cheaper chemicals.
3. Technological studies on Jithaka smoking process and quality studies of smoked prawns.
4. Studies on the storage life, microbial flora associated with and biochemical analysis of the different types of traditionally salted, smoked and dried fish.

Scientists Associated

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BOMBAY:	A. P. Valsan, V. N. Nambiar, S. P. Damle, D. K. Garg
KAKINADA:	D. Imam Khasim Saheb, Subrata Basu, Sibsankar Gupta

BURLA: S. K. Bhattacharyya, A. K. Chattopadhyay, J. K. Bandyopadhyay

4.2. FREEZING

CHIEF FINDINGS

A comparative study of the frozen storage characteristics of skinless fillets and minced meat from two species of cat fish (Tachysurus jella and Pseudarius jella) *has shown that the fillets had a better shelf life compared to minced meat as judged by biochemical, bacteriological and organoleptic tests. Mackerel (fat content* 9% DWB) *frozen individually and stored at* —20° C *without any glazing or packaging remained in acceptable condition for* 12 *weeks.*

Studies on frozen storage characteristics of sole fish have shown that the fish could be kept in frozen storage in good condition for a period of 20 *weeks.*

Studies on the ice storage characteristics of seven commercially important species of fresh water fish have shown that on the basis of organoleptic evaluations Barbus sarana *was acceptable till* 23 *days,* Cirrhinus reba *for* 21 *days,* Labeo rohita *for* 15 *days,* Catla catla *for* 22 *days,* Labeo gonius *for* 17 *days,* Cirrhinus mrigala *for* 22 *days and* Labeo calbasu *for* 17 *days.*

RESEARCH IN HAND

Frozen storage characteristics of skinless fillets and minced meat prepared from two species of marine catfish were studied. The maximum shelf life of minced meat was five months at —23°C. in the case of *Pseudarius jella* and four months for *Tachysurus jella* as judged by biochemical, bacteriological and organoleptic tests. But the frozen fillets were acceptable for seven months at —23°C. The total bacterial count of minced meat was slightly higher compared to fillets. The protein denaturation was more in minced meat compared to fillets. Based on the request of Kerala Fisheries Corporation, work was undertaken to improve the yield and organoleptic qualities of fish cutlets prepared from minced meat. The yield of cutlets could be improved by 10% using the improved method developed.

The studies on the frozen storage characteristics of mackerel with 9% fat (on DWB) were continued upto 17 weeks. Biochemical and organoleptical changes during storage were studied. Studies on freezing and frozen storage characteristics of block frozen glazed mackerel are in progress.

Comparative studies on frozen storage characteristics of two species of *Hilsa*, viz. *Hilsa toli* and *Hilsa ilisha* were carried out .After 12 weeks of frozen storage, the quality characteristics of *H. toli* were found to be better than those of *Hilsa ilisha*. Studies on freezing and frozen storage characteristics of beheaded and gutted sharks of the species *Scoliodon sorokowa* in two forms i.e. with skin and without skin are in progress.

The storage studies of commercially important fishes taking into consideration the changes in chemical, microbiological and organoleptic qualities are continued.

RESEARCH CONTEMPLATED

1. Studies on freezing and storage characteristics of Elasmobranchs
2. Freezing and storage characteristics of fatty fishes
3. Studies on the freezing characteristics of squid and cuttle fish
4. Technological aspects of freezing and storage of fish mince and products using fish mince
5. Studies on the spoilage characteristics of fresh water fishes stored in ice
6. Studies on the low temperature preservation of fresh water fishes in refrigerators and deep freezers
7. Studies on the present system of transportation and marketing of fresh water fishes of Hirakud reservoir

SCIENTISTS ASSOCIATED

COCHIN:	P. A. Perigreen, Chinnamma George, Jose Joseph, Dr. K. Gopakumar, P. Ravindranathan Nair, Nirmala Thampuran
VERAVAL:	K. K. Solanki, A. C. Joseph, Anil Agarwal.
KAKINADA:	R. Chakraborty
BURLA:	J. K. Bandyopadhyay, A. K. Chattopadhyay, S. K. Bhattacharyya

4.3. CANNING

CHIEF FINDINGS

Studies undertaken on canning of the meat from wild and cultured oysters have shown that the latter yielded a superior product. Smoking and canning of oyster meat was also attempted. A formula was worked out for preparing a ready to

serve curry with fish processing parameters evolved for canning the same. Tuna whole meat was found to yield a good product in curry form. Bacteriological studies of canned samples as well as clams during different stages of processing were carried out. In canning light smoked fish and frog legs, direct smoking gave better results than using smoke solution.

RESEARCH IN HAND

Canning of oyster meat in different media was studied. Oyster cultured by CMFRI at their Tuticorin Research Centre and the wild samples collected from Cochin backwaters, both belonging to the species *Crassostrea madrasensis* were used in these studies. In the case of cultured oyster, the yield of raw meat was 5%, the yield on steaming whole oyster 2.8% and the yield on blanching 2.3%. Yields from wild oyster under similar conditions were 4.3%, 2.2% and 2% only. The steamed and shucked meat was blanched in brine and packed in cans in brine containing citric acid, EDTA or both, or in oil or tomato sauce. Heat processing in steam at 15 psig (1.05 Kg/Sq.Cm) for 15 minutes gave a product with good texture. Oil packed oyster meat was best followed by sauce pack and brine pack in this order. Complete chemical and bacteriological analysis of both samples have been carried out.

Use of smoke solution in place of conventional smoking was attempted to impart light smoke flavour to canned fish and froglegs. The resultant products varied widely in flavour. The smoke flavour was very much less in samples packed in smoke solution.

Development of a suitable recipe for preparation of ready-to-serve canned fish in curry was attempted. The ingredients of curry included red chilly, ginger, green chilly and vegetable like tomato, carrot, green peas and onion, in appropriate quantities. The fish used for the studies included mackerel and tuna. After heat processing, it was observed that alterations in flavour were contributed significantly by vegetables like carrot and ginger and a new formula was worked out excluding those two. By suitably modifying the combination, it has been possible to prepare canned fish curry with either mild or intense flavour. A canned fish curry with mild flavour lasts well for three months.

Canned curry with tuna whole meat prepared using the improved recipe yielded a well acceptable product irrespective of the presence of black meat. The black meat in can developed a liver like flavour and compared with the white meat canned identically, it showed better acceptability. Further work is in progress for confirmation of results and for studying the storage characteristics. Storage study of mackerel canned as curry is also under progress.

Bacteriological analysis of all canned samples and clam meat were carried out to decide the extent of heat processing required in individual cases. Bacteriological quality of the pickles prepared out of clam meat were also regularly carried out.

In Veraval, a modified process for canning of squids has been worked out by using blanch liquor as filling medium and by canning mantles rather than rings. This process gave a higher drained weight and better flavour retention of the squids. Hilsa eggs canned in tomato juice yielded a better product. Further canning trials are being carried out for standardization of the techniques.

RESEARCH CONTEMPLATED

1. Further studies on canning of oyster meat
2. Standardisation and storage of fish curry
3. Continuation of studies on light smoked froglegs
4. Thermal distribution studies in canned products
5. Studies on canning of fish roes and squids
6. Evaluation of bacterial saftey in canned products

SCIENTISTS ASSOCIATED

COCHIN: K. K. Balachandran, P. V. Prabhu, P. K. Vijayan, P. K. Surendran

VERAVAL: M. R. Raghunath, Anil Agarwal

4.4. PROTEINS, ENZYMES AND LIPIDS:

CHIEF FINDINGS

Lipase isolated from hepatopancreas of oil sardine had a molecular weight of 53700. *The enzyme showed no absolute substrate specificity, but glycerides of* C6 *and* C12 *acids were hydrolysed at a relatively faster rate. Almost* 75% *of the original activity of the enzyme was found to be retained even after immobilisation. Storage at* −5°C *after immobilization did not decrease the activity further, even after* 4 *months. Total volatile carbonyls from muscle of sardines and mackerels could be separated into* 15 *different compounds by thin layer chromatography. Polyunsaturated fatty acids increased during June-July period in lipids of skin and muscle of oil*

sardine. Muscle lipids were generally richer in polyunsaturated fatty ecids, compared to skin lipids. Fish oils in diet reduced the cholesterol level in albino rats considerably. Data collected so far indicated that fish proteins also had a cholesterol lowering effect. Common food fishes were found to be generally poor in their content of B. Vitamins, except Nicotinic acid. Mercury and other toxic rare metals were found to be well below the permissible maximum limits in fishes of Cochin coast. Of all the common food fishes, mackerel showed the highest rate of self digestion.

Research in Hand

Toxic amines in spoiling fish were isolated and identified. Free amines were found in very low amounts in fresh sardines and fresh water fishes. In advanced spoilage 10-13 amines could be detected. Attempts to separate putrescine, cadaverine and histamine are in progress.

Identification of the volatile carbonyls isolated from muscle of sardines and mackerels is also being attempted.

Invitro digestibility of muscle proteins as affected by heat treatment and the influence of the amino acid composition of the particular species of fish on this digestibility were studied in detail.

The heat coagulation of muscle proteins was studied as a function of pH of the medium and time and temperature of heating.

Studies on the seasonal changes in lipid composition of oil sardines were continued. Further characterization of lipase enzyme is in progress.

Survey of the food fishes landed along Cochin coast for ascertaining their contents of toxic elements was continued.

Research Contemplated

1. Effect of different time temperature combinations at varying pH on the coagulation of fish muscle proteins
2. Invitro pepsin digestibility of fish protein as affected by heat treatment
3. Effect of lipid oxidation on the solubility and nutritional quality of fish proteins
4. Characterization of fibrillar proteins of fish muscle
5. Distribution of lipases in fishes and shell fishes with a view to locating economic sources of the enzyme

6. Self digestion of muscle constituents in shell fishes
7. Composition and nutritional characteristics of fish solubles
8. Volatile flavourous principles of processed fishery products
9. Nutritional evaluation of red and white meat of scombroid fishes and also of muscle proteins of other common food fishes by feeding experiments
10. Survey of toxic components in fish muscle

SCIENTISTS ASSOCIATED

COCHIN: M. R. Nair, K. Devadasan, P. D. Antony, A. G. Radhakrishnan, P. G. Viswanathan Nair, M. K. Mukundan, Dr. Jose Stephen, K. Ammu

4.5 FOOD POISONING MICRO-ORGANISMS AND THEIR CONTROL

CHIEF FINDINGS

Comparative studies on the performance of four selective microbiological media for the isolation of Salmonella *serotypes revealed that Hektoen Enteric Agar (H. E. Agar) and XLD Agar gave a higher recovery of the organisms than B.G. Agar and Bismuth sulphite agar.*

At Bombay, a rare serotype of Salmonella (S.ohio) *was isolated from a sample of fresh ribbon fish. Two serotypes of* Salmonella (S. mueunchen *and* S. alachua) *were isolated from fresh fish for the first time in India.* Clostridium perfringens *was isolated for the first time in India from silver pomfrets, lesser sardines and eel.*

RESEARCH IN HAND

Studies on microflora of fresh and brackish water fishes were continued. Bacterial cultures isolated from fresh and iced pearl spot and milk fish contained *Pseudomonas, Acinetobacter, Moraxella* and *Micrococcus.* Quantitative studies on the microflora of pearl spot showed that during storage period of more than three weeks in ice, the bacterial load increased to 10^9/g from an initial value of 10^5/g on the fresh fish muscle. Qualitatively the final flora consisted mainly of *Pseudomonas spp.* (80%). The general bacteriology of clams and oysters was investigated. Quantitative changes during depuration of clams showed a 90% reduction in total count and more than 90% in the *E. coli* count.

Extensive studies were carried out to determine the 'hold-up' time. Diluents used for this study were distilled water (control), sea water,

normal saline and phosphate buffer. Eight samples of raw fish, seven samples of iced fish and six samples of frozen fish were analysed. Normal saline gave a better bacterial recovery in raw and iced fish, while in frozen fish samples, both normal saline and phosphate buffer were equally suitable. The 'hold-up' time was found to be 20-30 minutes.

