

ANNUAL REPORT 1989-'90



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

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CONTENTS

	<i>Page</i>
Introduction	
History	1
Research Accomplishments	1
Extension & Consultancy	32
Collaborative Projects	39
Island Fishery Development Programme	39
Fishing Cruises	40
Symposia / Seminars / Workshops Etc. Attended	40
Training / Deputation of Scientists	44
Degree / Award	46
Representation in Committees	46
National Science Day	51
Project Advisory Committee	52
Official Language Implementation Programme	52
Technical Section	52
Library	53
Administration	54
Management Committee	54
Institute Joint Council	55
Monitoring Cell	55
Grievance Committee	55
Visitors to the Institute	56
Publications	57
Appendices	65
Salient Achievements in Hindi	

INTRODUCTION

Steady progress was maintained in the various research projects and extension activities undertaken by the Institute during the period. Some of the salient achievements are briefly mentioned below.

The design details of a 7.6m OAL fibreglass open boat for Lakshadweep were finalised.

The keel was laid of a 15.25 m. wooden fishing vessel which is under construction at the Institute.

A private firm at Calcutta has taken up commercial production and marketing of combination wire ropes as per CIFT specification.

A numerical classification for netting yarns was worked out and based on this, the systematic position of nylon twines, HDPE twisted twines and PP twines tabulated.

Polypropylene gill nets have been found equally efficient as nylon nets.

Method was standardised for preparation of stuffed squid.

Optimum conditions for production of surimi from fish mince were worked out.

Method was developed for production of very low viscosity chitosan.

Chitosan was assessed to be useful as an adhesive for packing paper in corrugated fibre board manufacturing process.

A chitosan plant with a capacity to produce 10 Kg. of finished product/batch was set up at Neendakara, Quilon Dist. by MATSYAFED with technical assistance by CIFT Scientists. The plant was formally inaugurated on 30 - 3 - 1989 by Shri T. K. Ramakrishnan, Hon'ble Minister for Fisheries, Kerala.

Chitosan film and chitosan impregnated gauze were found suitable for use as haemostatic agents in neurosurgery, dental surgery etc.

The overall quality of manually peeled shrimp was found superior to machine peeled shrimp.

Method was developed for refining commercially dry cured fish.

Hydnocarpus oil was found effective against both beetles and blowflies infesting cured fish while mustard oil and sunflower oil were specifically effective against blowflies.

Good quality smoked cured products were prepared from tuna.

Salmonella oslo and *S. urbana* were isolated for the first time from seafoods.

Histamine content in salted sun dried whole white bait was less than that in unsalted whole sundried fish.

Listeria selective agar (LA) (Oxford Formulation) and Polymixin acriflavin lithium chloride ceftazidime asculin mannitol agar (PALCAM) were found effective in recovering *Listeria* from fish and fishery products.

A medium which will prevent swarming of bacteria in culture plates was formulated for bacteriological sampling of canned, pickled and cured fish products.

Polyurethane is a better substitute as insulating material both for expanded polythene and polystyrene.

The thermal efficiency of polythene lined bamboo baskets was found to be 20% more than that of the traditional sal leaf lined bamboo baskets.

Design of a liquid nitrogen spray system for freezing fishery products was completed.

A cutlet moulding machine was developed and trial runs carried out successfully.

A double glass plate, all weather type solar dryer with a drying rate three times faster than the conventional process was developed.

The yield rates of commercially important varieties of prawn were estimated and their size - grade wise and region - wise differences noted.

Survey was undertaken of the problems involved in handling, processing and marketing of anchoviella with special reference to Kanyakumari District in Tamil Nadu.

A Summer Institute on Indigenous Instrumentation for Agro - climatological Investigations was held at the Institute in June 1989.

Training courses in Dried Fish Mycology and Isolation and Identification of *Listeria monocytogenes* from Seafoods were conducted in collaboration with the Natural Resources Institute, London.

(Sd)

(M. R. NAIR)

Director

HISTORY

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

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

The Institute is headed by a Director with whom all administrative and financial powers regarding Research and Management of the Institute are vested. He is assisted by a Senior Administrative Officer, an Administrative Officer and two Assistant Administrative Officers for dealing with matters relating to general administration and an Assistant Accounts Officer for looking after the financial accounting aspects as also internal audit of the Insti-

tute. One Technical Officer attends to the technical matters including those connected with research projects handled by the Institute at its Headquarters at Cochin, and Research Centres.

The Research work is carried out by the following research divisions.

1. Fishing Technology Division
2. Fish Processing Division
3. Bio-Chemistry, Nutrition & Microbiology Division
4. Engineering & Instrumentation Division
5. Extension, Information & Statistics Division.

RESEARCH ACCOMPLISHMENTS

HEADQUARTERS, COCHIN

FISHING TECHNOLOGY DIVISION

Scientists / Technicians associated:

P. A. Panicker, V. C. George, K. Ravindran, K. A. Sadanandan, N. Unnikrishnan Nair, A. G. Gopalakrishna Pillai, K. K. Kunjipalu, B. Meenakumari, N. Subramonia Pillai, M. R. Boopendranath, V. Vijayan, M.D. Varghese, M. Naser, A.C. Kuttappan, Leela Edwin, Saly N. Thomas, N. A. George, T. M. Sivan, Varghese Paul, K. Radhalakshmi, M. V. Baiju.

CHIEF FINDINGS

The general arrangement, specification and lines plan of a 7.6 m. OAL fibreglass open boat for Lakshadweep have been completed.

About 190 specifications of combination wire ropes of diameter ranging from 11 to 28 mm, breaking

strength 18 to 187 KN and made from steel wires of 0.50 to 1.00 mm diameter with different tensile strengths were worked out. Of these, 18, each with fibre core and steel core and steel wires of tensile designation 140 and 160 were selected as standard. The strand constructions selected were 6(8F), 6(12F), 6(9/6/F) and 6(15/9/F). M/s Usha Martin, Calcutta have taken up commercial production and marketing of 16 mm combination wire ropes as per CIFT specification.

A numerical classification for netting yarns was worked out incorporating type of polymer, yarn, construction and properties. The systematic position of nylon twines, HDPE twisted twines and PP twines were tabulated as per this classification.

Flexible floats of PVC coated nylon was found to be a suitable head line lifting device for demersal trawls in place of hard floats.

Square mesh cod ends of 30 mm mesh were found very effective in permitting escape of juveniles and is therefore worth considering as a conservation measure.

A 12.77 m two seam trawl net was operated along with 56 x 28 cm. flat rectangular otter boards from a 8.4 m. dug out canoe fitted with a 11 HP outboard engine. A 31.5% increase in yield of shrimp was observed with a corresponding increase (about 37%) in the revenue.

The newly designed 33.7m RMT6E

and 36.4 m RMT8P nets were operated from MV Saraswathy, the catch per unit effort obtained being 825 kg. and 645 kg. respectively.

Research Projects Handled

1. Studies on the construction and maintenance of medium and large class of fishing vessels in wood and steel for the Exclusive Economic Zone
2. Development of protective treatment for wooden boats
3. Studies on gear materials
4. Studies on demersal trawls
5. Studies on mid-water and semi-pelagic trawls
6. Low energy fishing techniques
7. Studies on lines and gill nets

Report of Work Done

Craft material

The strength properties — bending and compression parallel to grain — of Mango, Aini, Aranjali and Venteak subjected to different combinations of arsenic copper chrome and creosote and exposed under marine, terrestrial and atmospheric conditions were studied and compared with control. Wood subjected to combined treatment of oil and water borne wood preservatives revealed better residual strength.

Craft design and construction

Studies carried out on existing designs and construction practices of wooden and steel trawlers under construction at several boat yards in the country have revealed that the 16.5m outrigger steel trawler currently under construction is a modified

version of the 15.25m wooden trawler designed and developed at CIFT.

Data pertaining to different grades of steel of Indian origin used for boat construction and their composition and annual maintenance of different classes of wooden vessels of size 9.75m – 15.25m and steel trawlers of 22 and 23.2 m OAL (Mexican) were collected.

Wood protection

Background information on application of the existing caulking compound and the special type of indigenous "Sopper" compound on wooden hulls beneath the aluminium sheathing was collected and their usefulness studied. For compatibility studies, double boiled linseed oil was taken and allowed to react with cashew-nut shell liquid (CNSL) and WW rosin at different temperatures. Compatibility was observed to be significant at temperatures below 160°C. Rheological properties of the product were also satisfactory.

Gear materials

Data collected on the physical properties as well as properties due to environment of polypropylene (PP) netting yarns were compiled to assess the utility of PP as a fishing net material.

Photo-oxidation deterioration of HDPE twines and nylon monofilament yarns was studied by exposing the samples of different specifications outdoors and periodically determining the mechanical properties.

Cod end mesh studies

Experiments were carried out with square mesh and diamond mesh cod ends of mesh sizes 20 mm. and 30 mm. The

escapement of juveniles was observed to be more from square mesh cod ends. Reduction in mesh size from 30 mm to 20 mm was found to be harmful for fin fishes like *Johnius* sp. and *Lactarius* sp. both in square mesh and diamond mesh cod ends.

