

# ANNUAL REPORT

## 1975



**CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY**

COCHIN-682003, KERALA

(Indian Council of Agricultural Research)

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# ANNUAL REPORT

OF

## CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY

### FOR THE YEAR 1975

#### 1. Director's Introduction

In recent years greater emphasis was given to investigations on better utilisation of low priced fish which form the major component of the trawl catch. Sciaenids were found to yield a very good quality fish powder of high protein content. Based on the technology developed, a scheme for a pilot plant was drawn up and forwarded to Kerala Government for production of Kerala Indigenous Food (K.I.F.) - fish powder admixed with tapioca - for feeding school going children. The Institute's design of a fish dehydration plant of 1 tonne capacity was adopted by the Integrated Fisheries Project, Cochin for production of artificially dried fish. It is significant that the above organisation had hitherto been entirely depending on imported technology and equipment.

The setback experienced in frog-leg exports, particularly to USA, due to *Salmonella* contamination could be overcome by the technology developed at the Institute and confidence could be created among the industrialists and importing countries. Intensive training programmes were held at different centres to train technologists attached to fish processing factories in the production of frozen frog legs free of *Salmonella*. Standard procedures were evolved for freezing and canning of cat fish, fillets, squid, eel and crab meat.

Diversification of fishing methods for small mechanised crafts enabled the evolution of a design of small purse-seine suitable for such vessels. Sardines constituted the major catch. The in-board out-board drive for propulsion of country crafts using an in-board diesel engine was designed, fabricated and trials were undertaken successfully. In collaboration with the Institute an entrepreneur developed a hydraulic drive for the trawl winches in small and medium vessels. Fishing trials were also undertaken with encouraging results.

The first get-together of the Entrepreneurs/Industrialists, R & D Institutes and Financing Agencies organised by the National Research Development Corporation (NRDC) discussed the various processes and equipments developed in the Institute's laboratories and proposals have been finalised with interested entrepreneurs for the commercial production of weeding machine and power take-off clutch.

## **2. Administration**

Fifth Plan Schemes in respect of the Institute was approved in July 1975 and 68 new posts were sanctioned for the implementation of the schemes.

The vacant post of Project Coordinator was filled up during the year under report by appointing Shri. M. Rajendranathan Nair. The other posts filled up were one post of Senior Bacteriologist, two posts of Fishery Scientist (Craft and Gear), three posts of Fishery Scientist (Processing), one post of Fishery Scientist (Processing and Processing Engineering) two posts each of Junior Fishery Scientist (Craft and Gear), Assistant Fishery Scientist (Processing), Assistant Fishery Scientist (Craft and Gear), Assistant Fishery Scientist (Processing and Processing Engineering), one post of Assistant Extension Officer and six posts of Senior Research Assistants.

The construction of laboratory-cum-office building for this Institute at Willingdon Island was completed and various sections which were accommodated in hired buildings at Ernakulam and Cochin were shifted to the new building during December 1975. The construction work of the 44 staff quarters at Thevara was also completed except for electricity connection. As part of the reorganisation scheme of the ICAR the various posts existing at this Institute were classified as Scientific, Technical, Administrative, Auxilliary and Supporting.

### **2.1 Finance**

The details of the budget provision and the actual expenditure during the financial year 1975-76 are given below:



## 2.2 Committees Represented by Institute

The Director of the Institute served on the following scientific and allied bodies:

1. *Member* — Scientific Panel for Fisheries Research, ICAR.
2. *Ex-Officio Member* — Panel of Experts for the purpose of hearing appeals - Export Inspection Agency, Madras and Cochin.
3. *Member* — State Fishery Advisory Board, Kerala.
4. *Member* — Advisory Board, Export Inspection Agency, Cochin.
5. *Member* — Scientific Research Committee, Fisheries Technological Research Station, Kozhikode, Kerala.
6. *Member* — Central Advisory committee on Exploratory Survey of Marine Fisheries.
7. *Member* — State Fisheries Research Council, Government of Tamil Nadu.
8. *Member* — Marine Products Export Development Authority.
9. *Member* — Technical Committee of Marine Products Export Development Authority.
10. *Member* — Board of Studies in Marine Science, University of Cochin.
11. *Chairman* — TDC-42 - Textiles Materials for Fishing Purposes Sectional Committee, Indian Standards Institution.
12. *Chairman* — MCPD-21 - Marine Cargo and Packaging Division Council, Indian Standards Institution.
13. *Member* — Board of Examiners, Central Institute of Fisheries Education, Bombay.

The following are other committees in which the Institute was represented.

1. Panel of Experts for purpose of hearing appeals against rejection of canned prawns, Export Inspection Agency, Cochin.  
(*Shri. M. Rajendranathan Nair, Project Coordinator as Member*)
2. ISI, AFDC-27, Fish and Fishery Products Sectional Committee  
(*Shri. M. Rajendranathan Nair, Project Coordinator as alternate member*)

3. ISI, AFDC-27 - Frozen Fish Products - Subcommittee.  
(*Shri. M. Rajendranathan Nair, Project Coordinator as alternate member*)
4. ISI, AFDC-36.9 - Metallic Contaminants Subcommittee.  
(*Shri. M. Rajendranathan Nair, Project Coordinator as Technical Representative*)
5. Fish, Meat and their products Subcommittee. Directorate General of Health Services.  
(*Shri. M. Rajendranathan Nair, Project Coordinator as Member*)
6. Ship building Sectional Committee, MCPD-1.  
(*Shri. M. Velu, Fishery Scientist as Member*)
7. Marine Instruments and Safety aids Sectional Committee, MCPD-4.  
(*Shri. M. Velu, Fishery Scientist as Member*)
8. Committee of Experts constituted by the MPEDA, Cochin-16 for finalisation of feasibility reports in respect of new fish processing ice production units in Kerala.  
(*P.N.R. Kaimal, Extension Officer, as Member*)

### **Management Committee**

With the intention to broad-base the decision making process and to speed up the implementation of the research programmes, a Management Committee for the Institute was set up in October 1975 with Director as Chairman and 10 members representing the various State/Central organisations. The first meeting of the Committee was held on 19-12-1975.

### **Grievance Cell**

The Grievance Cell met 8 times during the period under report.

### **Staff Research Council**

The Staff Research Council of the Institute met regularly every quarter to discuss the progress of research projects undertaken at Headquarters, Substations and Units.

## **2.3 Symposia, Seminars and Meetings**

The following symposia, seminars and meetings were attended by the scientists of the Institute during the year.

1. Symposium on Transducer Technology held at Naval Physical and Oceanographic Laboratory, Cochin on 15th to 18th May 1975. Shri. Varghese Paul, Research Assistant and K. Ramakrishnan, Senior Research Assistant participated in the meeting).
2. First National Symposium on Cryogenics at Kharagpur held on 24th and 25th May 1975. (Shri. P. K. Chakraborty, Junior Fishery Scientist attended the Symposium).
3. Executive Committee of the Regional Crygenic Committee at Indian Institute of Technology, Madras on 9-8-1975. (Shri. S. Ayyappan Pillai, Fishery Scientist attended the meeting).
4. Symposium on "Estuarine Biology" organised by the Cochin University and the University Grants Commission during 4 - 6 February 1975.
5. Southern Regional Agricultural Information Communication Workshop - organised by the Directorate of Extension, Ministry of Agriculture & Irrigation, Department of Agriculture, New Delhi, at Trivandrum from 24th to 29th September, 1975 (Shri P.N.R. Kaimal, Extension Officer, participated in the workshop).
6. Get-together of Entrepreneurs, Industrialists, R & D Institutes, Financial Institutions and NRDC organised by the NRDC Ltd., New Delhi at Hyderabad from 6th to 8th May 1975 (Shri. P.N.R. Kaimal, Extension Officer participated in the discussions).
7. Third workshop on the All-India Coordinated Research Project on Transportation of Fresh Fish and Utilisaton of Trash Fish organised by the ICAR, New Delhi at Cochin on the 8th and 9th October 1975, (The concerned scientists of the Institute participated in the Workshop).

#### **2.4 Foreign Training**

Shri. P. Sulochanan, Junior Fishery Scientist of the Institute was deputed to USSR for training in Fishing Gear Technology for a period of 6 months from 12-4-1975 under UNDP/FAO programme. Shri. N. A. George, Assistant Fishery Scientist was deputed to UK for training in Deep water trawling from July to December 1975 under Colombo Plan.

#### **2.5 Visitors to the Institute**

State and Central Government officials, scientists from research organisations, foreign dignitaries and students from educational institutions visited the Institute during the period.

1. Mr. K. T. Rathod, Minister for Fisheries and Horticulture, Government of Karnataka.
2. Mr. Anders Tubbin, Managing Director and Mr. Bengt Sandberg of M/s. Tubbin & Melanden, AB, Surden.
3. FAO/UNDP team of Pelagic Fishery Project consisting of six members
4. Dr. Joseph C. Madamba, Director General, Philippine Agricultural Research.
5. Dr. W.H.L. Allsopp, Associate Director (Fisheries), International Development Research Centre, Vancouver, Canada.
6. Dr. Harlan C. Lampe, Professor, University of Rhode Island, Kingston, Canada.
7. Mr. Lal Karamchandani, Director, Farm Information Unit, Directorate of Extension, Ministry of Agriculture, Government of India, Shastri Bhavan, New Delhi and Mr. T.R. Rao, Liason Officer, Satellite Instructional Television Experiment of same Directorate.
8. Mr. Carlo Durarro, FAO Consultant.
9. Dr. Sharfe, FAO and Shri. J.V.H. Dixitulu, Deputy Commissioner of Fisheries.
10. Shri. P. V. Sheno, Secretary (Fisheries) Government of West Bengal, Calcutta.
11. Vars O. Engvall, FAO.
12. Dr. Hajima Yamanaka, Chief, Section of Environment, Division of Oceanography, for Seas Research Laboratory, Japan.
13. Mr. G. C. Eddie and D. Scharfe, Members, UNDP team.

## **2.6 Library**

A bibliography covering all aspect of fishery technology was prepared every month and distributed among scientific staff. Work on acquisition, service and documentation was continued. The total number of books and bound volumes of periodicals are 2650 and 1442 respectively. Indian and foreign journals subscribed during the year were 65, and 53 journals were received on exchange basis.

Reference facilities were extended to fishing and fish processing industrialists, research scholars, trainees from different Institutions, students from Universities etc.

### **3. Progress of Research**

#### **3.1 Processing and Packaging Division**

##### **3.11 Cochin**

###### **3.1.1.1 Freezing and Packaging**

###### *CHIEF FINDINGS*

*The storage life of partially dehydrated unsalted fish like mackerel and jew fish, having a moisture content 57 to 60%, at room temperature was determined to be less than a week while partially dehydrated salted fish packed in high density polythene bags or plastic coated paper bags remained in good condition for 3 to 4 weeks and 7 — 8 weeks respectively at room temperature and refrigerated temperature. An apparatus for the determination of water absorption and water penetration of packaging materials was designed and fabricated and initial trials were conducted.*

###### RESEARCH IN HAND

Studies on the bulk freezing of oil sardine were carried out. Fresh and iced sardine (upto 2 days) were frozen as blocks and stored at — 17°C and changes in organoleptic characteristics were followed. The suitability of frozen material for further processing into canned products was also studied. It was observed that sardine kept for one day in ice and subsequently frozen are suitable for canning. Attempts were also made to prevent the development of rancidity in oil sardine during storage at low temperature. The rate of thawing of frozen glazed sardine blocks (2 kg) at refrigerated temperature (7 — 9°C) in air (26 — 27°C and in running water (23 to 24°C) were determined. The water thawing was found to be the quickest (2 hours), then the air thawing (5 hours); the slowest being refrigerator thawing (23½ hours).

Methods for preparing skinless fillets from cat fish were worked out. Medium size cat fish (average 1 kg) yielded 25% of fillets. Studies on the freezing and storage characteristics of fillets in the form of small consumer type blocks (450 gms) are in progress.

Investigations were carried out on the production and Storage of partially dehydrated fish intended for consumption within the country.

Different varieties of fish like mackerel, lactarius, jew fish, anchovy etc. were partially dehydrated in unsalted and salted conditions to different moisture levels ranging from 55 — 65%, packed in different packaging materials like low and high density polythenes of different gauges and plastic-coated paper and stored at room temperature and refrigerated temperature (2 to 6°C). It was observed that the storage life of partially dehydrated unsalted fishes like mackerel and jew fish, having moisture content 57 — 60%, at room temperature was very limited (less than a week). But partially dehydrated salted fish (moisture 55 — 60%) packed in high density polythene and plastic coated paper bags remained in good condition for 3 — 4 weeks and 7 to 8 weeks respectively at room temperature and refrigerated temperature. The fish partially dehydrated to a moisture level of 55 — 60% had good texture and better appearance compared to fish dehydrated to a moisture level below 50%. The time taken for partial dehydration of fish at 45°C to 50°C to moisture levels 55 to 60% was observed to be 5 — 7 hours for fishes like mackerel, jew fish and anchovy.