At Bombay, investigations were carried out on the nature of the microflora on commercially important fishes which included silver pomfret and black pomfret. Some interesting variations in the proportion of gram-positive and gram negative bacteria were observed on the eight common species of fishes studied.

Studies on hygiene and sanitation in fish processing and quality of fish in the retail outlets in Bombay were undertaken. Six markets in Bombay, viz. Fort market, Crawford market, Wadala market, Dadar market, Andheri market and Thana market were selected for the purpose of collection of fresh fish samples. The markets were visited in rotation every week. During the year, a total of 173 samples, comprising 52 species were collected from the above markets and analysed. The fishes included marine, brackish water as well as fresh water species. The samples were analysed for physical, organoleptic, biochemical and bacteriological characteristics including presence of pathogens like coagulase positive *Staphylococci, Salmonella* and *Clostridium spp.* TVN and TBA values were the indices selected for chemical analysis. The results indicated definite difference in the quality of the fishes collected from different markets. Observations so far made indicated the sanitary conditions existing in Crawford and Fort markets to be sub-standard, those in Wadala and Thana markets to be satisfactory and those in Andheri and Dadar markets to be the best. Some of the *Salmonella* strains isolated from the fish samples collected from these markets were also serotyped. Thirtytwo samples of commercially frozen fishes comprising 14 species collected from the local processing factories were analysed for their bacterial quality. In general, all the samples had total bacterial count within permissible limits.

In Kakinada, different varieties of fresh water and marine fishes iced, frozen and dried as well as ready-to-eat fish products from local hotels were subjected to bacteriological analyses for the presence of human pathogens such as *Salmonella,* Coagulase positive *Staphylococci aureus* and *Vibrio parahaemolyticus.* None of the samples revealed the presence of these pathogens. Studies on fish and water samples from different water systems at different places exposed to industrial and agricultural pollution for presence of heavy metals (Hg, Rb, Tn, Cd etc) and pesticide residues were continued. At Veraval, a total of 72 samples comprising different species of marine and fresh water fishes and swab samples collected from local markets were examined for the incidence of *Salmonella* and *Vibrio parahaemolyticus.*

Salmonella was isolated from a sample of fresh water fish. *Vibrio parahaemolyticus* could not be isolated from any of the samples.

Under the studies on sanitary conditions of water supplies in fish processing plants, about 30 factories in and around Cochin were surveyed to study the method of storage and distribution and the sanitary quality of the water. The quality of water and the method of distribution were found to be satisfactory in most of the plants surveyed.

Investigations were undertaken to study the presence of *Salmonella* in various fishery products. Two hundred and ten samples comprising of frozen prawns, lobster tails, cuttlefishes, froglegs and clam meat were collected and tested for *Salmonella*. All the samples except two were free from *Salmonella*.

Studies relating to the assessment of quality of fish/shell fish landed at the Fisheries Harbour, Cochin, were continued. Ninetytwo samples comprising of fresh fish/shell fish and 24 samples of ice used for icing fish were examined for quality characteristics. Sixtyfive samples of canned marine products of different brands were analysed for heavy metals like Hg, Cu, Zn, Pb, Fe, etc. The levels of these metals were found to be well below the permitted limit except the level of copper in canned crab meat.

SCIENTISTS ASSOCIATED

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VERAVAL:	A. C. Joseph
BOMBAY:	T. S. Gopalakrishna Iyer, V. N. Nambiar, S. P. Damle, D. K. Garg
KAKINADA:	Sibsankar Gupta, D. Imam Khasim Saheb

4.6 PACKAGING OF FISH AND FISHERY PRODUCTS:

CHIEF FINDINGS

Synthetic strapping materials collected from different prawn freezing factories throughout the country and made of polypropylene, high density polythene and rayon were evaluated for their physical properties like tensile strength, as well as elongation in both dry and wet conditions, melting point etc. Changes occurring in these properties during frozen storage at −20°C *were followed up to* 6 *months. Tensile strength increased and elongation decreased in polypropylene during frozen storage, simultaneously becoming brittle. High density polythene behaved in an exactly reverse manner during storage. Rayon*

strap got wet and lost tensile strength in frozen storage and hence is unsuitable for use in frozen fish industry.

Samples of high molecular weight-high density polythene film of 40 gauge thickness obtained from different manufacturers were studied for their physical properties and utility as a packaging material in frozen prawn industry in comparison with conventional 100 gauge low density polythene film. Both were comparable in water vapour transmission rate, both at 38°C and −20°C, xylene and hexane extractives and flexibility at low temperatures. As regards tensile strength, the new film was even superior to the conventional one. In tearing strength alone it was inferior to the conventional one, which was of no significance in its use in frozen fish industry. The new film worked out to be cheaper than the other one.

Effect of coating corrugated fibre-board, duplex board and kraft paper with 2% chitosan in 1% acetic acid was studied. The treatment improved the bursting strength and water proofness of the corrugated fibre board. Notable improvements in all the physical properties of duplex board excepting moisture resisting capacity were achieved by the treatment. The chitosan coated board had better bursting strength, puncture resistance, tensile strength and tearing strength than its wax coated counterpart. The treatment also worked out to be cheaper than wax-coating. Grease resisting property and water proofness of kraft paper were enhanced by chitosan coating and butter packed in the treated paper remained in good condition in the refrigerator for one month without any oozing out of fat.

Research in Hand

Two films viz. 200 gauge high density polythene and 250 gauge polypropylene were experimented upon for their probable application as retortable pouches for packing fishery products. Different combinations of air and steam were tried for sterilization. While the former developed pin holes during processing, the latter gave encouraging results. In another series of experiments, mackerel fillets and sardine were packed in their own juice in pouches made of a laminate of aluminium foil with polythene inside and paper outside and polypropylene. Work is in progress to fabricate pouch carriers for holding the pouches during sterilization and to find out the most suitable indigenous film for the purpose.

Pouches of metallised polyester film with a polythene lamination inside proved to be good containers for clam pickles. In this respect, a laminate of MXXT cellophane-polythene worked out to be even superior.

Studies on salted and dried lizard fish packed in various synthetic films were continued. Samples stored at controlled temperatures remained in good condition even after 10 months. Storage life at room temperature varied from 3 to 9 months depending upon the films employed. Physical properties of the films employed in these experiments were also studied.

RESEARCH CONTEMPLATED

1. Improvements in functional properties of corrugated fibre-board master cartons by plastic and wax coating
2. Use of corrugated boxes made of plastic for frozen fish packaging
3. Further development of flexible packages for fish pickles
4. Development of retort pouches using indigenous materials
5. Effect of packaging materials on shelf life of frozen fishery products
6. Development of bulk packaging materials for dry fish products and use of chemical preservatives

SCIENTISTS ASSOCIATED

COCHIN: T. K. Govindan, P. A. Perigreen, T. K. Srinivasa Gopal, K. P. Antony

4.7 DIVERSIFIED PRODUCTS FROM FISH AND UTILISATION OF PROCESSING WASTES:

CHIEF FINDINGS

It was demonstrated that the technology developed as well as the pilot plant designed by the Institute for the production of chitosan from prawn waste is perfect, commercially viable and profitable.

Animal feeding experiments showed that shrimp extract prepared by alkali digestion had no untoward effects on weaning albino rats and that the PER (protein efficiency ratio) was more or less the same as that of casein.

The poultry feed formulated with prawn waste and fish meal was tested and birds fed with the experimental feed showed good growth and early sexual maturity, but lower rate of egg production compared to those fed with commercial feeds.

Chitosan coated duplex cartons were found to be better than waxed cartons in many of their characteristics. Chitosan coated kraft paper was found to be a good substitute for glassine paper.

The behavious of chitosan prepared from different sources did not differ considerably with respect to the metal binding property.

From the storage studies of fish fingers under frozen condition, it was observed that the quantity of lipid present in the fish meat as well as the batter applied on the fish fingers exercised significant influence on the storage life. Addition of prawn meat with minced fish meat at a level of 20% by weight has enhanced the flavour, taste and overall acceptability of fish fingers.

From the nutritional studies of the fish hydrolysate prepared from three different types of fishes, it was found that supplementation with limiting amino acids with the hydrolysates improved the PER and showed no untoward effect on the experimental rats fed with them.

A hand operated machine for producing isingless was fabricated with which small and medium size air bladders from eel fish could be processed.

Research in Hand

All the changes and improvements found necessary during the trial runs of the pilot plant designed at the Institute for the production of chitosan from prawn waste were incorporated and the plant was operated continuously for a period of three months in colloboration with M|s Oriental Chemical Industries, Cochin. The output from the plant was exported by the firm and the material was well accepted by the overseas buyers. A feasibility report on chitosan and shrimp extract has been prepared from the data collected from the pilot plant on the basis of the above trials.

Studies were continued on the properties of chitosan and its industrial applications. Chitin was isolated from crab, prawn, squid and squilla and deacetylated to chitosan. All the samples of chitosan prepared have been separately used for absorption studies of Fe^{+3}, Co^{+2}, Ni^{+2}, Hg^{+2} and Cu^{+2} from solutions. The behaviour of chitosan prepared from different sources did not differ markedly.

Chitosan was tried in paper chromatography by coating ordinary filter paper with its solution for separation of amino acids. Column chromatography was also tried by packing chitosan in the column and adsorption was tried with Co, Cu and Ni. Copper was adsorbed most and cobalt the least. Chitosan was also tried for improving the functional properties of packaging materials.

Nutritional studies on prawn shell proteins were continued. Proteins were extracted from fresh prawn shell by digestion with dilute alkali and assay diets prepared incorporating the test proteins, casein and a 1 : 1 mixture of test proteins and casein at 10% level. PER determinations were carried out using weaning albino rats. The effects of feeding were assessed by analysing the organs like liver, kidney, spleen and blood. No untoward effects were noticed during the feeding trial and PER of the groups fed with casein and a mixture of shrimp extract and casein were comparable. Feeding experiments with prawn shell powder prepared from fresh prawn shell waste are in progress.

Samples of poultry feeds formulated using prawn shell waste and fish meal were compared with commercial feeds by actual field trials in a commercial poultry farm after conducting experimental feeding trials at the Kerala Veterinary College and Research Institute, Mannuthy. Birds fed with the experimental feed showed good growth and early sexual maturity but lower rates of egg production compared to those fed with commercial feeds.

To study the utilisation of minced meat for the development of new flavoured fish fingers, two series of experiments were conducted. In the first one, fish fingers were prepared with fish meat along with different levels of prawn meat to get the optimum level of prawn flavour, texture and taste profile. In the second experiment, fish fingers were prepared from four combinations of minced fish meat from two different fish varieties differing in quality. Organoleptic evaluation of the stored fish fingers under frozen condition showed fish fingers prepared from minced meat of seer fish to be the best according to most of the evaluators.

Nutritional studies of fish hydrolysates prepared from three different varieties of fishes were carried out on albino rats.

Studies on physical and chemical properties of isinglass in relation to its property of clarification of wine were continued. Studies on separation of bitter fraction from fish hydrolysates for supplementation in human foods are in progress.

A recipe was standardised at Veraval for preparation of a local product Dhokra with fish powder and storage studies of the product are under progress.

Mussels collected from natural beds in the Calicut region were subjected to systematic analysis for the presence of heavy metal residues like Hg, Cd, Pb, and Fe. The processed mussel meat was also analysed to make a comparison to the quality of raw meat. The starvation technique of purification of mussel meat was carried out on live mussels collected from nearby centres. Variations in the bacterial loads and the quantity of nutrients

before and after starvation were assessed. Preliminary trials on the conversion of mussel shells which are at present thrown away as waste into slaked lime were carried out. The results so far obtained are very encouraging. Efforts are under way to prepare it on a commercial scale so as to work out the economics.

