

ANNUAL REPORT

1978



Central Institute of Fisheries Technology

COCHIN-682 029 INDIA

Indian Council of Agricultural Research

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Central Institute of Fisheries Technology

COCHIN-682029

INDIA

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I. DIRECTOR'S INTRODUCTION

The Institute, during the year 1978 took up studies on various problems in the field of fisheries technology as in the previous years. Efforts were continued to apply the results of research in the field so as to benefit a greater section of the people concerned.

Progress in Rand D:- The Institute made steady progress in all the research projects undertaken during the year 1978. Eight new projects were initiated. These, together with 25 on-going programmes, totaled to 33 projects under implementation. Of these, 6 projects were completed during the year under review.

As reported last year, emphasis was still on replacing the traditional and unhygienic method of drying fish under the sun by the improved artificial means by setting up fish dehydration plants. Keen interest has been shown by State Government organisations, Fisheries Corporations as well as private parties in this field. Studies were made to develop ready-to-serve smoked/dried products from different varieties of fish. The Institute also continued its efforts to utilise fishery wastes and uneconomical fishes for production of various by-products and development of low-cost diversified products from fish. Processes for canning and freezing a variety of fish and shell fish were also worked out.

Recommendations made by the Institute on utilising materials other than traditionally used costly timbers for boat construction have resulted in construction of a FRP catamaran by a private boat yard as also use of FRP boats in a few maritime States of India. Costly zinc anodes are now being increasingly replaced by equally effective ternary aluminium alloy anodes for cathodic protection.

Mid-water trawl operations for increased catch of column fishes are now gaining importance to which this Institute has contributed by designing some mid-water trawls and supplying them to interested parties. The efforts made by the Institute have also resulted in the development of a large mesh trawl for exploitation of the demersal fishery resources off Veraval. This net has been found to be much more efficient than the conventional bottom trawl.

The technical assistance rendered by the Institute and the testing services offered by it have greatly helped the fishery industry in turning out better products and materials. Enquiries continue to be received from every part of the country on various problems related to fishing and fish processing to which the Institute tries its very best to bring out some solution.

A Summer Institute on 'Fish Processing Technology', sponsored by the ICAR was held at the Institute from 1st to 31st May, 1978. A total of 21 participants, sponsored by different fish processing establishments, State and Central Government Organisations, attended the Institute. Lectures, field trips and film shows were arranged for the benefit of the participants.

1.1. ORGANISATIONAL SET-UP

The Institute is headed by the Director in whom are vested all the administrative powers regarding research and management of the Institute. He is assisted by a Senior Administrative Officer, Administrative Officer and Asst. Administrative Officer to deal with matters related to general administration, an Accounts Officer for looking to the accounts and internal audit and a Junior Technical Officer for attending to technical reports and matters connected with research projects handled by the different Divisions of the Institute and the Research Centres.

The headquarters of the Institute is located at Cochin with Research Centres functioning at Veraval, Kakinada, Burla, Bombay, Calicut and Goa.

The activities of the Institute are channelled through Seven Divisions - viz.

1. Craft Division
2. Gear Division
3. Craft & Gear Materials Division
4. Processing and Packaging Division
5. Biochemistry & Microbiology Division
6. Engineering Division
7. Extension, Information & Statistics Division

Work under these Divisions is extended to the Research Centres as well to tackle the problems facing the fishery industry specific to the area. Each Centre is under the control of a Scientist-in-Charge who carries out co-ordination, supervision and periodical assessment of the progress of the different projects.

1.2 MANAGEMENT COMMITTEE

The Committee could meet only once during the year under report. On the recommendation of the Management Committee, the Scientist-in-Charge of the Research Centres at Veraval and Kakinada were delegated with more powers on an experimental measure for one year. The concerned Scientists were also declared as Drawing and Disbursing Officers. Likewise, on the recommendations of the Management Committee, some of the temporary posts in the Administration section were converted into permanent ones. Further, the Management Committee considered the Research projects and decided to give more emphasis to mechanisation of traditional crafts, exploitation of cuttle fish and squid resources, popularisation of mid-water trawling and development of bulk packaging methods. The Committee also felt the need for establishing a Packaging Division and Electronics Division at the headquarters of the Institute. The Budget Estimate of the Institute for the year 1978-79 was also considered by the Committee and approved.

1.3 ADMINISTRATION

The Administration Section deals with recruitment, service policy, discipline, vigilance, staff welfare, lands and buildings, budget, expenditure, stores and purchase etc.

Except for the electrical work, construction of the quarters for the Chowkidar and Caretaker was completed during the year. Estimates worked out in respect of the construction of fireproof pilot plant and scooter park were approved. The Research Centres of the Institute continued to function in rented buildings. Addresses of the Institute and Research Centres are given in Appendix 1.

The personnel of the Institute were classified as Scientific, Technical, Administrative and Supporting according to their nature of duties. A list of the staff is given as Appendix 11.

Details of the budget provision and actual expenditure for the period 1978-'79 are given in Appendix 111.

1.4 INDUSTRIAL LIAISON COMMITTEE

The Industrial Liaison Committee which was constituted for the Institute in the year 1977 at the instance of the President, Indian Council of Agricultural Research met on 24th July 1978 at the Institute. Director of the Institute and Chairman of the Committee presided.

The progress of research during the year in the various Divisions of the Institute were reviewed. The importance of undertaking proto-type studies on the suitability and economic feasibility of ferrocement as a boat construction material was stressed as also the need for the exploitation of squid resources by the method of jigging. The need was also emphasized for preparation of a product directory incorporating details of products, markets, buyers etc. study on the export possibilities of different items to world markets, participation of the Institute as well in world trade fairs for exhibiting the various products developed at the Institute and collection of information on specification of products as required by importing countries.

1.5. STAFF JOINT COUNCIL

The following were the members during the year under review.

- | | |
|--------------------------------------|-------------------------|
| 1. Shri G. K. Kuriyan | Chairman |
| 2. Shri M. Rajendranathan Nair | } Members-Official Side |
| 3. Shri P.N.R. Kaimal/ Dr. P.N. Kaul | |
| 4. Shri S. Ayyappan Pillai | |
| 5. Shri P.C. Jacob/Shri K.M. Mathai | |
| 6. Shri T. Velayudhan Asari | |

7. Shri K. Mahadeva Iyer		Secretary, Official Side
8. Dr M. Shahul Hameed	}	Members-Staff Side
9. Shri Varghese Paul		
10. Shri R. Gopalakrishnan Nair		
11. Shri M. T. Joseph		
12. Shri T. T. Das		
13. Shri O. C. Lonan		
14. Shri V. N. Rajasekharan Nair/ Shri Varghese Paul	}	Secretary-Staff Side

The Council met three times during the year under report.

1. 6. GRIEVANCE CELL

In addition to the already existing Grievance Cell, a new Cell was constituted to deal with the grievances of ARS Scientists and other employees who are not covered by the existing scheme. The members included

1. Shri G. K. Kuriyan		Chairman
2. Dr. C. C. Panduranga Rao	}	Members nominated by the Management Committee of the Institute.
3. Shri S. Ayyappan Pillai		
4. Shri P. C. Jacob/Shri K. M. Mathai		Member Secretary

No grievances were received from the ARS grade officials.

1. 7. PROJECT ADVISORY COMMITTEE

The Committee met seven times during the year under report. The research project programmes drawn up both at the Institute's headquarters and its Research Centres for the year 1978 were finalized and progress of the work carried out under the different programmes reviewed periodically by the Project Advisory Committee. Programmes for the VIth Five Year Plan were also finalized. Draft research programmes for the year 1979 were drawn up and suggestions offered for their effective implementation.

1. 8 TECHNICAL SECTION

The Section continued to assist the Director in collecting research material from the different Divisions and Research Centres for preparation of technical notes and reports to be forwarded to the Council, Scientific Panel etc.

1. 9. STAFF RESEARCH COUNCIL

The Staff Research Council met once during the year during which the progress made in the various research schemes was reviewed. Twentynine technical papers presented were discussed in detail and later passed for publication.

1. 10. AGRICULTURAL RESEARCH SERVICE

During the year, 17 candidates who got selected to the ARS on the basis of the ARS competitive examination joined the Institute. Of these 14 were under the discipline of Fish Processing Technology, 2 under Fish and Fishery Science and 1 under Agricultural Extension.

The five-yearly assessment of 33 eligible Scientists of this Institute in the grade S and S-1 was conducted by the Agricultural Scientists' Recruitment Board, New Delhi, during the month of May-June, 1978. Of these, 7 Scientists in the grade S-1 got promoted to grade S-2 and 9 in the grade S to grade S-1. Eight Scientists got advance increments.

1. 11. REGIONAL COMMITTEE

The Director of this Institute continued to function as the Member Secretary of the ICAR, Regional Committee No. 6. The work relating to the follow-up action of the previous meeting was attended to as well as arrangements made and agenda prepared for the Second meeting held at UAS Bangalore-the subsequent follow-up one held at T. N. A. U on 7th October, 1978.

1. 12. SYMPOSIA, SEMINARS, WORKSHOPS ETC.

Shri P. N. R. Kaimal, Junior Scientist (Extension) attended the Seminar organized by Kerala Fishermen Union at Trivandrum on 18-2-78.

Shri R. Balasubramanian, Scientist S-3 attended the Third Symposium on 'Newer Fibres and Composites' sponsored by UNDP/UNIAA and organized by the Dept. of Science and Technology, Govt. of India and The Silk and Art Silk Mills' Research Association, Bombay during 20-24 February 1978.

Shri P. K. Chakraborty, Scientist S-2 and Dr. K. Gopakumar, Scientist S-2 attended the Indo Pacific Fishery Commission, Symposium on 'Fish Utilization Technology and Marketing in IPFC Region held at Manila, (Philippines) during 8-11 March, 1978. Two papers were presented at this Symposium. The same Scientists also participated in the subsequent Symposium on Radiation Treatment of Fish and Fishery Products held at Manila from 13-16 March, 1978.

Shri S. M. S. Abuthahir Ali, Scientist S-1 attended the Seminar on 'Industrial Valves and Piping System' held on 30th and 31st March 1978 at Bombay.

S/ Shri H. Krishna Iyer, Scientist S-2 and G. R. Unnithan, Scientist S attended the 3rd Conference of Agricultural Research Statisticians held at Indian Agricultural Statistics Research Institute, New Delhi during 24-26 April, 1978.

S/ Shri R. Balasubramanyan Scientist S-3, P. V. Prabhu Scientist S-2, K. K. Balachandran, Scientist S 2, P. N. R. Kaimal, Junior Scientist, K. N. Mhalathkar, Scientist S-2 and T. Joseph Mathai, Scientist S-1 attended the Seminar on 'Prospects for Fisheries Development for Goa' organized by Goa Chamber of Commerce and Industry in collaboration with Govt. of Goa, Daman and Diu at Panaji, Goa on 22nd and 23rd April, 1978.

S / Shri Subrata Basu, P. K. Surendran, V. N. Nambiar and M. K. Mukundan, Scientists S-1 and Francis Thomas, Scientist-S attended the ICFOST Convention on 'Science and Technology for Changing Food Concept' organized by the Association of Food Scientists and Technologists (India) and held during 22-24 June 1978 at CFTRI, Mysore.

Shri S. Ayyappan Pillai, Scientist S-2 attended the Seminar on 'Maintenance Welding' conducted by the Kerala chapter of Indian Institution of Plant Engineers, held at Cochin on 30th July, 1978.

Shri A. P. Valsan, Junior Scientist participated in the Symposium on 'Shrimp Farming' organized by the Marine Products Export Development Authority at CIFE, Bombay during 16-18th August, 1978.

Shri M. R. Nair, Scientist S-3 and Shri Subrata Basu, Scientist S-1 participated in the National Seminar on 'Small Scale Food Industry for Rural India' held at Jadavpur University, Calcutta from 9-10 December, 1978. Mr. Nair was also Co-Chairman for the Third Session of the seminar which dealt with Fish and Poultry.

Shri T. S. Gopalakrishna Iyer, Scientist S-2 participated in the WHO-Inter-Country Workshop on 'Advanced Microbiological Methods in Food Hygiene' at Izatnagar from 9-10-78 to 4-11-1978.

Shri P. K. Chakraborty, Scientist S-2 attended the Symposium on 'Appropriate Technology for Rural Development' sponsored by the University Grants Commission, New Delhi and held at TKM College of Engineering, Quilon, Kerala from 18-20th October, 1978.

S/ Shri K. K. Balachandran, T. S. Gopalakrishna Iyer and S. Ayyappan Pillai, Scientists S-2, attended the Seminar on 'Fish Canning Industry' organized by the Integrated Fisheries Project, Cochin from 2-3rd November, 1978. A paper was also presented at the Seminar.

Shri S. Ayyappan Pillai, Scientist S-2 attended the 3rd Workshop on 'All India Co-ordinated Research Project' on Brackish Water Prawn and Fish Farming at Cochin, 9-10 November, 1978.

Shri P. K. Chakraborty, Scientist S-2 attended the International Symposium on 'Biological Application of Solar Energy' organized by Madurai Kamaraj University, 1-5 December, 1978.

Shri Cyriac Mathen, Scientist S-2 participated in the FAO/DANIDA Workshop on Fish Technology and Inspection held at Colombo, Sri Lanka during 16th October - 24 th November, 1978.

S/Shri G. K. Kuriyan, Director, M. R. Nair, Scientist S-3, and P. V. Prabhu, Scientist S-2 attended the Seminar on 'Role of Small Scale Fisheries and Coastal Aquaculture in Integrated Rural Development' organized by CMFRI, at Madras during 6-9 December, 1978.

S/Shri T.K. Govindan and Cyriac Mathen, Scientists S-2 and M. Arul James, Scientist S-1 attended the Seminar on 'Quality Control of Processed Foods' organized by Trivandrum chapter of the Association of Food Scientists and Technologists (India) at Trivandrum, 15-16 December, 1978.

S/Shri S. Ayyappan Pillai and P. K. Chakraborty, Scientists S-2, attended the 6th National Symposium on "Refrigeration and Air-Conditioning" organized by Indian Institute of Technology, Bombay under the auspices of National Committee for International Institute of Refrigeration 12-13 December, 1978.

Shri P. Ravindranathan, Sr. Library Assistant, participated in the 8th IASLIC National seminar at IIT, Madras, 26-29 December, 1978.

S/Shri T.S. Gopalakrishna Iyer, Scientist S-2 and A. P. Valsan, Junior Scientist' attended the Technical Seminar on 'Individually Quick Freezing Systems by Sandvik Far East Ltd, AB, Bombay on 28-12-1978.