The thermal efficiency of waxed 3 ply corrugated fibre board box insulated inside with 25 mm thick fibreglass was found to be nearly the same as that of thermocole (25 mm) lined corrugated fibre board box. The thermal diffusivity of synagris was determined at — 18°C using fish previously frozen to — 54°C using solid carbon dioxide. The value worked out to be 0.6066 cm<sup>2</sup>/sec.

The water absorption and water penetration properties of different packaging materials were determined using the apparatus designed by the Institute.

#### RESEARCH CONTEMPLATED

1. Continuation of studies on bulk freezing of oil sardine and suitability of the material for processing into canned products.
2. Development of process for the production of partially dehydrated fishery products and extension of their shelf life at refrigerated temperature.
3. Study of the physical properties of fish and fishery products in relation to storage and processing and development of suitable machinery for rapid quality assessment of fresh and processed fish.
4. Improvements on the existing packaging materials and containers for fresh fish transport.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                     |                            |
|---------------------|----------------------------|
| 1. P. A. Perigreen  | .. Asst. Fishery Scientist |
| 2. Chinnamma George | .. Asst. Fishery Scientist |
| 3. T. T. Annamma    | .. Sr. Research Assistant  |
| 4. K. Ramakrishnan  | .. Sr. Research Assistant  |

### 3.1.1.2 Canning

#### CHIEF FINDINGS

*Standard procedures were worked out for canning of cat fish in chunk and fillet forms and crab meat. The causative factor of development of blackening during storage of canned crab meat was traced to be the content of copper and preventive measures were worked out.*

#### RESEARCH IN HAND

Studies were directed to find out the reasons for the development of blackening of canned crab meat during storage. Since crabs live out of water for a fairly long time attention was diverted to find out whether the state of live conditions of the crab had any effect on the phenomenon of blackening. Common mud crabs (*Scylla serrata*) were collected in very fresh conditions and killed at different intervals after exposing to sun for varying periods so that animals in actively live, live, nearly dead and dead conditions could be obtained. The meat picked from such crabs after cleaning and cooking were analysed systematically for the proximate composition, chemical indices of spoilage and content of iron and copper in order to correlate these factors with the development of blackening. The causative factor for producing blackening was determined to be the copper content of the meat. Where fresh crab contained copper to the extent of 37.5 ppm, there occurred blackening in the canned crab meat. By proper bleeding of the crab carcasses by repeated washing in running water its copper content could be brought down to a level such that the incidence of blackening was not apparent under the acidic conditions maintained in the can. By reducing the handling of picked meat to the minimum prime quality of the meat could be preserved in cans. For this thoroughly washed and bled carcasses should be cooked in brine and after picking the meat in the form of flakes should be directly packed in can provided with an inner parchment lining.

It was confirmed that the state of live conditions of crab meat does not affect the colour to any significant level. These affect the taste and

flavour to some extent. To determine the critical level of copper as much as it introduces blackening in the canned meat experiments have been carried out after incorporating copper at different levels in the can and then processing followed by subsequent observation.

Initial studies carried out on canning of cat fish in chunk and fillet forms showed that they yield good quality canned products. In the former type of pack whole fish was cooked in steam and processed as in the case of tuna and seer while the fillets after initial brining and precooking in cans were packed in oil.

#### RESEARCH CONTEMPLATED

1. Standardisation of processing conditions for canned crab meat in brine and clam in oil.
2. Continuation of studies on canning of cat fish in oil in different forms. Standardisation of procedure and shelf life of the products.
3. Feasibility studies on canning of mackerel in natural style.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                       |                            |
|-----------------------|----------------------------|
| 1. K. K. Balachandran | .. Jr. Fishery Scientist   |
| 2. V. N. Nambiar      | .. Asst. Fishery Scientist |
| 3. Cyriac Mathen      | .. Quality Control Officer |
| 4. P. K. Vijayan      | .. Sr. Research Assistant  |

### 3.1.1.3 Use of Processing Waste

#### CHIEF FINDINGS

*Application of chitosan in purification of water was investigated. Studies were made on the binding of metallic ions with chitosan and further precipitation from impure water. It was observed that treatment with chitosan helps to remove even metallic impurities present in impure water.*

#### RESEARCH IN HAND

Investigations on the production and utilisation of chitosan from prawn shell waste were continued. Technical data required for designing a pilot plant for the production of chitosan were collected after a number of experiments starting upto 50 kg of fresh shell waste. The density of raw material, water required at various stages of production, time required in each step, quantities of acid, alkali and other chemicals etc. to be used have been assessed to facilitate designing of the pilot plant.

The viscosities of solutions of chitosan were found to decrease on keeping. Prolonged storage of chitosan at room temperature also brought down the viscosity when dissolved in dilute organic acids. The relation of viscosity of chitosan solutions with the copper ion absorption capacity of chitosan was investigated. The study of complex forming property of chitosan with copper and cobalt ions was continued with a view to assess the degree of deacetylation of chitin for which there is no satisfactory method available so far.

Chitosan films were prepared. The transparency and colour of the film were adversely affected at higher temperatures. Further studies are under progress.

Using chitosan as a binder thick boards were made with dry "African Payal" (*Salvinia spp.*). These boards prepared were found to be light and firm and the insulation properties of the board are being studied.

Some of the formulations of fish feed were tested at one of the Universities. Large quantities of this feed were supplied to different fish farms for trial feeding.

Whole trash fish was canned in brine to be used as pet feed. However, the product did not have appealing colour and appearance due to the presence of guts and gills. Fish paste for pets was also prepared by incorporating trash fish with starch.

#### RESEARCH CONTEMPLATED

1. Application of chitosan in industries such as paper, paint, wrapping films and adhesives.
2. Study of intrinsic properties of chitosan such as viscosity, complex forming and coagulation.
3. Separation of oil from frog waste and standardisation of method.
4. Preparation of hydrolysates from fish | shrimp waste and assessing their chemical and nutritional qualities.
5. Preparation and standardisation of fish feed.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                            |                             |
|----------------------------|-----------------------------|
| 1. P. Vasudeva Prabhu      | .. Fishery Scientist        |
| 2. P. Madhavan             | .. Junior Fishery Scientist |
| 3. K. G. Ramachandran Nair | .. Asst. Fishery Scientist  |
| 4. A. Lekshmy Nair         | .. Asst. Fishery Scientist  |

### 3.1.14 Quality control

#### CHIEF FINDINGS

*The design for a frogleg processing centre was made available. The method of processing of frozen froglegs free from salmonella was demonstrated to almost all of the frogleg processors; as a result commercial production was resumed in October/November. The method of test for salmonella in frozen froglegs was modified and it was furnished to the ISI for incorporation in the relevant standard. Salmonella organisms isolated from frogs did not show any definite pattern when typed. Survey on the quality of raw wet fish available locally was continued. As in the previous years, the section continued to render assistance to the trade in the form of analysis of samples and demonstration of processes.*

#### RESEARCH IN HAND

##### 1. *Studies on frogleg processing*

Moist gunny bags, nets and bamboo baskets were found to be suitable for keeping live frogs. Storage of live frogs in metal boxes with a layer of water at the bottom was found to keep them alive for 3 days. Prolonged storage resulted in mortality — the rate was 38% after nine days. The skinned legs from the above showed slight discolouration and a few blood clots. However, the processors are reluctant to arrange the whole process under a single roof starting with live frogs.

Spurting of gut contents during severing of the hind legs was avoided by removing the cloaca with the intestines by skinning from the ear drum down. In this case too salmonella was absent.

The method of test for salmonella was modified by introducing pre-enrichment in lactose broth followed by enrichment in salinite cystine and tetrathionate broths. Three different agars — S.S. agar, brilliant green agar and bismuth sulphite agar were found essential to get reliable results. Some of the salmonella cultures isolated from frog skin, froglegs, processing environments etc. were got typed at the National Salmonella and Escharichia Centre, Kasauli. No definite pattern was observed. Direct enrichment of large inoculum into selenite broth as well as pre-enrichment of smaller inoculum was not enough for the isolation. Quantity of the material as well as pre-enrichment were found to be essential factors for detection of salmonella. Bones, carefully removed from frogs were free of salmonella indicating the absence of infection. Forty samples of cooked frozen prawns

and 20 of fresh frozen prawns when tested for Salmonella-Shigella group of organisms were found to be free of them. One hundred and thirty samples of process water were tested for salmonella and were free of the organism.

It was found that 30 workers were required to process 500 kg of skin-on-legs in 8 hours and that the processed yield was 65 — 70%.

## 2. Survey of quality of raw fish

Samples of raw wet fish available locally were appraised for their quality. Nearly 15% were substandard in organoleptic aspects and 14% had SPC above  $1 \times 10^6$ /g. Faecal indicator organisms were present in very high numbers. *Vibrio parahaemolyticus* like organisms were present in 10%. Salmonella and coagulase positive staphylococcus were absent.

### Analytical

The following samples received from the industry were analysed and results furnished for necessary action.

1. Water   ice of which	138 nos.
1) Detailed analysis	31 nos.
2) Routine analysis	107
2. Cooked, peeled frozen shrimp of which	218
1) Bacteriology only	52
2) Full analysis	166
3. Fish meal and feed components	33
4. Prawns, canned	14
5. Sardine, canned	18
6. Chunk flesh, canned	4
7. Prawn pickle	2
8. Survey on sanitation	19 (229 samples)
9. Washing procedure appraisal	4
10. Common salt	4
11. Frozen P and D prawn of which	103
1) bacteriology only	44
2) full	59
12. Phosphates	10
13. Detergent   deodorant	8
14. Chlorine	7
15. Slipper tails for bacteriology only	22
16. Frozen squid (full analysis)	3

#### RESEARCH CONTEMPLATED

1. Survey on the quality of raw wet fish available in the trade.
2. Quality changes in important species of raw fish during different conditions of storage and formulation of specifications for the same.
3. Quality levels of dried fishery products available in the trade.
4. Maintenance of analytical service to the benefit of the industry.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                             |                           |
|-----------------------------|---------------------------|
| 1. Cyriac Mathen            | .. Fishery Scientist      |
| 2. T. S. Gopalakrishna Iyer | .. Jr. Fishery Scientist  |
| 3. A. C. Joseph             | .. Sr. Research Assistant |
| 4. Francis Thomas           | .. Sr. Research Assistant |
| 5. Annamma Mathew           | .. Analyst                |

### 3.1.2 Veraval

#### 3.1.2.1 Freezing and canning

##### CHIEF FINDINGS

*The distribution of major protein nitrogen fractions and lipids of fishes like black and silver pomfrets, Hilsa toli and Hilsa ilisha and their changes during storage in ice and under frozen storage were studied. Black pomfret in general showed quicker spoilage compared to silver pomfret. It was also observed that in black pomfret the deteriorative changes affected the red muscle to a greater extent than white muscle. Further studies on this line showed that the red muscle contained higher fat content than white muscle. The ice storage shelf life was found to be only 2 days but they could be kept in good condition up 5 months by freezing and storage at  $-18^{\circ}\text{C}$ . Squid yielded a good canned product of good storage life. Studies on canned eel fillets showed that the treatment with alum improves the texture of the product considerably.*

*Liver oil residue after oil extraction was found to be a rich source of vitamins and was found suitable as an additive to enhance the nutritive value of high energy protein food after suitable treatments. Methods were standardised to prepare good quality leather out of shark skin. Shark muscle after removal of urea could be minced and frozen to 'keema' like product.*

#### RESEARCH IN HAND

Systematic and extensive investigations on the seasonal variation of composition of the muscle proteins and lipids of commercially important fishes of Gujarat coast were taken up.

The water soluble proteins in pomfrets were, in general, lesser. But salt solutions of high ionic strength extracted about 80% of total protein nitrogen. In silver pomfrets the soluble proteins did not decrease to any great extent even after storage for 10 days. *Hilsa toli* had a slightly higher percentage of water soluble proteins compared to *Hilsa ilisha*. In buffers of 0.5 ionic strength about 50% of the proteins could be extracted from both species and when ionic strength of buffers was increased to 1 about 65 — 70% of the proteins could be extracted. Their changes during frozen storage are being studied.

Lipids were extracted from black pomfret, silver pomfret, *Hilsa toli*, *Hilsa ilisha*, ghol, dhoma, eel, horse mackerel etc. by the chloroform methanol extraction procedure. Samples were taken every month and lipids of muscle and skin were separately extracted and the lipids in each case were analysed to determine their saponification value, iodine value, unsaponifiable matter, refractive index etc. In the case of black pomfret the red muscle had a higher fat content compared to white muscle whereas skin contained a still higher percentage of fat. In silver pomfret the muscle contained a very low percentage of fat whereas skin had a high fat content. The oil of silver pomfret was more saturated, having a much lower iodine value compared to that of black pomfret. *Hilsa ilisha*, during November-December had a high fat content than *Hilsa toli*.