Development of fishing gear for operation from FORV 'Sagar Sampada'

Fishing operations with the proven designs of CIFT High Speed Demersal Trawls (HSDT) were carried out along the South East coast. The catch comprised of quality fishes like perches, carangids, mackerels and oil sardines.

Designs of new demersal trawls for operation from FORV 'Sagar Sampada' and for exploitation of the EEZ were developed.

Midwater and pelagic trawls

Performance evaluation of 24m SMT and RMT 8 and RMT 6 midwater trawls was completed. The total towing tensions offered for RMT 8 and RMT 6 trawls were almost the same (ie. 2.0 – 2.1 t and 2.5 – 2.6 t) for the two towing speeds viz. 2.0 and 2.5 knots while the SMT net registered higher values equal to 2.76 and 3.4 t under identical conditions. Maximum vertical opening of 5.0 – 5.95 m was got with the SMT and maximum horizontal opening of 9.34 – 12.36 m with the RMT 8.

The 23.4 m. RMT 6 was rigged with vertically curved otter-boards of size 180 x 90 cm., 120 Kg. wt. and 24 m sweep line and operated at a trawling speed of 3.4K. The net offered a tension of 1.8 t with vertical and horizontal spreads of 4.5 m and 12.9 – 13.5 m

respectively attaining 58% of the head rope length. A catch per unit effort (CPUE) of 125 Kg. was obtained which consisted of pelagic and semi-pelagic fishes like horse mackerel, lesser sardines and silver bellies along with quality fishes like silver pomfret forming a good percentage. The results suggest the effectiveness of the gear as a pelagic trawl.

Fabrication and assembly of the 18.5 m RMT 8P trawl and 25.2 m rope trawl were completed.

Line Fishing

Fishing operations were carried out at Agathi island, Lakshadweep with 0.4 size hooks of different shapes. The lines were operated 5-10m above sea bed at 50-200m depths. Data were collected on the location of the ground, type of bait used and size of catch. The catch of oceanic sharks of the family *Isuridae* in the weight group 25-100 Kg indicate scope for the introduction of this fishing technique.

Studies were continued on the efficiency of different snood materials for drift long lines.

Data are being gathered on the performance of circular hooks distributed to the fishermen at Colachel and Cochin.

Gill net fishing

Field operations were conducted with polypropylene multimesh gill nets of mesh size ranging from 32 - 140 mm. Variations in mesh size afforded scope for capture of different varieties of fishes. Sharks were landed by nets with 60-90mm. mesh, seer by 70-120mm, pomfret by

90-130mm. and sardines and mackerels by 32-50 mm mesh size.

Design aspects of entangling gill nets for prawns were finalised. Three sets of inner webbing of 34, 40 and 50 mm mesh and outer webbing of 250 mm mesh were fabricated.

Research Contemplated

1. Catalogueing of traditional and mechanised fishing craft in India.
2. Studies on alternative materials for fishing boat construction
3. Studies on fouling accumulation on fishing vessels operated at different places, development of protective measures etc
4. Studies on mechanical strength of metals and alloys in sea water.
5. Studies on mechanical strength, bio-resistance and treatability of selected species of timber
6. Studies on natural oils and synthetic resins as caulking compounds
7. Introduction of newer fishing gear materials
8. Photo-oxidation, deterioration and abrasion resistance of synthetic netting yarns
9. Studies on demersal trawls, mid-water trawls and semi-pelagic trawls
10. Light fishing and development of catching devices

FISH PROCESSING DIVISION

Scientists associated

K. Gopakumar, P. V. Prabhu, K. K. Balachandran, T. S. G. Iyer, P. K. Surendran, P. Madhavan, K. G. Ramachandran Nair, P. A. Perigreen, P. T. Mathew,

T. K. Thankappan, A. Lekshmy Nair, A. Vasanth Shenoy, A. C. Joseph, Jose Stephen, T. K. Sreenivasa Gopal, Jose Joseph, Chinnamma George, V. Muraleedharan, P. R. G. Varma, V. Narayanan Nambiar, P. T. Lakshmanan, Nirmala Thampuran, G. R. Unnithan, P. K. Vijayan, R. Thankamma, S. K. Bhattacharya, K. P. Antony.

CHIEF FINDINGS

Lowering of storage temperature from -20°C to -30°C doubled the frozen shelf-life of oil sardine while that of mackerel was increased by $1\frac{1}{2}$ times.

Method was standardised for preparation of stuffed squid.

Two attractive products were developed under the programme on retort pouch processing - 'Fish in rice' - a tasty and nutritious product and a modified curry medium for packing fish.

Minces were prepared from sixteen species of fish. The yield of mince and the quantities of waste from these species and their chemical composition were determined. The yield of mince varied from 30 to 56%, the maximum being from the deep sea fish *Pentaprion* and the minimum from cat fish.

Washing the fish mince with chilled water improved the colour and reduced the fat content of the product.

Optimum conditions for production of surimi from mince were

worked out.

Fish meal prepared from the deep sea fishes *Pentaprion* and *Lepidotrigla* showed good growth promoting properties, thereby proving to be a good source of animal protein.

Cutlets with firm texture could be prepared by treating the raw mince with salt before cooking, thereby increasing its yield by 25-30%.

Chitosan was assessed to be useful as an adhesive for packing paper in corrugated fibre board manufacturing operation.

Broiler chicks fed on a chitin diet exhibited a lowering in fat and cholesterol levels.

Protein powder prepared from deep sea prawn compared well with that from Jawla prawns.

Microencapsulated fish feed prepared using chitosan for capsulation was found acceptable to aquarium fishes.

A method was developed for production of very low viscosity chitosan.

Chitosan film and chitosan impregnated gauze were found suitable for use as a haemostatic agent in neurosurgery, dental surgery etc.

A simple technology was perfected for improving the colour and texture of frozen squid and cuttle fish.

Good correlation was observed between organoleptic qualities and hypoxanthine levels in squid and cuttle fish.

Salmonella oslo and *S. urbana* were isolated for the first time from seafoods.

V. cholerae inoculated into shrimp survived for about 5 months at -23°C .

The viability of *V. cholerae* suspended in sea water, was more at refrigerated temperature compared to room temperature.

Fried thelly prawn stored well even after 10 weeks at ambient temperature when packed in 90-100 μ LD / BA / Nylon / BA / Primacor.

Packaging improved the shelf life of frozen stored cutlets considerably and the effect of packaging materials such as HM-HDPE, LDPE, LLDPE and Nylon / Polythene in extending the shelf-life was almost same.

Fish fillets of *Catla catla* packed in 100 gm lots in 12 μ plain polyester / 230 gauge polythene in an atmosphere of O_2 and CO_2 , in the ratio of 1:1 and 1:4 remained in acceptable condition for 21 days and 29 days respectively at $0-4^{\circ}\text{C}$ when compared to the 12 days in case of control samples kept in air.

Polyester tracing sheets were found to be good substitutes for paper code slips which are presently being

used in frozen fishery products.

Dry fish pickle of *Kowala coval* can be stored in good condition for one year in laminates, namely 12 μ metallised polyester / 200 gauge low density polythene, 12 μ plain polyester / 200 gauge LDPE and 85 μ Nylon / Surlyn co-extruded film.

Overall migration residues from LDPE films and HM-HDPE films used in frozen shrimp industries of Kakinada, Veraval and Cochin were found to be within the prescribed limits.

Polyurethane is found to be a better substitute for either expanded polythene or polystyrene.

Research Projects Handled

- 1 Extension of shelf life of chilled and frozen fish and fish products
- 2 Technology of production, processing and shelf life assessment of fish mince and product development
- 3 Canning requirements for fish and fishery products
- 4 Studies on use of chitinous waste, fermented fishery products and by-products
- 5 Utilization of deep sea resources for product development
- 6 Upgradation of quality in the seafood industry
- 7 FAO programme on quality control and shrimp hygiene in Asian region
- 8 Enhancement of shelf life and consumer appeal of fish and fishery products by appropriate packages

Report of Work Done

Freezing

Studies on the effect of storage temperature on the shelf life of oil sardine and mackerel were completed. Sardines and mackerel belonging to different seasons were used and the frozen materials stored at -10° , -20° and -30°C . It was observed that at -10°C , the frozen shelf life of these fishes was very short, viz. 6-8 weeks in the case of mackerel and 4-6 weeks for oil sardine. At -20°C the frozen shelf life was 6-7 months and 3-5 months respectively for mackerel and oil sardine. Lowering the storage temperature from -20°C to -30°C almost doubled the frozen shelf life of oil sardine while that of mackerel was increased by $1\frac{1}{2}$ times.

The method of preparation of stuffed squid from cooked small squid tubes was worked out.

Canning

Histamine formation in fresh, ice stored, ambient temperature stored and canned tuna (*Euthynnus affinis*) was studied. Significant levels of histamine were formed at ambient temperature (30°C) by 14 hrs. storage. Histamine content was 26.09 mg.% at 14 hrs. and reached 172.15 mg % by 22 hrs. storage. No significant amount of histamine was formed during iced storage. It was found that the histamine content was slightly higher in the canned meat compared to the corresponding iced fish, but it was below the recommended safe level.