1.13. HIGHER STUDIES AND TRAINING

Shri V.K. Ibrahim, Head Draughtsman, was deputed for training at Bangkok in Fishing Vessel Design during the period September - December, 1978.

Shri R. Balasubramanyan, Scientist S-2 attended a short term course on Fibre Reinforced Plastics Technology organized by the IIT, Madras from 28th August to 2nd September, 1978.

Shri R. Balasubramanyan was also nominated to undergo a two week course on Agricultural Research Management at the Central Staff College for Agriculture, Hyderabad during 18-30 December, 1978. The course was intended to expose the Research Managers in the ICAR Institutes to the concept of research management as applied to agriculture and train them in effective methods of research management.

Shri R. Balasubramanyan is also a registered candidate for the P. H. D. degree of the Cochin University in the Faculty of Marine Sciences (1978). The approved title of his thesis is "Biological and technological studies on the destruction of timber structures by marine organisms in the Cochin backwaters".

1. 14. LIBRARY

During the year 459 books and 100 bound volumes of journals were added to the collection of the Institute Library, bringing the total to 3661 books and 1886 bound volumes of journals.

About 83 Indian and Foreign journals were subscribed to during the year and about 60 journals received on exchange or gratis basis.

Indexing of current literature, compilation of Bibliography on Fishery Technology, Photocopying service, ready reference service etc. were continued. In addition to the staff of the Institute, visitors including students and Research Scholars from Universities, educational and Research Institutes, technical personnel from Fishery & Fish Processing Industry etc. made use of the Library. Inter Library loan facilities were also maintained in collaboration with other Institutes.

1. 15. COMMITTEES REPRESENTED BY THE INSTITUTE

The Director of the Institute served on the following Scientific and allied bodies.

1. Member : Scientific Panel for Fisheries Research, ICAR.
2. Member : Central Advisory Committee on Exploratory survey of Marine Fisheries.
3. Ex-Officio : Panel of Experts for the purpose of hearing
Member appeals-Export Inspection Agency, Karnataka and Kerala.
4. Member : State Fishery Advisory Board, Kerala.
5. Member : Fishery Advisory Committee, Kerala Agricultural University, Mannuthy.
6. Member : Management Committees, Krishi Vigyan Kendra (CMFRI), Narakkal.
7. Member : Management Committee; Operational Research Project of CMFRI, Kovalam (T.N)
8. Member : Steering Committee on Fisheries Development, State Planning Board, Kerala.
9. Member : Task Force on Fish Processing and Marketing, State Planning Board, Kerala.
10. Member : Task Force on Fisheries Research and Education, State Planning Board, Kerala.
11. Member : Scientific Research Committee, Fisheries Technological Research Station, Kozhikode, Kerala.
12. Member : Marine Products Export Development Authority.

13. Member : Technical Committee of Marine Products Export Development Authority.
14. Member : Board of Studies in Marine Sciences, University of Cochin.
15. Member : State Fisheries Research Council, Government of Tamil Nadu.
16. Member : State Level Committee for Co-ordination of Work on Marine Fisheries in the State and Central Sectors in Tamil Nadu.
17. Chairman : TDC-42- Textile materials for fishing purposes - Sectional Committee, Indian Standards Institution.
18. Chairman : MCPD-21- Fishing Vessels Sectional Committee, Indian Standards Institution.
19. Member : Board of Examiners, Central Institute of Fisheries Education, Bombay.
20. Member : ICAR Visiting Team for Establishment of a Fisheries College under Kerala Agricultural University

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 and Fisheries Sectional Committee.
 - b) Member : ISI. AFDC-27;2, Frozen Fish Products Sub-Committee.
 - c) Technical Representative : ISI, AFDC-36:9, Metallic Contaminants Sub-Committee.
2. Dr. C.C. Panduranga Rao, Scientist S-3 as:-
 - a) Principal Member : ISI, AFDC-27, Fish and Fisheries Products Sectional Committee.
3. 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.

4. Dr. K. Ravindran, Scientist S-2 as:-

- a) Member : Committee of Experts to consider the feasibility of setting up an Aluminium fish can manufacturing Unit.
- b) Member : Advisory Committee of MPEDA frozen storages at Cochin and Calcutta.
- c) Associate : Development of chilled sea water system on board a carrier vessel for preservation of purse seine catch, sponsored by FAO team of Experts.

5. Shri K.K. Balachandran, Scientist S-2 as:-

- a) Alternate Member : ISI, AFDC-27 1., Canned Fish Products Sub-Committee.
- b) Member : Group of Experts on Aluminium can fabrication Unit.

6. Shri K.K. Solanki, Scientist S-2 as:-

- a) Member : ISI, AFDC-27, Fish and Fisheries Products sub-Committee.

7. Shri S. Ayyappan Pillai, Scientist S-2 as:-

- a) CIFT Nominee : National Committee for International Institute of Refrigeration.
- b) Executive Committee Member. : Indian Cryogenic Council, South Zone.
- c) Alternate Member : ISI, MCPD-1, Ship-building Sectional Committee.

8. Shri P.K. Chakraborty, Scientist S-2 as:-

- a) Member : Indian Cryogenic Council Sub-Committee II.

9. Shri A.P. Valsan, Junior Scientist as:-

- a) Principal Member and Convener : ISI, AFDC-27 : 3, Dried Fish Products Sub Committee.
- b) Member : State level Committee for the Co-ordination of Works on Marine Fisheries, Maharashtra.

- c) Member : Panel of experts for hearing of appeals in respect of compulsory quality control preshipment inspection of fishery products for the regions of Maharashtra, Gujarat, Goa.
- d) Member : Regional Committee of the ICAR for Western Zone - 7 comprising Maharashtra, Western and Central Madhya Pradesh.
- e) Associate : Institute of Chemists (India)
- f) Member : Central Advisory Committee of the Exploratory Fishery Project, Bombay.

1.16. VISITORS

Several State and Central Government Officials, students from educational institutions, foreign dignitaries etc. visited the Institute and Research Centres during the year. These include:-

1. Dr. Javier Perez Villasenor, Chairman of Dept. of Biotechnology, Universidad Autonoma Metropolitana, Mexico.
2. Sir Charles Pereira, Member, Consultative Mission on Aquacultural Research, C/o IDRC, Vancouver.
3. Dr. D.L. Umali, Assistant Director General, Food and Agricultural Organization, Bangkok.
4. Dr. John Chadwick, Director of Commonwealth Foundation, London.
5. Dr. D.W. Thorne, Utah State University, Logan, Utah, U.S.A.
6. Mr. W. Krone, FAO, Rome.
7. Mr. Carl F. Kossack, University of Georgia, U.S.A.
8. Mr. Bryan Swingler, British Council's Education Advisor in India, New Delhi and Mr. Geraint Thomas, Regional Education Advisor in South India, Madras.
9. Mr. Trevor Drieberg, Correspondent in India of Fishing News International, London.
10. Dr. O.A. Koleoso, Director, Federal Institute of Industrial Research, Oshodi, Nigeria.
11. Prof. P.O. Ngoddy, Head of Dept; Food Science and Technology, University of Ife, Nigeria.
12. Mr. A.F. Sonde, Lagos State Fisheries, Nigeria.
13. Major K. Mohanachandran, Dy. Assistant Director of Remount Veterinary Services. Madras.
14. Mr. J.R.P. Dumas, High Commissioner of Trinidad and Tobago to India.

15. Mr. P.P. Williams, Director of Fisheries, Andhra Pradesh.
16. Mr. V.L.C. Pietersz, Mr. CH.M.T. Chandrasekharan and Mr. A.S. Mendis, Ministry of Fisheries, Sri Lanka.
17. Mr. K. Sankaranarayanan, Minister for Agriculture and Community Development, Kerala.
18. Mr. Bhanu Pratap Singh, Minister of State and Mr. R. Saxena, Joint Secretary, Govt. of India, New Delhi.
19. Mr. Arne Arnesen, Director General, NORAD, Norway.
20. Mr. U.K. Ba Thaug, M.D: PFFC, Rangoon, Burma.
21. Mr. Ebrahim Abdul Qader, Ministry of Commerce and Agriculture, Fisheries Resources Bureau, Bahrain.
22. Mr. S. S. Dhanoa, Secretary, Indian Council of Agricultural, Research New Delhi.
23. Parliamentary Consultative Committee, New Delhi.
24. Committee of Parliament on Official Languages at Goa Centre.

1.17. APPOINTMENTS

Shri R. Balasubramanyan, who was hitherto working as Junior Fishery Scientist was appointed as Scientist Grade S-3 (Fish and Fishery Science).

Dr P. N. Kaul, who was working as Scientist Grade S-2 at the Indian Veterinary Research Institute, Izatnagar, joined the Institute as Scientist Grade S-3 (Agricultural Extension).

Dr. K. Ravindran, on deputation to MPEDA as Deputy Director returned to CIFT during 1978 as Scientist Grade S-2.

Shri K.M. Mathai joined the Institute as Sr.Administrative Officer.

Shri James Abraham, joined the Institute as Administrative Officer in place of Shri P.C. Jacob who has been transferred.

1.18. RETIREMENTS

Shri R. Venkataraman, Scientist S-3 who was in charge of the Institute's Veraval Research Centre retired after 34 years of service on 30th September, 1978.

Shri R.S. Nair retired as Assistant Fishery Scientist (Craft and Gear) on 30th November, 1978 after a service of 20 years in the Institute.

1.19. OBITUARY

Shri M.N. Junji, Junior Laboratory Assistant at Institute's Research Centre at Veraval passed away on August, 7, 1978.

2. PROGRESS OF RESEARCH

2.1 DEHYDRATION AND SMOKING

CHIEF FINDINGS

A process for production of dried mussel meat was standardised. Studies on the rate of penetration of salt in different forms of sardines have shown that headless scaleless sardines exhibit maximum rate of absorption in initial stages followed by scaleless whole fish, headless scale-on and whole round fish. Smoked products of good quality were also prepared from silver bar and razor edge.

Research in hand

A number of experiments were conducted to standardise the process for production of dried mussel meat of desirable quality. Comparative studies between cold blanching and hot blanching of the meat have shown the suitability of the latter over the former. However, in the experiments conducted earlier it was observed that in the case of hot blanching, the product exhibited high bacterial contamination. The process had therefore to be modified. Studies now carried out show that 5% of salt to the weight of fresh meat as well as 3/4 of the volume of brine to the meat is quite satisfactory for blanching. Reboiling for five minutes after the meat has been put into the brine is also found essential and optimum. Reboiling up to 10 minutes can also be done without any added advantage, but beyond 10 minutes some nutrients tend to get lost on prolonged cooking. For a good storage life, drying to a level below 20%, preferably around 10%, is recommended.

Studies were carried out on the rate of penetration of salt in 1) whole round 2) whole scaled 3) headless scale-on and 4) headless scaleless sardines. It was observed that headless scaleless sardines showed best rate of absorption of salt in the initial stages followed by whole scaled, headless scale-on and whole round in that order.

Preliminary trials were carried out on preparing boiled and dried products from mackerel. The major drawback experienced was the difficulty in handling the boiled fish which becomes very soft as a result of partial cooking. Further trials with other varieties of fish are underway.

Experiments for standardisation of the procedure for preparation of smoked mussel meat were continued. The process details have been worked out and storage characteristics studied. At the request of M/s Kerala Fisheries Corporation Ltd, a few trial consignments were prepared and handed over to them. These were later sent to the prospective buyers. Results are awaited.

Studies were also initiated on the preparation of light smoked products from edible oysters. Preliminary trials have given products of excellent taste and flavour.

Isinglass prepared in a scientific manner from the air bladder of eel, catfish etc. were sent for comparative assessment of quality along with conventionally dried air fish bladders to some breweries. Report on their merits and demerits is awaited.

Minced meat from sharks, rays etc. were subject to light smoking by spreading over wire meshes and then dried and powdered before packing. The smoked minced meat has a very appealing flavour, and finds ready acceptance when used in preparation of snacks.

A comparative study was taken up on the quality of edible fish powders prepared from Dhoma (*Sciaenids sp*), dai, (*Chirocentrus dorab*) and razor edge (*Opisthopterus tardoore*). Comparative yields of muscle from these fishes by hand and mechanical operation were also worked out and it was observed that 5-10% more meat could be obtained as a result of mechanical operation when compared to manual operation. Ribbon fish (*Trichiurus sp*) was also used for preparing good quality fish powder. Incorporation of these powders at various levels in tapioca powder to give a fortified nutrient food was also tried with encouraging results.

Light salting of *Lactarius* and razor edge (*Opisthopterus tardoore*) was studied in detail. The latter was given different antioxidant treatments before drying in order to prevent prominent discolouration of its salted and dried products. Study on the keeping quality of the treated samples under different storage temperatures is in progress.

Research contemplated

1. Development of products based on mussel meat.
2. Further studies on development of boiled-dried, boiled-smoked and cooked-smoked ready-to-serve products from different varieties of fish.
3. Further studies on preparation of heavy smoked and light smoked products like that from edible oysters.
4. Bacteriology of cured products of commerce, and those prepared in the laboratory with special emphasis on halophilic types and study on the microbiology of spoilage in cured fishery products,
5. Frozen storage characteristics of smoked eel and 'dai' (Silver bar) fish fillets.
6. Preparation of edible fish powders from different cheaper varieties of fish and assessment of their technoeconomic aspects along with biochemical qualities.
7. Improvement on the processing conditions of sun-drying.

Scientists associated

VERAVAL : K. Devadasan, K.K. Solanki, H.K. Beri.

CALICUT : T. S. Unnikrishnan Nair, V. Muraleedharan,
K. George Joseph.

KAKINADA : Subrata Basu.

2.2 FREEZING

CHIEF FINDINGS

Studies on the frozen storage characteristics of different fish have shown that whole Threadfin (rawas), Pellona and Chirocentrus, frozen and stored at -18°C remained in acceptable condition for six months.

Ribbon fish fillets and picked meat, when frozen and stored at - 18°C also remained in good condition after six months storage.

Studies on the freezing and cold storage of catfish, Kalawa and Indian halibut were completed. Observations reveal that in the case of catfish fillets, proper glazing and packaging are essential to get a product of maximum shelf life and one free from weight loss and deterioration like dehydration, oxidation of fat and discoloration. For eg. individually frozen fillets of catfish stored without glazing and packaging was found to spoil after 4 weeks storage, whereas the frozen fillets packed in 200 gauge polythene remained in acceptable condition for 4-5 months at -18°C. Maximum shelf-life was obtained when fillets were frozen as glazed blocks and packed in polythene lined waxed cartons.

Studies on freezing, storage (at -18°C) and subsequent canning of oil sardines were completed. It was observed that by using absolutely fresh material for freezing and by proper glazing and packaging, the storage life of frozen oil sardines (average weight 40 gm, fat content 13.98% WWB) could be extended up to 8 months at - 18°C.