The shelf life of frozen black pomfret was found to be 10 weeks at — 18°C. The frozen storage shelf life of silver pomfret in whole as well as gutted forms were assessed, both as such and also after treatment with anti-oxidant like BHA. Similar studies on hilsa have also been taken up.

Detailed studies on the processing and preservation of squid were conducted. Squid could be stored in ice only for 2 days but on freezing the shelf life was found to be 5 months. Attempts were made to produce good canned product from squid with good storage life. Attractive canned products of eel in brine, oil as well as in 'natural pack' were also prepared.

The native bacterial flora present in each fish and their changes during storage was followed systematically.

### **3.1.2.2 Smoking, dehydration and fumigation techniques to control insect infestation of fish products:**

Methods were standardised to prepare attractive smoked products from eel fillets by cold smoking. Smoked eel fillets had a reasonably good storage life at room temperature, but on prolonged storage mites appeared and within a month after their appearance, samples were completely spoiled. But the infestation by usual insect was not noticed in these products.

Attempts were made to turn out good smoked products from sharks and rays. In the case of shark the smoked product was susceptible to mould attack. De-salting the brined fillets prior to smoking was found to reduce urea and prevent the appearance of white encrustations on the product on storage. Smoked ray had a dark appearance.

Almost all the samples infested had a high uric acid content, while in freshly dried fish uric acid was negligible. Attempts are continued to arrive at a threshold value of uric acid in dried fishery products.

An improved horizontal type of smoke kiln with arrangements for controlling and adjusting the temperature, humidity, air velocity, smoke intensity etc. was designed and fabricated. The relative merits over the conventional vertical smoke kilns are under investigation.

Ethylene dibromide was found to be a very efficient fumigant for preventing insect infestation in fishery products. But due to its high density its uniform circulation in the godown was found difficult. In this respect phosgene had an advantage. Attempts are being made to standardise methods for the estimation of residual fumigants in the fumigated fishery products in collaboration with Indian Veterinary Research Institute, Izatnagar. A comparative study on the relative efficiency of monochloramine and alcoholic potash for estimating residual EDB has also been undertaken.

### **3.1.2.3 Economic utilisation of elasmobranch fishes**

Detailed studies were conducted to evolve better methods for the economic utilisation of sharks, skates and rays which occur in substantial quantities in the catches along Gujarat coast but fetching very poor returns to the fishermen.

In the case of shark methods were worked out to utilise all the parts of the fish. The processing of shark skin to good quality leather could be achieved with the help of the Regional Station of the Central Leather Research Institute, Rajkot. Shark fin rays extracted by easy methods already developed by the Institute fetch better price than dried shark fins in the export market. Shark teeth, a wasted product on dilute alkali digestion and

subsequent extraction and bleaching with hydrogen peroxide is a valuable export item. Shark flesh was subjected to removal of urea by treatment with 1% NaHCO<sub>3</sub>, 0.5% NaOH, 1% acetic acid, urease etc. Of these urease was found to be very useful for removal of urea. The urea removed flesh pieces gave very attractive smoked products on cold smoking. Alternatively they could be converted into minced and frozen blocks of fish.

Shark liver from the *Carcharius* species had a high oil content of about 45% and it was found to contain more than 12000 I.U. vitamin A. The studies on other characteristics of the oil like its saponification value, iodine value, unsaponifiable matter and refractive index with regard to different species, size, sex and time of capture are underway. The liver residue after oil extraction which is at present wasted and thrown away by factories is a rich source of vitamins. Preliminary studies conducted have shown that after complete defatting the liver residue can be hydrolysed and advantageously used for incorporation in protein rich high energy beverages as a source of vitamins and other nutrients.

Studies on ray muscle showed that it contained a higher percentage of urea; liver oil contained very little vitamin A.

#### **3.1.2.4 Utilisation of dhoma**

Dhoma was found to keep well in ice for a period of 5 days only. The minced muscle on freezing gave a good product which remained in good condition for 2 months. Dhoma yielded a very good smoked product of good storage life. The powder prepared from dried dhoma muscle was found to be very rich in proteins. Systematic studies are in progress on the seasonal variations in the biochemical composition of dhoma with respect to size and species.

##### **RESEARCH CONTEMPLATED**

Studies on the freezing will be continued under a combined project "Development of improved techniques for preservation and packaging of commercially important fishes". The canning part will be done under "Canning techniques for fish and shell fish" and studies on curing and smoking will be carried out under the revised project "Improvements in curing of fish and fishery products". The economic utilisation of dhoma and non-penaeid prawn will be tackled as a separate project to be carried out from Veraval and Bombay.

##### **RESEARCH WORKERS ASSOCIATED WITH THE PROJECT**

- |                       |                            |
|-----------------------|----------------------------|
| 1. K. Devadasan       | .. Fishery Scientist       |
| 2. P. R. Giriya Varma | .. Asst. Fishery Scientist |
| 3. Jose Joseph        | .. Sr. Research Assistant  |

### 3.1.3 Kakinada

#### 3.1.3.1 Packaging

##### CHIEF FINDINGS

*The rate of melting of ice with respect to different containers showed that the average rate of melting of ice of waxed 3 ply corrugated fibre board insulated inside with 2.5 cm thick fibreglass during first 72 hours was 0.118 kg/hr. and was found to be approximately same as that of thermo-cole lined CFB box. Best insulated CFB box appears to possess maximum thermal efficiency among the currently used fish boxes.*

##### *Packaging of fresh fish*

Experiments were conducted to study the variation in the rate of melting of ice block with its size and shape under different ambient temperature and humidity conditions with a view to correlate its rate of melting with its surface area, volume | thickness and ambient conditions.

#### 3.1.3.2 Salt curing of fishes

The rate of penetration of salt in the fish muscle during curing was taken up. Commercially important fishes like *Synagris japonicus*, *Lactarius*, *Sciaenides* etc. were used for the experiments and were salted in the ratios 1:3, 1:5, 1:7 (salt : fish) and were held at 10°C, room temperature and 40°C and the variation in their salt and moisture contents were followed at regular intervals upto 6 days. Simultaneous measurements on the electrical conductivity of these fish samples were made using conductivity bridge method. This aspect could not be continued due to low sensitivity of the technique at higher salt levels. To overcome this, a new technique based on the measurement of chloride ion activity was developed. Silver chloride electrode for chloride estimation (and hence % salt) has been developed and the potential developed due to chloride ion activity was read on a millivolt meter.

The effect of natural preservative in salt curing of mackerel was studied in detail along with its storage characteristics.

##### RESEARCH CONTEMPLATED

Studies on the physical properties of fish and fishery products in relation to storage and processing and development of suitable machinery for rapid quality assessment of fresh | processed fish will be continued.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                     |                            |
|---------------------|----------------------------|
| 1. C. V. N. Rao     | .. Jr. Fishery Scientist   |
| 2. S. S. Gupta      | .. Asst. Fishery Scientist |
| 3. D. Narayanaswamy | .. Sr. Research Assistant  |

### 3.1.4 Bombay

#### 3.1.4.1 Freezing

##### CHIEF FINDINGS

*Studies on the frozen storage characteristics of eel and ghol in different dressed forms showed that the drip loss was lower in phosphate treated samples.*

##### RESEARCH IN HAND

Survey of the quality of fresh fish landed at docks and that of commercially frozen fish was continued. Freezing characteristics of eel and ghol in different dressed forms were studied in detail in relation to storage temperature, use of polyphosphates and antioxidants in reducing excessive thaw drip loss and oxidative rancidity. Stored eel chunks and fillets on biochemical assessment showed an increase in amino nitrogen and TVN values while TBA values did not show any appreciable variation. Texture was observed to be hard and spongy in chunks and fillets not treated with polyphosphate while treated one was soapy. Colour of all the samples after cooking in 5% brine was observed to be white.

Ghol fillets individually wrapped in polythene and treated with polyphosphate showed a slight increase in TVN values while no appreciable increase in TBA value was noticed in both.

#### 3.1.4.2 Studies on non-penaeid prawns

A series of investigations were carried out to separate proteins free from shell, of the tiny Jawala prawn which is a major fishery of Maharashtra coast. The process consists in coarsely distintegrating the whole jawala prawn in water and then filtering through a coarse filter whereby the shell material is segregated. Protein is separated from the filtrate by application of heat. Chemical composition of the product was estimated.

##### RESEARCH CONTEMPLATED

The programmes undertaken will be continued in the following lines:

1. Preparation of smoked product, sausages and edible fish powder from dhoma and studies on the nutritive value and shelf life of the products.

2. Development of rapid process for the maximum separation of proteins and use of non-penaeid prawns for preparing consumable products.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

1. Dr. Jose Stephen .. Asst. Fishery Scientist
2. D. K. Garg .. Sr. Research Assistant

### 3.1.5 Calicut

#### 3.1.5.1 Smoke curing and pickle curing

##### CHIEF FINDINGS

*Several experiments were conducted for the preparation of attractive and tasty products from fish that have only limited value in the fresh condition by employing the technique of smoke curing. It was observed that 20% brine is preferable to saturated brine for salting prior to smoking. The objectionable odour and illtaste characteristic of cat fish could be effectively masked by smoking. The resultant product is readily acceptable and have attractive colour and good flavour. For pickle curing of fish different natural preservatives like pepper-spikes and goruka puli were tried.*

##### RESEARCH IN HAND

Cat fish fillets were dipped in 20% brine for 15 minutes, drained and smoked for 4 — 5 hours at 80 — 90°C. The smoked product was dried to a moisture level of about 35%.

Smoked fillets with attractive appearance and excellent flavour could be prepared from sole. The method consisted of brining the eviscerated and dressed fish in 15% brine containing 1% turmeric powder for 15 minutes, followed by draining and smoking for 2 — 3 hours at 80 — 90°C. The smoked product was dried further to bring down the moisture level to about 30%.

Experiments for improving the appearance and shelf life of smoked sardine fillets were carried out. It was seen that sealing of the fish was highly beneficial in improving the appearance of the final product and increasing the smoke absorption, besides making it more aesthetically acceptable. In addition to sealing, treatment with turmeric gives a still better product in appearance, palatability and shelf life. The scaled fish are dipped in turmeric solution (1 gm|100 ml water) for 15 minutes followed by salting in

20% brine for another 15 minutes. The brined fish was smoked, dried and packed.

Green pepper spikes at present discarded by pepper cultivators were tried both as a substitute for goruka puli and as an adjuvant along with it in Colombo curing and pickling of different fishes. It was noted that apart from preservative action pepper spikes impart characteristic flavour. Besides the preservative action of turmeric in conjunction with other preservatives like tamarind, tartaric acid and vinegar in pickled fishery products was studied. It was observed a combination of 5% (W|W) of Malabar tamarind and 0.5% (W|W) of turmeric (in powder form) apart from salt was effective in preserving pickled fish. Addition of 2% (W|W) garlic to the above combination makes the product still better in flavour and shelf life.

Japanese style seasoned-dried and seasoned-smoked products were prepared using cat fish. The seasoning solutions prepared were according to different recipes. These contained sugar, glucose, potassium sorbate, agar, sodium polyphosphate etc. 3 hours of seasoning was given. Seasoned fish was dried and smoked and both the products had attractive appearance, good flavour and mildly sweet taste.

#### RESEARCH CONTEMPLATED

Studies on the following lines will be taken up.

1. Preparation of light salted and mild cured products.
2. Standardisation of various types of pickled products.
3. Microbial spoilage in various types of cured fishery products.
4. Popularisation of successful methods developed in the laboratory by field trials.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                            |                            |
|----------------------------|----------------------------|
| 1. T. S. Unnikrishnan Nair | .. Asst. Fishery Scientist |
| 2. V. Muraleedharan        | .. Sr. Research Assistant  |
| 3. K. George Joseph        | .. Sr. Research Assistant  |

## 3.2 Biochemistry, Nutrition and Microbiology Division

### 3.2.1 Enzymes in fish

#### CHIEF FINDINGS

*The changes in free reducing sugars during ice storage of tropical fishes showed a 30% increase in the first four days and then decreased to remain almost at the initial level of about 3.5 mg/g. The trend was found similar in the case of*

*lactic acid which increased gradually in the first four days (over 0.2 mg/g of tissue) without any noticeable change thereafter remaining at 2.7 mg/g of tissue.*

#### RESEARCH IN HAND

Investigations on the constituents released or used up from fresh tissue during ice-storage of tropical fishes as a result of carbohydrate and nucleotide metabolism showed that the general pattern of change in constituents was similar in most cases of samples examined, as for example mackerel recorded a decrease in glycogen content from 1260 ug/g to 540 ug/g (i.e. about 57% break down) in a period of two days. Similar was the case with nucleotides where about 50% had undergone decomposition in the course of 10 days in ice.