At Bombay, a method was developed to extract shell free meat from non-penaeid prawn for human consumption. The product so obtained could be stored in block frozen condition or dried and powdered. An yield of 37.5% in the wet condition and 20.58% in dry condition was obtained. Investigations carried out indicated that good quality sauce could be prepared from non-penaeid prawn using a fermentation technique.

RESEARCH CONTEMPLATED

1. Studies on fish powder incorporated products
2. Further studies on development of low cost products from prawn waste and utilization of squid fishery waste
3. Studies on properties and uses of chitosan
4. Studies on utilization of squilla
5. Preparation of feasibility reports on the production of by-products already developed in the Institute

SCIENTISTS ASSOCIATED

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CALICUT:	T. S. Unnikrishnan Nair, V. Muraleedharan, N. Kalaimani, K. George Joseph
VERAVAL:	M. R. Raghunath

4.8 CRAFT MATERIALS

CHIEF FINDINGS

Studies on the compatibility of different metallic fastenings showed that, among the several protective coatings tried on

them, aluminizing had maximum effectiveness followed by galvanizing. Cadmizing could not afford protection for even two months. Aluminizing to a thickness less than 20 microns was sufficient to provide protection for about 10 years. These results clearly showed that aluminized fastenings could successfully substitute the costlier brass fastenings in boat building.

The protective action provided by chromating and phosphating was only temporary and hence cannot be recommended as standard practice for long term applications.

As regards Arsenic - copper - chrome (ASCU) treated wood, none of the treated fastenings withstood the corrosive attack and hence cannot replace brass. If however, the ASCU treated wood is subsequently treated with fuel oil or creosote, corrosion attack could be reduced to a great extent.

Another important observation was that galvanic corrosion resulting from use of different metallic fastenings on the same structure was very severe in the case of ASCU treated timbers. Studies are underway to overcome this drawback.

A coating of epoxy resin containing finely divided silica on cast iron propellers could withstand the stress and strain experienced by them under working condition. Beneficial effects were observed when the shaft was coupled to galvanic anodes, which imparted supplementary protection through cathodic action. For small boats, cast iron propellers, with the protection system suggested could be used in place of more expensive copper based propellers.

As a result of both laboratory and field observations carried out on the utility of Fibre-glass Reinforced Plastics (FRP or GRP) for the construction of canoes of traditional shape and small fishing crafts, the following salient features could be highlighted.

(1) *F.R.P. crafts are light but strong*

(2) *Mass production of standardised designs through moulding system is possible*

(3) *They are free from biological degradation and marine corrosion in sea-water and hence long lasting and causing least maintenance problems*

(4) *More suitable for low energy fishing methods like gill netting, long lining, trolling and trap operations*

(5) *Can be operated manually with oars|paddles and sails with light out-board motors and with light inboard diesel engines*

(6) *Many FRP fabricators have now come up in private sector for undertaking construction programmes*

(7) *Careless handling of the FRP craft while beaching and launching is likely to cause abrasion at the bottom of the hull*

RESEARCH IN HAND

(i) *Wood polymer composites* (WPC)

The existing technology of production of WPC was extended to a new series of materials known as toxin incorporated wood polymer composites (TWPC) which could be expected to withstand biodeterioration much better than WPC, by virtue of biocide incorporation into wood. TWPC incorporated and polymerised balsa, haldu and mango woods were put to field tests in sea water and an assessment made of their resistance to marine borer and fouler attack. Their mechanical properties like bending strength, compression strength, cleavage strength etc. were also evaluated.

(ii) *Boat Building Materials*

(a) Ferrocement

Expanded metal reinforcement was tried in combination with sand and cement mortar in the construction of a ferrocement prototype canoe (56' OAL Thanguvallam) for further field trials. This material and method of construction adopted for smaller crafts were not costlier than the traditional wooden counterparts and maintained the same operational efficiency if not more.

(b) Treated timbers for boat building

Tetrameles nudiflora (Chini|Maina wood); *Bombax insigne* (Didu); *Albizzia stipulata* (Siris); *Canarium euphyllum* (White dhup); *Ailanthes excelsa* (Maharukh); *Bombax malabaricum* (Semul) and *Pterocybium tinctorum* (Papita) were located as prospective substitutes for the existing traditional Kottumaram logs. These timber species could be easily seasoned and suitably treated with chemical preservatives for enhanced service life.

RESEARCH CONTEMPLATED

1. Further studies to locate alternative building materials, method of construction and preservation techniques for fishing crafts

2. Development of binary or ternary alloy of high current output for cathodic protection of fishing boats and marine structures

3. Evaluation of bio-resistance and mechanical properties of TWPC containing arsenic copper chrome, creosote and tributyl tin oxide in graded amounts

4. Studies on polymer impregnated ferrocement composites

SCIENTISTS ASSOCIATED

COCHIN: R. Balasubramanyan, Dr. K. Ravindran, K. S. Namboodiri, N. Unnikrishnan Nair, A. G. Gopalakrishna Pillai, P. N. Joshi, B. Meenakumari

4.9 GEAR : MARINE

4.9.1 TRAWLS (A) EVOLUTION OF SUITABLE GEAR FOR INSHORE FISHING

CHIEF FINDINGS

With a view to effecting economy in the use of newer materials in the construction of trawls, comparative studies were undertaken with eight and twelve panel parachute trawls for capture of prawns and fish, without in any way affecting the catching efficiency of the gear. The nets were operated along with 17 m. conventional four seam trawl. The chief observations are given below:

1) *The catches/hr of prawn and fish with 17 m. twelve panel parachute trawl and 17 m. four seam conventional trawl were 10 kg and 11 kg and 4 kg and 22 kg respectively. Between nets, there was a saving of 10% material in the construction of twelve panel parachute trawl.*

2) *The catches/hr of prawn and fish with twelve panel and eight panel parachute trawls were 15 kg, 17 kg and 1 kg and 29 kg respectively. Between nets, there was a saving of 30% material in the construction of the eight panel trawl.*

The newly developed 32 m large mesh demersal trawl continued to give good catches, confirming the earlier findings. This net can therefore be recommended for better exploitation of the demersal fishery resources of Veraval inshore waters by medium size trawlers of 14-17 m. length. Ribbon fish and Lactarius formed the major catches.

RESEARCH IN HAND

With a view to evaluating the utility of Mexican type otter boards, comparative studies were undertaken at Kakinada along with the conven-

tional rectangular flat boards. Data so far obtained showed the rectangular boards to be more efficient.

Field trials were initiated with two 13.5 m. four seam nets operated along with a sled and a single trawl of double the size. The catch with the twin rig trawl was 17.25 kg|trawling hour compared to only 13.3 kg with the single trawl.

Field trials were carried out with the 11 m midwater trawl. Ribbon fishes continued to dominate the catches (27.7%) followed by anchovies (15.4%), chirocentrus (12.7%), seer (9.5%) and miscellaneous (34%).

Comparative fishing operations were continued with the 23 m high opening trawl and the 20 m bulged belly trawl. Data pertaining to strictly comparable hauls are given below:

No. of days of operation	35	
Net used	20 m. bulged belly trawl	23 m. high opening trawl
Otter board	Rectangular flat, 130 x 70 cm	
Trawling time	43.45 hrs	
Catch|hr.	24.81 kg.	46.83 kg.

These data proved that the high opening trawl constantly gave better results with 88.75% more catch than the bulged belly trawl.

At Goa, trial operations were carried out with the 15 m bulged belly trawl with tapering jibs. Data collected indicated that the net with tapering jibs landed better catch, especially of prawns. Further studies are in progress.

Studies on the effect of large meshes in the bosom area of a 10.3 m unequal panel midwater trawl indicated the superiority of the large mesh net in landing better catches, especially of quality fishes. The studies are being continued.

Research Contemplated

1. Studies on a separator trawl
2. Further studies on all the different aspects under investigation in the current year

SCIENTISTS ASSOCIATED

COCHIN: K. N. Kartha, T. P. George, P. George Mathai, A. C. Kuttappan

VERAVAL: K. K. Kunjipalu, N. Subramonia Pillai, M. R. Boopendranath

KAKINADA: A. V. V. Satyanarayana, G. Narayanappa, S. V. S. Ramarao, R. Mangayya Naidu, J. Sitaramarao

GOA: H. N. Mhalathkar, M. Syed Abbas, T. Joseph Mathai, V. Vijayan

TRAWLS (B) DEVELOPMENT OF GEAR FOR OFFSHORE FISHING

RESEARCH IN HAND

For the exploitation of squid fishery resources in Cochin area, squid jigging equipments and 100 nos. of Japanese type squid jigs were fabricated for operation from the newly acquired 17.5 m steel vessel.

After undertaking a survey of the designs available, design details of Kalava lines were finalised.

In order to standardise trawling operations from the 17.5 m. steel vessel, "Matsyakumari," fishing operations were conducted with 40 m. bulged belly trawl in combination with oval otter boards weighing 150 kgs. each. The total catch recorded was 1200 kg for 4 hrs and 15 mins. trawling and the catch/hr. worked out to 264 kg. The catch comprised mainly of Carangids, Sciaenids, Synagris and Cat fish.

RESEARCH CONTEMPLATED

All the above work will be continued.

SCIENTISTS ASSOCIATED

COCHIN: K. A. Sadanandan, P. Appukutta Panicker, K. N. Kartha, N. A. George, T. M. Sivan, P. George Mathai, T. P. George, K. V. Mohan Rajan, A. C. Kuttappan

4.9.2 IMPROVEMENTS TO THE TRADITIONAL FISHING CRAFT, GEAR AND METHODS

The above integrated project initiated during the year 1980 for the benefit of the small scale fishing sector continued to maintain steady progress during the year under report at the respective Centres at Cochin (Kerala), Kakinada (Andhra Pradesh), Veraval (Gujarat) and Goa.

Cochin Centre:

Craft Development

At the fishing village of Chellanam, a number of local wooden fishing crafts were identified and preservative treatments given following CIFT formulations (*Arsenical creosote*) and technique of application (brushing). The preservative treatment was demonstrated to the local fishermen who evinced keen interest in the programme. Application of modern wood preservatives enhanced the service life of these fishing crafts which otherwise underwent biological degradation both in the sea water and while hauled up on the beach. The modern preservatives protect the boats longer than the conventional ones.

In the context of scarcity of the conventional timber species as experienced by the local fishermen, alternative timbers as well as newer construction materials were suggested as a result of laboratory studies and findings. Treated mango, haldu and chini woods are suitable for these traditional crafts in lieu of the conventional and costlier aini wood.

Frictional resistance on the hull below water-line was considerably reduced by proper shaping and fairing of the hull and by avoiding external appendages. These changes have resulted in better sailing properties of the canoes.

MOTORIZATION

The following systems of powering the local crafts for mechanical propulsion were demonstrated and relative merits and demerits observed: (a) Light diesel inboard-outboard engine and drive (b) Light diesel inboard engine and stern gear arrangement and (c) Light outboard motors.

Though light air cooled diesel engines of 8 to 10 H.P. are best suited for Thanguvallams for economical operations, fishermen preferred the imported outboard motors of 8 to 12 H.P. running on kerosene with petrol start. Inboard engine installation requires further modifications in the existing hull. A combination of sail-cum-engine power is expected to be more economical. Further studies are in progress on the cost benefit aspects.

GEAR DEVELOPMENT

Materials: Nylon knotless webbings were introduced for thanguvala and purse seine nets. The resultant benefits were actually demonstrated to the local fishermen. Maintenance and mending techniques were passed on to the fisherfolk.

Gear Design: The new thanguvala made of nylon knotless webbing was operated from country crafts. Catches were encouraging and proved to be

economical when operated from motorized crafts. More operations could be made in a day and wider as well as deeper grounds covered.

A mini-purse seine was designed and rigged for operation from country crafts. Trial operations showed encouraging results and scope for further improvement in the gear. This new gear and fishing method are likely to catch up soon because of their high productivity.