Research in hand

Studies were continued on the freezing and cold storage characteristics of different varieties of fish. Whole 'rawas' (*Polynemus sp*), *Pellona sp* and *Chirocentrus sp*. were wrapped in polythene, frozen and stored at -18°C and the changes taking place were followed systematically. It was observed that all the three varieties of fishes could be frozen as whole and stored for 6 months at -18°C without appreciable loss in overall quality and acceptability of the material and without any significant change in texture and flavour of the product. Increase in oxidative rancidity as measured by TBA values was insignificant in the case of rawas and *Pellona* but *Chirocentrus* showed a slight increase. Total nitrogen values, non protein nitrogen and soluble

nitrogen values, showed a steady decline while alpha amino nitrogen values remained fairly steady in the case of rawas, although in the case of *Pellona* and *Chirocentrus* the values registered a slight decrease. Total volatile nitrogen and free fatty acid values showed steady increase in all the samples. Total bacterial count remained low in all the three samples throughout the investigations.

Studies on the frozen storage of whole, fresh water fishes, crabs, fillets of perch, jew fish, thread fin bream etc. are in progress.

The iced and frozen storage characteristics of milk fish (*Chanos chanos*) were studied in detail. Fresh and iced whole *Chanos* were frozen individually, glazed, wrapped in polythene and stored at -18°C . After 18 weeks' storage at -18°C , the fresh frozen material showed only slight changes in texture and flavour whereas iced and frozen samples showed changes of varying degrees in flavour and texture depending on the duration of pre-process ice storage.

Studies were also initiated on the effect of different types of packaging materials on the quality and shelf-life of salted and dried fish.

The frozen storage characteristics of whole cooked lobsters were taken up for study during the year under report. Samples of rock lobster and sand lobster were immersed alive after cleaning well in boiling 5% brine and cooked for 25 minutes. The cooked whole lobsters were then wrapped in clean polythene bags after cooling and then frozen at -40°C . After freezing, the samples were stored at -18°C . Regular periodical analysis of the samples are being conducted to follow the bio-chemical and organoleptic changes in the samples during storage.

Ribbon fish fillets were frozen at -40°C as individual fillets wrapped in polythene and fillets frozen as 2 kg. blocks. In addition, picked meat of the fish was also frozen as blocks. The frozen samples were stored at -18°C and quality changes in the samples assessed. It was seen that even after 6 months storage the samples retained very good quality thereby showing that ribbon fish meat is ideal for making frozen fish meat blocks.

Research contemplated

1. Studies on the iced and frozen storage characteristics of commercially important fresh and brackish water fish of Kerala.
2. Freezing of whole tuna and suitability of frozen tuna for canning.
3. Freezing and storage of oil sardines at -30°C and extension of shelf - life of oil sardines at low temperature.
4. Further investigations on freezing and storage characteristics of fish fillets.
5. Comparative studies on the freezing and storage of whole crabs and cooked crabs, raw meat and cooked meat and raw claw and cooked claw of crabs.

6. Frozen storage characteristics of lightly smoked eel and dai (silver bar) fish.
7. Study on the amenability of commercially important fishes of Maharashtra coast to freezing.

Scientists associated

COCHIN: T. K. Govindan, P. A. Perigreen, Chinnamma George, Jose Joseph, K. Vijayabharathi, T. K. Srinivasa Gopal.

VERAVAL: K. Devadasan, Rajendra Badonia.

BOMBAY: Jose Stephen, D. K. Garg.

KAKINADA: Subrata Basu.

2. 3. CANNING

CHIEF FINDINGS

Canning mackerel tuna (Euthynnus affinis) in oil coloured red and spiced with chilli extract was shown to improve the overall appearance, taste, flavour and general acceptability of the product. Incorporation of other spices like nutmeg, mace etc, was found to further improve the flavour. Milk fish (Chanos chanos) yielded a very good product when canned in oil. Studies on the canning of Bombay duck in paste form have shown that incorporation of starch considerably enhances the palatability, spreadability and flavour of the product.

Research in hand

Mackerel tuna (*Euthynnus affinis*) is not normally used either for canning or freezing and is not generally relished as the skipjack tuna. But of late, the interest shown for canned mackerel tuna by some of the consuming centres necessitated a modification in the process of canning the meat to improve the general appearance of the product, its colour and flavour. Colouring the filling oil red was found to improve the appearance. Studies made to identify a natural colouring matter which would retain its colour during heat processing through storage period revealed chilli as a good source. Filling the tuna cans with oil spiced with chilli yielded the dual benefit of improving the colour and thus the general appearance of the product at the same time improving its flavour and general acceptability. The product had good consumer acceptance. Further modification to the process was effected by incorporating other spices like nutmeg, mace etc. both individually and collectively with and without the chilli extract. Comparative studies have shown the superiority of the process of canning the tuna meat along with extract of mixed spices over the others. The process has however to be further evaluated in terms of the storage life of the product.

Canning of milk fish (*Chanos chanos*) showed that good quality products could be obtained when absolutely fresh fish was packed in fillet form

in oil, as well as in its natural juice in quarter dingley cans. However, in the case of fish canned after a short period of frozen storage, it was observed that the 'natural pack' was far from satisfactory. To gather more details on the effect freezing/icing the fish had on the canned product, further studies were carried out on freezing progressively iced fish and subsequently canning them. Studies reveal that while fish packed in oil remained in an acceptable condition even when the raw material was stored in ice upto 7 days before canning, the 'Natural pack' prepared from the same raw material yielded highly erratic results.

Studies were undertaken on working out a standard process for canning Bombay duck in paste form either as such or in combination with other additives. Fresh as well as frozen Bombay duck was used for the study. It was noted that the yield, palatability and characteristic flavour reduced considerably when the paste was made out of frozen fish. Incorporation of starch was seen to improve the consistency of the product. Analysis of the product at different stages of processing with regard to loss in nutrients, salt uptake, moisture loss etc. was also carried out. The studies are in progress.

Canning of oyster meat was also taken up for study. Use of different media for filling, effect of other parameters of processing on the quality of the finished product as also its shelf life are also being studied. Initial attempts were made on canning the oyster meat in its own 'juice' and the canned samples were stored for more than three months for assessing the storage behaviour. It was observed that the canned oysters had a very good characteristic flavour, but its appearance was not satisfactory as revealed by its intense discolouration.

The possibility of using cheaper varieties of fishes like dai (silver bar), ribbon fish, kati (razor edge), *Lactarius* etc. for canning purposes in different forms was explored during the period under report. Various filling media were tried to increase the shelf-life, palatability and quality of the canned products. It was observed that Kati fish, which is not normally eaten fresh, can be made into a palatable and easily acceptable product by highly smoking and then canning in refined groundnut oil. Similarly, lightly smoked *Lactarius* also gave an excellent canned product.

Research contemplated

1. Further studies on canning of mackerel tuna with special reference to problems on histamine poisoning.
2. Canning of speciality products from different varieties of fish.
3. Canning of ghol, horse mackerel etc.
4. Further studies on canning brackish water fishes, mackerel fillets and smoked fish

Scientists associated

COCHIN: K. K. Balachandran, T. K. Govindan, P. K. Vijayan,
K. Vijayabharathi.

VERAVAL: K. K. Solanki, R. Badonia.

2. 4. ENZYMES, PROTEINS AND LIPIDS

CHIEF FINDINGS

Of the tropical fishes analysed, mackerel recorded high content of proteolytic enzymes and hence fast textural degradation post mortem as compared to other fishes like oil sardine. Studies reveal the existence of a general trend of fast glycogen breakdown, a slow nucleotide degradation and a slow initial rise in reducing sugars during chilled storage of tropical fishes. The hydrolytic rancidity in fishes is highly influenced by the phospholipid content which undergoes rapid hydrolysis while the triglyceride content was observed to have very little influence. The pattern of liquid breakdown in fishes is similar both during ice storage and frozen storage.

Research in hand

Preliminary investigations were carried out on the purification and concentration of pituitary hormones from cheap commercial sources with a view to studying the feasibility of their use for increased production of fish in small ponds and lakes.

A detailed study of the pattern of change in flavourous compounds like nucleotides, reducing sugars, glycogen etc., during chilled storage was taken up to assess the relationship between the organoleptic quality and content of the aforesaid constituents.

The changes in the major protein fractions during different processing conditions are being investigated as they play a sub-standard role in deciding the texture of the processed product. Further, such a study is also expected to help in selection of fractions for other special product formulations.

The fatty acid compositions of phospholipids are being worked out as they are nutritionally important constituents. However, it has been observed that the highly labile nature of this fraction introduces fast hydrolytic rancidity (even during chilled storage) as well as oxidative rancidity.

Research contemplated

1. Investigations on growth promoting hormones and their biochemical evaluation.

2. Biochemical composition and nutritional value of edible fishes and shell fishes and studies on the distribution of toxic constituents in these fishes.
3. Studies on the structural proteins and enzyme systems of fish muscle.

Scientists associated

COCHIN : P. D. Antony, A. G. Radhakrishnan, M. K. Mukundan,
P. G. Viswanathan Nair, N. Unnikrishnan Nair.

2. 5. FOOD POISONING MICRO-ORGANISMS AND THEIR CONTROL

CHIEF FINDINGS

The effect of primary incubation temperature on the growth temperature range of bacteria was studied with reference to 296 bacterial cultures isolated from sardines using streak plate technique. The primary incubation temperature used during isolation of strains caused a selection of strains based on their growth temperature requirements. It has also been shown that a primary incubation temperature of 30°C is necessary to facilitate the growth of both psychrophiles and mesophiles from fish specimens.

Salmonella roan, S newport and S. hiedelberg, artificially inoculated on crab meat and stored at -20°C were found to be viable up to 2 months.

Studies on the nature of microflora on fresh water fishes have shown the presence of 80% gram negative rods, 6% gram positive micrococci and the rest gram positive rods. Studies indicate a greater percentage of the gram positive organisms on fresh water fishes than on marine fishes.

For estimation of chlorine content in process water, the orthotolidine method is the one generally used. But this method can estimate chlorine levels only up to 6 ppm. correctly. Higher concentration levels are now being used in the processing industry, especially in frog leg processing. No method exists at present for the rapid determination of chlorine at higher levels. Studies carried out at the Institute have shown that filter paper impregnated with a reagent consisting of starch, potassium iodide and acetic acid gave a gradation in developed colour when in contact with different chlorine levels. Standard colour charts are now being made for comparison with unknowns.

Commercial samples of cooked frozen crab meat were highly contaminated with bacteria due to the time involved in picking a sizeable

lot of the meat. Use of chlorine above 3 ppm for washing the picked meat was seen to adversely affect the odours of the product. Hence, a method of re-cooking the picked meat before freezing was worked out. The process when applied on a commercial basis has yielded an acceptable product. Similarly, cooked-peeled-frozen prawns got rejected in foreign markets because of the high total plate count at 30°C. Examination of the commercial samples showed that the total plate count at 30°C is much higher than that at 37°C. A process was therefore worked out for re-cooking the picked meat without further contamination. This has been accepted and the method is now being practised by the industry. The re-cooking loss is about 3%.

Research in hand

The Intelectron fish tester readings, TPC at 37°, 30° and 5°C, TVN, hypoxanthine and α -NH₂-N levels were compared with characteristics of fish in the raw state as well as in the cooked state. Pearl spot stored in ice remained in acceptable condition for 12-14 days. Intelectron fish tester readings and TPC at 30°C and 5°C showed gradual changes with declining sensory characteristics. During storage at ambient temperature, the fish remained in acceptable condition for 12 hours. In this case, all objective indices showed gradual changes with sensory characteristics. Sardines also were studied at ambient temperature and at 0°C in ice. Shelf lives were observed to be 8 hours and 5-6 days respectively. Intelectron fish tester readings PV and FFA showed changes with decreasing sensory characteristics. Squids stored whole in ice, immediately after catch remained without discolouration for 2 days, while as dressed tubes they remained thus for 4 days. The shrinkage of squid meat on cooking is seen to be related to its quality. It increased to more than 5% after storage in ice for 4 to 5 days from the initial shrinkage of less than 15%.

The effect on the quality of fish due to delay in icing was studied. The species of fish taken for the studies was trivalley (*Caranx sp.*) Changes in quality were followed by sensory examination and by following Torry meter readings and TPC at 37°C and 15°C. It was observed that delay in icing of more than 6 hours adversely affected the quality of the fish. The shelf life was decreased by 70% compared to 12% for a delay of 3 hours. However, TPC at 37°C cannot be taken as a reliable index of quality in iced fish.

Study on the quality characteristics of more samples of dried lactarius, silver bellies and sole fish were taken up and completed. The data are being processed.

Research contemplated

1. Studies on microflora of fresh and brackish water fishes and microbial pollution in inland waters.

2. Studies on the mechanisms of microbial spoilage of fish.
3. Development of methodology for the quantitative and qualitative studies on bacterial load in fish and fishery products.
4. Comparison of freshness meters — Intelectron fish tester and Torry Freshness Meter — to evaluate quality of wet fish during storage at ambient temperature and at 0°C (in ice).
5. Sensory evaluation of quality of wet fish and its correlation to objective quality indices and formulation of specification.
6. Quality of cured products and their specifications.
7. Bacterial quality of new commercially frozen products.

Scientists associated

COCHIN : Cyriac Mathen, T. S. Gopalakrishna Iyer, K. Mahadeva Iyer, P. R. Girija Varma, Arul James, Nirmala Thampuran, P. K. Surendran, A. C. Joseph, V. Narayanan Nambiar, Francis Thomas.

2.6 UTILIZATION OF PROCESSING WASTE

CHIEF FINDINGS

A soluble form of modified chitosan was prepared. The product is a thick gel which easily dissolves in water, thus avoiding the need for acetic acid for dissolving chitosan. Samples of fish feed prepared from fishery and agricultural wastes have been found suitable for feeding cultured fish.

Research in hand

Studies were continued on the application of chitosan for flocculation purposes. It was observed that the product could be effectively used in flocculating carbon from slurries which are usually discharged as industrial affluent. It was also found effective in coagulation and sedimentation of iron hydroxide from the digested zinc ore solution. In order to enhance the property of chitosan, condensation with formaldehyde was tried which considerably increased the viscosity. However, on keeping, the product became insoluble in water as well as in acid. Soaking in formic acid was tried to make it water soluble. The product thus obtained was soluble in water and could be used for flocculation purposes.

Studies were also continued on complete utilization of squilla. The nutritional value of squilla protein and non-protein nitrogen fractions are being investigated.

A small animal house was set up with albino rats for studying the nutritional value of protein from squilla and prawn waste.