The specific nature of peptide bonds in the breakdown of proteins effected by proteolytic enzymes had been investigated so as to assess easily susceptible bonds to fish tissue enzymes. It was observed that aromatic amino acid containing peptide bonds as well as amide bonds are the easily affected ones by these enzymes and most of them required — SH compounds for full activity. Specific synthetic peptides were used as substrates for the assay. Muscle enzymes from *Calla-calla* showed a catheptic A activity of 50 ug/g of fresh tissue under specified reaction conditions using 0.01 M.CBZ L-glutamyltyrosine. In the case of Cathepsin B1, B2 activities with Benzoyl L — Arginine amide as substrate the respective tissue activities varied between 300 to 336 ug/g and 100 to 120 ug/g of fresh tissue under the reaction conditions. The assay of various proteolytic enzymes after electrophoretic separation showed only very feeble activity either due to lack of sufficient quantity of individual enzymes or due to destruction of the same during the run. Moreover many of the electrophorograms were poor for the assay or enzyme activity and hence protection of the enzymes by various systems as well as improvement in separation was investigated. It was found that many alcohols in sufficiently low concentrations and low ionic strength buffer in the running gel in disc electrophoresis improved the separation markedly without affecting the general pattern.

#### RESEARCH CONTEMPLATED

1. Studies on distribution and activity of the enzymes in crustacean fishes are to be continued.
2. Studies on degradation of nucleotides and energy phosphates in fish muscle and their changes during handling fresh fish.
3. Studies on the extent of protein cleavage brought about by proteolytic enzymes under different preservation conditions, as also the self destruction of the enzymes involved.

4. Formation of volatile carbonyls and sulphur compounds in fish during preservation and measurement of the threshold levels in relation to flavour generation.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

1. M. R. Nair . . Fishery Scientist
2. P. D. Antony . . Jr. Fishery Scientist
3. M. K. Mukundan . . Sr. Research Assistant
4. K. Vasudevan Nair . . Analyst

### 3,2,2 Nutritional evaluation of proteins and lipids

#### CHIEF FINDINGS

*The ratio of actomyosin to sarcoplasmic proteins was characteristic of the particular species of fish and showed a variation range of 0.2 to 1.2 amongst the fishes analysed. In the case of prawns high levels of mercury (0.10 to 0.18 ppm) was recorded in the backwater prawns compared to prawns from sea (0.06 to 0.09 ppm).*

#### RESEARCH IN HAND

The analysis of toxic elements such as mercury and cadmium in a few species of fishes and shell fishes revealed that the cadmium levels varied between 0.01 to 0.09 ppm in various fishes and shell fishes analysed. Heat coagulation studies are being done in mixed systems of actomyosin and sarcoplasmic proteins from common food fishes viz. mackerel, sardine, cat fish, malan — kanambu, poolan, tilapia and prawns at varying concentrations. The ratio of actomyosin to sarcoplasmic protein varied with respect to species and the ratio of actomyosin and heat coagulable sarcoplasmic proteins also varied between these species from 0.8 to 2.0. These variations may have a direct bearing on the gel forming capacity of their respective meat, further these information might be of use in the selection and preparation of speciality products from fish. Studies were also undertaken for the identification of species by disc electrophoresis of tissue extract both from fresh as well as cooked meat, the latter as 6M urea extracts. The study revealed definite species specific protien patterns both for the fresh tissue and cooked meat though the pattern of cooked meat was different from that of fresh myogen.

Lipid hydrolysis and free fatty acid (FFA) production, in a few samples of oil sardines having different fat contents, during ice storage as well as frozen storage followed similar patterns. The relative amount of

neutral lipids present was found not to exert much influence on the phospholipids which undergoes rapid hydrolysis. Sardines under frozen storage undergoes about 15-20% hydrolysis of its phospholipids during a period of 5 months in tissue of varying fat contents with concomittant FFA production of about 140 to 180 mg% expressed as oleic acid. In the case of oil sardines in ice storage the corresponding values for phospholipids and FFA are 20 and 190 mg% for a period of storage of ten days.

#### RESEARCH CONTEMPLATED

1. Study of intrinsic properties of the proteins of important fishes and shell fishes.
2. Investigation of free and combined amino acids, vitamins and minerals in commercially important fishes with emphasis on the levels of toxic elements.
3. Determination of fatty acid make up of neutral lipids and phospholipids and unsaponifiables in fish and changes in levels of polyunsaturated acids in products held in frozen storage.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                           |    |                         |
|---------------------------|----|-------------------------|
| 1. P. D. Antony           | .. | Jr. Fishery Scientist   |
| 2. A. G. Radhakrishnan    | .. | Asst. Fishery Scientist |
| 3. M. Arul James          | .. | Asst. Fishery Scientist |
| 4. P. G. Viswanathan Nair | .. | Sr. Research Assistant  |
| 5. Francis Thomas         | .. | Sr. Research Assistant  |
| 6. K. Vasudevan Nair      | .. | Analyst                 |

### 3.2.3 Food poisoning organisms

#### CHIEF FINDINGS

*Differences in the rate of growth of Clostridium perfringens were observed with respect to temperature. The optimum temperature for maximum growth was room temperature ( $28 \pm 1^{\circ}\text{C}$ ). None of the strains grew under aerobic conditions while good growth was observed under anaerobic conditions. Hence it was concluded that incubation at room temperature under anaerobic condition is optimum for the growth of Clostridium perfringens strains.*

#### RESEARCH IN HAND

The recovery of salmonella organisms from artificially inoculated media kept at subzero temperatures was studied. Studies were carried out

mainly with *Salmonella typhimurium* and *Salmonella anatum* as test organisms. These organisms were inoculated separately at initial concentrations of  $1.2 \times 10^4$ ,  $1.2 \times 10^2$ , 10-50 cells/ml in peptone broth and subjected to slow freezing and stored at  $-10^\circ\text{C}$ . After a month's storage the recovery of the organisms was tested with and without pre-enrichment. Pre-enrichment was found essential for recovery especially in samples inoculated with the minimum number of organisms.

Investigations were carried out on the growth temperature requirement of *Clostridium perfringens* strains isolated from processing factory environs. 32 cultures of the organisms were inoculated into thioglycolate broth and incubated at room temperature,  $37^\circ\text{C}$  and  $56^\circ\text{C}$ . Difference in rate of growth were observed at these temperatures.

Studies were also conducted on the degree of survival of *Clostridium perfringens* inoculated into canned fishery products and kept at room temperature. The cans were found to be bulged and the contents were spoilt. The organisms survived inside the cans even after two months of storage at room temperature.

Work on the effect of various concentrations of nisin in the thermal susceptibility of pathogenic bacteria during heat pasteurization of fishery products was continued. Pure cultures of Streptococci were used in these studies. At  $50^\circ\text{C}$ , nisin at 5 R.u. and 10 R.u. suppressed the growth of 60 — 70% of the streptococci cells. Lower concentrations of nisin did not display any appreciable effect on thermal death during pasteurization at  $50^\circ\text{C}$ . But subsequent experiments showed strain difference in tolerance towards nisin.

Experiments were carried out on the effect of plating methods and recovery media on bacterial enumeration. Between pour plate and spread plate techniques, no significant difference was observed to the bacterial counts of the microflora of gills of sardines. Among the recovery media used, the efficiency was in the order — sea water agar — nutrient agar — tryptone glucose agar.

#### RESEARCH CONTEMPLATED

1. Application of fluorescence antibody technique for the rapid detection of salmonella.
2. Studies on the degree of survival as well as toxin production potential of clostridium spp. under different storage conditions.
3. Survey on the incidence of clostridium spp. in raw materials and factory environs and to improve methods of isolation of the species.
4. Studies on the action of certain fish spoiling bacteria on the protein and non-protein fractions of fish muscle with respect to formation of off-odours and toxic amines.

5. Improvement of the existing sampling procedure for bacterial enumeration in fish. The study to include improvement in plating media and in experimental manipulation.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                      |                            |
|----------------------|----------------------------|
| 1. K. Mahadeva Iyer  | .. Bacteriologist          |
| 2. M. Arul James     | .. Asst. Fishery Scientist |
| 3. V. N. Nambiar     | .. Asst. Fishery Scientist |
| 4. P. K. Surendran   | .. Asst. Fishery Scientist |
| 5. Nirmala Thampuran | .. Sr. Research Assistant  |

### 3.3 Craft Technology Division

#### CHIEF FINDINGS

*Investigations so far carried out have revealed the possibility of fabricating the Malabar fishing canoes out of fibreglass reinforced plastics (FRP). The process of 'ferrocement' boat construction will be advantageous only when a suitable size range (viz. 12 M to 25 M) and a standard method of construction were adopted. A heavy duty top coat of painting on the external hull of ferrocement craft was found to be very essential. The inclusion of "sap-wood" and infected timbers in boat construction are likely to affect the other wooden parts if timely precautions are not taken. Antifouling paint formulations of CIFT continued to give better performance in the field for a period of two years and was also found economical. Ternary aluminium alloy anodes were found to be better than the conventional zinc anodes in fishing trawlers.*

#### RESEARCH IN HAND

##### 3.3.1 Marine fouling

A number of methods were tried with a view to preventing the settlement of the various marine fouling organisms on boat hulls.

Solubility studies were carried out with different toxic pigments like Bis Tributyl tin oxide; Triphenyl tin acetate; Triphenyl tin hydroxide and Tributyl tin acetate. The dissolution of the above chemicals incorporated both in soluble as well as insoluble matrices were studied in sea water with the conventional cuprous oxide as the control.

Bioassay techniques and toxicological studies carried out so far have revealed that Tributyl tin oxide is highly toxic to most of the marine fouling organisms and a suitable paint designed and formulated is likely to solve the present fouling problem to a considerable extent.

The CIFT formulation of antifouling paint with copper-acetoarsenite was produced in bulk quantity under a pilot plant study for the exclusive use of all the departmental fishing boats both at headquarters and substations.

### **3.3.2 Marine fungi**

Experiments have proved that most of the boat building timbers are susceptible to fungal attack. The presence of sap-wood, poor ventilation and proximity to already infected timbers are some of the factors that induces rapid attack and spread of fungal decay. Treated mango wooden panels and controls were exposed to simulated condition in a specially fabricated chamber. Wood preservatives like a) coal tar derivatives, b) Pentachlorophenol, c) copper chrome arsenic compound, d) organo tin compounds, e) copper creosote, f) arsenical creosote and g) cashewnut shell liquid were tried and their relative toxicity were assessed. Some of the testing parameters were standardised. Studies on tensile strength of wooden panels before infection and after infection were observed. The present laboratory findings on the performance of some of the selected wood preservatives will be tried on the indigenous fishing crafts like catamaran logs and dug-out canoes with a view to enhancing their service life. These crafts suffer damages mostly due to fungi.

### **3.3.3 FRP and Ferrocement boats:**

Among the different varieties of fibreglass mats studied, fibreglass woven roving (A glass 30 ends) mat exhibited better strength properties under fabrication with polyester resin. With chopped strand mat, uniformity of glass spread was not obtained. A triple combination of woven roving chopped strand mat and surfacing mat is being tried for fabricating a mock-up model.

In the fabrication of a malabar dug-out canoe, instead of the rigid polyurethane foam for the core material, a suitable light and cheap material is being located. The present cost of resin and the core material has considerably enhanced the price of the FRP canoe.

A standard procedure is being worked out for carrying out rapid repairs to FRP hulls. 'Ferrocement' construction for fishing boats will tend to be heavier if not adopted for a particular size range (viz. 12 M to 25 M). In case of smaller crafts, the primary reinforcements have to be totally altered.

On account of the sand-cement mortar characteristics in sea water the finished ferrocement hull requires a coat of heavy-duty paint on the external surfaces so as to successfully prevent water permeation to the internal reinforcement. Paints like CNSL resin, epoxy coal tar or chlorinated rubber have given the desired effect. Ribbed mild steel rods exhibited better grip with the mortar than the mild steel round rods. The use of the former was found to ensure slight reduction in the over-all weight also. A '50'-OAL (15 M) ferrocement trawler under construction at Madras is under observation.

### 3.3.4 Cathodic protection

Electrolytic zinc anodes as well as ternary aluminium alloy anodes were put to laboratory tests for their comparative protective efficiency in sea water, with special reference to cathodic protection of the boat hulls. Ternary aluminium alloy produced adequate current at the same time undergoing a slow rate of wear on its surface. One square inch of this anode is likely to protect one square foot surface area for the same effect of which zinc anodes will work out to be costlier.

Under further tests Ternary aluminium alloy exhibited better protective characteristics than the conventional zinc blocks when installed on the hull of wooden fishing boats sheathed with aluminium-magnesium alloy. Field trials are under way with the departmental fishing trawlers.

#### *Ad-hoc work*

Technical details on FRP and ferrocement fishing boats were made available to interested parties.