As a result of comprehensive trials made in the field, modern lobster traps designed and developed by CIFT have been accepted by the fishermen of the Kanyakumari coast of Tamil Nadu.

The trap fabricated out of mild steel rod and welded wire mesh and fully coated with plastic as a protection against marine corrosion lasted longer and was more efficient in catching the Indian rock lobsters compared to the traditional traps.

Under a scheme sponsored by Marine Products Export Development Authority, 200 lobster traps based on CIFT design were made and distributed to interested fishermen at 50% of the cost price. This system of popularisation and transfer of technology are being extended to a coastal village of Kerala (Vizhinjam) shortly.

Kakinada Centre:

A local traditional fishing gear (Bag net operated with stakes) was studied in detail and improvements suggested for increasing its catching efficiency. A modified design of the gear was made and trial operations conducted for comparative studies. Catches in the new gear were encouraging with larger quantities of prawns.

A new design of gill net with varying meshes was fabricated and put to field operations associating local fishermen. For efficient operation, a suitable traditional "nava" was located and the studies are being continued.

Veraval Centre:

A suitable design of gill net was developed and prototypes fabricated. The efficiency of the new gear for the capture of fishes like Hilsa, pomfrets, sharks and lobsters was studied in the field.

Studies on coloured gill nets showed interesting findings for future course of action and for their extensive adoption among the local fishermen. As observed earlier, yellow coloured nets with 60 mm. bar mesh, fabricated from nylon 210 D|2|3 were more effective for Hilsa and white nets of 60 mm. bar mesh from nylon 210 D|2|3, for pomfret.

Preliminary studies on "Goonja" stake net of the Kutch region showed scope for improvement for better prawn landings.

Goa Centre:

The encircling gill net based on a new design made by CIFT for the capture of mackerels using the local country crafts was put to field trials at Candolim village. More units of nets are under fabrication for extensive operations along with the local nets for comparative studies.

RESEARCH CONTEMPLATED

The integrated activities will be intensified further at all the Centres and most successful results will be transferred to the respective State Fisheries Departments for follow-up action.

SCIENTISTS ASSOCIATED

COCHIN:	R. Balasubramanyan, Dr. K. Ravindran, S. Ayyappan Pillai, S. Gopalan Nayar, P. Appukutta Panicker, N. Unnikrishnan Nair, A. G. Gopalakrishna Pillai, K. Radhalekshmi, N. A. George, T. M. Sivan, P. George Mathai, T. P. George, A. C. Kuttappan, K. V. Mohan Rajan, B. Meenakumari
KAKINADA:	G. Narayanappa, A. V. V. Satyanarayana, J. Sitaramarao, R. Mangayya Naidu, S. V. S. Kama Rao
VERAVAL:	N. Subramonia Pillai, K. K. Kunjipalu, K. Gopalakrishna, M. R. Boopendranath
GOA:	T. Joseph Mathai, V. Vijayan, M. Syed Abbas

4.9.3 ROUND HAUL NETS

CHIEF FINDINGS

Work relating to the standardisation of the design of a 265 *m. purse seine for operation from small class of vessels of size* 9.75 *m. in the sea off Goa was completed. Training was imparted in the fabrication, operation and handling of the gear. A survey was made of the existing gear in Mangalore.*

Purse seine designs are now available for 32 *ft.,* 36 *ft. and* 45 *ft. class of vessels.*

RESEARCH CONTEMPLATED

Operation and popularisation of the 265 m. purse seine net

SCIENTISTS ASSOCIATED

COCHIN: P. Appukutta Panicker, T. M. Sivan, N. A. George

GOA: V. Vijayan, M. Syed Abbas

4.9.4. 'DOL' NETS

RESEARCH IN HAND

Experiments were continued with 'dol' nets having 40 mm. cod end mesh size. The experimental net provided escapement of more juveniles (15% to 30%) of Bombay duck than the traditional nets with smaller cod end mesh size of less than 20 mm. There was also a marked improvement in the size of the catch landed, though the total catch was less in the experimental net. Bulk of the catch of the traditional nets consisted of juveniles below 120 mm. in total length.

Five more experimental dol nets were designed and fabricated for confirmatory studies from Bombay and Saurashtra coasts.

RESEARCH CONTEMPLATED

All the above aspects will be studied further.

SCIENTISTS ASSOCIATED

VERAVAL: K. K. Kunjipalu, M. R. Boopendranath

4.9.5 GEAR MATERIALS

With a view to finding out a suitable substitute for nylon multifilaments to reduce cost without affecting the efficiency and|or to enhance the output, mackerel gill nets of 0.4 mm. dia. nylon monofilament were experimented along with the conventional multifilament nets in Nayarambalam village near Cochin. It was observed that the fishing power of the monofilament gill nets was more than double that of the multifilament nets.

RESEARCH IN HAND

Polypropylene multifilament yarns and twines, produced for the first time in the country for fishing nets, were analysed and suggestions given on yarn denier, number of filaments|yarn, tenacity, twist etc. and its potential as a fishing gear material.

Studies were carried out on the possibility of using HDPE fibrillated tape twisted twines for certain marine gill nets. In this connection, a survey was made of the seer gill nets in operation in the area. Webbings were made with 1000 x 2 x 3 HDPE fibrillated tape twines and nylon No. 8 with a mesh size of 14.5 cm and rigged with polyethylene monofilament rope of 6 mm dia. with 0.66 hanging co-efficiency. Airoplast floats of specification 60 x 50 mm. were tied at intervals of 5.4 and 9.5 m. to the nylon and tape net respectively and jerry cans of 5 lit. capacity, used as master floats. Stones were tied at intervals depending on the fishing conditions for keeping the nets vertical. Comparative trials with the gear are to be carried out.

Polyethylene monofilament yarns of 0.25 mm. dia. were analysed to assess their suitability in fabrication of small meshed gill nets, which are at present fabricated with 210|1|2 nylon twines. Webbings of polyethylene monofilament yarn of 0.25 mm. dia. having 35 mm. mesh size were procured and got ready for operation.

Netting yarns belonging to different chemical classes like amides, esters, ethylene were subjected to U. V. exposure tests. Standardisation of U. V. exposure parameters in the laboratory was carried out. Polypropylene monofilament of 0.4 mm. dia. was exposed to a U. V. source of 60 watts. The strength reductions after regular intervals of time were studied. U.V. exposure tests with polypropylene twines were also initiated. Further work on these lines, including field tests for deterioration of strength due to exposure to sea water is to be carried out.

RESEARCH CONTEMPLATED

1. Analysis of the properties of newer gear materials and their scope for use in fabrication of fishing gear
2. Field trials with nets fabricated from cheaper synthetic materials
3. Field trials with fibrillated tape seer gill nets
4. Studies on the effect of sea water and U.V. rays on a few selected synthetic materials

SCIENTISTS ASSOCIATED

COCHIN: S. Gopalan Nayar, K. Radhalekshmy, Dr. K. Ravindran, B. Meenakumari

4.10 GEAR : INLAND

CHIEF FINDINGS

Young ones of major carps and cat fishes of economical importance of size up to 20 cm. in length were found to be the major constituents of the landings by small meshed shore seine nets.

As a result of the recommendations made by the Institute, the State Govt. has imposed mesh regulation|seasonal restrictions on the operation of these nets.

Based on the data obtained for different species caught, percentage frequency curves for five species of fishes were drawn and the proportionality co-efficient for these fishes worked out.

Research in Hand

As in the previous year, experimental fishing operations were carried out with frame nets of 90 and 105 mm. bar made of nylon 210|1|3, 210|2|2 and 210|2|3. Among all the nets tested, those made of 210|2|3 twines with mesh bar 105 mm yielded better results. The work is to be continued.

Comparative fishing operations with 13 m. bulged belly trawl and 12 m. high opening trawl were continued. The catch per hour was more in the high opening trawl, both in the morning and in the evening. Both the nets were found to be more effective in the morning hours. The species caught included *R. cotio* which dominated the catch, followed by *Sciaenids, R. chrysea, Mystus sp., W. attu* and juveniles of *S. silondia.*

Studies were continued with set long lines using round bent and kirby bent hooks of size 11-20 and prawns, earthworm, green algae, tadpoles and miscellaneous fish as bait. As in the previous years, hook size 19 & 20 and baits prawn and earthworm were found most efficient. Experiments conducted with drop lines also showed the efficiency of hooks of size 20 and prawn as bait.

Investigations were undertaken to find out the intensity of occurrence of fish in the Hirakud Reservoir during different quarters of the day using small meshed gill net. It was observed that the fishes were caught in large number during 00.00 - 06.00 hours.

Research Contemplated

1. Development of suitable fishing technique for major carps, catfishes and undesirable fishes
2. Biological and limnological studies as ancillary to fishing gear investigations
3. Multilocational testing of prototype of shore seine in other reservoirs

Scientists Associated

BURLA: V. C. George, A. A. Khan, M. D. Varghese, R. S. Manoharadoss, Percy Dawson, S. K. Bhattacharyya

4.11 MARINE ENGINEERING

CHIEF FINDINGS

Both the indigenously developed, diesel powered inboard outboard drive units and diesel outboard drive units exerted their impact on the mechanisation of fishing crafts. The imported outboard motor with engine starting with petrol and running on kerosene also found acceptance in the field.

Design of torque measuring device to find out the torque transmitted from the engine gear box unit to the propeller through the intermediate shaft was initiated.

RESEARCH IN HAND

Further studies on the mechanisation of traditional fishing crafts.

Comparative studies on the performance of different types of drives used for mechanising the traditional fishing craft have been carried out.

Fish pump

The fish pump was operated and the pumping of the fishes was watched. It was found that live fish were readily sucked up by the pump. The suction force was such that at times the fish concentration at the suction end even choked the pump.

In order to improve fishing operation, designing of deck equipments like net hauler, line hauler and squid jigging contrivances was taken up.

RESEARCH CONTEMPLATED

Studies to develop ways and means of reducing the cost of operation of mechanised fishing vessels

SCIENTISTS ASSOCIATED

COCHIN: S. Ayyappan Pillai, K. Sreedharan Naboodiri, P. N. Joshi

4.12 PROCESSING ENGINEERING:

CHIEF FINDINGS

Modification of smoke distribution in the Electro-thermal smoke kiln was carried out enabling uniform distribution of smoke inside the chamber. Studies on the heat and mass transfer of multi-deck tunnel drier were undertaken to find out the

drying rate equations and other design parameters. Performance of solar dryer installed at Veraval Research Centre was studied and the insufficient air velocity inside the dryer resulting in longer drying time has been rectified by replacing the defective air blower.

Fabrication of the Deep Freezer to maintain -30° C was completed and installation of the same was started.

A special design of a reaction vessel incorporating electrical heating instead of steam heating was prepared for the production of commercial chitosan.

Research in Hand

Studies on the solar dryer were continued. It is proposed to bring down the cost of the unit by suitable incorporation of alternative materials for the construction of the dryer which are cheaper than the conventional materials. It is also proposed to bring down its operating cost by using cheaper alternative sources of energy in place of electricity.

The smoke kiln is being suitably modified to make it more efficient based on experiments conducted with the kiln.

A continuous dryer called 'through circulation multistage conveyor dryer' is being designed for drying fish. A technical design report of the equipment is also being prepared.

To increase the yield of cooked prawn, a mechanical device which can cook the prawn and subsequently cool it under pressure is being designed.

The pilot plant for the production of glucosamine hydrochloride from prawn shell waste was designed and the fabrication of the pilot plant is being taken up.

To produce chitosan on a commercial scale, suitable design of the individual equipments of the plant was started. The commercial plant is designed applying the performance data of pilot plant which was already put into operation.

The installation of the deep freezer was started and the individual components are now being assembled.

Research Contemplated

Studies to develop methods and equipments for the removal of mercury from industrial effluents using chitosan and design and development of prawn washing machine.