Hydrolysates of red meat of tuna using pineapple enzymes were prepared. After separating the non hydrolysed proteins, the hydrolysates were concentrated and mixed with molasses and spices to obtain syrupy products. The products had appealing taste and fair shelf life.

Hydrolysates of filleting waste from catfish, jew fish, Kalava and *Chanos chanos* were prepared using papain. The process helps to remove the bones easily. From the filtered hydrolysate, fat also could be separated easily and the unhydrolysed portion dried and powdered. The possibility of using this powder for poultry or animals is being studied as also the composition of various fractions obtained in the hydrolytic process.

Samples of fish feed which were sent to the Orissa Research Centre of C. I. F. R. I. were reported suitable for feeding cultured fish. Larger quantities were later prepared and sent to the Centre for pond feeding trials. Results of the trials are awaited. The feed samples were analysed for protein, carbohydrate, fat and trace elements.

Trials were also carried out for obtaining fish albumin from trash fish. The effect of temperature and concentration of alkali on the quality of fish albumins has also been studied.

Research contemplated

1. Continue studies on (a) industrial application of chitosan for flocculation and in paper industry (b) properties of condensation product of chitosan with formalin.
2. Evolving an integrated process for separation of proteins and extraction of non-protein (soluble) fractions from squilla and conversion of squilla shell into chitosan.
3. Studies on the nutritional evaluation of squilla protein and shrimp extract by feeding trials.
4. Further studies on hydrolysate from filleting wastes of catfish, jew fish etc and fish albumins from trash fish.
5. Studies on isinglass from fish bladder.

Scientists associated

COCHIN: P. V. Prabhu, K. G. Ramachandran Nair, A. Lekshmy Nair,
P. T. Mathew.

KAKINADA: Subrata Basu

2.7 CRAFT MATERIALS

CHIEF FINDINGS

Construction of a 4m. prototype wooden row boat with seasoned and preservative treated mango wood has been completed. A prototype fibreglass reinforced plastic (FRP) catamaran has been developed, designed and built in the private sector of the boat building industry. On the basis of technical assistance rendered by the Institute, 13m. mechanised wooden purse seiners, 10 m. steel trawlers and 11 m. FRP boats have been in demand along the coasts of Karnataka, Kerala and Tamilnadu respectively during the year under report. Ternary aluminium alloy anodes are now being extensively used in fishing boats in place of the conventional zinc anodes for cathodic protection. Copper based alloys with high content of copper alone have been found to resist the settlement of the marine fouling organisms under prolonged immersion. Tributyl tin oxide (TBTO) incorporated wood preservatives showed greater resistance to marine wood borer attack on boat building timbers.

Research in hand

1. Bio-deterioration of boat building materials in sea water

a) Marine fouling

Sequential fouling and corrosion on copper, cupronickel, aluminium magnesium alloy, stainless steel and lead were studied together with the effect of anodic polarisation and fouling on these panels. Panels polarised with ternary aluminium alloy inhibited corrosion. However, over protection by anode resulted in heavy fouling on copper and cupronickel panels owing to the prevention of dissolution of metals and formation of toxic films on the surface.

b) Marine wood borers

Four organometallic compounds, viz. lead acetyl acetate (LAA), tributyl tin acetate (TBTA), triphenyl tin acetate (TPTA) and triphenyl tin hydroxide (TPTH) which are produced on an experimental basis at the National Chemical Laboratory at Poona employing indigenous technology were experimented as marine wood preservatives and their performance compared with that of tributyl tin oxide (TBTO), an imported chemical and the best known biocide for controlling the growth of organisms responsible for biodeterioration.

The biocides were solubilised/ dispersed in cheap and readily available media like diesel oil, turpentine and kerosene and applied as a preservative by

brush treatment as the penetration was found to be adequate. Timber species like mango (*Mangifera indica*) and ventek (*Lagerstroemia lanceolata*) which generally satisfy the strength requirements for boat building but lack resistance to biodegradation were treated with the preservatives and subject to laboratory tests as well as short and long term field trials.

All the biocides tested were found to ward off fouling complex, the anti-borer activity showing gradation. The principal borers noticed were *Martesia striata*, *Nausitora sp* and *Sphaeroma teredrans*. The data given below show the total number of borer holes counted on the surface of test blocks after a termination of six months' field test.

Preservative used	No. of borer holes per M ²
LAA	780
TBTA	414
TPTA	344
TPTH	97
TBTO	NIL

The release of toxin from the wood, which was found to be non-linear, was observed to be related to the nature of the dispersion/solubilisation medium.

Results indicate that TPTH and TPTA are near substitutes to TBTO and could advantageously be used in the formulation of marine wood preservatives.

2. a) Marine corrosion and its prevention

While formulating a suitable resin incorporating double boiled linseed oil, cashewnut shell liquid, sardine oil, rosin, phthalic anhydride and glycerol, a number of screening tests were made with reference to Indian Standard specifications.

A combination with double boiled linseed oil and rosin in the ratio of 1:3 at a range of 240-250°C was seen to withstand all the tests and as such, a resin combination of the above specification was selected for incorporating suitable pigment for formulating a heavy duty anticorrosive paint coating for fishing boats.

b) Ternary aluminium alloy anodes under actual field observations were found to perform much better than the conventional zinc anodes for cathodic protection in fishing boats. The poor performance of the zinc anodes has been attributed to the impurities in it, especially iron. The quantity of anodes required to protect a known area and proper method of installation have been standardised. In the case of zinc, 99.5% purity (electrolytic zinc) has been recommended.

3. Boat building materials

a) Fibreglass reinforced plastic [FRP]

Organic fibres like jute and coir were tried as reinforcing material in combination with activated polyester resin. FRP reinforcement was found to be far superior to organic fibres as regards compatibility, strength and moisture resistance.

Due to the high cost of sophisticated mould required for the fabrication of malabar canoes out of FRP, the work could not be initiated. New and cheaper moulding techniques are being explored and experimented with.

b) Ferrocement

Improvements and newer innovations are being tried on the primary reinforcement of steel rods and chickenwire mesh fabrication with a view to reducing the dead weight.

c) Treated timbers for boat building

Construction of a 4 M. row boat built exclusively of seasoned and treated mango wood was completed.

The preservative chosen was copper chrome arsenic compound in water and treatment under light pressure was resorted to. Specification, design and construction work was completed at the Institute while preservative treatment was carried out at the Bangalore Wood Preservation Centre of Forest Research Institute. The boat is now under actual field exposure tests and trial runs.

The characteristic features of haldu wood (*Adina cordifolia*), debdaru (*Polyalthia longifolia*) and cheeni or maina (*Tetrameles nudiflora*) were studied for their treatability with preservatives.

Research contemplated

1. Mass treatment of traditional fishing crafts like catamarans and canoes with toxic wood preservatives designed and developed at the Institute. Monitoring of the results.
2. Completion of prototype construction of FRP and ferrocement crafts.
3. Actual monitoring of construction materials in seawater with a view to suggesting suitable preventive measures with worked out standards.
4. Location of metallic corrosion in fishing boats, isolating causative factors and recommendation of preventive measures.
5. Investigations on cashewnut shell liquid (CNSL), fish oil and Indian lac for their efficient utility in marine coatings.

Scientists associated

COCHIN : R. Balasubramanyan, Dr. K Ravindran,
N. Unnikrishnan Nair, A. G. Gopalakrishna Pillai,
Dr. M. Shahul Hameed, B. Meenakumari, Rani
Mary Jacob.

2.8. GEAR: MARINE

2.8.1 (a) TRAWLS (A) : Evolution of suitable gear for the exploitation of shallow water mix

CHIEF FINDINGS

Studies initiated earlier at Veraval on the comparative evaluation of the 25m. bulged belly trawl and 25m. six seam trawl have conclusively shown, in confirmation with earlier findings, that the 25m. bulged belly trawl is more efficient than the six seam trawl for operation in shallow waters (up to 40m. depth), especially for prawns and small miscellaneous fish.

A new high opening trawl of 25m. head rope length designed and developed as a multi-purpose trawl was seen to have the properties of a mid-water trawl as well as a high-rising bottom trawl

At Kakinada, studies on twin trawling with sled have given encouraging results. The 18.6m parallel double trawl net, operated for the first time at the Centre was seen to work quite satisfactorily, meeting the requirements of the new design like more horizontal spread and less resistance.

Investigations on the two designs of mid-water trawls, viz-10.5m. equal panel and 10.3m. unequal panel trawls continued from the Goa Research Centre indicate the superiority of the unequal panel net over the other in landing column fishes. The nets were operated in combination with 120X60 cm. vertical curved otter boards.

Research in hand

At Cochin, trial operations were carried out with three types of separator trawls, viz. a conventional four seam trawl with a separator panel, a wing trawl with a double walled wing and a bottomless trawl in order to ascertain their comparative efficiency in separation of shrimp from the total catch. Studies are in progress.

A 17m parachute trawl was fabricated and comparative fishing trials with other types of bottom trawl nets initiated to study its efficiency.

A 12.5m single boat type mid-water trawl net suitable for smaller vessels was designed and fabricated and trial operations carried out with the same.

Studies were continued at the Veraval Research Centre with the newly designed and developed 25m high opening trawl. A total of 24 comparative hauls were made with three nets, viz 25m. six seam trawl 25m. bulged belly trawl and 25m high opening trawl. The new high opening trawl was seen to exhibit qualities of a mid-water trawl and a high rising bottom trawl without in any way affecting the normal bottom trawling efficiency and engine RPM or fuel consumption, the two pre-requisites for sophisticated mid-water trawling.

A 27.4 m four seam shrimp trawl was designed for assessing its comparative efficiency with two pairs of 6.8m twin trawls operated from two out-rigger booms. Fabrication of the gear has been initiated.

At Goa Centre, comparative efficiency studies with the three types of trawls, viz 15m bulged belly, 15.8m six seam and 29.26m long wing trawls were continued in combination with flat rectangular and horizontal curved boards. The number of operations were not sufficient to arrive at any conclusive results. Studies are to be continued.

With the double objective of introducing mid-water trawl operations along the coast of Goa as well as evolving a suitable design for medium class vessels, studies were continued on the two designs of mid-water trawls, viz 10.5m equal panel and 10.3m unequal panel net in combination with 120x60cm. vertical curved board. Results of operations conducted indicate the superiority of the 10.3m unequal panel net over the other in landing column fishes. These are in confirmation with the results obtained last year.

At Kakinada, studies on trawls in the following combinations were pursued

a) Studies on parallel double trawls

An 18.6m parallel double trawl was operated in comparison with a 20m bulged belly net. Data collected earlier were subject to analysis of variance for horizontal opening, warp tension and catch. The parallel double trawl gave more horizontal spread than the bulged belly trawl. But in the case of warp tension and catch, the rates were much lower though catch composition showed variation. The studies are to be continued in deeper waters.

b) Studies on vertical double trawl

Experiments were continued with the 15.5m vertical double trawl net in comparison with the 20m. bulged belly gear. The experiments were attempted in shallow waters of 10-20m depth with 2.0-2.25 knots towing speed. The catch rate was observed to be very much less than that obtained in the previous year. Experiments are to be continued.

c) Studies on twin trawling with sled

Initially, experiments were continued with two 10.5m bulged belly trawls in combination with 70x40cm, 22 kg. otter boards with a sled in the centre. Later, the otter boards were replaced by slightly bigger boards of specification 115x63 mx40kg for getting more spread, when the performance of the net was observed to be significantly better. A comparative study with a single 20m bulged belly net was also attempted.

In addition to the above, design was developed for a Mexican type otter board of size 150cm length x 60cm breadth x 50 kg weight with chain bridles and broad shoe. The board was fabricated and in combination with a 20m bulged bellynet comparative trials made with a flat rectangular board of size 130 x 70cm x 50kg. in 10-25m depth water and an average trawling speed of 2.00 knots. Catch rate (per trawling hour) was observed to be 11.8 kg and 14.6 kg respectively. The performance of the board improved with slight adjustment in the weight and fixing of the bridle.

Research contemplated

1. Studies on mid-water trawling to be continued from Veraval, Kakinada, Goa and Cochin.
2. Studies on separator and parachute trawls to be continued at Cochin
3. Double-rig-twin-trawling for shrimps and studies on different designs of otter boards from Veraval Centre
4. Further studies on twin trawling with sled from Kakinada Centre.
5. Comparative efficiency studies of different concepts of trawl designs to be continued from Goa and Veraval Centres.

Scientists associated

COCHIN : K. A. Sadanandan, P. Appukutta Panicker,
T. M. Sivan, K. N. Kartha, P. George Mathai,
K. Gopalakrishnan.

VERAVAL : K. K. Kunjipalu, A. C. Kuttappan.

KAKINADA : A. V. V. Satyanarayana, G. Narayanappa,
S. V.S. Rama Rao, R. Mangayya Naidu,
J. Sitarama Rao, Percy Dawson (Transferred to
Burla Centre in August, '78), K. Gopalakrishnan
(Transferred to Cochin in September, '78).

GOA : H. N. Mhalathkar, T. Joseph Mathai,
T. P. George, Syed Abbas.

2. 8. 1(b) TRAWLS (B) : DEVELOPMENT OF GEAR FOR OFFSHORE FISHING

CHIEF FINDINGS

Further studies on the large mesh demersal trawl of 32m head rope length designed and developed by the Veraval Centre have shown its suitability and efficiency for exploitation of demersal fishery resources off Veraval when operated from a medium size trawler. The new net is simple to construct and easy to repair and maintain as it involves lesser number of meshes.

Research in hand

At Cochin, a 32m. large mesh high opening trawl suitable for offshore grounds was designed and fabricated. The new net has a mesh range of 120mm. at the fore part and 30mm. at the cod end. The net was operated in comparison with a 32m. bulged belly trawl for studying the relative efficiency, results of which indicate the higher efficiency of the large mesh net.

A 17.5m single boat type mid-water trawl was designed and fabricated and trial fishing experiments conducted with the same.

In confirmation with the earlier findings, the 32m large mesh demersal trawl developed at Veraval and operated from a medium size vessel was found more efficient for capture of demersal fisheries off that region when compared to a standard bottom trawl of same head rope length with conventional small meshes. Increased catch with a proportionate increase of quality fishes and demersal species was obtained with the large mesh trawl. The total catch including the smaller varieties, was also more with the large mesh trawl than the conventional small mesh trawl. This suggests the possibility of increasing the mesh size of trawl nets in the fore part without affecting the total catch, by which the mouth area of the net can be increased enhancing the fishing power by covering a larger area per tow. The net was also found simple for construction and easy to repair and maintain as it involves lesser number of meshes.