It was found that the fresh water fish mrigal packed in natural style, if canned after cold blanching in brine, gave

a product better than the one in which salt was sprinkled over raw skinned meat and processed directly.

Fish Mince

Minces were prepared from 16 species of low cost fish. The yield of mince and waste from these fishes and their chemical composition were determined. The yield of mince varied from 30 to 56% on the basis of whole fish, the maximum yield being obtained from *Pentaptrion* and minimum from cat fish. The colour of minces from jew fish, *Otolithus*, glass perch, ribbon fish, barracuda etc. was white or slightly pinkish and the fat content ranged from 0.39 to 1.88%. But fishes like horse mackerel (*Caranx* sp.), scad and *Decapterus russeli* gave slightly dark coloured minces with the fat content varying from 0.41 to 2.57%. The maximum fat content (7.37%) was shown by goat fish mince. The ash content of the mince was in the range 0.83 to 1.40%.

Studies on the frozen storage of minces from barracuda and *Upeneus taeniopterus* were carried out upto 8 months at -20°C . The *Upeneus taeniopterus* samples showed slight rancidity and discoloration while the barracuda mince was still in acceptable condition. The effect of cryoprotectants like sucrose, sorbitol and sodium tripolyphosphate is under study.

The effect of washing in improving the quality of minces was studied. Washing with chilled water improved the colour and reduced the odour and fat content of the minces. But the losses due to washing was 20-25% and the moisture content of the washed and

pressed minces was higher than that of the unwashed mince by 2 to 3%. Final washing with 0.1% sodium chloride solution and pressing could bring down the moisture content of the washed mince almost to the original level.

Attempts were made to prepare prawn analogues using washed minces. Washed minces from jew fish and threadfin bream were mixed with salt (2.5%), ground well and mixed with flavouring agents, moulded in the form of shrimp and cooked in water. The cooked material had texture and flavour almost similar to that of prawn.

Suitability of different minces for the preparation of cutlets was studied. Minces from jewfish, thread fin bream, goatfish, glass perch etc. gave good quality cutlets. Attempts were also made to improve the texture of cutlets, Cutlets having firm and meaty texture could be prepared by treating the mince with salt prior to cooking. By this process, the cooking losses were reduced and the yield of cutlet increased by 25 - 30%.

Fishery by-products

Variations in the parameters on the preparation of very low viscosity chitosan and their effects were studied. A 50% concentration of caustic soda at a temperature of 100°C and treatment time 3 hours gave chitosan with viscosity 20 Cp. whereas at the same concentration and time of treatment but at a higher temperature of 120°C, the viscosity of chitosan obtained was 6 Cp. Since boiling starts at 120°C, still higher temperatures could not be tried as the caustic soda solution became saturated. Prolonged treatment under such conditions

brings down the nitrogen content of the chitosan probably due to deamination. Optimum conditions are being worked out.

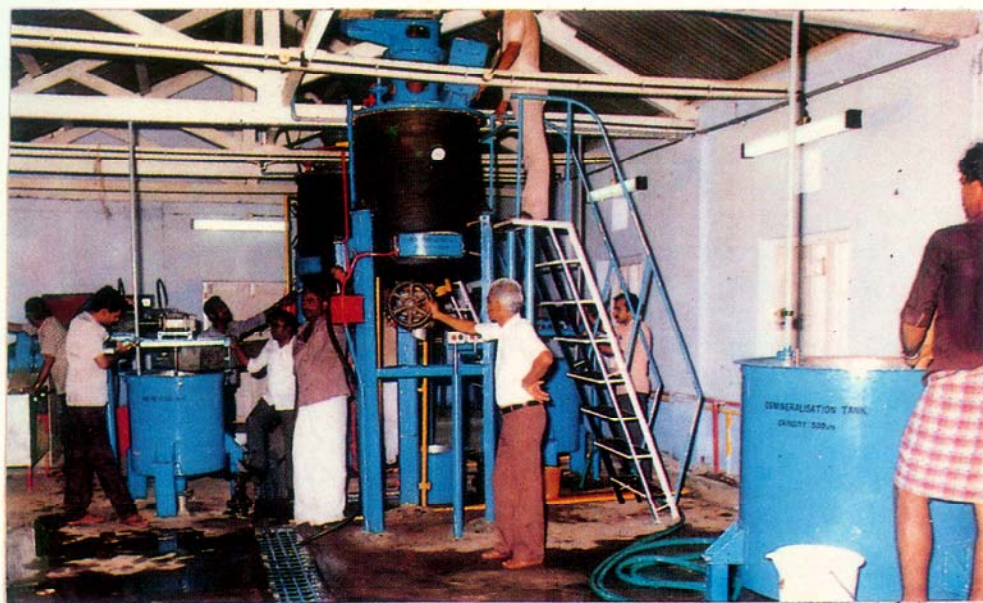
Studies with chitosan of viscosity 120 Cp. gave reasonably good films with 4% concentration in 1% acetic acid by spreading on glass or S. S. plates, drying in electric heater at about 90 - 100°C, neutralisation with 3% caustic soda, washing and drying. The films obtained were transparent.

Chitosan impregnated cotton gauzes and chitosan powders were also prepared. The haemostatic effect of all these materials were studied in association with the Medical College, Trivandrum and found very effective. Clearance has been obtained from the ethical committee for the use of chitosan in humans. Samples of special grade chitosan and chitosan based gauzes were prepared and supplied to Sree Chithira Tirunal Institute of Medical College and Technology, Trivandrum for experiments in medical applications.

Studies carried out at Dental College, Madras with the chitosan samples given by the Institute showed that chitosan is very effective as a topical haemostatic agent in post extraction haemorrhage management.

The hypocholesterolemic effect of chitin was significant in rats fed on high fat diet with 0.5% chitin for 100 days.

The properties of corrugated fibre boards prepared using chitosan adhesive and starch adhesives and stored at -20°C for 5 months were studied. Bursting strength, puncture resistance and flat



The Chitosan plant set up at Neendakara, Quilon, by MATSYAFED in collaboration with CIFT



Chitosan impregnated gauze and chitosan film

crush of both chitosan and starch boards were found reduced.

Studies on the behaviour of metal ions towards chitosan have shown that the quantity of cadmium adsorbed per gram of chitosan was less than that of copper ions under identical conditions.

Liver oil of certain species of sharks is found to be rich in squalene which has wide applications in the cosmetic and textile industries. A sample of *Cetorhines* sp. shark liver oil containing 1.85% non saponifiable (NS) matter when scanned in the Introscon showed presence of 69% of hydrocarbons in the NS matter, of which 84% was constituted by squalene.

Granulated fish feeds were prepared incorporating chitosan and their acceptability for aquarium fishes and *Macrobrachium* larvae tested. While the feeds were found quite acceptable for aquarium fishes, their particle size and composition are to be modified to suit the requirements of the different larval stages of *Macrobrachium*.

A method was developed for determination of the gel strength of agar agar using Universal Testing Machine.

Nutritional studies on hydrolysates from miscellaneous fish were carried out. The protein efficiency ratio (PER) of the hydrolysate was much lower than that of casein. But when the hydrolysate was incorporated at 4% level to the casein diet, enhanced PER was obtained.

Utilisation of deep sea resources

Twenty nine samples of fish, including squid and cuttle fish, caught from the

east coast of India by FORV 'Sagar Sampada' and from the west coast by the FSJ vessel 'Matsya Nireekshini' were identified and their proximate composition, mineral content and amino acid profile determined. The samples were rated good to fair by sensory evaluation. The yield of picked meat varied from 8.7 to 46.3%, the minimum yield being recorded from *Halientaea fitzsimonsi*, belonging to the family *Ogcocephalidae*.

The yield of meals from three of the deep sea fishes, viz. *Trigla* sp. *Lepidotrigla* sp. and *Pentaprion* sp. were also determined. The yield varied from 20.05 to 22.38% (WWB) with the protein efficiency ratio (PER) being higher than that of the reference protein casein. The meals from *Pentaprion* and *Lepidotrigla* showed good growth promoting properties followed by that from *Trigla*, all the three faring better than casein in rat feeding studies.

Studies on the nutritional evaluation of fish meals prepared from three other deep sea fishes, viz. *Chlorophthalmus agassizi*, *Pseneopsis cyanea* and *Expinulla orientalis* showed a lowering in protein quality when converted into meals by conventional methods. Better processing techniques are being developed for effective utilization of these fishes.

Fish wafers prepared using picked meat from *Gymanocranius robinsoni*, *Epinephelus malabaricus* and *Pentaprion longimanus* had excellent colour and good swelling properties. The products remained in acceptable condition upto 3 months' storage at room temperature in polythene bags.

Good quality fish fingers were also

prepared from *P. longimanus*.