#### RESEARCH CONTEMPLATED

1. To evolve a new antifouling paint coating incorporating Tributyl tin oxide as a toxic pigment.
2. Further studies on marine fungi that destroy boat building timbers.
3. Studies on FRP and ferrocement fishing boat construction.
4. Standardising the use of ternary aluminium alloy anodes in the field.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                               |                           |
|-------------------------------|---------------------------|
| 1. R. Balasubramanyan         | .. Jr. Fishery Scientist  |
| 2. N. Unnikrishnan Nair       | .. Sr. Research Assistant |
| 3. A. G. Gopalakrishna Pillai | .. Sr. Research Assistant |
| 4. Dr. M. Shahul Hameed       | .. Res. Assistant         |

## 3.4 Gear Technology Division

### 3.4.1 Trawls (Cochin)

#### CHIEF FINDINGS

*Studies on introduction of new concepts of designs of six seam and high opening trawls were carried out and completed. The analysis of data indicated that the bulged belly type of trawl introduced earlier confirmed to be an efficient gear for the exploitation of shrimps, the other two designs have the added advantage of catching more fishes as well.*

#### RESEARCH IN HAND

The separator trawls designed with a view to segregate prawns and fishes, thus improving the quality of prawns and saving labour and time in the sorting of catches were put to field trials. As the performance of the gear was not found satisfactory two new designs were worked out for implementation, a bottomless type of trawl and the other a double walled wing type trawl.

Since the present efforts are concentrated only in the exploitation of off bottom fishes, mainly prawns, the returns have become rather poor resulting in uneconomical efforts. Hence alternate trawling methods — mid water trawling — were programmed from smaller fishing crafts during the year. Design of 11 x 11 m. midwater trawl using polyethylene twisted monofilaments was fabricated with suitable combination of otter boards. The net was made ready for trial operations.

During trawling voyages bottom deposits were collected using Petersons grab. The bottom water samples were also analysed for the estimation of salinity and dissolved oxygen. This aspect was taken up to study the depthwise distribution of prawns in the area for the different periods of the year.

#### RESEARCH CONTEMPLATED

1. Continuation of the studies on separator trawls.
2. Studies on mid water trawling.
3. Design, fabrication and operation of pelagic trawl.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                   |                            |
|-------------------|----------------------------|
| 1. P. A. Panicker | .. Jr. Fishery Scientist   |
| 2. R. S. Nair     | .. Asst. Fishery Scientist |
| 3. T. M. Sivan    | .. Asst. Fishery Scientist |

- |                         |                            |
|-------------------------|----------------------------|
| 4. N. A. George         | .. Asst. Fishery Scientist |
| 5. V. Vijayan           | .. Sr. Research Assistant  |
| 6. R. S. Manoharadoss   | .. Sr. Research Assistant  |
| 7. N. Subramonia Pillai | .. Sr. Research Assistant  |
| 8. C. Hridayanathan     | .. Research Assistant      |

## Veraval

### CHIEF FINDINGS

*In order to evolve a suitable and efficient gear for the exploitation of shallow water mix, investigations on twin trawling were initiated in comparison with double rig trawling. Preliminary studies showed better catch of prawns in twin rig. Twin rig from stern was found easier to operate than double rig from out-rigger booms.*

### RESEARCH IN HAND

Twin trawling experiments were conducted using a single cable with sled or dummy door. The design was 6.8 m. four seam net in pair, and side by side a single trawl of 13.7 m. four seam was operated for comparative studies. Twin rig offered less resistance than single rig. Prawn catch was found to be more in twin rig and fish catch was more in single rig.

Comparative studies on bottom trawl designs — six seam, long wing and bulged belly nets were also continued.

### RESEARCH CONTEMPLATED

1. Continuation of studies on twin-trawling in comparison with double rig trawling.
2. Continuation of comparative studies on bottom trawls.
3. Development of a large demersal trawl and tagger nets.

### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                      |                            |
|----------------------|----------------------------|
| 1. V. C. George      | .. Jr. Fishery Scientist   |
| 2. K. K. Kunjipalu   | .. Asst. Fishery Scientist |
| 3. S. V. S. Rama Rao | .. Sr. Research Assistant  |
| 4. P. George Mathai  | .. Research Assistant      |

## Kakinada

### CHIEF FINDINGS

*Scope ratio studies on trawls confirmed higher catch rates for bulged belly and six seam nets when operated with*

1:7 ratio at 10 metres depth, 1:6 at 20 to 40 metres and 1:5 at 50 m. depth. Investigations on the new concepts of design, rigging and accessories for trawl nets for operation from small vessels on the east coast were completed successfully. The comparison of catch rate revealed that both six seam and bulged belly were found better than long wing net while between these two nets the difference was not significant.

#### RESEARCH IN HAND

Studies on the design, construction and operation of parallel and vertical double trawls were pursued. Two small sized two seam nets of head rope length 13.5 m. were fabricated and joined to form a single parallel double trawl net with a head rope length of 18.6 m. This net was compared with 20 m. bulged belly type trawl. 12 fishing trips were conducted and the catch per hour was 20.4 and 2.7 kg. respectively. The results of trial fishing showed that the new net was working satisfactorily and further experiments are in progress.

#### RESEARCH CONTEMPLATED

1. Continuation of investigations on parallel double trawl nets.
2. Studies on twin trawling as a double rig and as single cable operation with the help of a sled on the east coast of India.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                           |                           |
|---------------------------|---------------------------|
| 1. A. V. V. Satyanarayana | .. Jr. Fishery Scientist  |
| 2. K. Gopalakrishnan      | .. Sr. Research Assistant |
| 3. S. V. S. Rama Rao      | .. Sr. Research Assistant |
| 4. J. Sitarama Rao        | .. Sr. Research Assistant |

## Goa

#### CHIEF FINDINGS

*Survey of the designs of shrimp trawl nets and their accessories operated from local trawlers off Goa was completed. It was confirmed that local trawlers of OAL 15.24 m to be more efficient than others for the capture of both prawns and fish.*

#### RESEARCH IN HAND

In order to evolve a suitable gear combination for small mechanised vessels for the efficient exploitation of fish population in shallow waters comparative operations were carried out with two different gear combinations.

Preliminary studies indicated the superiority of six seam net with flat rectangular otter boards over long wing trawl.

#### RESEARCH CONTEMPLATED

Comparative studies on six seam and long wing nets are to be continued.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                     |                            |
|---------------------|----------------------------|
| 1. K. A. Sadanandan | .. Jr. Fishery Scientist   |
| 2. H. N. Mhalathkar | .. Asst. Fishery Scientist |
| 3. T. P. George     | .. Research Assistant      |

### Madras

#### RESEARCH IN HAND

An 11 metre midwater trawl with detachable wings and a pair of vertical curved otter boards of size 120 x 60 cm and weight 140 kgs. each were made ready and regular fishing operations were conducted with a view to use this as a multipurpose trawl with provision for conversion as bottom, midwater and pelagic trawl.

#### RESEARCH CONTEMPLATED

Regular fishing operations with the above gear are planned in bottom, midwater and pelagic layers of the sea.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                   |                           |
|-------------------|---------------------------|
| 1. K. N. Kartha   | .. Sr. Research Assistant |
| 2. G. Jagatheesan | .. Sr. Research Assistant |
| 3. M. Syed Abbas  | .. Sr. Research Assistant |

## GILL NETS

### 3.4.2 Veraval

#### CHIEF FINDINGS

*Studies on the spatial distribution of hilsa gill net were continued and completed and the data are under analysis.*

#### RESEARCH IN HAND

Fabrication of 30 shots of shark gill nets using 2 mm and 2.5 mm dia polyethylene twines with mesh sizes 90, 95, 100 and 105 mm. bar

were undertaken. Nine units of gill nets were rigged with vertical lines for studying the efficiency. Trials with vertical gill nets showed encouraging results.

#### RESEARCH CONTEMPLATED

1. Studies on shark gill net with respect to twine size, mesh size, ratio of take up and depth wise distribution of sharks.
2. A gill net hauler has to be installed so as to increase the length of fleet of gill nets operated from smaller vessels.
3. Studies on bottom set gill nets for exploitation of spiny lobsters.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                     |                            |
|---------------------|----------------------------|
| 1. V. C. George     | .. Jr. Fishery Scientist   |
| 2. K. K. Kunjipalu  | .. Asst. Fishery Scientist |
| 3. P. George Mathai | .. Research Assistant      |

### **Kakinada**

#### *CHIEF FINDINGS*

*Studies on gill nets for seer, pomfret, hilsa with the object of working out a suitable design of gill nets with optimum height for the effective capture of the above fishes were completed and the data collected for the last 3 years are under statistical analysis. The following are some of the findings.*

1. *Nets having 50-55 mm mesh bar yielded better catches.*
2. *Majority of fishes were caught within 4 m depth of net.*
3. *Pomfrets are caught more or less in the same numbers in surface and bottom drift operations.*
4. *Hilsa was found to be prominent in bottom drift operations.*

#### RESEARCH IN HAND

Investigations to evolve suitable gear designs for commercial exploitation of big sized prawns were pursued. Designs were worked out and fabrication of 18 units of experimental gear having different mesh sizes and twine sizes was completed. Trial fishing with the completed gear was conducted.

#### RESEARCH CONTEMPLATED

Combination of studies on prawn gill nets.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

1. A. V. V. Satyanarayana .. Jr. Fishery Scientist
2. Percy Dawson .. Research Assistant
3. K. Gopalakrishnan .. Sr. Research Assistant

### **Burla**

#### *CHIEF FINDINGS*

*Research work on the effect of colour on frame nets in the reservoir was continued during this year also and the previous finding that the white nets caught significantly higher catch could be confirmed and the order of preference of colour was grey, green, yellow, and blue. The study was completed and on statistical analysis it was noticed that the interaction of species to any particular colour was not significant.*

#### RESEARCH IN HAND

In order to evaluate suitable gear for eradication of uneconomical fish from the reservoir studies were initiated. Gill nets comprising of 30 mm, 35 mm, 40 mm and 45 mm mesh bar were fabricated and fishing operations were conducted. Preliminary observations tend to indicate that nets with 30 mm contributed nearly 50% of the total catches of forage fish.

Frame nets of 75 mm along with simple gill nets of mesh sizes 90 mm, 105 mm and 120 mm mesh bar were fabricated to initiate standardisation of gill net for the capture of *Catla catla*.

#### RESEARCH CONTEMPLATED

1. Studies on eradication of uneconomical varieties of trash fish.
2. Standardisation of gill net for *Catla-catla*.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

1. G. Narayananppa .. Asst. Fishery Scientist
2. R. M. Naidu .. Asst. Fishery Scientist
3. A. A. Khan .. Sr. Research Assistant

### **3.4.3 Line Fishing**

#### **Cochin**

#### RESEARCH IN HAND

Squid fishing has got potential market for export as well as for internal consumption. Attempts were made for the exploitation of squids.

3 sets of squid lines were fabricated and made ready for operation. The total length of the line was 60 metres, 20 squid jigs were attached to the line from the bottom end of the line at a distance of 1 metre. The jigs were made of soft plastic and of length 12 cm. Seven hooks were welded together and attached to the bottom of the jigs and were provided with swivels at both ends for the attachment of the line.

#### RESEARCH CONTEMPLATED

1. Studies on the selectivity of hooks, baits, and rate of hooking | hour of effort in Kalava hand lining.
2. Operation of squid jigs during fishing season to study the intensity of light attraction, effectiveness of coloured jigs and hooking rate.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                         |                            |
|-------------------------|----------------------------|
| 1. K. S. Namboodiri     | .. Asst. Fishery Scientist |
| 2. N. A. George         | .. Asst. Fishery Scientist |
| 3. M. Velu              | .. Fishery Scientist       |
| 4. N. Subramonia Pillai | .. Sr. Research Assistant  |
| 5. P. Sulochanan        | .. Jr. Fishery Scientist   |

### Veraval

#### RESEARCH IN HAND

12 units of shark long line were prepared with 6 mm dia. polyethylene and 4|0 mustard hooks. 8 more units of lines have to be fabricated and the work is under progress. Different baits like buffalo meat, sciaenids, rays, chirocentrus etc. have to be tried to study the bait selectivity for sharks.

#### RESEARCH CONTEMPLATED

1. Additional 8 more units (200 hooks) have to be fabricated and the total 30 units are to be operated using different baits for capture of sharks.
2. To study the effect of electric light for the capture of squids and cuttle fishes.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                      |                            |
|----------------------|----------------------------|
| 1. K. K. Kunjipalu   | .. Asst. Fishery Scientist |
| 2. V. C. George      | .. Jr. Fishery Scientist   |
| 3. S. V. S. Rama Rao | .. Sr. Research Assistant  |
| 4. A. C. Kuttappan   | .. Sr. Research Assistant  |

### 3.4.4 Round Haul Nets

#### Cochin

##### RESEARCH IN HAND

Rythmic or sporadic occurrence of large shoals of pelagic fishes such as sardines and mackerels is well known off the west coast of India. Efforts were made to exploit the same using smaller fishing crafts and suitable small purse seine was designed and fabricated. Some changes were effected to th purse seine already fabricated and the final dimensions of the purse seine was 265 m. length, 25 metre depth and the material was nylon 210D|24|yarn 16 mm knotless net except for the bunt portion which was made of 210|2|3 knotted nylon twines. The fabrication and rigging were completed and the gear was put to trials as a single boat seine. The net was operated successfully thereafter and sardines were the main catches. The development of small purse seine which can be operated from small fishing vessels opens up a new avenue of diversified fishing method for the profitable employment of smaller categories of trawlers, especially during seasons when shrimp trawling is not remunerative.