Designs were also developed of a new 21m large mesh mid-water trawl with four equal panels and a 21m 'Zagger Net', characterised by presence of strands in the fore-part instead of meshes for fishing in the off-shore waters.

Research contemplated

1. Further studies with the 32m large mesh demersal trawl from Cochin and Veraval.

2. Studies on mid-water trawls from Cochin, Kakinada and Veraval and 'Zagger' net in combination with vertical curved boards from Veraval.
3. Studies on 'Dol' nets to be initiated at Veraval.

Scientists associated

COCHIN : K. A. Sadanandan, K. N. Kartha, N. Subramonia Pillai,
P. George Mathai, K. Gopalakrishnan, N. A. George.

VERAVAL : K. K. Kunjipalu, A. C. Kuttappan.

KAKINADA : S. V. S. Rama Rao, A. V. V. Satyanarana,
: G. Narayanappa.

2.8.2. LINES

Research in hand

Fishing trips for squid jigging were undertaken off Cochin at a depth range of 25-75m. Two sets of lines with 10 jigs on each were operated with light attraction using 1000 watts underwater and above water lamps. It was observed that the squids attracted towards the illuminated areas were too few to facilitate hooking by jigs. Studies are to be continued.

Similar operations were carried out at Veraval using 1000 watts above water lights. Squids and cuttle fishes were found attracted towards the light beams on the surface waters. Hand lining with squid jigs and scooping with small dip net were also tried. The methods are to be perfected for better efficiency.

At Kakinada, a set of long line gear consisting of 200 hooks was fabricated and trial operations carried out for capture of eels.

Research contemplated

1. Experimental squid jigging to be continued to study the following.
 - a) Intensity of light attraction
 - b) Effectiveness of coloured jigs
 - c) Hooking rate
2. Continuation of trials with long line gear for capture of eels at Kakinada.
3. Long line fishing for sharks from Veraval for selectivity of baits.

Scientists associated

COCHIN : N.A. George, K. Sreedharan Namboodiri,
N. Subramonia Pillai.

VERAVAL : A.C. Kuttappan, M.R. Boopendranath.

KAKINADA : G. Narayanappa, R. Mangayya Naidu, J. Sitarama Rao.

2.8.3. ROUND HAUL NETS

CHIEF FINDINGS

The 260.5m. one boat type purse seine design evolved for operation from smaller class of vessels was released to the industry.

Research in hand.

The design of the 260.5m. purse seine which was evolved earlier for operation from small class of vessels was released to the industry. Attempts are being made to popularise the gear, especially along Karnataka coast.

Steps have also been initiated to design a suitable net for operation from medium class vessels.

Research contemplated

1. Evolution of design of two boat purse seine operation from country crafts.
2. Field trials at Goa with standard purse seine evolved for small classes of vessels.

Scientists associated

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

2.8.4. GILL NETS

CHIEF FINDINGS

In confirmation with earlier findings, gill nets for HILSA rigged up with vertical and horizontal lines were found more efficient than simple gill nets.

Research in hand

Studies were continued from Veraval Centre, with 27 shots of *Hilsa* gill nets with different riggings as simple gill net, vertical line net and frame net. As observed earlier, nets with both vertical and horizontal lines gave better catch than the simple gill nets. This was due to the fact that lines enhance the entangling capacity of the net as a result of the increase in looseness of webbing which is indicative of the fact that the method of capture in gill nets with respect to many a species is more by entangling than by gilling.

Studies were also initiated on coloured gill nets. Twenty shots of nylon gill nets of 50 mm and 60 mm bar meshes fabricated out of twines of specification 210D/2/3 were dyed in five shades. viz yellow, orange, blue, brown and green, mounted and kept ready for operation along with original white. Another 18 shots of gill nets of 70mm bar mesh in 210 D/3/3 were also dyed for carrying out trials.

Investigations on shark gill nets were continued. An abnormal catch of Devil ray, *Dicerobatis eregoodoo* was recorded on a single day's fishing. The catch rate per unit effort was 175 kg/1000 sq m of net. It has been recorded as one of the largest catches in gill netting in Indian waters and may be suggestive of the maximum catch that can be encountered in gill nets.

At Kakinada, fishing operations were carried out with prawn gill nets.

Research contemplated

1. Studies on coloured gill nets for *Hilsa*, pomfret, seer, dai, kati etc.
2. Studies on shark gill nets for sharks, ghol, perches etc.

Scientists associated

VERAVAL : K. K. Kunjipalu, A. C. Kuttappan, M. R. Boopendranath

KAKINADA : G. Narayanappa, R. Mangayya Naidu, J. Sitarama Rao

2. 8. 5. LOBSTER GEAR / TRAPS

Research in hand

With a view to evolving a suitable gear for lobster and to study the efficiency of indigenous lobster traps in relation to bottom set gill nets and new designs of traps, 20 units of new and old designs of bottom set] gill nets, 6 numbers of lobster traps (iron traps) and 20 numbers of lobster Colachel type trap were got ready and experimental fishing operations conducted along Goa coast. The new designs of lobster gill nets and the new design of iron trap were found more efficient than the other two. More data are required for confirmation.

At Kakinada, different types of traps for crabs and perches were fabricated and made ready for trial operations.

Research contemplated

1. Further studies on efficiency of indigenous traps in relation to new and old designs of bottom set gill nets and new design of trap from Goa centre.
2. Fishing operations with different types of traps from Kakinada.
3. Operation of traps and pots made out of bamboo and iron reinforcements for lobster fishing from Veraval.
4. Studies on indigenous lobster traps of south-west coast of India to be made at Cochin.

Scientists associated

GOA : T. Joseph Mathai, T. P. George, M. Syed Abbas.

KAKINADA : G. Narayanappa, R. Mangayya Naidu; J. Sitarama Rao.

2.8.6. GEAR MATERIALS

CHIEF FINDINGS

The incorporation of denier sizes other than 210 d for preparation of netting yarns has been recommended to the Indian Standards Institution. This is to be issued as a revision to the existing Standard IS: 4401-1967.

Research in hand

Three sets of samples of polyethylene monofilament braided twines were analysed for their basic properties in comparison with twisted samples. The present set of samples were found to compare favourably with twisted ones based on strength and runnage values. The knot efficiency of the sample was good and knot slippage resistance, better.

Different specifications of knotless nettings were procured from different manufacturers comprising a total of 12 samples. The method of specification of the webbing was studied which gave an indication that the use of thicker samples of laid-in threads, compared to swing threads used during the manufacturing process of knotless webbing results in stronger webbing. This is mainly because the strain on the webbing comes more on the laid-in threads rather than on the swing threads. This interim finding was communicated to the manufacturers. Knotless webbings equivalent to different specifications of knotted webbings are manufactured by a process of using different combinations of laid-in and swing threads. Based on this principle, the samples of knotless webbings were analysed in comparison with knotted nettings.

Twentyeight fishing trips were undertaken using a net preserved by the method developed by the South India Textile Research Association (SITRA) along with a control net. The difference in catch between the treated net and the control net was however not significant. Both the nets were damaged and became unserviceable at the end of the trials.

Research contemplated

1. Studies on synthetic ropes
2. Analysis of braided twines
3. Field trials of nets made of braided twines
4. Testing, analysis and field trials of knotless webbing

Scientists associated

COCHIN: S. Gopalan Nayar, K. Radhalekshmy, T. T. Annamma, Varghese Paul

2. 9. GEAR: INLAND

SURVEY OF LANDINGS FROM HIRAKUD RESERVOIR

CHIEF FINDINGS

The total fish landings from Hirakud Reservoir has been estimated to be 759 tonnes.

Research in hand

Collection of data on fish landings from the Hirakud Reservoir was carried out using stratified random sampling procedure. It is the first time that such a sampling is done in Indian reservoirs. The landings were estimated at 759 tonnes with an error of 2. 6%.

Research contemplated

1. Continuation of survey on landing statistics, and collection of limnological and hydrographic data

Scientists associated

BURLA: M.D. Varghese, A. A. Khan V. C. George.

COCHIN: A. K. Kesavan Nair

2. 9. 1. GILL NETS

CHIEF FINDINGS

Frame nets with 90mm. bar were found to be suitable for exploitation of the predominant size group of C. CATLA in Hirakud reservoir. The 25mm bar simple gill nets landed significantly higher catches of uneconomical fishes.

Research in hand

Experiments with 75, 90, 105, and 120mm. bar simple gill nets and frame nets were carried out for exploitation of the fishery resources of Hirakud reservoir. It was observed that frame nets landed 84.8 % of the total catch by weight, while with respect to *C. catla* frame nets landed 88.1% by weight. Among the four mesh sizes experimented with, nets with 90mm. bar landed the maximum (6.01kg) catch followed by 105mm (5.99kg) per unit area.

Studies continued on the eradication of uneconomical fishes from the lower reaches of the reservoir have shown that 25mm. bar simple gill nets are most effective for capture of the uneconomical fishes compared to the other mesh sizes tried, viz 30, 35, 40 and 45mm. bar.

Research contemplated

Further studies on the above.

Scientists associated

BURLA : V. C. George, A. A. Khan, M. D Varghese.

2.9.2. DRAG NET

Research in hand

As part of the exploitation of minor fishery resources, trials were carried out with a drag net operated along the banks of the Hirakud reservoir. The net was found effective in catching juveniles of *Puntius sp.*, *Chela bacaila*, *R. cotio*, *G.chapra* and *R. corsula*.

Research contemplated

Further trials with the drag net.

Scientists associated

BURLA : V. C. George, M. D. Varghese, A. A. Khan

2. 9. 3. SHORE SEINE

Research in hand

Prototype of the shore seine designed earlier was fabricated and field trials carried out with the same. The catch was constituted by eighteen species of fish, of which *R. cotio*, *C. catla*, *L.bata* and *C.mrigala* were predominant, accounting for 23.57%, 21.20%, 7.35% and 7.80% by weight of the catch respectively.

Research contemplated

1. Effect of shore seining on the fishery.
2. Economics of shore seining.

Scientists associated

BURLA : V. C. George, A. A. Khan, M. D. Varghese.

2. 10. MARINE ENGINEERING

CHIEF FINDINGS

A fish pump for pumping fish without causing any damage to it has been designed and developed. Successful field trials were carried out with the inboard/outboard drive from small fishing crafts fitted with indigenously manufactured light weight diesel engines.

Research in hand

For carrying out field trials of the fish pump, the compressor, receiver and the engine driving the compressor were fixed on a common base to enable the whole unit to be fixed on the deck of a trawler.

Modifications were effected in the inboard/outboard drive to suit different types of small crafts and engines.

A testing tank for carrying out tests of stern gear made out of cheaper materials is under construction.

Research contemplated

1. Field trials and standardisation of the fish pump
2. Field trials of the inboard/outboard drive after effecting modifications to suit various types of small country fishing crafts
3. Investigations on the reduction in the cost of mechanical fittings of mechanised fishing vessels

Scientists associated

COCHIN : S. Ayyappan Pillai, K. Sreedharan Namboodiri.

Testing of Marine Engines

Two indigenous diesel engine manufacturers offered their engines for type testing during the year under report. Tests were carried out and their suitability for installation in fishing boats studied. Details of the engines tested are given below:

M/S Kirloskar Oil Engines Ltd, Poona.	R-11M
	RB-22M
	RB-33M
	RB-44M
	RB-66M
M/S Greaves Lombardini Ltd, Aurangabad.	500
	520
	523
	LDA-80
	LDA-450
	LDA-510

Type OM-312 engine of M/S Tata Engineering and Locomotive Co-Ltd, Poona was installed in the 9.82M(32ft) departmental vessel and fishing-cum-endurance test conducted for a full season as per ISI specifications.

Scientists associated

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

2. 11. PROCESSING ENGINEERING:

CHIEF FINDINGS

A method was worked out and drying conditions standardised for preparation of laminated Bombay duck using hot air tunnel dryer, An improved sun drying arrangement was designed and developed and the fabrication of a prototype solar drying yard completed.

Research in hand

A design has been developed of a fish meal plant of 50 tonnes capacity.

Based on the design of the smoke kiln prepared earlier for small scale production of smoked fishery products, fabrication of a modern type smoke kiln with several control arrangements was undertaken.

A method was worked out for preparation of laminated Bombay duck by laminating the fish in fresh condition without partial dehydration by hanging in the sun and then drying in hot air tunnel dryer. A very good quality product was obtained within 8-10 hours as against the 2-3 days normally required in the conventional sun-drying process.

An improved sun drying arrangement was developed using the solar drying technique. A prototype solar drying yard was also fabricated. It consists of a bamboo reinforced concrete platform fixed at 0.75m. from the ground. A box formed by fixing transparent polyethylene sheet on a wooden frame covers the slab. Design for a commercial model has been undertaken.

Design has also been taken up of a solar cooling system using solar energy.

Research contemplated

1. Design of a commercial model modern type fish drying yard using solar drying technique and its fabrication.
2. Design and fabrication of a commercial fish dryer.
3. Completion of fabrication of the smoke kiln and production of smoked fish on an experimental basis.
4. Installation and field trials of the solar dryer.
5. Fabrication of fish cutting and scaling machines.
6. Development of a pressure cooling device for cooling cans immediately after sterilisation.

Scientists associated

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

2.12. ELECTRONICS AND INSTRUMENTATION

Research in hand

Work on the development of a brine concentration meter was completed. A prototype was made and tested with satisfactory results.

Development of the bilge water indicator alarm designed earlier was completed and the same installed in the 15.25m (50ft) departmental vessel 'SINDHUKUMARI' with satisfactory results.

Preliminary studies were undertaken in designing a fish freshness tester.

Research contemplated

1. Development of a buoy telemetry system for automatic acquisition of marine environmental data related to fishery hydrography.
2. Development of an electronic boat log for monitoring speed and distance for use in small and larger vessels.
3. Development of a water current meter for easy and convenient measurements upto 100M-depth.
4. Development of a freezer temperature alarm for remote display of temperature of cold-storages and automatic alarm when the temperature deviates from the desired range.
5. Development of an Ocean Tele Lab for on- the- spot measurement of water current, current direction, temperature, salinity and depth upto a depth of 100M. by means of a single sensing probe and single portable display unit.
6. Development of an auto- brineo meter for automatic measurement of brine concentration in blanching tanks with permanent installations.

Scientists associated

COCHIN: S. Ayyappan Pillai, T.K. Sivadas, K. Ramakrishnan, K. Vijaya-bharathi.