Quality Control

Studies were continued on the viability of *V. cholerae* in water. Maximum viability of 165 days was observed in sterile sea water kept at refrigerated temperature (8–10°C) whereas in sterile sea water kept at room temperature, the organism survived for only upto 30 days. In non-sterile sea water kept at refrigerated temperature, survival was only upto 60 days. Results, in general, indicated extended survival at refrigerated temperature.

With a view to determining the viability of *V. cholerae* in shrimps during frozen storage, headless (HL) and peeled and deveined (PD) shrimps were inoculated with *V. cholerae* (Ogawa and Inaba) and stored at –20°C. *V. cholerae* was found to survive for about 5 months at –23°C when inoculated both into HL and PD shrimps.

Studies were continued to assess the quality of commercially frozen squid and cuttle fish. Sixty five commercially frozen samples packed in different styles like whole, whole cleaned, fillets and tubes and procured from various fish processing factories at Cochin were analysed for their sensory, chemical and bacteriological characteristics. Based upon sensory characteristics, 14% were poor, 20% were very good and the rest were good and good to fair. Average moisture content was 83.4% and pH varied between 6.2 and 7.38. Hypoxanthine content exceeded the prescribed limit of 2 micromoles/g in 19% of the samples. There was good correlation between the sensory characteristics and the hypoxanthine

content.

About 25% of the samples had total bacterial count more than the prescribed limit of 2 lakhs/g. Coliforms were present in 13.5% of the samples, whereas *E. coli* was noted only in 3.6% of the samples. About 82% of the samples had faecal streptococci more than 100/g. 10.7% of the samples were contaminated with coagulase positive staphylococci in concentrations more than 100/g.

V. cholerae 01 was absent in all the samples tested. However, 16.6% of the samples had *V. cholerae* non 01. *Salmonella* could be detected from 6.06% of the samples. On serotyping, the strains were identified to be *S. oslo*. There is no previous report of isolation of this serotype from seafoods.

Seventy samples of commercially frozen shrimps were tested for *Listeria monocytogenes*. The pathogen was absent in all samples.

Based upon several series of experiments, a simple technique was developed for improvement of the colour and texture of frozen squid and cuttle fish. The technique involves treatment of squid and cuttle fish in a solution containing 2–3% salt and 0.2% citric acid/lemon juice before freezing. Commercial scale trial carried out in a processing factory was highly encouraging.

Under the FAO Project on quality control and shrimp hygiene in Asian regions, 97 samples comprising swabs (70), water (8), ice (8) and raw material (11) were collected from shrimp processing factories for detailed bacteriological

analysis. All the samples were free from *V. cholerae* whereas 18.1% of the raw shrimps were contaminated with *Salmonella*. *E. Coli* was absent in all samples. Staphylococci was present on one contact surface.

Packaging of fish and fishery products

Survey on the packaging materials for export of shrimps namely master cartons, duplex cartons and strapping materials was completed. Bursting strength, puncture resistance and Cobb value (water proofness) qualities of master cartons showed improvement compared to the previous survey. Slight improvement in bursting strength, puncture resistance and water proofness of duplex cartons was also observed but they were not in conformity with ISI specifications. As far as waxing of duplex cartons are concerned, no uniformity was found. Some processing factories do not use duplex cartons for packing 2 kg. shrimp slabs. On the consent of the buyers, the slabs are packed in primary polythene packs and ten numbers of such slabs are packed in polythene bag which is then packed in master carton. Regarding the tensile strength of strapping materials used, considerable variations were noticed. Only two types of plastic materials are used by the fish processing industries namely recycled HDPE and polypropylene (PP). Since PP straps have good strength properties, many factories have switched over to PP straps. Because of several disadvantages, rayon or steel strappings are no more being used.

Fried thelly prawns could be stored well even after 10 weeks at room temperature when packed in 90-100 μ LD/BA/Nylon/BA/Primacor. The bacterial quality

of the sample was also good throughout storage.

Fish cutlets prepared from perch meat, tuna meat and barracuda meat had shelf-lives of 11 months, 4 months and 10 months respectively at -20°C when packed individually in HM-HDPE, LDPE, LLDPE and Nylon/polythene. When no packaging materials were used, the shelf-lives were observed to be 60, 30 and 40 days respectively. Between the packaging materials, there has been no difference in extending the shelf-life of the cutlets.

With a view to preventing damage of the packaging material due to the sharp edges of the conventionally prepared fish wafers, wafers with smooth edge were prepared using cooked fish and tapioca starch. They had good colour and swelling property.

Studies were continued on storage of fish fillets in modified atmosphere. Fish fillets of *Catla catla* in 100 gm lots when packed in 12 μ plain polyester/230 gauge LDPE in modified atmosphere of O₂ and CO₂ in the ratio of 1:1 and 1:4 at 0-4°C had shelf-lives of 21 days and 29 days respectively, while the control samples kept in air had a shelf-life of only 12 days. At the time of spoilage, the samples stored in modified atmosphere of O₂:CO₂ in 1:4 ratio had 48% *Aeromonas*, 33% *Lactobacillus*, 5% *Vibrio*, 5% *Bacillus* and 9% *Pseudomonas*. The extension in shelf-life in modified atmosphere may be due to *Lactobacillus*, *E. coli*, Coagulase positive staphylococci and anaerobic *Clostridium* species were not detected in any of the samples.

Polyester tracing sheets were found

to be good substitutes for paper used for code slips used in frozen fishery products meant for export. These sheets are non-mutilable and printable and do not lose their original property even in contact with water.

Dry fish pickles made from *Kowala coval* could be stored in acceptable condition for one year if packed either in 12/ μ metallised polyester/200 gauge LDPE, 12/ μ plain polyester/200 gauge LDPE or 85/ μ Nylon/Surlyn co-extruded film. Of these, 85/ μ Nylon/Surlyn was found to be best.

Overall migration residues from LDPE films and HM-HDPE films used in different shrimp processing industries of Kakinada, Veraval and Cochin were found to be well within the prescribed limits for food contact application (10 mg/dm²),

Polyurethane can be an effective substitute as insulating material for expanded polythene and polystyrene. It is found to have thermal conductivity of 0.022 w/mk.

Research Contemplated

1. Preparation of minces from under-utilized species of fish—Yield and chemical composition of mince and waste
2. Storage characteristics of minces
3. Improvement in quality and functional properties of mince and use of cryoprotectants
4. Development of products using fish mince
5. Development of value added products from deep sea fishes and their consumer acceptability studies

6. Studies on the suitability of un-economic fishes for surimi preparation
7. Variables in the production process of chitosan
8. Use of chitinous materials in animal feeds
9. Physico-chemical aspects of chitin and chitosan
10. Studies on protein isolates and liver oils
11. Incidence of *Listeria monocytogenes* in shrimp and its viability in water during chlorination, freezing and frozen storage
12. Quality of squid and cuttle fish and IQF shrimp
13. Effect of different treatments on corrugated fibre board boxes for frozen shrimp packaging
14. Development of consumer packages for fishery products in general and chilled fish / fishery products in controlled atmosphere
15. Packaging of IQF products
16. Effect of insect penetration on different packaging materials

BIOCHEMISTRY, NUTRITION & MICROBIOLOGY DIVISION

Scientists associated

K. Devadasan, P. D. Antony, P. K. Surendran, Nirmala Thampuran, Jose Stephen, A. G. Radhakrishnan, V. Narayanan Nambiar, S Sanjeev, P. T. Lakshmanan, R. Chakraborti, K. V. Lalitha, K. Ammu, Imam Khasim Sahib.

CHIEF FINDINGS

The maximum solubilisation of red meat from tuna is effected at

pH 5.5 at a temperature of 40°C by bromelain.

Rats fed with the control diet (fish protein as such with alanine / proline ratio 1.94) showed lower serum cholesterol compared to the rats fed with the test diets wherein the alanine / proline ratio of fish protein was adjusted to 0.19 and 0.38.

Histamine content in salted sun dried whole white bait was less than that in unsalted whole sun dried fish.

Fresh water fishes caught from Godavari river near Dowleswaram and Kovvur accumulated the toxic metals in levels more than that in marine fishes of Andhra coast, more so in spiny eel than in other fishes.

The optimum pH for ensiling ribbon fish viscera is found to be 4.3, and of the two proteinases separated and purified viz. acid and alkaline proteinases, alkaline proteinase was rapidly destroyed. The alkaline proteinase resembled trypsin.

Of the 72 cultures isolated from marine and fresh water fishes, five cultures showed strong lipolytic activity. The viability of such cultures as commercial sources of lipase is under way.

Among five different media compared, *Listeria* selective agar (Oxford formulation) (LA) and Polymyxin acriflavin lithium chloride ceftazidime asculin mannitol agar (PALCAM) were found to be comparatively better in recovering *Listeria* from fish and fishery products,

Listeria innocua, *L. seeligeri* and *L. ivanovii* were isolated from fresh fish and shellfish from local markets.

Swarming bacteria, causing spreading of colonies on culture media during microbiological sampling of pickled / cured / canned fishery products were found to belong to *Bacillus subtilis*, *B. coagulans*, *B. alvei* and *B. circulans*.