##### RESEARCH CONTEMPLATED

1. Field trials with purse seine.
2. Standardisation of the gear to suit to different classes of vessels.

##### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

1. P. Sulochanan .. Jr. Fishery Scientist
2. T. M. Sivan .. Asst. Fishery Scientist
3. M. Velu .. Fishery Scientist

#### Goa

##### RESEARCH IN HAND

Data collection on the operational efficiency of different size groups of purse seines with particulars on the type of net, total catch, average catch per operation and composition of fishes caught were continued during this year also. Catches comprised of 40.3% oil sardines and 4.3% mackerel during the year. While during September to December mackerels predominated and during that period mackerel comprised of 55% of catch, ghol 28.1%, oil sardine 10.8% and flat sardine 4.8%.

#### RESEARCH CONTEMPLATED

Studies on the operational efficiency of purse seines are to be continued.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                     |                            |
|---------------------|----------------------------|
| 1. H. N. Mhalathkar | .. Asst. Fishery Scientist |
| 2. T. Joseph Mathai | .. Sr. Research Assistant  |
| 3. K. A. Sadanandan | .. Jr. Fishery Scientist   |
| 4. T. P. George     | .. Research Assistant      |

### 3.4.5 Indigenous Gear

#### Goa and Cochin

##### RESEARCH IN HAND

The project is aimed at the exploitation of lobster off the coast of Goa on a commercial scale so as to evolve suitable designs. Survey on the traps and pots used for this fishery was conducted and arrangements were made for the procurement of this indigenous gear to conduct trials. 40 shots of bottom set gill nets according to a new design was prepared with 200 meshes length and 20 meshes depth with mesh size 75 mm bar. Lobster fishing trials are to be conducted with these nets along with the studies on the operation of lobster pots and traps.

##### RESEARCH CONTEMPLATED

Improvement of indigenous fishing gear for the exploitation of lobsters off the coast of Goa.

##### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                             |                            |
|-----------------------------|----------------------------|
| 1. T. Joseph Mathai         | .. Sr. Research Assistant  |
| 2. G. B. Meshram            | .. Sr. Research Assistant  |
| 3. T. P. George             | .. Research Assistant      |
| 4. K. Sreedharan Namboodiri | .. Asst. Fishery Scientist |
| 5. R. Balasubramanyan       | .. Jr. Fishery Scientist   |

### 3.4.6 Gear Materials

#### CHIEF FINDINGS

*The salient features of the specifications worked out by the Institute for aluminium and glass floats for consideration as National Standards are given below.*

Material Dia (mms)	Weight (gms)	Extra buoy- ancy (gms)	Pressure (kg/cm <sup>2</sup> )	Equivalent depth in water (metres)	
Aluminium	7.62	80	150	4.9 to 7.72	45 to 75
Alloy	10.02	150	400		
Alloy	12.60	250	790		
Alloy	15.20	330	1400	upto 21.5	200
Alloy	20.30	950	2750		
Glass	10.20	200	400	5.75 to 21.5	55 to 200
Glass	12.60	300	625		
Glass	15.20	625	1175		
Glass	22.80	1500	3750		
Glass	30.50	3500	10000		

The study was necessitated with the greater stress laid down by the industry on deep water fishing methods which demand the supply of suitable fishing gear accessories. High density polyethylene tape twisted twines using 1000 denier yarns were tested and specifications were prepared.

#### RESEARCH IN HAND

To standardise braided twines one set of commercial sample of polyethylene monofilament braided twines was procured and analysis was taken up. Standardisation involves specification of yarn as well as tightness of braid and hence experimental preparation of braided twine was taken up.

A weathering chamber was ordered with a local firm in order to study the weathering of netting yarn under controlled conditions.

#### RESEARCH CONTEMPLATED

1. Preparation and testing of braided twines of polyethylene monofilament, nylon and combination of synthetics.
2. Studies on weather resistance under controlled conditions.
3. Studies on synthetic ropes.
4. Investigations on reinforcement for aluminium floats, preparation and testing of steel floats, studies on protective covering to avoid corrosion of metal.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

1. K. Radhalekshmi .. Asst. Fishery Scientist
2. P. J. Cecily .. Junior Technical Officer

- |                       |                           |
|-----------------------|---------------------------|
| 3. A. G. G. K. Pillai | .. Sr. Research Assistant |
| 4. Varghese Paul      | .. Research Assistant     |

### 3.5 Engineering Division

#### 3.5.1 Marine Engineering

##### CHIEF FINDINGS

*Equipments for in-board out-board drive for small crafts were developed and trials were taken successfully.*

##### RESEARCH IN HAND

In-board out-board drive for use in small crafts including country crafts was installed in a small departmental dingy. On the basis of trials some modification such as folding type propulsion system was introduced. Further field trials showed that this system is working satisfactorily and can be easily installed in country crafts also.

A fish pump which works on the principle of pressure difference was designed. The pump has no rotating or moving parts. A prototype of the pump was fabricated and trials were undertaken and it was found that there is no possibility of fish damage while pumping the fish which is very advantageous in the collection of fish gathered in a purse seine. The method is also useful in fishing with light attraction devices. A brine chilling tank was installed in the fish hold of 'Sindhukumari'.

##### RESEARCH CONTEMPLATED

Development of a portable equipment for loading ice and unloading fish from fish hold of medium and large vessels.

##### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                         |                            |
|-------------------------|----------------------------|
| 1. M. Velu              | .. Fishery Scientist       |
| 2. K. S. Namboodiri     | .. Asst. Fishery Scientist |
| 3. S. Ayyappan Pillai   | .. Jr. Fishery Scientist   |
| 4. P. A. Perigreen      | .. Asst. Fishery Scientist |
| 5. N. Subramonia Pillai | .. Sr. Research Assistant  |
| 6. C. V. N. Rao         | .. Jr. Fishery Scientist   |
| 7. Syed Abbas           | .. Sr. Research Assistant  |
| 8. K. Ramakrishnan      | .. Sr. Research Assistant  |
| 9. V. C. George         | .. Jr. Fishery Assistant   |
| 10. George Mathai       | .. Research Assistant      |

### 3.5.2 Processing Engineering

#### CHIEF FINDINGS

*For the first time in India a tunnel dryer of one tonne capacity was installed as per Institute's design at Integrated Fisheries Project, Ernakulam for the commercial production of artificially dehydrated fish. The moisture meter developed at the Institute was tested with different samples having varying moisture levels and the accuracy was compared with the values obtained by the oven drying method.*

#### RESEARCH IN HAND

A new moisture meter was developed using injection needle made of stainless steel and the performance was comparable with that of platinum needle previously used in its place.

Arrangements were made to procure indigenously available refrigeration machineries required to instal the belt freezer and plate freezer obtained through Norwegian Aid.

Designed an air permeability testing device for determining air permeability of packaging materials like polythene film, aluminium foil etc.

Designed an automatic grading machine for cooked prawn meat. Prepared design for a pilot plant for edible powder of 50 kg/day capacity. A complete project report was prepared incorporating specifications of each equipment, process details, layout and flow sheet of the process, instructions for operation and fabrication of the plant. The estimated cost of production worked out to be Rs. 7 per kg. of fish powder.

An automatic gutting and beheading machine for sardine was developed and trials were undertaken successfully.

Supervised the fabrication and installation of one tonne tunnel drier as per Institute design at IFP Cochin. Efforts were also made to instal one commercial dryer near Quilon under Kerala Fisheries Corporation.

Prepared preliminary designs of fish flaking machine and efforts were made for its fabrication. Work on designing of a smoke kiln (automatic type) and fish cutting machine were undertaken.

Prepared more batches of edible fish powder from various types of miscellaneous fishes incorporating improvement in the process for reducing the grittiness in the product. The product prepared from Amchovie was found to be the best. Steps like washing, cooking, pressing, drying and pulverising also contribute to the final quality of the product. The most impor-

tant step is the sieving of the pulverised product which was done through — 80 mesh screen in a mechanical shifter and the over size product is recycled once again and discarded to reduce grittiness. The product was analysed and sent to Directorate of Kerala State Fisheries for field trials.

Experiments on drying were continued in multideck tunnel drier and solar drier using different types of fishes. No change of drying efficiency (time) was observed while operating the solar dryer after two years. Pilot tunnel dryer was dismantled and despatched to CIFT Calicut for carrying out trials with locally available fish there.

#### RESEARCH CONTEMPLATED

1. Modification and fabrication of improved version of meat picking machine and gutting machine.
2. Design and development of descaling machine and fish cutting machine.
3. Fabrication of automatic grading machine and cooking chamber.
4. Installation of belt freezer and plate freezer.
5. Design and fabrication of air permeability testing device.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

- |                       |                            |
|-----------------------|----------------------------|
| 1. S. Ayyappan Pillai | .. Jr. Fishery Scientist   |
| 2. P. K. Chakraborty  | .. Jr. Fishery Scientist   |
| 3. M. Velu            | .. Fishery Scientist       |
| 4. P. N. Joshi        | .. Asst. Fishery Scientist |
| 5. K. Ramakrishnan    | .. Sr. Research Assistant  |
| 6. P. Madhavan        | .. Jr. Fishery Scientist   |
| 7. K. Krishna Rao     | .. Jr. Statistician        |
| 8. P. N. R. Kaimal    | .. Extension Officer       |

### 3.6 Extension, Information & Statistics Division

#### 3.6.1 Statistics Section

##### CHIEF FINDINGS

*Study on the extent of wastage of raw material occurring in prawn freezing factories in Cochin area revealed wastage upto 1-12% in the case of prawn meat and 0.5 — 20% in the case of headless shell-on prawns. The maximum wastage observed was 25%. The wastage was found to increase with increasing delay between the time of catch and time of processing. Improper icing and shell damages were observed to be the main reasons for the spoilage. In the case of*

*froglegs wastage upto 4-7% in the locally procured material and 10% in the case of material brought from distant places was observed. For a given species of prawn, higher rates of recovery were observed with higher size grades. Variations in the rates of recovery even among prawns of the same species and sizes were seen to be caused by the difference in the quality of peeling and due to a seasonal phenomenon (locally known as 'kali') characterised by the presence of a fluid in the heads of prawns.*

#### RESEARCH IN HAND

##### *Statistical applications in fish processing industry*

Investigations were oriented mostly on (i) the extent of wastage of material in the prawn processing industries and (ii) the recovery of prawn meat and head-less shell-on prawns from whole prawns.

Data pertaining to the extent of wastage were collected from 10 factories in Cochin. The discoloured meat found unsuitable for processing and the material wasted in the floor while handling constitute the wastage. About 1-12% by weight in prawn meat and 0.5 to 20% by weight in the headless shell-on prawns were the wastages observed. Higher percentages of wastage (upto 25%) were observed in the material brought from far off places as these could be processed only after 2 or 3 days after catch. In general, spoilage was found to increase with the time lag between catch and processing. Improper icing and damages to shells were the main causes for the spoilage. About 3% of the material was lost while washing and 3% on the floor while handling. Regular production of frozen froglegs did not exist in the factories in Cochin during the period. However, from the available data, wastage due to the presence of blood clot in the froglegs was observed to be 4-7% in the case of material available locally and 10% in the case of material brought from some places on the east coast.

Data on the rates of recovery of material after preparation for processing were collected from 6 peeling sheds in Cochin. The rates of recovery refer to the percentages of the prawn meat and the headless shell-on prawns of counts 150-250 per kg, the rate of yield ranged from 42 to 46% in the case of peeled and deveined type. For whole prawns of grade 110-200 per kg, the rates of recovery were found to vary between 50 and 52% per peeled and undeveined type. Generally, for a given species of prawn higher rates of recovery were observed with higher size grades of prawns. Variations in the yield even among prawns of the same species and size are caused by the difference in the quality of peeling and due to a seasonal phenomenon (locally known as 'kali') characterized by the presence of fluid in the heads

of prawns. In the laboratory, the rates of yield was found to vary between 49 and 54% for raw material of counts varying between 75 and 120 pieces per kg.

Size grades of mainly 26|30 and 31|35 were obtained on beheading Naran of counts 60-80 per kg. On peeling and deveining poovalan of counts 85 and 145 per kg. prawn meat of size grades mainly 61|70 and 111|130 were obtained.

#### *General*

Statistical analysis and interpretation of data collected under different research projects on fishing gear and methods undertaken by the Craft and Gear Division of the Institute including its substations and units continued to be one of the main activities of the section.

Statistical analysis of data to compare the efficiency of nets in the case of 3 experiments conducted at Burla by the Institute's substation and 2 at Cochin by the Institute's Fishing Methods Section were analysed during the year. Length-weight relationship for *Catla-catla* of the Hirakud reservoir was worked out from the data for 10 years on length and weight, sent from the Substation at Burla.

#### RESEARCH CONTEMPLATED

Additional data on wastage will be collected to estimate the species-wise percentages of wastage separately for prawn meat and headless shell-on prawns. Adequate data on recovery will also be collected to tabulate the main size grades of the prawn meat and headless shell-on prawns collected according to the species and counts of the raw material.