SCIENTISTS ASSOCIATED

COCHIN: S. Ayyappan Pillai, P. K. Chakraborty, P. N. Joshi, S. M. S. Abuthahir Ali

4.13 ELECTRONICS AND INSTRUMENTATION

CHIEF FINDINGS

Design, development and field trials of water current meter was completed in all respects. This instrument was developed for insitu measurement of the amplitude and direction of water current in the sea and estuarine waters. The rotor sensor developed was subjected to detailed performance studies in order to estimate its linearity and accuracy at the towing tank of IIT Madras. The test revealed very good linearity and consistency throughout the range of operation. Field trials were also carried out successfully.

Following are the general features of the instrument:

Capacity : 0 *to* 300 *cum|sec. with an accuracy of* ± 1 *cum|sec.*

Power requirement : 35 mA at 9 VDC

Cost : Rs. 15,000|-

RESEARCH IN HAND

Buoy Telemetry System

This instrument system is being developed for automatic acquisition of marine environmental data using moored buoys. The performance of CMOS operated multiplexer system with IC 4017 was developed and its working was found to be satisfactory.

Ocean Tele Lab

This instrument performs on-the-spot measurement of current, current direction, temperature, salinity and depth using a single sensing probe and a single console unit for fishery hydrographic investigations. The complete system was constructed in the final form and laboratory trials were conducted with satisfactory results.

Crane Load Monitor and Alarm

A suitable reluctance type sensor was developed for use inside the transducer for converting load into electrical signals. The linearity of the

reluctance type transducer was studied in relation to displacement. The effects of capacitance and ohmic resistance were noted and suitable compensation method worked out.

Low-cost Fish Finder

An acoustic transmitter circuit was developed with the existing acoustic transducer and its performance studied.

RESEARCH CONTEMPLATED

Development of an instrument for the instantaneous and remote measurement of water density at different depths of the sea.

SCIENTISTS ASSOCIATED

COCHIN: T. K. Sivadas, K. Ramakrishnan, K. Vijayabharathi

5. EXTENSION AND INFORMATION

Replies to technical queries

From January 1981 to March 1982, 625 technical queries were replied to. Comments were offered on the use of sodium metabisulphite in shell fish processing, on freezing different varieties of fish and shell fish and cryogenic freezing of fish. Information was also given on the methods of processing of canned fish and shell fish, on scheme for setting up a prawn canning plant, effect of using ascorbic acid in canning prawns as a protection against blackening and on the qualities of lacquer meant for coating fish cans.

Methods were furnished on preparation of prawn, clam and mussel pickle and comments offered on containers suitable for these products. Method for extraction of shark fin rays was furnished as also list of equipments required for production of fish wafers on a commercial scale. Informations on the yield of isinglass from fish maws and on raw material other than cat fish for preparation of isinglass were supplied.

Process details for preparation of a number of speciality and by-products from fish were furnished. These include methods of preparation of fish feed and chitosan, uses of the latter, production of fish meal on a large scale, utilisation of frog and prawn shell wastes, processing frozen shark fillets and method of preparing shark skin leather.

Information was furnished on the use of chitosan for coating corrugated fibre board boxes and expanded polyethylene as insulation materials, disjoinable insulated container for transportation of fish, details of setting up a laboratory for testing fish meal, equipments for setting up a quality control laboratory and details of fish markets and fish stalls.

On the fishing gear side, advice was given on the gear suitable for riverine fishing, on utility of extruded perforated plastic sheets in fabrication of lobster|kalava traps, on suitable gear for sampling fish population of Idukki reservoir and comments on the development of bottom and mid-water trawling for feed fish in Palk Bay and Gulf of Mannar.

Technical advice was furnished on the advantages and disadvantages of knotless nets, on the probability of nylon nets replacing cotton nets, on the comparative efficiency of nylon knotted and knotless nets as drag nets and efficiency of high density polyethylene knotted and knotless webbings over nylon for construction of fish cage. In addition, information was given on machinery needed for setting up nylon net making factory, requirements of floats for fishing purposes and factors determining efficiency of floats.

On fishing crafts, details were provided on sheathing wooden boat hulls with fibreglass reinforced plastic and use of cashewnut shell liquid for marine application.

Information was given on the weed harvester for clearing inland water areas, on the inboard|outboard drive, on the suitability of Greaves Lombardini outboard engine with inboard drive for fitting in 'Valloms,' on the necessity for conducting endurance tests for an engine, advantages and disadvantages of freon and ammonia as refrigerants and specifications of fish finders for small and medium sized vessels.

Testing of materials and products

A total of 597 products and materials were analysed during January 1981 to March 1982 as detailed below:-

Particulars	*No. of samples*
Canned fish products	55
Frozen fish products	356
By-product	19
Speciality products	5
Fresh deep sea lobster	4
Packaging materials	4
Chemicals and deodorants	2
Water	73
Ice	50
Fishing gear	1
Fishing gear materials	18
Sheathing materials	5
Marine paints	3
Marine engines	2

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Fishing gear materials	18
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Marine paints	3
Marine engines	2

Publications

The following publications were brought out during the period January 1981 to March 1982.

1. Survey Report of Kandakkadavu, a fishing village of Kerala State : Special Bulletin 10
2. Cheaper wooden fishing boats : Technical pamphlet
3. Improved container for transportation of fresh fish: Technical pamphlet
4. Motorization of indigenous fishing crafts : Technical pamphlet (Malayalam)
5. Handling of prawns - Precautions to be taken : Technical pamphlet (Malayalam)
6. Improved method of fish curing : Technical pamphlet (Tamil)
7. Fish Technology Newsletter, Vol. II, Nos. 6 to 12, Vol. III, No. 1
8. Matsya Technology Samachar (Hindi) Vol. I, Nos. 9 to 12

Supply of designs and publications

Seventy seven designs of gear, craft, fishing accessories and fish dryers as detailed below, were issued during the period January 1981 to March 1982.

Particulars	*No. of designs*
Fishing gear	21
Pressure tank for testing floats	1
Fishing accessories	3 sets
Pearl-culture nuclei manufacturing machine	1
Fishing craft	22 sets
Fish dryers	29

Seven copies of the Special Bulletin I, 'An Account of the Inland Fishing Gear and Methods of India' and 309 copies of the book 'Quality Control in Fish Processing' were also supplied to interested parties on request.

Exhibitions and Film Shows

Forty-two film shows were held during the period for the benefit of students of local educational institutions, visiting students, officials from State Government Departments etc. The films screened were those on fish

by-catch, the fishermen of Kerala, the world beneath the sea, electronic fish finder, induced breeding, fish culture and control of spoilage in prawns.

The Institute also took part in four exhibitions during the period. Exhibits depicting salient achievements both in fish processing and fishing craft and gear were sent for display at a fisheries exhibition held in Sambalpur, Orissa in March 1981. Exhibits were also sent for the exhibition at Kavarathi (Lakshadweep Islands) in October 1981 held in connection with the World Food Day Celebrations. The Institute also participated in the exhibition at the FACT Township, Eastern U.P. School, at Eloor, Alwaye, in October-November 1981. Exhibits were also forwarded to ICAR in connection with proposed Embassy Science Fair to be held in London.

Radio Talks

Radio talks were given by Shri K. C. Purushothaman, Editor-cum-Information Officer, on "CIFT's Contribution to the Fishing Industry and Extension Activities of CIFT" under the Farm and Home Programme of All India Radio, Trichur.

Shri M. R. Nair, Scientist S-3 also gave a talk on 'Contributions of CIFT in the Development of Fisheries Industry.'

Training

Particulars of the training programmes organised by the extension division in collaboration with other Scientific divisions of the Institute and State Governments from January 1981 to March 1982 are given below:-

Subject|area	*Place*	*Duration*	*No. of trainees*
1. Fish processing	Tuticorin	6 days	39
2. Methods of analysis in quality control of seafoods.	Cochin	2 months	14
	"	7 weeks	1
	"	13 days	3
	"	16 days	2
	"	5 weeks	1
	"	10 days	1
3. Production of fish wafers	Cochin	1 day	1

Subject area	*Place*	*Duration*	*No. of trainees*
4. Gas chromatography	Cochin	1 week	1
5. Preparation of diversified fish products.	Cochin	2 weeks	1
	"	3 days	1
	"	9 days	1
	"	11 days	3
6. Media preparation and sterilisation of glass wares	Cochin	2 weeks	1
7. Preparation of fish pickle	Cochin	4 days	1
8. Fisheries in general	Cochin	10 days	1
	Bombay	4 months	1
9. Fish curing	Calicut		1
10. US FDA methodology for fish processing (with MPEDA collaboration)	Cochin	3 weeks	40
11. Handling practices of shrimps and fishes at pre-processing and processing plants (with MPEDA collaboration)	Cochin	4 weeks	35
12. Setting up small scale industry in processing clam meat	Vaikom	2 days	6
13. Trawl fishing in reservoir	Burla (Orissa)	9 days	3
	"	10 days	7

PERSONS ASSOCIATED

COCHIN: Dr. P. N. Kaul, M. K. Kandoran, P. N. R. Kaimal, Mary Thomas, S. Balasubramaniam, G. R. Desai, K. C. Purushothaman

Information-seeking Behaviour in Fisheries Technology:

During the period January 1980 to December 1980, 639 technical queries were received. The largest number (30.52%) was received during July to September 1980. The number of queries received increased from 6.57% in January to 12.21% in September, with slight declines in February, May and August. The curve tapered off to 5.95% in November. The queries from India were 95.93% and 4.07% were from foreign countries. From the coastal States of India, 84.17% of the Indian queries were received, some of the top ones being Kerala (33.49%), Maharashtra (10.49%), Tamil Nadu (9.39%), Delhi and Punjab (9.08%), and Andhra Pradesh (8.14%). A part of the subject-matter-wise distribution is as under: Analysis of fishery products (13.73%), publications (16.36%), speciality products (9.41%), training (9.41%), fishing crafts (8.18%), by-products (9.10%); (for this analysis, N = 648, as some parties asked for information under more than one subject). Complete replies were sent for 94.68% and partial replies for 5.32% of the queries. The average number of days taken in replying was 27.29, with S.D. 16.16.

SCIENTISTS ASSOCIATED

COCHIN: Dr. P. N. Kaul, Mary Thomas

ADOPTION OF INNOVATIONS DEVELOPED AT CIFT

RESEARCH IN HAND

The collection of informations about parties who have received CIFT designs of boats, gear and fishing accessories during the period 1963-1979 was completed. The list of gear manufacturers and boat builders in the country was also updated. The questionnaire for collection of information on adoption of CIFT designs of fishing boats was prepared and finalized for pre-testing. One for fishing gear, on similar lines, was also drafted.

With regard to the study on adoption of improved practices of fish curing, collection of data, tabulation and analysis were completed. The findings have been brought out in the form of a research paper 'Adoption of improved fish curing practices,' which is under publication.

A study on the technological gap among traditional and mechanised fishing boat owners was initiated during the period under report. Five technical practices applicable to traditional fishing boat owners and eleven practices for mechanised fishing boat operators were identified and selected tentatively for the study. Structured interview schedules have been developed separately for traditional and mechanised fishing boat owners. This study is being conducted in selected fishing villages of Kerala and Karnataka.

Research Contemplated

Further studies on extent of adoption of CIFT designs of fishing craft and gear and the technological gap among the traditional and mechanised fishing boat owners.

Scientists Associated

COCHIN: Dr. P. N. Kaul, A. K. Kesavan Nair, M. K. Kandoran, S. Balasubramaniam, G. R. Desai

6. STATISTICS

CHIEF FINDINGS

The idle capacity of fish processing plants (freezing) in India for 1978 *and* 1979 *based on* 250 *normal working days in a year and double shift per day was estimated to be* 76.6% *and* 73% *respectively. The respective figures for plants in the east coast were* 75.9% *and* 72.5% *and those for plants in the west coast* 76.9% *and* 73.1%.