A medium which will prevent swarming of bacteria in culture plates was formulated for bacteriological sampling of canned, pickled and cured fish products.

Nine rare serotypes of *Salmonella* were isolated from fresh and frozen fish in retail trade in Cochin.

Clostridium botulinum type A and B have been isolated respectively from lizard fish (*Saurida undosquamis*) and ribbon fish (*Trichiurus sp.*), caught during the cruise of FORV 'Sagar Sampada'.

Research Projects Handled

1. Flavour bearing compounds of fish muscle and the effect of their possible interaction during processing
2. Nutritional and toxicological studies on fresh and processed marine products
3. Investigations on toxigenic and pathogenic bacteria associated with marine and cultured fishes

Report of Work Done

Carbonyls in fish

Carbonyls play a major role in flavour

and keeping quality of fishery products. Carbonyls were separated into major classes by column chromatography, and their composition evaluated by gas liquid chromatography. The interaction of carbonyls like acrolein, crotonaldehyde etc. with minced meat from oil sardines was studied. The effect of these reactions on the sarcoplasmic and myofibrillar proteins and consequent impact on flavour are under study.

Enzymes

The optimum pH of ensilation of ribbon fish viscera was investigated and found to be pH 4.3. Acid proteinases and alkaline proteinases were separated and purified. The alkaline proteinase was found to be highly labile compared to the acid proteinase. Fractional precipitation with ammonium sulphate did not effect a near complete separation of these proteinases. Ion exchange chromatography with a low pH starting buffer resulted in good resolution of the acid proteinase, but affected that of alkaline proteinase adversely. The alkaline proteinase resembled trypsin.

Seventy two bacterial cultures isolated from marine and fresh water fishes were screened for extracellular lipase activity on a modified tributyrin agar medium. Strong lipolytic activity was shown by 5 cultures. The suitability of such cultures as commercial sources for lipase is underway.

Nutritional aspects

During the year, the chemical composition and the fatty acid composition of various fish and shell fish were determined. The amino acid composition of fish proteins of different species of fish

and shell fishes was also determined. The results indicated nutritionally a well balanced pattern of amino acids in fish proteins

In order to utilize the red meat of tuna for edible purposes, conditions for the hydrolysis of red meat proteins were worked out using the enzyme bromelain. The maximum solubilization of red meat solids was achieved at pH 5.5, at 40°C in 2 hrs.

To study the carcass retention of amino acids in rats, feeding trials were carried out with synthetic amino acid mixtures. The studies are in progress.

In order to study the lowering of serum cholesterol, the alanine / proline ratio of amino acids was adjusted to 0.38 and rats were fed with such a diet for 2 months. The control rats were given fish protein as such. The blood sera are being analysed.

Toxic constituents

Fish and shell fish collected from off Andaman Islands, offshore Vizag and Godavari river were analysed for toxic metals like mercury, cadmium, copper, zinc and lead. It was observed that the samples collected off Andaman contained cadmium at 0.5 ppm, copper 4.0 ppm, zinc 15 ppm and mercury in very negligible levels in edible meat. In cuttle fish meat, cadmium was around 7 ppm and zinc 24 ppm.

In marine fishes collected offshore Vizag the toxic metals were within tolerable levels in their edible meat.

The sediment samples collected from

Godavari river near Kovuur and Dowleswaram contained mercury at 2 to 33 ppm, cadmium 1.5 to 4.5 ppm, lead 20–50 ppm, zinc 50 to 200 ppm and copper 20–70 ppm. Fresh water fishes caught from Godavari river near Dowleswaram and Kovuur accumulated the toxic metals in levels more than the marine fishes off Andhra coast. This accumulation was comparatively more in spiny eel than in other fishes.

Fresh water fishes obtained from Kolleru lake contained all the above toxic metals, but within safe limits.

Frozen samples of cuttle fish, frozen squid, liver of cuttle fish, gills, gonad and ink sac of cuttle fish were analysed for the content of toxic metals, mercury, cadmium, lead, zinc and copper. Mercury, lead and copper content in these samples were above the limit as to cause toxicity in human beings. In whole cuttle fish, cadmium level exceeded 2 ppm. Liver, gills and gonad of cuttle fish showed higher levels of cadmium. These toxic metals were also lower in frozen clams, mackerel, pearl spot, seer, tuna, prawns and sardine.

The histamine content in salted un-gutted sun dried white bait was less than that in unsalted, un-gutted sun dried fish.

Listeria in fish / fishery products

Of the five different selective media evaluated for the recovery of the food poisoning bacteria belonging to the *Listeria* spp., Listeria agar (LA) (Oxford formulation) and Polymixin Acriflavin Lithium chloride Ceftazidime Asculin Mannitol agar (PALCAM) were found to be better. Using these media, 46 different samples of fish, shellfish and fishery

products of the local markets were screened for the presence of *Listeria* spp., with particular reference to *L. monocytogenes*. Of the 160 presumptive *Listeria* cultures isolated, 68 were characterised. None of them were *L. monocytogenes*. Seven of them were found to be *L. innocua*, two *L. seeligeri* and two *L. ivanovii*.

Salmonella

Studies on the effect of freezing and frozen storage of *Salmonella* serotypes inoculated in fish meat showed that, even after 10 to 12 months of storage at -35°C , detectable numbers of *Salmonella* cells survived. The rate of destruction of *Salmonella* serotypes in fishery products during frozen storage could be enhanced either by lowering the pH to 5.4 or by increasing the salt level to 5% NaCl.

Studies have also shown that *Salmonella* serotypes could grow in fishery products at refrigerated temperatures, namely 5° to 11°C . However, such growth could be inhibited either by lowering the pH to 5.4 or by high salt level (5% NaCl).

Nine rare serotypes of *Salmonella* strains were isolated from fresh and frozen fish of retail trade in Cochin. They are *Salmonella adelaide*, *S. braendrup*, *S. emek*, *S. cerro*, *S. chingola*, *S. mbandaka*, *S. nchanga*, *S. oslo* and *S. richmond*. Some of these serotypes have been very rarely reported from fish and fishery products.

Clostridium botulinum

A detailed survey on the distribution of *Clostridium* spp, particularly *Cl. botulinum* in fish and shellfish, resulted in the

detection and isolation of *Cl. botulinum* type A and B, respectively from lizard fish (*Saurida undosquamis*) and ribbon fish (*Trichiurus sp.*) caught by FORV Sagar Sampada, during her experimental cruises. *Cl. botulinum* type C was detected in the freshly landed oil sardine (*Sardinella longiceps*).

Studies on the production of toxin by *Clostridium botulinum* strains in laboratory media showed that, *Cl. botulinum* type B produced 1.6×10^4 mouse MLD per milli-litre in cooked meat medium and tryptone-peptone-glucose yeast extract thioglycollate broth.

Medium for enumeration of bacteria in canned / pickled / cured fishery products.

A total of 43 chemicals including sugars, salts of organic acids, surfactants etc. were tested for their ability to inhibit the formation of spreading colonies of *Bacillus* species. Based on their performance, a medium was formulated for the enumeration of bacteria in fishery products like canned, pickled or cured fish. The advantage of this medium is that colonies developed in this medium are very distinct and clear thereby making enumeration accurate and easy.

Enterotoxigenic staphylococcus

Enterotoxin production by *Staphylococcus aureus* strains in fish and fishery products was studied by the reverse passive latex agglutination (RPLA) technique. It was found that in presence of native flora in fish, enterotoxigenic staphylococci strains did not produce detectable levels of enterotoxins A, B, C and D, even though such toxins were produced by them in sterile fish muscle. Temperature had a marked influence on toxin

production. While the strains tested failed to produce detectable levels of enterotoxin in fish media kept at 2°C and 10°C, high levels of toxins were produced at $30^\circ \pm 2^\circ\text{C}$ and detectable levels at 43°C.

Effect of handling on bacterial flora of cultured rohu

The initial native flora of cultured rohu, consisting of 66% *Micrococcus*, 7% each of *Bacillus*, *Aeromonas*, *Pseudomonas* and yeast, underwent significant changes during handling. After gutting, the flora comprised of 90% *Micrococcus* and 10% *Pseudomonas*. On washing, there was an increase in the percentage of yeast, constituting 32%, the rest being *Micrococcus* (32%), *Bacillus* and *Aeromonas* 8% each and *Pseudomonas* (16%). On iced storage, the predominantly gram positive flora suddenly changed over to a predominantly gram negative flora. However, gutted fish had more gram positives than ungutted control.