#### RESEARCH WORKERS ASSOCIATED WITH THE PROJECT

1. K. Krishna Rao	.. Junior Statistician
2. A. K. Kesavan Nair	.. Assistant Statistician
3. G. R. Unnithan	.. Statistical Investigator
4. P. Srinivasa Rao	.. Sr. Research Assistant
5. P. N. R. Kaimal	.. Extension Officer
6. P. A. Perigreen	.. Asst. Fishery Scientist
7. Cyriac Mathen	.. Fishery Scientist

### **3.6.2 Extension and Information Section**

The Section continued its activities in popularisation of the research findings of immediate application and benefit to the industry, answering the hundreds of technical enquiries received from all over the country, bringing

out popular information material on new developments in the Institute, solving technical problems of the industry through correspondence, on-the-spot visit and personal discussions, preparation of technical notes and reports on specific subjects to meet the requests from different quarters, publicising the significant achievements of the Institute through the media of the press and radio and above all pioneering new developments in the fishing and fish processing sectors. Particular attention was paid to popularise the bulged belly trawl of high catching efficiency in different regions of the coast line of the country, the weeding machine and power take off clutch towards their commercial production by interested entrepreneurs, the deodorant for use in fish processing establishments, the antiseptic ointment for use by prawn handlers, methods to produce diverse products such as fish wafers, soup powder and edible fish powder from by-catch of fish, the tunnel dryer for production of quality dry fish products and improved method of production of frozen froglegs free of salmonella for the export markets. The bulged belly type trawl in greater or lesser numbers are now used in different coastal fishing centres throughout the country. Terms and conditions for release of technical know-how in respect of the weeding machine and power take off clutch by a private manufacturer for commercial production of the items could be finalised through the National Research Development Corporation of India. A few firms have made proposal for manufacture of the deodorant and processed products out of low quality fish as per the Institute's methods. One more tunnel dryer, the second of its kind in India, was installed at Cochin for commercial production of dry fish. The continued assistance given to processors of different fish shell fish products in maintaining sanitation in the processing establishments and improving quality of products helped to better the quality thus bringing down the rejection during inspection and enhancing production and export of various items. The set back experienced in frogleg exports to USA could be overcome and confidence could be created among the industry to produce products of quality as required by any sophisticated world market.

### **3.6.2.1 Technical consultancy service at headquarters**

#### *1) Replies to technical enquiries*

Three hundred and seventy two technical queries received from the fishing and fish processing units all over the country, State Fishery Departments, other fishery organisations and new entrepreneurs in the field in different aspects of fish processing and fishing craft and gear were replied during the year. The details furnished on fish processing technology include methods for canning and freezing different varieties of fish and shell fish, remedial measures to solve specific technical problems encountered, quality standards for specific canned fish products, utilisation of shark flesh as fillets, schemes for production of minced meat from Dhoma fish, smoked and

dried eel and production of laminated Bombay duck, details on different aspects of production and quality control of fish products, details of processes| equipments in fish, compositions of dry fish varieties, measures for prevention of salmonella in frozen fishery products, processing of cuttle fish meat and bones, details of the turtle fishery including production of processed products from turtle meat, use of High density polyethylene (HDPE) bags for packing frozen prawns instead of paper cartons, methods for preparation of a variety of speciality products and by-products like fish maws, shark fin rays.

Details furnished with reference to fishing craft and gear include specifications of nylon twines for gill nets and trawls, method of estimation of weight of fish net webbings, use of polyethylene tape twisted twines for fish nets, suitability of manila rope for anchoring, specifications of nets for deep sea trawlers, details of bulged belly trawls of different sizes, comments on use of artificial tyre roof for effective exploitation of fish, notes on the use of tickler chain in bottom trawl operations and double rig trawling, methods for tuna fishing, and technical details and economics of operation of the weeding machine designed and developed by this Institute for eradication of aquatic weeds and power-take-off clutch for marine engines.

#### 2) *Testing of materials and products*

Samples of different kinds of products and raw materials received from indigenous processors and manufacturers were arranged to be analysed and analysis reports furnished to the concerned parties along with suggestions for improvements wherever necessary. A total of 542 such samples were analysed during the period which include 5 samples of nylon twine, 11 of polyethylene monofilament twine, 2 of high density polyethylene (HDPE) fibrillated tape, 8 of HDPE fibrillated tape twisted twine, 1 sample of manganese bronze, 3 samples of copper sheet, 6 samples of prawn canned in brine, 4 of canned chank flesh, 2 samples of sardine of sardine canned in brine, 4 of canned chank flesh, 2 samples of sardine froglegs, 198 samples of cooked and peeled frozen prawns, 108 samples of frozen peeled and deveined shrimp, 22 samples of frozen slipper lobster tails, 3 of frozen squid meat, 16 samples of fish meal, 6 of artificial prawn feeds, 9 samples of cattle feed, 2 samples of sodium hypochlorite, 1 each of sodium chloride and prawn pickle, 5 samples of detergent, 88 samples of water and 26 samples of ice.

#### 3) *Visit to fish processing establishments*

Regular visits were made to the fish processing establishments in the area for assessment of the sanitary conditions, demonstration of the cleaning schedule recommended by the Institute and for having discussions with the concerned technical staff on the problems facing the industry and suitable

remedial measures were recommended. On specific request, surveys were made in a few processing factories on the hygienic conditions in the establishments, washing procedures followed and personal hygiene of the workers in handling the different products.

#### 4) *Supply of design drawings and publications*

Altogether, 110 designs consisting of 38 designs of trawl nets, 20 of otter boards of different sizes, 7 sets of trawl winch designs, 5 of hydrographic winch, 1 of power-take-off clutch, 1 each of a 15 ft. row boat for inland waters and a mouth piece, 17 designs of the rotary drum dryer designed and developed by this Institute for production of fish meal, 17 of the tunnel dryer of 1 ton raw material capacity for dehydration of fish and 3 designs of screw press were supplied to interested parties on request. Besides, thirty two copies of the special bulletin on Inland Fishing Gear and Methods of India and 17, 22, 16 & 18 copies each of the booklets on 7.62 m. fishing boat, 9.75 m. trawler-cum-gill netter 10.97 m. shrimp trawler and 12.8 m. drifter trawler respectively were also issued.

#### 5) *Exhibitions, films shows etc.*

The Institute put up a stall in the Exhibition conducted by a local College, in connection with its Golden Jubilee celebrations. A number of exhibits pertaining to important achievements of the Institute were displayed in the pavilion which was visited by thousands of people.

A few exhibits pertaining to recent developments in fish processing and fishing craft and gear were also sent for display at the Educational Exhibition conducted by a local school and a Science Fair held at Thodupuzha in Kerala State.

### II. *Refresher Training Course*

Three refresher courses were held during the year for the benefit of the technical personnel from fish processing establishments on improved methods of fish processing. The courses held were on processing canned fish and shell fish and production of frozen froglegs free of Salmonella. Two of the courses were held at Cochin, while one on processing of froglegs was held at Calcutta in collaboration with the Marine Products Export Development Authority. In all, 51 candidates attended these courses.

### III. *Ad-hoc training*

The Institute imparted ad-hoc training to 22 trainees sponsored by fish processing establishments, Central Government organisations and State Fisheries Corporations in biochemical and bacteriological aspects of fish, production of speciality products and fishing gear fabrication.

## General

At the request of the Pondicherry Industrial Promotion Development and Investment Corporation Limited, Pondicherry-1 Shri. P.N.R. Kaimal, Extension Officer undertook a preliminary survey with reference to development of fish processing industry in Pondicherry region of the U.T. of Pondicherry in June 1975 and a detailed report including schemes for establishment of prawn/fish freezing and dehydration plants to begin with in selected centres in the region was furnished to the Corporation for further action.

Representing the Institute, Shri. P.N.R. Kaimal, Extension Officer participated in the first Get-together of Entrepreneurs/Industrialists, R & D Institutes, Financial Institutions and NRDC organised at Hyderabad from 6th to 8th May 1975 by the National Research Development Corporation of India, New Delhi. Technical details and economic feasibility of five processes/equipments viz. Machine for removal of aquatic weeds, power-take-off clutch for marine engines for fishing boats, tunnel dryer for dehydration of fish, deodorant for use in fish processing establishments, antiseptic ointment for prawn handlers all developed by the Institute, were discussed with twenty entrepreneurs who showed interest in manufacture of the items. As a result of the discussions, proposals are underway for manufacture of the weeding machine and power-take-off clutch by a private manufacturing firm at Kolhapur in collaboration with the Institute and the NRDC on mutually agreed conditions.

Established the second fish dehydration plant in India, by the Integrated Fisheries Project, Government of India, Cochin-16 as per the design of the 1 tonne tunnel dryer developed by the Institute and technical guidance was given for its installation and operation. The dehydration plant which started functioning from August 1975, now serves as the demonstration unit for several entrepreneurs throughout India in venturing on artificial drying of fish, a technique so far alien to the fishery trade to get product of excellent quality. Dried fish processed in the dryer and available in the market in Cochin region have turned out to be very popular within the short period.

### *Persons associated with the work*

- |                    |                                 |
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| 3. Mary Thomas     | .. Assistant Extension Officer  |

#### **4. Work carried out on All India Co-ordinated Project on Transportation of fresh fish and Utilisation of Trash fish at the Centres of the Institute.**

##### **4.1 Transportation of fresh fish:**

###### **4.1.1 Veraval:**

During the year under report a total of 33 consignments of fresh fish were transported to Bombay. Various species of fish as well as prawns were used for these studies. Of these consignments, twenty were sent in frozen condition and thirteen in iced condition. Twentyfive of these consignments were sent in thermocole insulated second hand tea-chests. Nine were packed in non-insulated aluminium containers and then put in thermocole insulated boxes. The frozen consignments consisted of silver pomfrets, hilsa and razor edge. Headless prawns and *Lactarius sp.* formed the consignments sent in iced condition. All these consignments reached the destination in prime condition.

Preliminary experiments were done on the transportation of bulk consignments of headless dhoma in big aluminium boxes.

Fillets of seer, hilsa and eel in block frozen form were successfully transported to Bombay.

Systematic and thorough survey on the quality of fish landed at Veraval fishery harbour by private trawlers was undertaken. Periodical samples were drawn from local markets as well as local fish processing factories to assess their bacteriological quality. The market samples showed high incidence of gram positive organisms.

###### **4.1.2 Kakinada**

Eight types of fish viz. *Synagris sp*, *Saurida sp*, *sciaenids*, *Arius sp*, *Chanos sp*, *Decapterus sp* and *Trichiurus sp* were tested for their amenability to transport by rail from Kakinada to Howrah. The fish were examined for quality criteria at the despatching and receiving ends.

Thirty two consignments of fish were transported in iced condition with gunny cloth either in 4 layers or 2 layers. Besides gunny cloth, mats fabricated out of locally available grass were also tested for their insulating property in actual transportation experiments.

Investigations were undertaken on the ice storage shelf-life of different fishes of Kakinada coast. Horse mackerel, synagris and sciaenids were stored in ice in 1 : 1 ratio with and without replacement of ice and their quality characteristics followed at intervals until they are virtually spoiled.

Studies on amenability of Seer fillets to transportation in ice were undertaken and consignments were sent from Kakinada to Howrah in second hand teachests with 2 layers of gunny. All the consignments were graded as fair organoleptically on analysis at the receiving end.

Samples of fish belonging to varieties sciaenids, catfish, mackerel, *Synagris sp*, clupeids, *Anchoviella sp*, *Polynemus sp* collected from Kakinada markets and landing centres were analysed for chemical, bacteriological and organoleptic characteristics coliforms were present in majority of samples although salmonella and coagulase positive staphylococci were absent. *Vibrio parahaemolyticus* were not detected in any of the samples. The fish landed by commercial trawlers were graded good organoleptically.

### **4.1.3 Bombay**

The fish consignments despatched from Veraval in frozen as well as iced conditions were received at Bombay and the fish sampled for organoleptic, chemical and bacteriological, analysis.

The consignments consisting of eel, silver pomfret, hilsa, catfish, pella, chirocentrus, dhoma etc. were received in good condition. It was noted that prefrozen fish required only little ice or no ice at all during the 24 hours transportation system.

Investigations were also carried out on consignments of head-less shrimp and spilt dhoma booked by G.F.C.C.A. Ltd. Veraval to their processing plant at Bombay and transported in trucks. Large sized Aluminium insulated boxes and ordinary tea chests were used in these experiments to test out their relative efficiency.

Suitability of transported fish for further preservation was tested on hilsa transported from Veraval.

123 random samples were collected from fish markets of the city and subjected to analysis for quality assessment.