3. EXTENSION AND INFORMATION

Replies to technical queries

During the year under report, more than 525 technical queries received from various State Fishery Departments, private entrepreneurs etc on different aspects of fishing and fish processing were replied. Details furnished on fish

processing include comments on long distance transport of iced and frozen fish, improvement of colour of frozen frog legs, on the frozen storage life of headless, frozen and peeled and deveined shrimp, process for freezing whole cooked lobster, canning crab meat, clam meat canning mussels in oil and canning oyster meat, method for preparation of frog oil schemes for setting up canning plant, prawn freezing plant, plant for production of edible fish powder, a fish dehydration plant and one for production of fish meal, comments on revisions to be incorporated in standards issued for mackerel canned in oil, lactarius canned in oil, frozen prawns and dried prawns, details of solar dryer designed for dehydration of fish. a note on the fundamental research carried out in bacteriology with reference to cultured fish, method of production of chitosan from prawn shell waste and details of the plant and information regarding the antioxidant used in extraction of sardine oil.

Details furnished on the craft and gear side include estimate of expenditure for fabrication of 325m. and 60.5m purse seines comments on use of mid-water trawls, specification of gill nets and drift nets to be used with catamarans, dug-out canoes and plank built boats, requirements of ropes, floats and sinkers for frame net, comments on different types of nets used for mechanised fishing, specifications of plastic floats manufactured in India and abroad, comments on the construction materials for a 30ft vessel, deck equipments gear etc. to be used for experimental fishing and general survey in Umiam Reservoir near Shillong, comments on the suitability of 210/D 14 and 25 filament yarns for fishing purposes, on the suitability of using aluminium alloy sheathing for hulls of wooden fishing vessels, on the suitability of aluminium alloy anodes in place of electrolytic zinc, on the feasibility of using fibreglass reinforced plastic for mass production of canoes similar to Malabar dug-out canoes, comments on the different types of traditional fishing crafts and materials for their construction that would be suitable for use by traditional fishermen along the coast of Kerala and on the suitability of Kirloskar air-cooled engines. Technical guidance was also given to those who called on the Institute for guidance in matters relating to improved fish processing techniques, setting up fish processing units, fishing craft and gear etc.

The Research Centres also imparted technical guidance to those who called on them with problems related to fishing and fish processing.

Testing of materials and products

Different kinds of products and raw materials received from indigenous processors and manufacturers were tested and the analysis reports furnished to the concerned parties with suggestions for improvement wherever necessary. A total of 460 such samples were tested during the year under report which include twelve samples of HDPE monofilament twine, one of HDPE braided twine, 19 samples of cotton rope, 14 samples of nylon knotless webbings, 7 samples of nylon twine, 4 samples of nylon yarn, 14 samples of monofilament nets, 9 samples of leader wire, 3 of tuna hooks, two of seikiyama, 4 of brass

swivels, one of galvanized wire rope, one sample of Aini timber, 14 samples of aluminium alloy sheet, 8 of indigenously manufactured engines, 64 samples of canned prawns, 15 of canned crab meat, one of a can lacquer, 45 samples of frozen shrimp, 13 of frozen squid tubes, one of frozen cuttle fish head, 4 of frozen squid head and tentacles, 3 samples of frozen frog legs, 46 samples of frozen crab meat, two samples of frozen ray wing, three of skate wing, one sample of frozen whole squid, 4 of cuttle fish fillets, 2 of a liquid detergent, 10 samples of sliced IQF seer fish, one sample of fish oil, one of ocean manure, 21 samples of fish meal, 8 of poultry feed, 2 of cattle feed, 1 of a chemical for preventing blackening of prawns during storage, 64 samples of water and 35 samples of ice.

Visits to fish processing establishments

Regular visits were made to fish processing establishments in and around Cochin by the Scientists of the Institute for rendering technical assistance and conducting demonstrations on the improved methodologies evolved by the Institute. Some of the technical assistance rendered / demonstrations held, include those on economic canning of prawns by avoiding losses, canning of crab meat without blackening, processing of cooked peeled frozen prawns and colour changes in a fresh water prawn and the fresh water '*Konchu*' *Macrobrachium rosenbergii*.

Publications

The publication of 'Fish Technology Newsletter', which was pending for quite some time, was renewed during the year under report. Whereas previously it was issued every quarter, now it is brought out every month. Six issues of Vol. I have so far been published. Other publications brought out include:

1. CIFT-activities and achievements (both in Hindi and English)
2. Pamphlet on CIFT in Hindi
3. Production of frozen prawn products in Hindi

Also published were the following pamphlets issued in connection with refresher courses held during the period.

1. Handling and transportation of fish
2. Filleting and freezing of fish
3. Common spoilage in processed foods

Supply of design drawings and publications

In all, 91 designs of fishing gear and accessories, dryers etc were supplied to interested parties on request. These include 17 designs of bulged belly type

trawls, 4 of mid-water trawls, 3 of conventional four seam trawls, one each of a long wing trawl and try net, 16 designs of otter boards, one of a seer gill net and 2 of purse seines, one design each of a row boat and a beach landing mechanised boat, 8 designs of an electrically operated boiling kettle, 9 sets of designs of trawl winches for different sizes of vessels 1 design of the solar dryer and 14 of the tunnel dryer of 1 ton raw material capacity for dehydration of fish and 12 designs of the rotary drum dryer for dehydration of fish meal. Fourteen copies of the Special Bulletin 'An Account of the Inland Fishing Gear and Methods of India' were also supplied on request.

Film shows

Twelve film shows were conducted at the request of private organisations and State and Central Government Departments. The films shown included those on topics related to pond culture, induced fish breeding, fish spoilage control, fundamentals of fish spoilage, tuna packing, lobster fishery etc.

Extension training

Refresher courses were conducted for the benefit of the fish processors in turning out better quality products. The courses conducted include those on Raw Material Preservation held in collaboration with the MPEDA at Calcutta and Puri, one on Handling and Transportation of Fish also jointly organised by the MPEDA and held at Bombay, another on Fish Plant Sanitation, Quality Control and In-plant Inspection conducted in collaboration with the Department of Fisheries, Gujarat State at Veraval and another on Filleting and Freezing of Low Cost Fish at Cochin. About 100 trainees participated in these courses.

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

Ad- hoc training

Short- term training was also given to a few candidates sponsored by processing establishments, Central Government organisations etc, in different disciplines of fisheries technology as detailed below:-

<i>Name of trainee</i>	<i>Sponsored by</i>	<i>Period</i>	<i>Subject</i>
1. Mr. George Leonard Makwinya	Government of Tanzania	13-1 -78 to 25-10-78	Fish Processing technology
2. Mr. K. Thomas Eipe	Tata Oil Mills Co. Ltd, (Fisheries Division) Cochin-5	9-1 -78 to 31-1 -78	Bacteriological analysis of frozen shrimp

<i>Name of trainee</i>	<i>Sponsored by</i>	<i>Period</i>	<i>Subject</i>
3. Miss Grace John	Indo-Marine Agencies Cochin-5	10-10-77 to 9-1 -78	Fish Microbiology, fish plant sanitation, to water analysis and quality control
4. Mr. B. A. Jolly Jacob	India Sea Foods, Cochin-5	From 1-1 -78 for 3 months.	Engine room assistance on board the Departmental 15.25m vessel 'SINDHUKUMARI'
5. Miss Ivy Thomas	Mini Sea Foods, Cochin-5	1-3 -78 to 31-3 -78	Quality control of fresh, frozen and canned fish, detection and isolation of bacteria of public health significance, preparation of bacteriological culture media
6. Miss K.S. Revathy	Bluewater Fisheries Co, Cochin-6	1-9 -78 to 30-9-78	Quality control and bacteriology of fish
7. Mr. M. Syed Mohammed	Office of the Assistant Director of Fisheries (Technology) Tuticorin	16-10-78 to 14-11-78	Fish Microbiology
8. Miss K.N. Geetha	XL Seafoods, Cochin-5	From 20-11-78 for 2 months	Quality control of fish
9. Mr. K.G. Vijayakumar	Polyplate India, Calcutta	1-11-78 to 15-12-78	Processing to Chitosan and allied products from prawn shell waste
10. Mr. John Mitford	} International Development Research Centre Project in Guyana.	1-10-78	Fish processing to technology.
11. Mr. Indra Paul		30-6-79	

In addition to the above, an In-process Quality Training was given to 11 Quality Supervisors sponsored by the MPEDA. Lectures and practical classes on quality control aspects were held for students of the Department of Industrial Fisheries, Cochin. Similar classes on quality control and inspection of frozen squid, cuttle fish and pomfrets were also held for technical officers of the Export Inspection Agency, Cochin.

4. STATISTICS

CHIEF FINDINGS

In order to determine the relevant factors to be considered for statistical analysis of data to compare the efficiency of trawl nets, multiple regressions of prawn and fish catches on depth of operation, length of warp, speed of the vessel, time of hauling, horizontal opening and towing tension were set up. The explanatory variables were found to be horizontal opening, depth, speed of the boat, time of shooting and towing tension.

Research in hand

To determine the relevant factors to be considered for statistical analysis of data to compare the efficiency of trawl nets, data on the depth of operation, length of warp, speed of the vessel, time of hauling, horizontal opening and towing tension and the corresponding prawn and fish catches were collected from Cochin, Veraval and Kakinada. The data thus collected were subject to multiple regression analysis by taking prawn and fish catches as dependent variables and the others as independent variables. The analysis was carried out on the Electronic computer at IASRI, New Delhi, after tabulation, punching and sorting out of the data according to centre, year and gear. Linear and quadratic effects of the independent variables were considered on the dependent variables (with and without transformation of the dependent variables). There were in all 29 sets of eight equations fitted for each gear, year and centre. The multiple correlation coefficients were found to be significant for certain sets. The logarithmic transformation of the dependent variables did not show any appreciable difference in the results, as also the relationship involving the quadratic effects. The relative importance of the variables was compared by working out the formula $B_i \frac{\sqrt{\text{vari}(x_i)}}{\text{vari}(y)}$. From this, the explanatory variables were found to be, horizontal opening, depth, speed of the vessel, time of shooting and towing tension.

Data were collected on the quantity of fish and prawn landed, total sale proceeds, cost of HSD oil and engine oil, repair charges, cost of implements, commission and the number of fishing trips undertaken during each month from seven, sixtysix and fifty two boats of size 7.62m, 9.75m and 10.97m, respectively for the period 1977-1978. Analysis of the data is in progress.

Research contemplated

1. Study on the economics of operation of trawlers along the Indian coast.
2. Study on the idle capacity of fish processing plants in India.
3. Estimation of monthly landings from the Hirakud reservoir in association with the Gear section of Burla Research Centre.

Scientists associated

COCHIN : H. Krishna Iyer, A.K. Kesavan Nair, P. Srinivasa Rao,
R. Gopalakrishnan Nair

5. ALL INDIA COORDINATED RESEARCH PROJECT

Transportation of Fresh Fish and Utilization of Trash Fish

CHIEF FINDINGS

Both Veraval and Kakinada Centres continued to despatch experimental consignments of iced fish in thermocole insulated teachests to Bombay and Calcutta respectively by road/rail. Split bamboo baskets with palmirah leaf mat linings inside and gunny wrappings outside were also employed at Kakinada, but with a higher proportion of ice than used in the other containers. Madras was newly introduced as a receiving Centre for consignments from Kakinada. Demonstrations were also conducted at both Veraval and Kakinada of the improved methods of handling and packaging of fresh fish and some plywood containers fabricated at the latter Centre supplied to some parties for free field trials. Hygienic conditions at both fresh fish markets and processing factories at both the Centres required further improvement. Bacteriological peptone prepared by the Cochin Centre was tested at three different laboratories and found to perform exceedingly well. Optimum conditions for enzyme hydrolysis of threadfin bream for maximum yields of hydrolysates were (1) enzyme nitrogen to protein nitrogen ratio of 1:30, (2) pH, 6.5, (3) temperature, 55°C and (4) time, 60 minutes. Rice flour and water and a mixture of bread powder, milk powder, wheat flour and egg white were found to be the best batters for fish fingers prepared out of comminuted fish meat.

Review of the work done at the Institute's Centres:

Veraval

The Centre continued experimental transportation of iced and frozen fish in 25 mm/15mm thick expanded polystyrene-insulated teachests to Bombay after detailed assessment of biochemical, microbiological and organoleptic assessment of their quality. Local fish markets, fish landing centres, pro-

cessing factories and water and ice used by these factories were regularly surveyed for the quality of fish handled as well as hygienic conditions and timely technical advice rendered for rectification of defects wherever necessary.

Demonstrations of the improved methods of handling and packing of fresh fish in the containers developed by the Centre were held at Jaipur (Rajasthan), Delhi, Punjab (Patiala, Ludhiana, Jullunder, Kapurtala, Amritsar and Harike) and Haryana (Ambala and Rohtak) for the benefit of the local fishermen and fish dealers.

Bombay

The fish consignments received from Veraval were subjected to detailed quality evaluation. About 200 random samples of fresh fish drawn from different fish markets in the city were studied in detail with respect to their organoleptic, biochemical and bacteriological quality. As has been observed earlier, the quality was highly variable, considerable quantities showing substandard quality due to unhygienic and careless handling practices.

Kakinada

Several consignments of fish consisting of mullet, chanos, rohu, catla and tilapia packed with ice in plywood boxes insulated with expanded polystyrene were despatched as usual to Calcutta. In one case, bamboo basket with a palmirah leaf mat lining inside and gunny wrapping outside was also employed simultaneously for comparison. Similar consignments of iced fish were also transported to Madras by rail. In nine cases, bamboo baskets as described above were employed simultaneously for comparison. Fish to ice ratios of 1:1 and 1:1.5 were maintained in the plywood boxes and bamboo baskets respectively. Organoleptic, biochemical and microbial qualities of the samples were studied before despatch. In all cases, the fish reached Madras in good condition excepting one basket which got damaged enroute inflicting physical injury to the fish.

Demonstrations were conducted to train the local man in proper handling and packaging of fish for transportation. Locally fabricated, expanded polystyrene insulated plywood boxes of about 120 kg, capacity were given on loan to some fish dealers for field trials.

Several samples of fish, ice, water and swabs from floors and containers in the local markets and processing factories were examined for general hygienic quality with special reference to presence of pathogens. Some of the fish and ice samples showed the presence of *Pseudomonas aeruginosa*, while the majority of the samples were free from human pathogens.

Cochin

Bacteriological peptone samples were prepared from threadfin bream and supplied to Sri Chitra Medical Centre, Trivandrum, Central Tuber Crops

Research Institute, Trivandrum and Kakinada Research Centre of C.I.F.T. for laboratory trials. Reports from these laboratories indicated that the peptone developed was comparable to commercial samples already in the market

Hydrolysis of threadfin bream meat with papain (enzyme nitrogen to protein nitrogen ratio 1:30) at pH 6.5 and temperature 55°C, gave yields of 9.2, 9.54, and 10.27% in 30, 90 and 120 minutes respectively. Enzyme nitrogen to protein nitrogen ratio of 1:20, 1:30, 1:40 and 1:60 gave percentage yields of hydrolysates of 8.9, 8.0, 6.1 and 5.3 respectively in 2 hours at pH 6.5 and temperature 55°C from jew fish meat.