Studies on fish pathogens

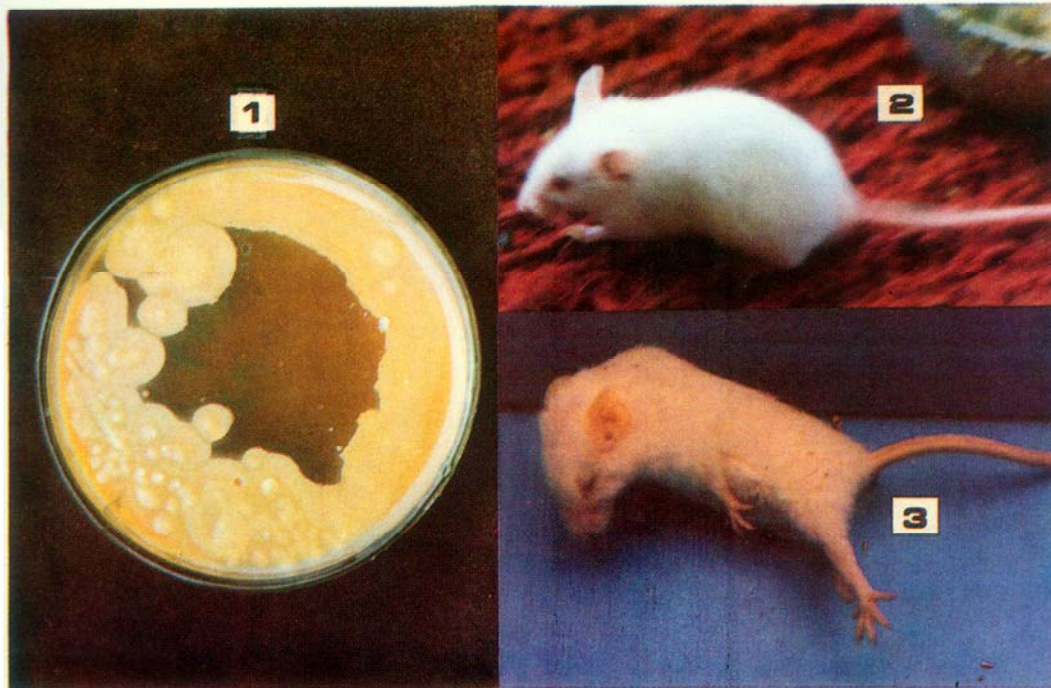
Screening of the internal organs like kidney, liver, spleen and blood of cultured fresh water fish mrigal and rohu from Muhamma showed the presence of *Aeromonas hydrophila*, a fish pathogen, in their liver. *A. hydrophila* was also isolated from the culture pond water.

Lactic acid bacteria

Lactobacillus plantarum, *L. brevis* and *L. confuses* were isolated from fresh fishes of retail trade. These cultures were found to be psychrotrophic.

Research Contemplated

1. Influence of major muscle constituents on the flavour of fish and fishery products



1. Colonies of *Clostridium botulinum* type B isolated from *Trichiurus* sp.
 2 & 3, Mouse Bioassay (Normal mouse & Mouse showing symptoms of botulism-hindleg stretching, paralysis, breathing difficulty.)



Bacterial colonies on :

- A. tryptone glucose agar – the medium currently used for TPC
- B. newly formulated medium for enumeration of bacteria of canned, pickled and cured fish products

2. Hydrolytic enzymes from fishes & marine bacteria— isolation and characterisation
3. Nutritional evaluation of newer fish species
4. Accumulation of toxic amines, pesticide residues, heavy metals in fish and processed fish
5. Microbiology of cultured fresh and brackish water fish
6. Studies on the incidence of pathogenic bacteria in marine / culture environments
7. Studies on lactic acid bacteria for preservation of fish
8. Enterotoxin production by *Staphylococcus aureus* in fishery products

ENGINEERING & INSTRUMENTATION DIVISION

Scientists associated

S. Ayyappan Pillai, T. K. Sivadas, K. Sreedharan Namboodiri, P. K. Chakraborty, P. N. Joshi, K. Vijayabharathi, N. Subramonia Pillai, K. Ammu, T. K. Thankappan.

CHIEF FINDINGS

The design of a liquid nitrogen spray system for freezing fishery products was completed.

A cutlet moulding machine was developed and trial runs carried out successfully.

A double glass plate all weather type solar dryer, with a drying rate three times faster than the conventional sun drying was developed.

The average fuel consumption of

the modified Kaplan propeller-nozzle combination was found to be 6 litres/hr. which is 25% less than the fuel consumption with a round tipped normal propeller-nozzle combination.

A portable model of the Environmental Data Acquisition System was fabricated for demonstration in the field.

Research Projects Handled

1. Development of equipment and machinery for harvest and post-harvest technology of fish
2. Studies on various propulsion systems and their effect on fuel consumption
3. Electronic aids for fishing and fisheries research

Report of Work Done

Fabrication of a flue gas drier-cum-smoke chamber was initiated.

Trials were carried out with the new all weather type solar dryer developed. The dryer recorded a temperature of 50°C during rainy/cloudy days and 95°C during sunny days. The temperature can be controlled by adjusting the ventilation and by using suitable solar filter.

The bio-gas plant developed earlier was modified by incorporating a working platform, gas light and cooking gas stove. Gas was produced by 7-10 days incubation in a specially designed digestion chamber and could be used both for lighting purpose as well as for cooking. Gas lights using petromax gas mantle burnt with brilliant white light while cooking gas burners burnt with blue flame. The gas produced contained

about 75.2 mole % of methane and the rest carbon dioxide. Its calorific value was estimated at 6,044 K Cal/kg. which was comparable to LPG now widely used for cooking purpose.

Several experiments were carried out on smoke drying of fish and the composition of smoke analysed.

At the request of the Indian Institute of Technology, Kharagpur, another unit of the Solar Processing Monitor was developed and handed over to them. The instrument was developed for remote monitoring of 1) drying parameters of solar dryer. 2) estimation of solar and wind energies used during the drying process, 3) physical changes in fish during dehydration and 4) other environmental changes.

The 'fishing log' developed at the Institute was subjected to field trials and valuable data collected.

An additional unit of the 'fishing log', was also developed for the Kakinada Research Centre for monitoring five important parameters of trawl performance and water quality during fishing operations.

The performance of the sensors of Anemometer and flow meter developed as per CIFT know-how was evaluated.

Research Contemplated

1. Fabrication of liquid nitrogen spray system
2. Development of cutlet frying system with temperature control arrangement
3. Fabrication of flue gas drier-cum-smoke chamber

4. Further improvement in biogas technology
5. Development of SBP (slotted blade propeller) propulsion system for mechanised trawlers
6. Development of instrument for monitoring load of dip nets

EXTENSION, INFORMATION & STATISTICS DIVISION

Scientists associated

K. Krishna Rao, H. Krishna Iyer, M. K. Kandoran, A. K. Kesavan Nair, Mary Thomas, G. R. Unnithan, V. Annamalai, R. Thiagarajan, S. Balasubramaniam, Braj Mohan

CHIEF FINDINGS

The yield rates of commercially important varieties of prawns were estimated and their size-grade wise and region wise differences noted. Yield estimates for squid and cuttlefish were also worked out.

While the prices of fishes landed at Cochin Fisheries Harbour were subject to seasonal fluctuation, the extent of price variation was seen to be more pronounced in the case of fishes that go directly to the consumer markets than those which go to the processing units first. Some of the normally costly fishes fetch very low price when the quantity landed is too small to attract buyers. This is contrary to the general pattern of inverse relationship between price and quantity landed.

Marketing research of the fishery products developed should be inten-

sified for commercialisation of the products.

As retort pouch processing appears to be more economical than canning on a long term perspective, this technology may be adopted for processed fish and fishery products.

Studies on the impact of training programmes in quality control have shown that in 98% of the cases, the trainings received have been very useful in production of quality products.

The rate of adoption of quality measures in handling and pre-processing prawns in the peeling sheds of Kerala was found to be very low.

Institutional and non-institutional sources of communication among fishermen were found to be more credible than mass media source.

Research Projects Handled

1. Statistical studies on quantitative relationship between product weight and weight of raw material used for processing
2. Price fluctuations of fish at landing centres
3. Adoption of innovations developed at CIFT

Report of Work Done

Data on the weight of headless prawns and yield of prawn meat from specified weight of whole prawns were collected from peeling sheds in and around Cochin and Mandapam. Data from the centres in and around Cochin were collected regularly. From these,

estimates of yield with 95% confidence intervals were worked out for all commercially important varieties of prawns. Three types of yield rates, namely, the yield of prawn meat from whole prawns, the yield of headless prawns from whole prawns and the yield of prawn meat from headless prawns were worked out. Separate estimates were made for different size grade of prawns. Region-wise differences in the yield rates were also found to exist.

The study on the weight of raw material and the respective product weights were extended to squid, cuttlefish and octopus. Samples of these varieties (whole) were drawn from peeling sheds at Aroor and Edacochin and the respective product weights were noted. Squid (whole) yields 43% when converted to tubes, whereas cuttlefish and octopus (whole) yields 70% and 84% respectively when converted to whole cleaned.

In the project on price fluctuations of fish at landing centres, systematic collection of data was carried out by direct observation of open auction of fishes at the landing centre. Exact information on auction prices was available for each lot of fish from auction. The quantity data for most of the lots could be recorded when the auctioned fish lot is weighed before loading for transport. As the baskets used for gathering the auctioned fish were of standard sizes, the quantity data could be recorded with least possible error.