Analysis of the data collected on the economics of operation of fishing vessels from Kerala state showed that the number of fishing trips made by a boat during a year is a determining factor responsible for the profit or loss of a fishing boat. As a part of the survey on sources of supply of raw materials to the processing factories, it was observed that the quantity of raw material for freezing, received by the processing factories located at Veraval during the year 1981 *was about* 7500 *tonnes.*

Research in Hand

Data on the installed capacity, production figures, factors leading to under-utilisation of plants, number of personnel employed, sources of getting raw material and ice and cold storage facilities in the plants were collected from 93 freezing plants, spread all over India as per the stratified sampling plan, for the years 1978 and 1979. Based on the data collected, estimates of idle capacity were worked out for all the maritime states in the east and west coasts and for the whole of India. These estimates were worked out by taking 200 and 250 normal working days in a year and single, double and triple shifts per day. In the west coast, the idle capacity of the fish processing plants was estimated to be 76.9% in 1978 and 73.1% in 1979 and in the east coast the corresponding figures were 75.9% and 72.5%, based on double shift and 250 working days in a year. The idle capacity of the fish processing plants estimated for the whole of India was 76.6%

in 1978 and 73.0% in 1979. The % error of estimates of idle capacity were 4.8 and 5.3 respectively for 1978 and 1979.

The major factors responsible for the under-utilisation of plants in India were (1) non-availability of raw material (2) high cost of production (3) labour problems (4) delay in getting the purchase order (5) cut throat competitions among processors in procuring the raw material (6) investment in holding the material upto shipment and (7) unsteady foreign market.

Analysis of the data collected on the economics of operation of fishing vessels from Kerala State showed that the number of fishing trips made by a boat in a year was a determining factor responsible for the profit or loss of a fishing boat. From the preliminary analysis of the data it was observed that for 32 ft. boats, when the number of fishing days in a year was less than 75, they were running at a loss and as the number of fishing trips increased from 75 to 100, the percentage loss gradually decreased and at about 100 fishing days per year, there was neither profit nor loss.

The estimated total quantity of the material for freezing received by the processing factories at Veraval for the year 1981 was 7543 tonnes. Of this, 4870 tonnes (comprising 65% of the total material) were shrimp and the rest other materials like lobsters, cuttle fish, pomfrets, etc. Of the total quantity of shrimps received, 1491 tonnes (31%) were procured from Veraval fishing centre itself and the rest from other supplying centres. Out of the 2673 tonnes of other type raw material, 2041 tonnes, (76%) were from Veraval itself.

In addition to these, the section has rendered help in the design, analysis and interpretation of the data collected in connection with the various research projects undertaken by the Institute.

Research Contemplated

All the above studies will be continued in the year 1982

Scientists and others Associated

COCHIN:	K. Krishna Rao, H. Krishna Iyer, P. Srinivasa Rao, A. K. Kesavan Nair, G. R. Unnithan, R. G. Nair, P. T. Lakshmanan
VERAVAL:	Anil Agarwal
KAKINADA:	R. Chakraborthy
BOMBAY:	S. P. Damle

7. PUBLICATIONS

1. *Ali, S. M. S. Abuthahir, Madhavan, P. & Thankappan, T. K.* - Technology of production of chitosan from crustacean waste - *Proc.* Seminar on Polymeric Materials and Their Engineering Applications, Engineering College, Trivandrum, 28 & 29 Dec. 1981.

2. *Balachandran, K. K.* - Fish and shell fish pickles - *Proc.* Summer Insti tute on Non-Traditional Diversified Fish Products and By-Products, Cochin, 27 April - 26 May, 1981.

3. *Balachandran, K. K.* - Canning techniques for clam and mussel meat - *Proc.* Summer Institute on Non-Traditional Diversified Fish Products and By-Products, Cochin, 27 April - 26 May, 1981.

4. *Balachandran, K. K., Vijayan, P. K. & Jose Joseph* - Improving the acceptability of canned mackerel tuna (*Euthynnus affinis*) - *Fish. Technol.* 19(1) : 59, 1982.

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19. *George, V. C., Percy Dawson, Khan, A. A. & Varghese, M. D.* - Experimental trawling in Hirakud Reservoir - *Fish. Technol.* 19(1) : 15, 1982.

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21. *Gopakumar, K.* - Production techniques of fish hydrolysates - *Proc.* Summer Institute on Non-Traditional Diversified Fish Products and By-Products, Cochin, 27 April - 26 May, 1981.

22. *Gopakumar, K.* - Fish protein concentrate - Production, problems and prospects - *Proc.* Summer Institute on Non-Traditional Diversified Fish Products and By-Products, Cochin, 27 April - 26 May, 1981.

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58. *Nair, K. G. Ramachandran* - Role of fishery waste in animal feeds - *Proc.* Summer Institute on Non-Traditional Diversified Fish Products and By-Products, Cochin, 27 April - 26 May, 1981.

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60. *Nair, K. G. Ramachandran & Gopakumar, K.* - Influence of sex, spawning, starvation and water temperature on fatty acid composition in *Tilapia mossambica* - *Fish. Technol.* 18(2) : 123, 1981.

61. *Nair, K. G. Ramachandran & Gopakumar, K.* - Effect of dietary fat on fat deposition and fatty acid composition of Tilapia - *J. Fd. Sci. Technol.* 18(3) : 108, 1981.

62. *Nair, M. R.* - Status of diversified products in fish processing industry - *Proc.* Summer Institute on Non-Traditional Diversified Fish Products and By-Products, Cochin, 27 April - 26 May, 1981.

63. *Nair, M. R. & Govindan, T. K.* - Scope for diversification in marine products - Souvenir in Commemoration of Fourth Indian Seafood Trade Fair, Madras : 5, 1981.

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65. *Nair, P. Ravindranathan, Thankamma, R. & Gopakumar, K.* - Biochemical changes of fish fingers held at frozen storage - *Fish. Technol.* 19(1) : 19, 1982.

66. *Nayar, S. Gopalan & Radhalekshmi, K.* - Studies on Raschel knotless netting - *Fish. Technol.* 18(1) : 13, 1981.

67. *Perigreen, P. A.* - Technology of production of minced fish meat from low cost fish and its storage characteristics - *Proc.* Summer Institute on Non-Traditional Diversified Fish Products and By-Products, Cochin, 27 April - 26 May, 1981.

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69. *Pillai, S. Ayyappan* - Development of mechanisation of traditional fishing vessels in India - Paper presented at Workshop on Appropriate Technology for Alternative Energy Sources in Fisheries, Manila, Philippines, 16-21 Feb., 1981.

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73. *Rajan, K. V. Mohan, Meenakumari, B. & Balasubramanyan, R.* - Spiny lobsters and their fishing techniques - *Fish. Technol.* 18(1) : 1, 1981.

74. *Rao, C. C. Panduranga* - Diversified fish products with special reference to their microbiological aspects - *Proc.* Summer Institute on Non-Traditional Diversified Fish Products and By-Products, Cochin, 27 April - 26 May, 1981.

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K. V. N.] - Comparative study of traditional and improved containers for transportation of fresh fish - *Fish. Technol.* 18(1) : 29, 1981.

76. *Sivadas, T. K.* - Marine environmental monitoring systems - Paper presented at All India Seminar on Status of Environmental Studies in India, Trivandrum, 26-28 March, 1981.

77. *Sivadas, T. K.* - Salinity, temperature and depth meter - Paper presented at First Indian Conference in Ocean Engineering, Madras, 18-20 Feb., 1981.

78. *Sivadas, T. K.* - Rotor induction current meter - Paper presented at First Indian Conference in Ocean Engineering, Madras, 18-20 Feb., 1981.

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80. *Sivadas, T. K.* - Electronic instruments for marine environmental monitoring - Paper presented at 2nd World Instrumentation Symposition and Exposition, Bombay, 15-18 April, 1981.

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83. *Thampuran Nirmala, Krishna Iyer, H. & Mahadeva Iyer, K.* - The influence of plating technique and incubation temperature on bacterial count from fish and fishery products - *Fish. Technol.* 18(2) : 95, 1981.

84. *Varghese, M. D.* - On the importance of *Mesopodopsis zeylanica* (Crustacea, *Mysidacea*) as food of fish - *Fish. Technol.* 18(1) : 61, 1981.

85. *Varghese, M. D., Kesavan Nair, A. K., George, V. C. & Khan, A. A.* - Estimation of fish production from Hirakud reservoir - *Fish. Technol.* 18(1) : 17, 1981.

86. *Vijayan, P. K. & Balachandran, K. K.* - Studies on blue discolouration in canned body meat of crab (*Scylla serrata*) - *Fish. Technol.* 18(2) : 117, 1981.

8. APPENDICES

APPENDIX - I

HEADQUARTERS: CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY,
Willingdon Island, Matsyapuri P.O.,
Cochin, P.C. 682 029, Kerala,

TLX No. 0085 - 440

Telephone No. 6845 (10 lines)

Telegram: MATSYAOUDYOGIKI or
FISHTECH, COCHIN

Director's Telephone: Per: 6880.

DIRECTOR	..	Dr. C. C. Panduranga Rao
	Scientists-in-Charge	
Biochemistry & Nutrition Division	..	Shri M. Rajendranathan Nair
Processing & Packaging Division	..	Dr. K. Gopakumar
Microbiology Division	..	Shri K. Mahadeva Iyer
Craft Division	..	Shri R. Balasubramanyan
Gear Division	..	
Engineering Division	..	Shri S. Ayyappan Pillai
Electronics & Instrumentation Division	..	Shri T. K. Sivadas
Extension, Information & Statistics Division	..	Dr. P. N. Kaul

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 - 362 265, Gujarat	297	MATSYAOUDYOGIKI	Shri K. K. Solanki
2.	KAKINADA	Research Centre of CIFT D. No. 54-2-9, Yesuvari St., Jagannaickpur, Kakinada - 533 002, Andhra pradesh	4436	MATSYAOUDYOGIKI	Shri G. Narayanappa
3.	BURLA	Research Centre of CIFT Burla P.O. 768 017 Sambalpur Dist., Orissa	19	MATSYAOUDYOGIKI	Shri V. C. George
4.	BOMBAY	Research Centre of CIFT 162, Sassoon Dock, Colaba, Bombay - 400 005, Maharashtra	213892	FISHPROCESS (FT)	Shri T. S. Gopalakrishna Iyer
5.	CALICUT	Research Centre of CIFT Beach Road, West Hill, Calicut - 673 005, Kerala	76607	CARE 'KADALMIN'	Shri T. S. Unnikrishnan Nair
6.	GOA	Research Centre of CIFT 2nd Floor, 'Shanta' 18th June Road, St. Inez, Panaji - 403 301, Goa	3905	MATSYAOUDYOGIKI	Shri H. N. Mhalathkar

APPENDIX - II

List of Personnel in CIFT as on 31-3-1982

SCIENTIFIC PERSONNEL

DIRECTOR

Dr. C. C. Panduranga Rao
(Officiating)

Scientist S-3

1. Shri M. Rajendranathan Nair
2. Shri R. Balasubramanyan
3. Dr. P. N. Kaul
4. Dr. K. Gopakumar

Scientist S-2

1. Shri K. Mahadeva Iyer
2. Shri T. K. Govindan
3. Shri S. Ayyappan Pillai
4. Shri P. Vasudeva Prabhu
5. Shri V. C. George
6. Shri K. A. Sadanandan
7. Shri K. Devadasan
8. Shri T. S. Gopalakrishna Iyer
9. Shri K. Sreedharan Namboodiri
10. Shri K. K. Balachandran
11. Shri P. Madhavan
12. Shri P. Appukutta Panicker
13. Shri H. N. Mhalathkar
14. Shri M. K. Kandoran
15. Shri P. K. Chakraborty
16. Shri K. K. Solanki
17. Shri T. K. Sivadas
18. Dr. K. Ravindran
19. Shri H. Krishna Iyer
20. Shri K. Krishna Rao
21. Shri G. Narayanappa
22. Shri M. Arul James