Out of 7 different batter formulations tried out for fish fingers, (1) rice flour and water and (2) a mixture of bread powder, milk powder, wheat flour and egg white were found to be the most acceptable to the taste panel. Storage changes occurring in this product at -13°C have been studied.

General

The Project Coordinator paid a visit to all the east coast Centres of the Project viz; Madras, Kakinada, Kujang and Jadavpur in February 1978 and made an on-the-spot appraisal of their work *vis a vis* difficulties faced by them in the prompt and proper execution of programmes of work allotted to them.

The Sixth Workshop on the project was held on 3rd and 4th November, 1978 at the College of Fisheries, Mangalore. It was well attended and representatives of both Central and State Fisheries Organizations took part in the deliberations. The workshop made a detailed review of the progress of work achieved in the previous year and drew up technical programmes for the different Centres for the remaining part of the current financial year, at the end of which the project is to be terminated, having served the purpose for which it was meant.

Scientists associated

COCHIN : M. Rajendranathan Nair, (Project Co-ordinator),
T.K. Govindan, K. Mahadeva Iyer, Dr. K. Gopakumar,
A. Vasanth Shenoy, G. Rajagopalan Unnithan,
R. Thankamma
VERAVAL : R. Venkataraman (Retired on 30-9-1978),
H K Beri.
KAKINADA: Dr. C. C. Panduranga Rao, S.S. Gupta, Imam Khasim Saheb.
BOMBAY : A.P. Valsan.

6. PUBLICATIONS

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2. **Balachandran, K.K.**
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3. **Balachandran, K.K.**
Perigreen, P.A. &
Nair, M.R.
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Dehydration of fish and fishery products-Proceedings, Summer Institute on Fish Processing Technology, Cochin, 1-31 May, '78
5. **Chakraborty, P. K.**
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Technological development on artificial and solar dehydration of fish in India. -Paper presented at IPFC Symposium on Fish Utilization Technology and Marketing in the IPFC Region, Manila, Philippines, 8-11, March 1978.
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Venkataraman, R.
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Vekataraman, R.
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10. **Gopakumar, K.,
Vasanth Shenoy, A.&
Thankamma, R.**
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12. **Govindan, T.K.**
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13. **Govindan, T.K. &
Kuriyan, G.K.**
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14. **Govindan, T.K. &
Sibsankar Gupta**
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15. **Govindan, T.K.
Sibsankar Gupta,
Girija Varma, P.R. &
Chattopadhyay, P.**
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Vasanth Shenoy, A,
Arul James, M. &
Nair, M.R.
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- Quality control and inspection of fish and fish products-Proceedings, Summer Institute on Fish Processing Technology, Cochin, 1-13 May, 1978.
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EiEi Mu. Nyunt Nyunt Tun
& Wijerjitunga, R. S.
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Pampus argenteus-*Fish. Tech.*,
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Vijayan. V., Hridaya-
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panel trawls-*Fish. Tech.*, 15 (1): 71-75, 1978
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Balachandran, K. K.
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Madhavan, P. &
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wastes in India - Paper presented at Symposium
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Sibsankar Gupta.
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Special Bulletin - 6 : Bibliography of trawl gear - Part II.

Special Bulletin - 7 : Catalogue of implements / machinery for fish harvest technology.

7. APPENDICES

APPENDIX—I

HEADQUARTERS : CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY

Willingdon Island; Matsyapuri P. O.,

Cochin—29, P. C. 682029, Kerala

TLX No. 0885 - 440

Telephone No. 6845 (10 lines)

Telegram : MATSYAODYOGIKI or
FISHTECH, COCHIN

Director's Telephone : Per: 6880, Res: 35263.

DIRECTOR	.. Shri G. K. KURIYAN
Project Co—ordinator	.. Shri M. Rajendranathan Nair
<i>Scientists-in-charge</i>	
Processing & Packaging Division	.. Shri P. Vasudeva Prabhu
Biochemistry & Microbiology Division	.. Shri K. Mahadeva Iyer
Craft Division	.. Shri R. Balasubramanyan
Gear Division	.. Shri K. A. Sadanandan
Engineering Division	.. Shri S. Ayyappan Pillai
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 - 362265, Gujarat.	297	MATSYAOU DYOGIKI	Shri R. Venkataraman K. K. Solanki
2.	KAKINADA	Research Centre of CIFT, D. No. 1-14-7, Sreeram Nagar, Kakinada - 533003, Andhra Pradesh.	4436	MATSYAOU DYOGIKI	Dr. C. C. Panduranga Rao
3.	BURLA	Research Centre of CIFT, Burla - 768017, Sambalpur Dist., Orissa State.	19	MATSYAOU DYOGIKI	Shri V. C. George
4.	BOMBAY	Research Centre of CIFT, 162 Sassoon Dock, Colaba, Bombay - 400005, Maharashtra.	213892	FISHPROCESS (FT)	Shri A. P. Valsan
5.	CALICUT	Research Centre of CIFT, Beach Road, West Hill, Calicut - 673005, Kerala.	76607	CARE/KADALMEEN	Shri T.S. Unnikrishnan Nair
6.	GOA	Research Centre of CIFT, 2nd Floor, 'Shanta', 18th June Road, St. Inez., Panaji-403001, Goa.	2049	MATSYAOU DYOGIKI	Shri H. N. Mhalathkar

APPENDIX-II

List of personnel in CIFT as on 31-12-1978

SCIENTIFIC PERSONNEL

Director

SHRI G. K. KURIYAN

Scientist S-3

- | | |
|--------------------------------|----------------------------|
| 1. Shri M. Rajendranathan Nair | 3. Shri R. Balasubramanyan |
| 2. Dr. C. C. Panduranga Rao | 4. Dr. P. N. Kaul |

Scientist S-2

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

Junior Fishery Scientist

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

Junior Scientist

- | | |
|----------------------|-------------------------|
| 1. Shri A. P. Valsan | 2. Shri P. N. R. Kaimal |
|----------------------|-------------------------|

Scientist S-1

- | | |
|-----------------------------|----------------------------------|
| 1. Shri P. D. Antony | 11. Shri V. N. Nambiar |
| 2. Shri P. A. Perigreen | 12. Shri K. G. Ramachandran Nair |
| 3. Shri M. Arul James | 13. Shri A. Vasantha Shenoy |
| 4. Shri A. K. Kesavan Nair | 14. Shri T. S. Unnikrishnan Nair |
| 5. Shri A. G. Radhakrishnan | 15. Shri P. N. Joshi |
| 6. Shri P. K. Surendran | 16. Shri Sibsankar Gupta |
| 7. Smt. Chinnamma George | 17. Shri Korah Eapen |
| 8. Smt. Mary Thomas | 18. Shri G. Narayanappa |
| 9. Shri P. R. Girija Varma | 19. Shri N. Unnikrishnan Nair |
| 10. Shri K. K. Kunjipalu | 20. Shri T. Joseph Mathai |

- | | |
|-------------------------------------|---------------------------------|
| 21. Shri K. N. Kartha | 44. Shri Subrata Basu |
| 22. Shri N. Subramonia Pillai | 45. Shri T. K. Srinivasa Gopal |
| 23. Shri S. V. S. Rama Rao | 46. Kum. Rani Mary Jacob |
| 24. Shri A. C. Joseph | 47. Kum. B. Meenakumari |
| 25. Shri A. A. Khan | 48. Shri K. V. Mohan Rajan |
| 26. Dr. G. Jagatheesan | 49. Shri M. R. Boopendranath |
| 27. Shri R. S. Manoharadoss | 50. Shri P. K. Vijayan |
| 28. Shri A. G. Gopalakrishna Pillai | 51. Smt. K. Ammu |
| 29. Shri V. Muraleedharan | 52. Shri K. Ramakrishnan |
| 30. Shri T. P. George | 53. Shri P. T. Lakshmanan |
| 31. Shri P. George Mathai | 54. Shri Rupsankar Chakraborty |
| 32. Shri V. Vijayan | 55. Shri Anil Agarwal |
| 33. Smt. K. Vijayabharathi | 56. Shri S. P. Damle |
| 34. Shri M. K. Mukundan | 57. Shri J. K. Bandyopadhyay |
| 35. Shri P. G. Viswanathan Nair | 58. Shri S. K. Bhattacharyya |
| 36. Smt. Nirmala Thampuran | 59. Kum. K. V. Lalitha |
| 37. Shri T. K. Thankappan | 60. Shri P. Ravindranathan Nair |
| 38. Shri P. T. Mathew | 61. Shri K. Gopalakrishnan |
| 39. Shri Jose Joseph | 62. Shri S. Sanjeev |
| 40. Shri D. I. Khasim Saheb | 63. Shri S. Balasubramaniam |
| 41. Shri Rajendra Badonia | 64. Shri M. R. Raghunath |
| 42. Shri Harinder Krishan Beri | 65. Shri A. K. Chattopadhyay |
| 43. Shri S. M. S. Abuthahir Ali | 66. Shri N. Kalaimani |

Assistant Fishery Scientist

- | | |
|----------------------|---------------------------|
| 1. Dr. Jose Stephen | 4. Smt. K. Radhalakshmy |
| 2. Shri T. M. Sivan | 5. Smt. A. Lekshmy |
| 3. Shri N. A. George | 6. Shri R. Mangayya Naidu |

Scientist S

- | | |
|---------------------------------|--------------------------|
| 1. Shri Francis Thomas | 7. Shri D. K. Garg |
| 2. Shri J. Sitarama Rao | 8. Shri A. C. Kuttappan |
| 3. Shri M. Syed Abbas | 9. Shri K. George Joseph |
| 4. Shri P. Srinivasa Rao | 10. Dr. M. D. Varghese |
| 5. Shri Percy Dawson | 11. Smt. R. Thankamma |
| 6. Shri G. Rajagopalan Unnithan | |

Sr. Research Assistant

Smt. T. T. Annamma

TECHNICAL PERSONNEL

Technician T-7

- | | |
|--------------------------|-----------|
| 1. Shri M. S. Fernando | : Skipper |
| 2. Shri A.P. Jayaprakash | : Skipper |

Technician T-6

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

Technician T-4

1. Smt. Annamma Mathew : Sr Analyst
2. Shri N. Subramanian : Technical Assistant
3. Shri K. Vasudevan Nair : Sr Analyst
4. Shri V. K. Ibrahim : Head Draughtsman
5. Shri C. Chandrasekharan : Superintendent (E & M)
6. Shri N. Vareethiah : Glass Blower
7. Shri K. Bhaskaran : Photographer-cum-Artist
8. Shri Varghese Paul : Technical Assistant

Technician TII-3

1. Shri P. Ravindranathan : Sr. Library Assistant
2. Shri M. L. Anslem : Sr. Draughts man
3. Shri A. Kassimkundu : Analyst
4. Shri G. Mohanan : Artist
5. Shri K. K. Poullose : Instrument Technician
6. Shri R. Gopalakrishnan Nair : Computer

Technician TI-3

1. Shri P. Sadanandan : Analyst
2. Shri T. K. Syed Ali : Analyst
3. Shri K. J. Augustine : Senior Turner
4. Shri O. Subramonian : Senior Welder
5. Shri M. John : Instrument Technician
6. Shri M. Abdul Sathar : Media Supervisor
7. Shri M. R. Nair : Bosun
8. Shri N. Bahuleyan : Bosun
9. Shri A. K. Jaisingh : Bosun
10. Shri M. S. Rajan : Bosun
11. Shri B. Anandan : Foundry Assistant
12. Shri M. U. Vijayan : Senior Mechanic
13. Shri T. K. David : Fitter

Technician T-2

1. Shri E. K. Balakrishnan : Draughtsman
2. Smt. K. Sarasamma : Draughtsman
3. Shri S. R. Jethwa : Sr. Mechanic
4. Shri T. S. Bhaskara Menon : Sr. Mechanic
5. Shri K. E. Mani : Refrigeration Mechanic

6. Shri G. Ratnakaran Nair	: Refrigeration Mechanic
7. Shri Anil Kumar	: Refrigeration Mechanic
8. Shri Shanmughavel	: Refrigeration Mechanic
9. Shri C. Rajendran	: Refrigeration Mechanic
10. Shri Jose Kalathil	: Refrigeration Mechanic
11. Shri K. V. Madhavan	: Electrician
12. Shri P. M. Joseph	: Machinist
13. Shri V. S. Augustine	: Sr. Carpenter
14. Shri Philip Durom	: Sr. Carpenter
15. Shri A. R. Dharaneedharan	: Media Assistant
16. Shri K. K. Subramanian	: Engine Driver
17. Shri K. V. Baladasan	: Engine Driver
18. Shri Mohammed Jaffar	: Engine Driver
19. Shri A. Gopalakrishnan Nair	: Staff Car Driver
20. Shri P. P. Poullose	: Staff Car Driver
21. Shri P. Natarajan	: Driver
22. Shri M. G. Narayanan Nair	: Driver
23. Shri N. J. Tandel	: Driver (Launch)
24. Shri K. K. Pappukutty	: Driver (Launch)
25. Shri V. V. Johnny	: Sr. Field Assistant
26. Shri M. K. Sasidharan	: Sr. Field Assistant
27. Shri A. Haranath	: Sr. Field Assistant
28. Shri Nallababu Rao	: Sr. Field Assistant
29. Shri Thomas J. Mammoothil	: Sr. Laboratory Assistant
30. Shri V. K. Ramachandran	: Sr. Laboratory Assistant
31. Shri T. John	: Sr. Laboratory Assistant
32. Shri P. K. Damodaran	: Sr. Laboratory Assistant
33. Shri V. Venkata Rama Krishna	: Sr. Laboratory Assistant
34. Shri A. Veeranjanyulu	: Sr. Laboratory Assistant
35. Shri V. Gopalakrishna Pillai	: Sr. Laboratory Assistant
36. Shri P. V. Channey	: Sr. Laboratory Assistant
37. Shri G. P. Vaghela	: Sr. Laboratory Assistant
38. Shri P. M. Pattanayak	: Sr. Laboratory Assistant
39. Shri M. M. Devasaya	: Jr. Library Assistant
40. Shri T. Neelakandan	: Projector Operator
41. Shri V. Gaspar	: Field Assistant
42. Shri Tomy B. Fonseka	: Boilerman
43. Shri Gurudas Ram	: Tindal
45. Shri S. Laxmanadu	: Deckhand
45. Shri G.B. Tandel	: Deckhand
46. Shri K. K. Lekshmanan	: Deckhand