A project on 'Marketing Research of Products Developed by CIFT' was undertaken on an ad-hoc basis. On the basis of the data collected so far, the following

conclusions were arrived at tentatively.

- i. Marketing research of fisheries products developed should be intensified for commercialisation of the products.
- ii. As retort pouch technology appears to be more economical than canning on a long term perspective, the country may adopt this technology for processed fish and fishery products.

Seventy two factories from 9 maritime states of India were surveyed for studying the impact of training programmes on quality control. Ninety eight percent of the factories reported that the trainings received by the technologists on quality control were very useful in production of quality products. All the factories processed prawns, while 65% of them processed other fish as well. Many aspects like temperature of cold storage, source of water, source of raw material etc. varied from factory to factory.

The rate of adoption of the improved practices in handling and pre-processing prawns in peeling sheds was however observed to be very low.

The socio-economic conditions of the fishermen in Kerala and Tamilnadu were found to be very poor.

Data collected on the impact of motorisation of traditional fishing craft in Karnataka region have shown that there exists a system of operation of both mechanised and motorised craft by a single fishing unit, which avoided clash among the fishermen. However, it was noted that in this system, motorised

vessels are kept idle when mechanised vessels are operated. The economy of such an operation is under study.

Studies on the communication behaviour of the traditional fishermen show that institutional and non-institutional sources of communication are more credible than mass media sources. The fishermen are also seen to have undergone various stages of decision making with respect to two technological practices, viz. use of synthetic net materials and use of engines in traditional craft.

Studies were carried out on the technological changes and their impact on traditional fishermen with respect to four fishing villages in and around Cochin area. Data so far collected show that the introduction of outboard engines has greatly helped to increase the annual fish catch by the traditional craft.

Regarding the role and status of fisherwomen it was observed that about 80% of them are primarily engaged in household duties. Twenty three percent of the fisherwomen are partly engaged in fish marketing and 20% in prawn peeling. Forty percent of the women are educated upto the primary school level, 25% upto secondary school level while 14% are illiterate. Twenty percent of the women are members of Co-operative societies. About 75% of them gather information on the improved aspects of fisheries through contacts with friends and relatives while others get this information through private agencies. Only 4% of them have undergone any sort of training in fisheries. Many of them have expressed their need to be trained in various aspects of fisheries -viz. 28% in fabrica-

tion of improved fishing gear, 25% in production of value added products and 30% in handling and pre-processing seafoods in general.

Research Contemplated

1. Product evaluation and marketing research of products developed by CIFT
2. Improved practices adopted for protection of wooden hulls of fishing vessels
3. Motorisation of indigenous fishing craft
4. Role and status of fisherwomen
5. Communication and decision making behaviour of traditional fishermen
6. Technological changes and their impact on traditional fishermen

VERAVAL RESEARCH CENTRE

Scientists associated

K. K. Solanki, P. G. Viswanathan Nair, R. S. Manoharadoss, Rajendra Badonia, K. V. Mohan Rajan, P. George Mathai, A. Ramachandran, T. V. Sankar, Puthra Pravin.

CHIEF FINDINGS

Polypropylene gill nets were found equally efficient as nylon gill nets.

Substituting a light bridle with a heavy one in 25m. high opening and 32m. large mesh demersal trawls did not significantly improve the efficiency of the gears.

Susceptibility of pomfret lipids towards oxidation varies with the

lipid content of the fish and season: the lower the lipid content of the fish, the higher the rate of formation of peroxides.

Acceptability of frozen stored ray fillets increased considerably when urea level of the fillets was brought down prior to freezing.

Quality of semidried and dried ray fillets could also be improved by removal of urea.

Overall quality of machine peeled shrimp was found inferior to manually peeled shrimp. However, the product had better microbiological quality. Machine peeled prawns had also poor appearance and organoleptic quality, less water soluble components and higher proportion of lower grade material.

Brown discolouration in salted and dried dhoma was inversely related to the concentration of brine used for salting.

Smoking of eel fillets did not enhance the shelf life of the frozen fillets to any significant level.

Mince based dried products of fairly long shelf life were prepared from low cost fish.

Research Projects Handled

1. Studies on demersal trawls
2. Low energy fishing techniques
3. Studies on lines and gill nets
4. Investigations on toxigenic and pathogenic bacteria associated with marine and cultured fishes

5. Studies on the effect of pre-processing conditions on frozen storage characteristics of important varieties of fishes of Saurashtra coast
6. Studies on technological problems of commercial curing of important varieties of fishes of Saurashtra coast

Report of Work Done

Fishing gear

Experimental fishing operations were conducted with 25m. high opening and 32m. large mesh demersal trawls for comparing the effects of heavy and light bridles on the catch. A heavy and thick manila rope of 32mm. dia. was used as the lower bridle. No significant effect was observed on the performance of the trawls by using the heavy bridle, except for the catch of *Lactarius* which was significantly high in the 25m high opening trawl with heavy bridle.

Studies were carried out on the introduction of new fishing gear materials. Experimental fishing with 20 units of polypropylene and 10 units of nylon gill nets have shown the catching efficiency of polypropylene nets to be as good as nylon nets.

Fish processing

Susceptibility of pomfret lipids to oxidative and hydrolytic deterioration was studied by storing minced fish at about 0°C and monitoring the changes in peroxide value, TBA number and free fatty acids. The results obtained clearly indicate that the lipids are more prone to oxidation when the fish is lean than when it is fatty.

Maximum peroxide value for lipid of fish with about 9% lipids was only 18-24 meq / 1000 g. fat, whereas lipid from fish with a lipid content of 1.6% registered a maximum PV of 419 meq / 1000 g. Accumulation of free fatty acids was also highest in the sample with the lowest lipid content.

Frozen stored ray fillets have limited acceptability because of the high urea content of the meat. Washing the fillets in running water with constant agitation brought down the urea level to acceptable limit. Acceptability of the frozen fillets, subjected to the above treatment before freezing, was found to improve considerably.

Mince from low-priced fish was mixed with starch in different proportions and noodle-like products prepared from it. Physical characteristics like appearance, retention of shape during cooking etc. and organoleptic acceptability were highest when fish mince to starch ratio was 1 : 2. The dried product remained in good condition for 8 weeks at room temperature.

Smoked eel fillets were frozen and stored at -20°C. The colour and flavour imparted by smoking were retained during frozen storage, but smoking did not enhance the shelf life to any significant extent.

Salted and dried dhoma was prepared using brine of varying concentrations and the dried products packed in polyethylene bags and stored at room temperature. A significant observation was that the brown discoloration in the dried fish was maximum when the salt concentration was low.

Salted and pressed dhoma was prepared by salting gutted fish in saturated brine for 48 hours and pressing it in a specially designed box for 24 hrs. The pressed fish was packed in polyethylene and kept at room temperature. This product remained in acceptable condition for a period of 18–20 days.

Perch fillets in semidried form were prepared by salting the fillets in saturated brine for 24 hours followed by drying in sun for a short duration to a final moisture content of 55%. The product had very good appearance and flavour with a shelf life at room temperature of 3 weeks.

By-catch from trawlers are not economically utilised at present. Almost the entire quantity is going for fish meal production. A study on the species composition have shown that Dhoma, Ribbon fish, *N. japonicus*, non penaeid prawns etc. were the major constituents of the by-catch. Most of these species have white, lean meat. The yield of meat from whole fish varied from 30 to 48%. This meat can be utilized most profitably for preparing mince-based products.

Semidried and dried ray fillets were prepared after initial treatment for urea removal. Acceptability of the products increased considerably by lowering the urea content of the fillets. Shelf life of semidried fillets was maximum at an RH of 80%.

Research Contemplated

1. Studies on sputnik trawls
2. Studies on mesh regulation
3. Studies on susceptibility of pomfret lipids to oxidative and hydrolytic

deterioration during different seasons

4. Effect of delayed processing on the quality of frozen eel
5. Effect of pre-processing conditions on the quality of frozen squid
6. Studies on discoloration in frozen ghol and frozen tuna
7. Studies on lipid oxidation in dark and white meat of tuna, black pomfret and seer
8. Quality of commercial salt and its effect on quality of cured products
9. Upgradation of trawler by-catch for human consumption
10. Production and quality assessment of semidried products

KAKINADA RESEARCH CENTRE

Scientists associated

C. C. Panduranga Rao, Sib Sankar Gupta, Subrata Basu, D. Imam Khasim Saheb, R. Chakrabarthy, M. M. Prasad, S. V. S. Ramarao, J. Sitarama Rao.

CHIEF FINDINGS

Rope trawls continued to perform well in the fishing operations carried out during the year.

A new design of high opening trawl was prepared, the gear fabricated and field trials conducted with encouraging results.

An intermediate moisture fish product with 52 – 57% moisture content and amenable to storage at ambient temperature for a period of 2 – 3 months was developed.

Dried fish cake with improved texture was developed.

Texturised fish blocks and fish granules with a shelf life of 8 months were developed from cooked and minced meat using salt. The mode of mixing the ingredients and pressing were found to influence the texture of the finished product.