Scientist S-1

1. Shri P. D. Antony
2. Shri P. A. Perigreen
3. Shri A. K. Kesavan Nair
4. Shri A. G. Radhakrishnan
5. Shri P. K. Surendran
6. Smt. Chinnamma George
7. Smt. Mary Thomas
8. Shri P. R. Girija Varma
9. Shri K. K. Kunjipalu
10. Shri V. Narayanan Nambiar
11. Shri K. G. Ramachandran Nair
12. Shri A. Vasanth Shenoy
13. Shri T. S. Unnikrishnan Nair
14. Shri P. N. Joshi
15. Shri Sib Sankar Gupta
16. Shri N. Unnikrishnan Nair
17. Shri T. Joseph Mathai
18. Shri K. N. Kartha
19. Shri N. Subramonia Pillai
20. Shri S. V. S. Rama Rao

21. Shri A. C. Joseph
22. Shri A. A. Khan
23. Shri R. S. Manoharadoss
24. Shri A. G. Gopalakrishna Pillai
25. Shri V. Muraleedharan
26. Shri T. P. George
27. Shri P. George Mathai
28. Shri V. Vijayan
29. Smt. K. Vijayabharathi
30. Shri M. K. Mukundan
31. Shri P. G. Viswanathan Nair
32. Shri J. Sitarama Rao
33. Smt. Nirmala Thampuran
34. Shri T. K. Thankappan
35. Shri P. T. Mathew
36. Shri Jose Joseph
37. Shri D. I. Khasim Saheb
38. Shri Harinder Krishan Beri
39. Shri S. M. S. Abuthahir Ali
40. Shri Subrata Basu
41. Shri T. K. Srinivasa Gopal
42. Kum. B. Meenakumari
43. Shri K. V. Mohan Rajan
44. Shri M. R. Boopendranath
45. Shri P. K. Vijayan
46. Smt. K. Ammu
47. Shri K. Ramakrishnan
48. Shri P. T. Lakshmanan
49. Shri Rup Sankar Chakraborty
50. Shri Anil Agarwal
51. Shri S. P. Damle
52. Shri J. K. Bandyopadhyay
53. Shri S. K. Bhattacharyya
54. Smt. K. V. Lalitha
55. Shri P. Ravindranathan Nair
56. Shri S. Sanjeev
57. Shri S. Balasubramaniam
58. Shri M. R. Raghunath
59. Shri A. K. Chattopadhyay
60. Shri N. Kalaimani
61. Shri P. N. Ravindranatha Kaimal
62. Smt. A. Lekshmy Nair
63. Dr. Jose Stephen
64. Shri K. P. Antony
65. Shri Gopal Rao Desai
66. Shri R. M. Naidu
67. Shri P. Srinivasa Rao
68. Shri G. Rajagopalan Unnithan
69. Shri Francis Thomas
70. Shri K. George Joseph

Junior Fishery Scientist

1. Shri A. V. V. Satyanarayana
2. Shri S. Gopalan Nayar

Junior Scientist

1. Shri A. P. Valsan

Assistant Fishery Scientist

1. Shri T. M. Sivan
2. Shri N. A. George
3. Smt. K. Radhalekshmy

Scientist S

1. Shri M. Syed Abbas
2. Shri Percy Dawson
3. Shri D. K. Garg
4. Shri A. C. Kuttappan
5. Shri M. D. Varghese
6. Smt. R. Thankamma

Sr. Research Assistant

1. Smt. T. T. Annamma

TECHNICAL PERSONNEL

Technician T-7

1. Shri M. S. Fernando .. Skipper
2. Shri A. P. Jayaprakash .. Skipper
3. Shri K. S. Ganesan .. Workshop Engineer
4. Shri K. J. Francis Xavier .. Skipper

Technician T-6

1. Smt. P. J. Cecily .. Jr. Technical Officer
2. Shri K. C. Purushothaman .. Editor-cum-Information Officer

Technician T-5

1. Shri M. S. Rajan .. Fishing Mate
2. Shri N. Sriharshan .. Engineer

Technician T-4

1. Smt. Annamma Mathew .. Sr. Technical Asst.
2. Shri K. Vasudevan Nair .. Sr. Technical Asst.
3. Shri N. Subramanian .. Technical Asst.
4. Shri V. K. Ibrahim .. Head Draughtsman
5. Shri C. Chandrasekharan .. Superintendent (E & M)
6. Shri N. Vareethiah .. Glass Blower
1. Shri K. Bhaskaran .. Photographer-cum-Artist
8. Shri Varghese Paul .. Technical Asst.
9. Shri G. Mohanan .. Artist
10. Shri O. Subramanyan .. Sr. Welder
11. Shri P. Ravindranathan .. Sr. Library Asst.

Technician T-II-3

1.	Smt. T. L. Hemalatha	.. Hindi Translator
2.	Shri M. L. Anslem	.. Sr. Draughtsman
3.	Shri A. Kassim Kunju	.. Technical Asst.
4.	Shri P. Sadanandan	.. Technical Asst.
5.	Shri K. K. Poulose	.. Instrument Technician
6.	Shri R. Gopalakrishnan Nair	.. Computor
7.	Shri M. Abdul Sathar	.. Media Supervisor
8.	Shri B. Anandan	.. Foundry Asst.
9.	Shri M. U. Vijayan	.. Sr. Mechanic
10.	Shri T. K. David	.. Fitter
11.	Shri Thomas J. Mammoottil	.. Technical Asst.
12.	Shri M. K. Sasidharan	.. Technical Asst.
13.	Shri V. Gopalakrishna Pillai	.. Technical Asst.
14.	Shri T. John	.. Technical Asst.
15.	Shri A. Veeranjaneyulu	.. Technical Asst.
16.	Shri V. V. Ramakrishna	.. Technical Asst.
17.	Shri G. P. Vaghela	.. Technical Asst.
18.	Shri P. T. Sebastian	.. Technical Asst.
19.	Shri V. Gaspar	.. Technical Asst.
20.	Shri P. S. Alias	.. Superintendent (Instrumentation)
21.	Shri N. Baburao	.. Technical Asst.
22.	Shri N. M. Vasu	.. Technical Asst.
23.	Shri T. K. Sayed Ali	.. Technical Asst.
24.	Shri Stanislas Kiro	.. Technical Asst.
25.	Shri Baikumta Pradhan	.. Technical Asst.
26.	Shri N. Narayana	.. Technical Asst.
27.	Shri J. B. Paradva	.. Technical Asst.
28.	Shri D. K. Ukabhai	.. Technical Asst.
29.	Shri C. Sriharibabu	.. Technical Asst.

Technician T-I-3

1.	Shri K. J. Augustine	.. Sr. Turner
2.	Shri M. R. Nair	.. Bosun
3.	Shri A. K. Jaisingh	.. Bosun
4.	Shri K. K. Subramanian	.. Engine Driver
5.	Shri K. V. Baladasan	.. Engine Driver
6.	Shri V. V. Johni	.. Sr. Field Asst.
7.	Shri V. K. Ramachandran	.. Sr. Laboratory Asst.
8.	Shri V. S. Augustine	.. Sr. Carpenter
9.	Shri S. R. Jethwa	.. Sr. Mechanic
10.	Shri A. K. Dharaneedharan	.. Media Asst.

11.	Shri T. S. Bhaskara Menon	.. Sr. Mechanic
12.	Shri K. E. Mani	.. Sr. Mechanic
13.	Shri P. M. Joseph	.. Machinist
14.	Shri E. K. Balakrishnan	.. Draughtsman
15.	Shri Mohd. Jaffar	.. Engine Driver
16.	Shri G. Ratnakaran Nair	.. Refrigeration Mechanic

Technician T-2

1.	Smt. K. Sarasamma	.. Draughtsman
2.	Shri Shaju A. Averah	.. Draughtsman
3.	Shri C. C. Sivan	.. Welder-cum-blacksmith
4.	Shri Anil Kumar	.. Refrigeration Mechanic
5.	Shri Shanmughavel	.. Refrigeration Mechanic
6.	Shri C. Rajendran	.. Refrigeration Mechanic
7.	Shri Jose Kalathil	.. Refrigeration Mechanic
8.	Shri K. V. Madhavan	.. Electrician
9.	Shri Philip Durom	.. Sr. Carpenter
10.	Shri Vasudev G. Kubal	.. Engine Driver (Ad-hoc)
11.	Shri A. Gopalakrishnan Nair	.. Staff Car Driver
12.	Shri P. P. Poulose	.. Staff Car Driver
13.	Shri P. Natarajan	.. Driver
14.	Shri M. G. Narayanan Nair	.. Driver
15.	Shri N. J. Tandel	.. Driver (Launch)
16.	Shri K. K. Pappukutty	.. Driver (Launch)
17.	Shri M. M. Vara	.. Sr. Field Asst.
18.	Shri P. K. Damodaran	.. Sr. Laboratory Asst.
19.	Shri P. M. Pattanayak	.. Sr. Laboratory Asst.
20.	Shri M. M. Devasiya	.. Jr. Library Asst.
21.	Shri T. Neelakandan	.. Projector Operator
22.	Shri Gurudas Ram	.. Tindal
23.	Shri T. Gangadharan	.. Sr. Laboratory Asst.
24.	Shri M. K. Kuttykrishnan Nair	.. Sr. Field Asst.
25.	Shri P. A. John	.. Tindal
26.	Shri V. Veer Raju	.. Tindal
27.	Shri Koruthu George	.. Engine Driver
28.	Shri S. Laxmanadu	.. Deckhand
29.	Shri G. B. Tandel	.. Deckhand
30.	Shri K. K. Lekshmanan	.. Deckhand
31.	Shri T. Balan	.. Deckhand
32.	Shri H. M. Kotiya	.. Deckhand
33.	Shri P. K. Pushpangadan	.. Deckhand
34.	Shri K. Sarangadharadu	.. Deckhand

35. Shri G. R. Bhogte .. Deckhand
36. Shri T. K. Dasan .. Deckhand
37. Shri K. V. Rajan .. Jr. Laboratory Asst.
38. Shri G. Subba Rao .. Cook
39. Shri E. R. Krishnan .. Cook
40. Shri T. Gopalakrishnan .. Metal Worker
41. Shri Narasingh Panda .. Driver
52. Shri B. Ramaiah .. Jr. Laboratory Asst.
43. Shri C. C. Gandhi .. Plant Attendant
44. Shri N. C. Bhaskaran .. Plant Attendant
45. Shri K. B. Thilakan .. Jr. Laboratory Asst.
46. Shri P. Bahuleyan .. Telephone Operator
47. Shri T. N. Manibhadran .. Tindal
48. Shri T. K. Bhaskaran .. Jr. Laboratory Asst.
49. Shri A. B. Varghese .. Cockswain
50. Shri N. A. Kunjikannan .. Refrigeration Mechanic

Technician T-I

1. Shri T. K. Vasudevan .. Jr. Laboratory Asst.
2. Shri T. K. Aravindakshan .. Jr. Laboratory Asst.
3. Smt. K. K. Sumathy .. Jr. Laboratory Asst.
4. Kum. Florence Joseph .. Jr. Laboratory Asst.
5. Shri Kadermiyan Umermiyan .. Jr. Laboratory Asst.
6. Shri D .R . Aparnathi .. Jr. Laboratory Asst.
7. Shri K. R. Kesavan .. Plant Attendant
8. Shri Radhupandey .. Driver (Launch)
9. Shri V. P. Raphel .. Driver
10. Shri Vasanthrai Kanji Solanki .. Driver
11. Shri K. Prakash Rao .. Driver (Launch)
12. Shri M. Venkateswara .. Driver
13. Shri Malam Bachu Sidi .. Deckhand
14. Shri K. Gangaraju .. Deckhand
15. Shri T. A. Francis .. Cook
16. Shri P. Joseph Paul .. Carpenter
17. Shri Satrugan Kumura .. Tindal
18. Shri T. K. Bava .. Deckhand
19. Shri E. K. Chinnappan .. Deckhand
20. Shri M. K. Asokan .. Deckhand
21. Shri D. G. Rao .. Deckhand
22. Smt. Tara Karuppali .. Jr. Laboratory Asst.
23. Smt. M. K. Sreelekha .. Jr. Laboratory Asst.
24. Shri A .A Kunjappan .. Field Asst.