Technician T 1

1. Shri K. V. Rajan	: Jr. Laboratory Assistant
2. Shri P. T. Sebastian	: Jr. Laboratory Assistant
3. Shri P. S. Alias	: Jr. Laboratory Assistant
4. Shri B. Ramaiah	: Jr. Laboratory Assistant
5. Shri N. M. Vasu	: Jr. Laboratory Assistant
6. Shri T. K. Bhaskaran	: Jr. Laboratory Assistant
7. Shri K. B. Thilakan	: Jr. Laboratory Assistant
8. Shri T. K. Vasudevan	: Jr. Laboratory Assistant
9. Shri T. K. Aravindakshan	: Jr. Laboratory Assistant
10. Kum. K. K. Sumathy	: Jr. Laboratory Assistant
11. Shri C. C. Gandhi	: Plant Attendant
12. Shri N. C. Bhaskaran	: Plant Attendant
13. Shri K. R. Kesavan	: Plant Attendant
14. Shri T. Gopalakrishnan	: Metal Worker
15. Shri V. Veer Raju	: Tindal
16. Shri T. N. Manibhadran	: Tindal
17. Shri T. Balan	: Tindal
18. Shri A. B. Varghese	: Driver (Launch)
19. Shri V. P. Raphel	: Driver
20. Shri Vasanthrai Kanji Solanki	: Driver
21. Shri Narasingh Panda	: Driver
22. Shri M. Venkateswara Rao	: Driver
23. Shri Chantrakant X. Halernekar	: Driver
24. Shri P. Bahulayen	: Telephone Operator-cum- Receptionist.
25. Shri H. M. Kotiya	: Deckhand
26. Shri P. K. Pushpangadan	: Deckhand
27. Shri G. R. Bhogte	: Deckhand
28. Shri P. A. John	: Deckhand
29. Shri K. Sarangadharadu	: Deckhand
30. Shri T. K. Dasan	: Deckhand
31. Shri Malam Bachu Sidi	: Deckhand
32. Shri K. Gangaraju	: Deckhand
33. Shri G. Subba Rao	: Cook
34. Shri E. R. Krishnan	: Cook
35. Shri T. A. Francis	: Cook

ADMINISTRATIVE PERSONNEL

Sr. Administrative Officer

Shri K. M. Mathai

Administrative Officer

Shri James Abraham

Asstt. Administrative Officer

Shri A. Chakrapany

Accounts Officer

Shri T. Velayudhan Asari

Superintendent

- | | |
|-----------------------|----------------------|
| 1. Shri Varghese Paul | 3. Shri P. J. Joseph |
| 2. Shri V. Joseph | |

P. A. to Director

Shri K. J. Thomas

Assistant

- | | |
|-------------------------------|-------------------------------------|
| 1. Smt. T. N. Ambujakshy Amma | 4. Shri S. Naveen Chandra
Prabhu |
| 2. Shri P. A. Uthup | |
| 3. Shri M. George Joseph | 5. Smt. K. A. Devaky |

Stenographer

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

Jr. Stenographer

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

Senior Clerk

- | | |
|---------------------------|------------------------------|
| 1. Shri P. Vasudevan | 13. Shri A. K. Venugopal |
| 2. Smt. Alice M. Joseph | 14. Shri M. Ravindran |
| 3. Smt. Nafeesa Ali | 15. Smt. Annamma Varghese |
| 4. Shri T. M. Padmanabhan | 16. Smt. C. G. Marykutty |
| 5. Smt. N. K. Sulochana | 17. Smt. M. S. Susanna |
| 6. Smt. T. K. Sarala | 18. Smt. N. Prabhavathy Amma |
| 7. Shri R. S. Shanmugham | 19. Shri C. Ravindran Nair |
| 8. Shri A. L. John | 20. Smt. K. R. Gita Rani |
| 9. Shri M. Gopalakrishnan | 21. Shri. N. Venugopalan |
| 10. Shri M. T. Joseph | 22. Shri T. M. Ramraj |
| 11. Shri P. Vijayan | 23. Shri Veer Singh |
| 12. Shri M. J. Sebastian | |

Junior Clerk

- | | |
|--------------------------|----------------------------|
| 1. Shri Y. W. Mhadgut | 5. Smt. Smita K. Shrishkar |
| 2. Shri M. Balan Nambiar | 6. Smt. M. Jully |
| 3. Shri G. Somappan | 7. Shri K. Bhaskaran |
| 4. Shri V. R. Kesavan | 8. Smt. M. A. Prasanna |

- | | |
|-----------------------------------|-----------------------------|
| 9. Smt. K. A. Nazeem | 21. Shri P. V. Venugopalan |
| 10. Shri A. Chakrapany | 22. Shri A. George Joseph |
| 11. Shri Y. Phillipose | 23. Shri K. P. Velayudhan |
| 12. Shri A. B. Rodrigues | 24. Smt. T. K. Susannamma |
| 13. Shri Kailash Chandra Sahoo | 25. Shri C. A. Punnoose |
| 14. Shri Ch. Satyanarayana | 26. Smt. P. C. Kamalakshy |
| 15. Shri T. Veerabhadra Rao | 27. Shri R. Viswanathan |
| 16. Shri C. K. Muraleedharan | 28. Smt. T. L. Hemalatha |
| 17. Shri P. K. Sreedharan | 29. Shri P. K. Sankarakutty |
| 18. Smt. K. Gracy | 30. Shri K. Rajappan Pillai |
| 19. Shri M. K. Kuttykrishnan Nair | 31. Shri M. M. Vara |
| 20. Smt. B. Hemalatha | |

SUPPORTING STAFF

Supporting Staff Grade IV

- | | |
|-----------------------------|-----------------------------|
| 1. Shri S. S. Salvi | 5. Shri Koppada Gandhi |
| 2. Shri T. K. Bava | 6. Shri Gajendra Karali |
| 3. Shri B. Suryaprakash Rao | 7. Shri M. K. Prabhakaran |
| 4. Shri E. Gangadharan Nair | 8. Shri K. K. Radhakrishnan |

Supporting Staff Grade III

- | | |
|---------------------------------|--------------------------------|
| 1. Shri N. K. Kunjan | 18. Shri B. Tirupathi Rao |
| 2. Shri O. C. Lonan | 19. Shri D. Gopalakrishna Rao |
| 3. Shri E. S. Balachandra Pai | 20. Shri Radhu Pandey |
| 4. Shri E. S. Sreedharan | 21. Shri A. T. Waghmare |
| 5. Shri C. G. Tank | 22. Shri N. Gnanaranjan Rao |
| 6. Shri Krishna Chandra Meher | 23. Shri P. A. Abdul Rahman |
| 7. Shri V. V. John | 24. Shri Digamber D. Naik |
| 8. Shri S. M. S. Yadav | 25. Shri K. K. Appachan |
| 9. Shri P. A. Thomas | 26. Shri K. X. Joseph |
| 10. Shri C. S. Govindan | 27. Shri T. T. Das |
| 11. Shri K. Balakrishnan Pillai | 28. Shri Laba Nag |
| 12. Shri C. M. Gopalan | 29. Shri Satrugan Kumara |
| 13. Shri D. R. Apparanthi | 30. Shri O. M. Thankappan |
| 14. Shri P. J. George | 31. Shri O. A. Krishnan |
| 15. Shri P. C. Sukumaran | 32. Shri M. K. Thevan |
| 16. Shri A. G. Vasu | 33. Shri P. M. Pakeer Mohammed |
| 17. Shri C. A. Subran | 34. Shri Santhosh Banchor |

Supporting Staff Grade II

- | | |
|---------------------------------|----------------------------|
| 1. Shri K. Raghavan | 4. Shri Gokulchandra Mehar |
| 2. Shri Ramachandra D. Padnakar | 5. Shri Rattan Chand |
| 3. Shri Vasudev G. Kubal | 6. Shri Menino Souza |

- | | |
|-------------------------------|--------------------------------|
| 7. Shri Satrugan Seth | 20. Shri E. K. Chinnappan |
| 8. Shri Naran Lakhm Chorwodi | 21. Shri B. S. Thambe |
| 9. Shri K. K. Madhavan | 22. Shri Gordhan Mulji Vaghela |
| 10. Shri P. S. Morajkar | 23. Shri P. Padmanabhan |
| 11. Shri S. Rajan | 24. Shri C. A. Krishnan |
| 12. Shri C. Kamaraju | 25. Shri Krishna Chandra Nayak |
| 13. Shri Voleti Kamaraju | 26. Shri P. A. Shanmukhan |
| 14. Shri T. V. Manoharan | 27. Shri K. N. Mukundan |
| 15. Shri Sadhucharan Mehar | 28. Shri P. Gopalakrishnan |
| 16. Shri Chandru B. Shirodkar | 29. Shri Govind Laxmen Tandel |
| 17. Shri K. Kameswara Rao | 30. Shri Karsan Arjan Masani |
| 18. Shri Malladi Perraju | 31. Shri K. A. Gopinath |
| 19. Shri K. C. Fofandi | |

Supporting Staff Grade I

- | | |
|------------------------------------|----------------------------------|
| 1. Shri P. D. George | 23. Shri B. Sivanandan |
| 2. Shri K. B. Bhaskaran | 24. Shri Harbhajan |
| 3. Shri K. K. Karthikeyan | 25. Shri Banda M. Ghare |
| 4. Shri N. N. Goswami | 26. Shri P. N. Sukumaran Nair |
| 5. Shri T. T. Velayudhan | 27. Smt. P. L. Roseilly |
| 6. Shri K. A. Kunjan | 28. Shri Vinayak P. Halarnekar |
| 7. Shri A. P. Gopalan | 29. Shri Udekar Pandey |
| 8. Shri T. T. Thankappan | 30. Shri Thomas Topno |
| 9. Shri P. R. Unnikrishna Panicker | 31. Shri Gopi Xenkar Chodankar |
| 10. Shri R. Chellappan | 32. Shri Dharanidhar Nag |
| 11. Shri V. S. Ambasadhan | 33. Shri Lokanath Kumura |
| 12. Shri T. Kochukuttan Nair | 34. Shri T. K. Rajappan |
| 13. Shri Kirtan Kisan | 35. Shri O. K. Xavier |
| 14. Shri G. Chinna Rao | 36. Shri P. N. Chellappan Pillai |
| 15. Shri Vasipalli Vellaiah | 37. Shri Chandrakant Kolvalkar |
| 16. Shri M. K. Asokan | 38. Shri S. Chakram |
| 17. Shri A. R. John | 39. Shri S. Appa Rao |
| 18. Shri A. A. Kunjappan | 40. Shri Duda Pitha Parmar |
| 19. Shri C. N. Raghavan | 41. Shri Bashir Mohammed |
| 20. Shri Orilika Heman | Allarkha Khokhar |
| 21. Shri K. Appa Rao | 42. Shri Namdev S. Hiwale |
| 22. Shri A. Ravindran Nair | |

ON DEPUTATION

Sl. No	Name	Deputation with	Designation
1.	Shri M. Velu 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-110 011	Dy. Director
3.	Shri K. Krishna Rao Scientist S-2	Pelagic Fishery Project, Cochin-16	Statistician
4.	Shri P. Sulochanan Scientist S-1	Exploratory Fisheries Project, Kandla Base, Block No. 80/262, Kutch.	Dy. Director
5.	Shri Y. Sreekrishna, Scientist S-1	Central Institute of Fisheries Education, PB. 7392, Kakori Camp, J.P. Road, Bombay-58	Professor (Fisheries Technology)
6.	Shri M. Mukundan, Scientist S-1	Central Institute of Fisheries, Nautical and Engineering Training, Cochin-16	Instructor (Operation)
7.	Shri R. Rajendran Scientist S-1	- do -	Instructor (Craft & Gear)
8.	Shri C.P. Varghese, Scientist S-1	Integrated Fisheries Project, P B. No: 1801; Cochin-16	Asst. Director
9.	Dr. M. Shahul Hameed, Scientist S-1	Cochin University, Cochin	Reader
10.	Shri C. Hridayanathan, Scientist S	Cochin University Cochin	Lecturer.
11.	Shri M P. Chandra- sekharan, Superinten- dent	Central Tuber Crops Research Institute; Trivandrum	Superintendent
12.	Shri S. Sadanandan Superintendent	ICAR Research Centre for NEH Region, Sikkim;	Superintendent
13.	Shri V. N. Rajasekharan Nair, Sr. Clerk	Indian Institute of Horticultural Research, Bangalore.	Assistant

APPENDIX—III

FINANCE

Details of the budget provision and actual expenditure during the financial year 1978-79

PLAN	Budget provision Rs	Actual Expenditure Rs	
Salary of Officers	}	1,09,541	
Salary of Establishment		2,67,876	
Dearness Allowance		1,51,965	
Overtime Allowance		4,889	
House Rent Allowance		36,760	
City Compensatory Allowance		5,288	
Other Allowances + Honararia		60,00,000	6,331
Travelling Expenses		1,03,748	
Leave Salary Contribution		—	
Pension Contribution		—	
P. F. Contribution		—	
Summer Institute		—	25,105
Other Charges	—	49,06,544	
TOTAL	60,00,000	56,18,047	
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NON PLAN			
Salary of Officers	8,70,000	9,77,433	
Salary of Establishment	11,45,000	10,12,370	
Dearness Allowance	8,33,000	8,53,658	
Overtime Allowance	2,000	9,045	
House Rent Allowance	2,10,000	1,87,863	
City Compensatory Allowance	26,000	23,031	
Other Allowances + Honoraria	1,33,000	1,05,683	
Travelling Expenses	40,000	51,138	
Leave Salary Contribution	—	621	
Pension Contribution	}	601	
P. F. Contribution		5,000	935
Fellowships, Scholarships + Awards	10,000	—	
Other Charges	3,68,000	3,70,610	
TOTAL	36,42,000	35,92,988	

ABBREVIATIONS

AFDC	..	Agriculture and Food Products Division Council.
CFTRI	..	Central Food Technological Research Institute
DANIDA	..	Danish International Development Agency
FFA	..	Free fatty acid.
HDPE	..	High density poly-ethylene
HSD	..	High speed diesel.
ICFOST	..	Indian Convention of Food Scientists and Technologists.
IIT	..	Indian Institute of Technology.
IQF	..	Individual quick frozen.
MCPD	..	Marine Cargo and Packaging Division.
MPEDA	..	Marine Products Export Development Authority.
PV	..	Peroxide value.
RPM	..	Revolution per minute.
TBA	..	Triburetic acid.
TNAU	..	Tamil Nadu Agricultural University.
TPC	..	Total plate count.
UAS	..	University of Agricultural Sciences.
TVN	..	Total volatile nitrogen
WWB	..	Wet weight basis.