## **4.2 Utilisation of Trash fish**

### **4.2.1 Cochin:**

Peptone samples were prepared from cat fish, jew fish and perch using mixed enzyme hydrolysis (papain and pepsin) at two different Ph values of 4.0 and 6.0. The products were tested exhaustively for their ability to support microbial growth in synthetic media. The organism selected for tests included *Bacillus cereus*, *Staphylococcus aureus*, *E. Coli*. type I and *Salmonella anatum*. The peptones were incorporated in both the liquid media and solid agar media. In the case of liquid broth, the optical density

of bacterial suspension was measured to assess the growth promoting ability of the peptone and in the case of fish peptone incorporated solid agar media, the number and size of colonies and time taken for formation of colonies were reckoned as criteria. In all cases it was found that peptone samples compared well with Difco peptone.

The peptone samples were independently got tested in the laboratories of CIFT and CRP and encouraging reports have been received. The study of the effect of addition of extract, yeast extract and other growth promoting factors to the peptone samples to make the medium suitable for specific types of organism has also been undertaken.

*Fish hydrolysate:*

Samples of hydrolysates were prepared from trash fish by adopting the following methods.

1. Enzymatic hydrolysis using enzyme ~~papain~~ 0.2% at PH 6-7 for 6 hours at 45 — 50°C.
2. Enzymatic hydrolysis using ~~papain~~ 0.2% at PH 2-3 for 4 hours at 45 — 50°C.
3. Hydrolysis using papain 0.1% at 45 — 50°C for 3 hours followed by hydrolysis with pepsin 0.01% for 3 hours.

The hydrolysates were subjected to detailed chemical analysis. The P.E.R. recorded being low, attempts are being made to improve the technology of preparation of the hydrolysate.

*Fish protein concentrate:*

Work on fish protein concentrate was continued during the early months of the year and samples were prepared from trash fish like jew fish, silver bellies and perchs by the solvent extraction method developed at the Institute. Analysis for proximate composition and amino acid composition has been conducted on these samples and the results show that all these samples do have similar amino acid make-up. The FPC from silver bellies recorded maximum mineral content with calcium level 5.86 gm/100 gm.

Functional protein concentrate samples were prepared following the method standardised already from a few varieties of trash fish. The products were evaluated at the Division of Biochemistry and food technology, BARC, Bombay for their protein efficiency by feeding on rats. Functional FPC was adjudged to be superior to the conventional FPC in all respects.

FPC incorporated biscuits were prepared in bulk and subjected to consumer preference studies.

A workshop was held on 8th-9th October, 1975.

#### 4. PUBLICATIONS

##### List of scientific papers published:

1. **ANTONY, P. D. & M. RAJENDRANATHAN NAIR**  
Studies on phenolase enzyme in prawns — II. The inhibitory action on the enzyme by certain chemical agents. *Fish. Technol.* XII (2) : 112-115, 1975.
2. **BALASUBRAMANYAN, R.**  
A wider choice of construction for the modern fishing boats — *Fish. Technol.* XII (2) : 87-93, 1975.
3. **BALACHANDRAN, K. K.**  
Storage studies on prawns dried in rotary drum drier — *Fish. Technol.* XII (2) : 116-119, 1975.
4. **BALACHANDRAN, K. K.**  
Studies on Colombo curing of mackerel (*Rastrelliger kanagurta*), *Fish. Technol.* XII (2) : 145-150, 1975.
5. **CHAKRABORTY, P. K.**  
Artificial Dehydration in Seafood Industry. *Seafood Export Journal* — XII (6) : 9-16, 1975.
6. **CHINNAMMA GEORGE**  
Biochemical differences between the red and white meat of tuna and changes in quality during freezing and storage. *Fish. Technol.* XII (1) : 70-74, 1975.
7. **CYRIAC MATHEN**  
Quality control from catch to dining table. *Indian Farming*, Oct. 1975.
8. **CYRIAC MATHEN, FRANCIS THOMAS, ANNAMMA MATHEW & A. C. JOSEPH**  
A survey on the quality of Indian Fish meal of commerce — *Fish. Technol.* XII (1) : 16-20, 1975.

9. **DEVADASAN, K.,  
V. MURALEEDHARAN &  
K. GEORGE JOSEPH**  
Studies on smoke curing of tropical fishes — *Fish. Technol.* XII (1) : 77-80, 1975.
10. **DEVADASAN, K.,  
V. MURALEEDHARAN &  
K. GEORGE JOSEPH**  
Pickle curing of fish using tartaric acid and garlic as preservatives — *Fish. Technol.* XII (2) : 156-159, 1975.
11. **GEORGE N. A.,  
A. A. KHAN &  
O. P. PANDEY**  
Catch efficiency and selective action of coloured gill nets — *Fish. Technol.* XII (1) : 60-63, 1975.
12. **GOPAKUMAR, K.**  
Fatty acid composition of fresh water fishes — *Fish. Technol.* XII (1) : 21-24, 1975.
13. **GOPAKUMAR, K. &  
M. RAJENDRANATHAN NAIR**  
Fatty Acid composition of anchoviella and *Thrissocleus* — *Fish. Technol.* XII (1) : 75-76, 1975.
14. **GOPAKUMAR, K. &  
M. RAJENDRANATHAN NAIR**  
Lipid composition of five species of Indian prawns — *Journal of Science, Food and Agriculture*, 26 : 319-319-325, 1975.
15. **GOVINDAN, T. K.**  
Fish processing Industry in India. A retrospect, present status and future prospects — *Seafood Export Journal.* VII (1) : 143, 1975.

16. **GOVINDAN, T. K.**  
Freeze drying of fishery products. Part V. Storage characteristics of ready to serve freeze dried foods. *Fish. Technol.* XII (1) : 35-36, 1975.
17. **KAIMAL, P.N.R.**  
Fish protein to fight malnutrition — *Indian Farming* — July, 1975.
18. **KHAN, A. A.,  
N. A. GEORGE &  
O. P. PANDEY**  
On the fishing power of monofilament and multifilament gill nets. *Fish. Technol.* XII (1) : 64-69, 1975.
19. **KURIYAN, G. K.**  
Fish preservation. Souvenir brought out on Symposium on 'Fish Processing Industry, in India' — 13th and 14th February 1975 at Mysore.
20. **KURIYAN, G. K.**  
Technological Research in Indian Fisheries — *Seafood Export Journal*, VII (1) : 37-40, 1975.
21. **MADHAVAN, P. &  
K. G. RAMACHANDRAN NAIR**  
Chitosan from *Squilla* — *Fish Technol.* XII (1) : 81-82, 1975.
22. **MHALATHKAR, H. N.,  
S. V. S. RAMA RAO &  
P. GEORGE MATHAI**  
A new one boat mid water trawl for Indian waters — *Fish. Technol.* XII (1) : 37-44, 1975.
23. **PERIGREEN, P. A.,  
S. A. PILLAI,  
P. K. SURENDRAN &  
T. K. GOVINDAN**  
Preservation of fish in refrigerated seawater — Sardines, mackerel and Seer. *Fish. Technol.* XII (2) : 105-111, 1975.

24. PRABHU, P. V. &  
A. G. RADHAKRISHNAN  
Shrimp Extract from prawn waste — *Fish. Technol.*  
XII (1) : 31-34, 1975.
25. PRABHU, P. V.  
A. G. RADHAKRISHNAN &  
M. ARUL JAMES  
Beverage preparation from fish hydrolysates. *Fish.*  
*Technol.* XII (2) : 127-130, 1975.
26. RAJAGOPALAN UNNITHAN, G.,  
P. SRINIVASA RAO &  
H. KRISHNA IYER  
A study on the average yield of different species of  
prawns used for freezing and canning — *Fish. Technol.*  
XII (1) : 25-30, 1975.
27. RAVINDRAN, K. &  
R. BALASUBRAMANYAN  
Problems associated with the over protection of fishing  
trawlers against sea water — *Fish. Technol.* XII (2) :  
94-97, 1975.
28. SADANANDAN, K. A.,  
K. K. KUNJIPALU,  
N. A. GEORGE &  
T. JOSEPH MATHAI  
Purse seines off Goa — *Fish. Technol.* XII (1) :  
45-51, 1975.
29. SIBSANKAR GUPTA &  
T. K. GOVINDAN  
The free alpha amino acid nitrogen contents of some  
common food fishes of Kakinada region, Andhra Pra-  
desh — *Fish. Technol.* XII (2) : 151-155, 1975.

30. *SULOCHANAN, P.,*  
*K. A. SADANANDAN,*  
*T. JOSEPH MATHAI &*  
*M. SYED ABBAS*

Selectively of gill nets for *Scomberomorus commersoni*  
— *Fish. Technol.* XII (1) : 52-59, 1975.

## 5. SUMMARY

The various research programmes of the Institute were aimed at increased fish production both from the marine and inland resources and development of new processes for storage, transport and preservation. During the year under report more emphasis was given for the better utilisation of low priced miscellaneous fishes which form the major catch. Standard procedures were worked out for canning of cat fish fillets, squids, eels etc. The cause of blackening of canned crab meat was found out and remedial measures were taken up. The frozen storage characteristics of pomfrets both black and white and laminated Bombay duck were studied in detail. Special methods were evolved for curing of cat fish. The urease enzyme brought down the urea in shark muscle to negligible levels and shark muscles were processed to minced 'Keema' like product. Methods of smoking fillets of sole and sardine were perfected. *Sciaenids* which form 'trash' in a trawl catch yield fish powder of high protein content.

Experiments were conducted to evolve better packing material for transportation of fish to distant places. An apparatus for the determination of water absorption and water penetration of packaging materials was designed and fabricated.

Apart from the application in the dyeing and printing process chitosan can be used to clear the impurities of water. It was also observed that light firm boards could be prepared from dry weeds of African payal by pressing with chitosan solutions.

Diversification of fishing methods for smaller crafts for the exploitation of inshore fishery was achieved by designing a small purse seine of 265 x 25 metres and operating it successfully from small trawlers.

Large scale field trials have brought to light the successful utilisation of secondary species of timbers in boat building after seasoning and proper treatment with the recommended toxic wood preservatives.

In-board-out-board drive for propulsion of country craft using an in-board diesel engine of 3.5 HP was fabricated and trials were taken successfully. A prototype fish pump and a gutting machine for sardine were fabricated and tested. Designs of automatic grading machine for cooked prawn meat and design of a cooking chamber required in the sardine canning line were completed. A pilot plant of 50 kg. capacity for the production of fish powder was designed. Commissioned one tonne tunnel drier at IFP Cochin as per CIFT design for the production of artificially dried fish. Preliminary designs of flaking machine and fish cutting machine were prepared. In collaboration with CIFT a private party developed a hydraulic trawl winch for the first time in India and a prototype was fabricated using indigenous components and fishing trials have been carried out successfully.

Statistical applications in fish processing industry showed that spoilage of prawns increased with the time lag between catch and processing, improper icing and damages to shells. Wastage due to the presence of blood clot in froglegs was observed to be 10%. The rates of recovery for whole prawns of counts 150-250 per kg., ranged from 42-46% in the case of peeled and deveined types and for 110-200/kg., the rate was 50-52%. For a given species of prawn higher rates of recovery were observed with larger size grades of prawns. On beheading naran of counts 68-80 per kg. size grades of meat obtained were 26/30 and 31/35 and on peeling and deveining poovalan of counts count 85-145 per kg., prawn meat of size grades 61/70 and 111/130 were obtained.

The extension and information section continued its activities in popularisation of the research findings of immediate application and benefit to the industry. A total of 542 samples were analysed and reports were furnished to concerned parties on different products.

Three refresher training courses on improved methods of fish processing were held during the year for the benefit of the technical personnel from fish processing establishments.

During the year under report investigations on the All India Co-ordinated Project on Transportation of Fresh Fish and Utilisation of Trash Fish were continued at the Institute centres as per the approved programmes at the workshop. Consignments of iced and frozen fish were regularly despatched from Veraval to Bombay and from Kakinada to Howrah. Suitable designs containers with cheap insulation material were developed at Kakinada for transport. Functional protein concentrate was prepared from cat fish which was tested and found superior to the conventional FPC. The peptone samples prepared from cat fish and *Nomipterus sp* compared favourably with imported commercial samples.

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ALL INDIA COORDINATED RESEARCH PROJECT <sup>T&A</sup>  
ON TRANSPORTATION OF FRESH FISH AND UTILISATION OF FRESH FISH

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### 7. List of Abbreviations used in the Report

Abbreviations used	Full form
BHA	Butylated Hydroxy Anisole
BARC	Bhaba Atomic Research Centre
CBZ	Carbo benzyloxy
CFB	Corrugated Fibre Board
CNSL	Cashew Nut Shell Liquid
CRP	Co-ordinated Research Project
EDB	Ethylene Dibromide
FFA	Free Fatty Acid
FRP	Fibreglass Reinforced Plastic
FPC	Fish Protein Concentrate
IFP	Integrated Fisheries Project
IU	International Unit
IV	Iodine Value
OAL	Over All Length
PER	Protein Efficiency Ratio
R & D	Research and Development
RU	Reading Units
SPC	Standard Plate Count
TBA	Thio Barbituric Acid
TDC	Textile Divisional Committee
TVN	Total Volatile Nitrogen