25.	Shri K. K. Narayanan	..	Boiler man
26.	Shri G. L. Tandel	..	Cook
27.	Shri N. Venkata Rao	..	Field Asst.
28.	Shri O. M. Samuel	..	Jr. Laboratory Asst.
29.	Shri A. P. Joshi	..	Tindal
30.	Shri G. M. Vaghela	..	Jr. Laboratory Asst.
31.	Shri Damodar Rout	..	Jr. Laboratory Asst.
32.	Shri K. V. S. S. S. Kusuma Haranath	..	Jr. Laboratory Asst.
33.	Shri Subash Chandra Behera	..	Mechanic

ADMINISTRATIVE PERSONNEL

Sr. Administrative Officer

Sri K. M. Mathai

Administrative Officer

Shri James Abraham

Asst. Administrative Officer

Shri A. Chakrapany|Shri Varghese Paul

Accounts Officer

Shri K. T. Abubacker

Superintendent

Shri P. J. Joseph
Smt. T. N. Ambujakshy Amma
Shri P. A. Uthup

P. A. to Director

Shri K. J. Thomas

Assistant

1. Shri M. George Joseph
2. Shri S. Naveen Chandra Prabhu
3. Smt. K. A. Devaky
4. Smt. Alice M. Joseph
5. Smt. Naffeesa Ali

Stenographer

1. Smt. Mariamma Sadanandan
2. Shri K. Ravindran

Jr. Stenographer

1. Shri A. A. Sankarankutty
2. Smt. N. K. Saraswathy
3. Smt. R. Vasantha

Senior Clerk

1. Shri P. Vasudevan
2. Shri T. M. Padmanabhan
3. Smt. N. K. Sulochana
4. Smt. T. K. Sarala
5. Shri R. S. Shanmugham
6. Shri A. L. John
7. Shri M. Gopalakrishnan
8. Shri M. T. Joseph
9. Shri A. K. Venugopal
10. Shri P. Vijayan
11. Shri M. J. Sebastian
12. Shri V. N. Rajasekharan Nair
13. Shri M. Ravindran
14. Smt. Annamma Varghese
15. Smt. C. G. Marykutty
16. Smt. M. S. Susanna
17. Smt. N. Prabhavathy Amma
18. Shri C. Ravindran Nair
19. Smt. K. R. Gita Rani
20. Shri N. Venugopalan
21. Shri T. M. Ramraj
22. Shri Y. W. Mhadgut

Junior Clerk

1. Shri Veer Singh
2. Shri M. Balan Nambiar
3. Shri G. Somappan
4. Shri V. R. Kesavan
5. Smt. Smita K. Shirishkar
6. Smt. M. Jully
7. Shri K. Bhaskaran
8. Smt. M. A. Prasanna
9. Smt. K. A. Nazeem
10. Shri Y. Philipose
11. Shri A. B. Rodrigues
12. Shri Ch. Satyanarayana
13. Shri T. Veerabhadra Rao
14. Shri P. K. Sreedharan
15. Smt. K. Gracy
16. Smt. B. Hemalatha
17. Shri P. V. Venugopalan
18. Shri A. George Joseph
19. Shri K. P. Velayudhan
20. Smt. T. K. Susannamma
21. Shri C. A. Punnoose
22. Smt. P. C. Kamalakshy
23. Shri R. Viswanathan
24. Shri P. K. Sankarankutty
25. Shri K. Rajappan Pillai
26. Smt. N. I. Mary
27. Shri P. K. Janardhanan
28. Shri Gopal Chandra Adhikari
29. Shri Satish Chandra B. Purohit
30. Kum. K. Chandini
31. Shri N. S. Sangodkar
32. Shri M. M. Damodaran
33. Shri P. K. Thomas
34. Smt. P. K. Thankamma.

Caretaker

Shri A. Chakrapani

SUPPORTING STAFF

Supporting Staff Grade IV

1. Shri S. S. Salvi
2. Shri B. Suryaprakash Rao
3. Shri E. Gangadharan Nair
4. Shri Koppada Gandhi
5. Shri Gajendra Kerali
6. Shri M. K. Prabhakaran
7. Shri K. K. Radhakrishnan
8. Shri O. C. Lonan

Supporting Staff Grade III

1. Shri E. S. Balachandra Pai
2. Shri E. S. Sreedharan
3. Shri Krishna Chandra Meher
4. Shri V. V. John
5. Shri S. M. S. Yadav
6. Shri P. A. Thomas
7. Shri K. Balakrishna Pillai
8. Shri C. M. Gopalan
9. Shri P. J. George
10. Shri P. C. Sukumaran
11. Shri A. G. Vasu
12. Shri C. A. Subran
13. Shri B. Tirupathi Rao
14. Shri A. T. Waghmare
15. Shri N. Gnanaranjan Rao
16. Shri P. A. Abdul Rahman
17. Shri Digambar D. Naik
18. Shri K. K. Appachan
19. Shri K. X. Joseph
20. Shri T. T. Das
21. Shri Laba Nag
22. Shri O. M. Thankappan
23. Shri O. A. Krishnan
24. Shri M. K. Thevan
25. Shri P. M. Pakeer Mohammed
26. Shri Santhosh Banchor

Supporting Staff Grade II

1. Shri K. Raghavan
2. Shri Ramachandra D. Padnakar
3. Shri Gokulchandra Meher
4. Shri Rattan Chand
5. Shri Menino Souza
6. Shri Satrughan Seth
7. Shri K. K. Madhavan
8. Shri P. S. Morajkar
9. Shri S. Rajan
10. Shri C. Kama Raju
11. Shri Voleti Kamaraju
12. Shri T. V. Manoharan
13. Shri Sadhucharan Meher
14. Shri Chandru B. Shirodkar

15. Shri K. Kameswara Rao
16. Shri Vasudev G. Kubal
17. Shri M. N. Goswami
18. Shri T. T. Velayudhan
19. Shri Malladi Perraju
20. Shri K. C. Fofandi
21. Shri B. S. Thambe
22. Shri P. Padmanabhan
23. Shri C. A. Krishnan
24. Shri Krishna Chandra Nayak
25. Shri P. A. Shanmughan
26. Shri K. N. Mukundan
27. Shri P. Gopalakrishnan
28. Shri Karsan Arjan Masani
29. Shri K. A. Gopinath
30. Shri P. D. George
31. Shri K. B. Bhaskaran
32. Shri Kirtan Kisan
33. Shri G. Chinna Rao
34. Shri Orilika Heman
35. Shri K. K. Karthikeyan

Supporting Staff Grade I

1. Shri K. A. Kunjan
2. Shri A. P. Gopalan
3. Shri T. T. Thankappan
4. Shri P. K. Unnikrishna Panicker
5. Shri R. Chellappan
6. Shri V. S. Ambasudhan
7. Shri K. Kochukuttan Nair
8. Shri Vasipalli Vellaiah
9. Shri A. R. John
10. Shri C. N. Raghavan
11. Shri K. Appa Rao
12. Shri A. Ravindran Nair
13. Shri B. Sivanadam
14. Shri Harbhajan
15. Shri Bandu M. Ghare
16. Shri P. N. Sukumaran Nair
17. Smt. P. L. Roseilly
18. Shri Vinayak P. Halarnekar
19. Shri Udekar Pandey
20. Shri Thomas Topno
21. Shri Gopi Xenkar Chodankar
22. Shri T. K. Rajappan
23. Shri Chandrakant Kolvalkar
24. Shri S. Chakram
25. Shri S. Appa Rao
26. Shri Duda Pitha Parmar
27. Shri Bashir Mohammed Allarkha Khokhar
28. Shri Namdev S. Hiwale
29. Shri K. N. Velayudhan
30. Shri Badrinarayan Guru
31. Shri K. K. Lakshmanan
32. Shri Jayasingh Oram
33. Shri P. K. Bhangaraj
34. Shri Satyanarayan Mirdhe
35. Shri T. G. John
36. Shri Premlal Panda
37. Shri Surjananda Dishri
38. Shri Godabari Mahanandia
39. Shri O. K. Xavier
40. Shri T. Mathai
41. Shri P. T. Anthappan
42. Shri T. K. Viswanathan
43. Shri P. A. Sivan
44. Shri D. B. Chudasanna
45. Shri Dibyalochan Pattanayak

ON DEPUTATION

Sl. No.	Name	Deputation with	Designation
1.	Shri M. Velu Jr. Fishery Scientist	Cochin Port Trust Cochin-3	Dy. Chief Mechanical Engineer
2.	Shri C. V. N. Rao Scientist S-2	Office of the Development Commissioner (Small Scale Industries) Nirman Bhavan, New Delhi - 110001	Dy. Director
3.	Shri P. Sulochanan Scientist S-2	Exploratory Fisheries Project, Kandla Base, Block No. 80|262 Kutch	Dy. Director
4.	Shri Y. Sreekrishna Scientist S-2	Central Institute of Fisheries Education, P.B. 7392, Kakori Camp J. P. Road, Bombay-61	Professor (Fisheries Technology)
5.	Shri M. Mukundan Scientist S-1	Central Institute of Fisheries, Nautical & Engg. Training, (CIFNET) Cochin-16	Instructor
6.	Shri R. Rajendran Scientist S-1	CIFNET, Cochin-16	Instructor (Craft & Gear)
7.	Dr. M. Shahul Hameed Scientist S-1	University of Cochin	Reader
8.	Shri C. Hridayanathan Scientist S	University of Cochin	Lecturer
9.	Dr. G. Jagatheesan	Tamil Nadu Agricultural University, Coimbatore	Associate Professor (Fish Technology)
10.	Shri K. Gopalakrishnan Scientist S-1	Exploratory Fisheries Project, Bombay	Dy. Director
11.	Shri S. Sadanandan Supdt.	ICAR Research Complex for NEHR, Shillong	Asst. A. O.
12.	Shri V. Joseph Supdt.	Sugarcane Breeding Institute, Coimbatore	Asst. A. O.
13.	Shri Cyriac Mathen Scientist S-2	College of Fisheries Kerala Agrl. University Panangad, Cochin	Professor (Fish Processing)
14.	Shri C.K. Muraleedharan Jr. Clerk	ICAR Research Complex for NEHR, Shillong	Sr. Clerk

APPENDIX III

FINANCE

Details of budget provision and actual expenditure during the year 1981-82

PLAN

Head of Account	Budget Provision Rs.	Actual Expenditure Rs.
Salary of Officers	2,39,000	——
Salary of establishment	6,36,000	——
Dearness Allowance	6,04,000	——
Overtime Allowance	15,000	——
House Rent Allowance	60,000	——
City Compensatory Allowance	40,000	——
Other Allowances & Honoraria	1,23,000	——
Travelling expenses	1,00,000	90,455.36
Other charges	26,57,000	28,61,683.70
Total	44,74,000	29,52,139.06

NON-PLAN

Salary of Officers	13,00,000	14,01,820.59
Salary of establishment	14,00,000	14,21,052.96
Dearness Allowance	18,00,000	20,88,927.87
Overtime Allowance	15,000	18,250.60
House Rent Allowance	1,60,000	2,35,151.14
City Compensatory Allowance	25,000	26,126.82
Other Allowances & Honoraria	1,40,000	1,03,627.11
Travelling expenses	60,000	59,972.18
Leave Salary contribution, Pension contribution and P. F. contribution	2,000	216.00
Other charges	6,00,000	5,70,510.92
Total	55,02,000	59,25,656.19