Salted, pressed and vacuum packed *Psenus* was found to remain acceptable for about four months at ambient temperature.

Low cost ready to cook convenience products were prepared from dried Pellona, silver bellies, *Sciaenids* and small dry prawn incorporating a mixture of spices.

Research Projects Handled

1. Studies on demersal trawls
2. Studies on midwater and pelagic trawls
3. Nutritional and toxicological studies on fresh and processed marine products
4. Investigations on toxigenic and pathogenic bacteria associated with marine and cultured fishes
5. Studies on the preservation and utilisation of deep sea and other important fishes of Andhra coast
6. Development of product using minced meat from low cost fish available in Andhra coast
7. Microbiological studies on seafoods with special reference to spoilage and safety

Report of Work Done

Fishing gear

Fishing experiments were carried out with the rope trawl at different depths. The catch per hour was 15 kgs., *Trichiurus* sp. comprising major percentage of the landings. A rope trawl with hexagonal meshes in the front region was also tried, the net landing 11.4 kg. fish per hour.

A newly designed high opening trawl was fabricated and successful operations carried out with the same. The net yielded 24.7 kg. fish per hour, with ribbon fish constituting 73.6% of the total catch.

Fish processing and preservation

Dressed *Psenus*, immersed in saturated brine for 7 days, was subjected to a pressure of 0.048 to 0.08 kg./cm². The salted and pressed fish packed in 70mm nylon-surllyn bag under vacuum was acceptable for 120-135 days at ambient temperature while the same fish packed in 200 gauge polythene bag without vacuum was acceptable for 45-60 days. Propionic acid treated pressed and salted *Psenus* registered slightly longer storage life than the untreated sample

The residual SO₂ in the muscle of *P. indicus* and *M. monoceros* dipped in 0.315% of Sodium metabisulfite (97% purity) was 8.7 ppm and 7.27 ppm respectively after 4 to 5 days in ice storage. Black spot was not observed in any of the species, whereas the residual SO₂ in the muscle of *P. monodon* was between 17.4 ppm and 20.9 ppm. Retention of residual SO₂ in muscle of *P. monodon* was maximum in comparison with the other types of prawn. *M. monoceros* dipped in 0.42% Sodium metabisulphite (97% purity) was free of black spot in all

batches during 10 days of ice storage. Residual SO₂ in muscle was at constant level i.e. 13.1 ppm after 5 days of storage.

Three different intermediate moisture fish products were prepared from fillets of Rohu using different combinations of chemicals like glycerol, sucrose, sodium chloride and potassium sorbate. Product with moisture content between 52 - 57% remained well for 2 - 3 months.

Improved hydration and texture of dried fish cake was achieved by pre-heating fish mince and incorporation of tapioca starch (5%) and soya protein isolate (3%). The product had a shelf life of 6 months.

Iced storage as well as frozen storage shelf life of different varieties of deep sea fishes were studied.

A new species of fish, *Decapterus kurroidus*, was caught off Andaman Islands. It remained in good condition even after six months frozen storage at -18°C.

Freshly caught *Psenus* fish when stored in cold storage at around -18°C, remained in acceptable condition even after 12 months.

On board frozen *Decapterus dayi* was in acceptable condition only for 4 months. Physical damage was more than changes in flavour and texture.

On board frozen horse mackerel had good shelf life of 8 months at -18°C. The frozen fish when further stored in crushed ice at around 0°C, was in accept-

able condition upto 17 days whereas freshly caught horse mackerel had a shelf life of 13 days only.

Sixteen varieties of fish samples collected off Andaman coast were analysed for proximate composition and mineral elements. Butter fish (*Seriolina nigrofasciata*) contained high fat content around 16-18% on dry weight basis.

One hundred and ninety six samples of fish, shell fish and sediment samples collected from different water bodies viz., Godawari river near Kovvur and Dhowleshwaram, Kolleru lake, marine waters off Visakhapatnam and off Andaman Islands were analysed for toxic heavy metals. Fish samples caught off Andaman Islands contained less than 5 ppm of lead, 0.5 ppm of cadmium, 4 ppm of copper, 15 ppm zinc and negligible amounts of mercury in the edible muscle. However, cuttle fish samples were found to contain 0.7 ppm of cadmium and 24 ppm of zinc while meat of squid samples contained 24 to 41 ppm of zinc. Marine fish samples collected off Visakhapatnam contained heavy metals within tolerable limits. The sediment sample from Godawari river near Kovvur and Dhowleshwaram continued to reveal higher levels of lead, zinc, mercury, cadmium and copper.

Accumulation of lead, cadmium, copper and zinc in most of the fishes was in the order of liver > intestines > skin > muscle. Among fish samples collected from Godawari river, fresh water spiny eel was found to accumulate higher concentrations of these heavy metals than other fishes in the same location. Though concentrations of heavy metals in fish from Kolleru lake were generally low,

concentrations of zinc were more, even upto 55 ppm.

Low cost ready-to-cook convenience products could be prepared using dried Pellona, silver bellies, *Sciaenids* and small dried prawns by incorporating spices mixture. These products were in good condition even after four months storage at room temperature. Curry preparations made from these ready-to-cook products were good in taste and flavour.

Fortyfour out of 85 commercial samples of dry cured fish were found to develop red discolouration due to red halophiles in a period of 7 to 90 days storage at ambient temperature. Maximum number of samples were found affected in a period of 28 days from the time of purchase. *In vitro* sensitivity tests on red halophiles showed that the isolates are sensitive to one chemical at 0.5% concentration and to three chemicals at 2.0% concentration. Interestingly, sodium and calcium propionate were not found inhibitory to red halophiles even at 3% concentration. Salt samples containing red halophiles could be decontaminated by heating.

Thirtyfour vibrio isolates obtained by screening 129 samples of fish/shell fish were subjected to bacteriological characterisation. The isolates included non-agglutinating vibrios, *V. parahaemolyticus*, *V. metchnikovii* and *V. vulnificus*.

Research Contemplated

1. Studies on regulation of sulphiting agents in processing of fish
2. Monitoring of histamine content in identified dried fish with high histamine content during processing

3. Toxic polycyclic compounds in smoked fishery products
4. Development of pickles and intermediate fish products
5. Enhancement of shelf life of fresh fish using chemical preservative
6. Ice storage and frozen storage of deep sea fish of Andhra Coast
7. Studies on the processing requirement of seasonal bulk catch at Andhra Coast
8. Monitoring of fish and shell fish for heavy metals and pesticide residues
9. Control of insect infestation and red discolouration in dry fish
10. Screening of fish / shell fish including cultured and deep sea fish for pathogens and indicators

BURLA RESEARCH CENTRE

Scientists associated

C. V. N. Rao, A. A. Khan, K. N. Kartha, Percy Dawson, A. K. Chattopadhyay, J. K. Bandyopadhyay

CHIEF FINDINGS

Polypropylene twine maintained its superiority in catching efficiency for gill nets over other synthetic twines like nylon monofilament, HDPE yarn, nylon multifilament and HDPE twine.

Midwater trawling operations established the occurrence of *R. cotio*, *Mystus sp.*, *W. attu* and *S. silondia* at a depth range of 10-15m during the winter season whereas *R. chrysea*, *R. coilea* and *Sciaenids* were seen in plenty at depths of 15-20m.

Dry salted fresh water fish *M. seenghala* stored well for eight and half months when packed in low density (150 gauge) polythene pouches at ambient temperature.

The thermal efficiency of polythene lined bamboo baskets was found to be 20% more than that of the traditional sal leaf lined bamboo baskets.

Research Projects Handled

1. Development of suitable fishing gear and methods for the exploitation of reservoir fishery resources
2. Studies on fresh water and marine fish preservation in Orissa region

Report of Work Done

Fishing gear for reservoirs

Comparative studies of different gear materials have continued to reveal the superiority of polypropylene over nylon multifilament, HDPE yarn, nylon monofilament and HDPE twine. The catch per 1000 sq. m. of webbing worked out to 4.06 kgs, 2.84 kgs, 0.98 kg, 3.45 kgs and 0.78 kg respectively.

Midwater trawling operations were continued at three different depths, viz. 5-10m, 10-15m, and 15-20m. The data analysed showed that fishes like *R. cotio*, *Mystus sp.*, *Wallago attu* and *S. silondia* are abundantly available in the depth range 10-15m, while *R. chrysea*, *A. coilea* and *Sciaenids* are seen in plenty in the depth range 15-20m. A modification was effected in the existing gear by attaching false head rope thereby increasing the efficiency of the gear. Fishes like *Catla catla* which were not caught earlier were also caught at 10-20m. depth as a result

of this modification. The efficiency of the gear was further increased by attaching detachable wings. The catch comprised mostly quality fishes, with cat fishes constituting 23.25% of the total catch.

Light fishing operations were carried out using a 112.5m purse seine and a scoop net of 7m circumference.

Fish processing and preservation

Studies were continued on development of sun dried products from filleted freshwater fish by resorting to artificial tenderization with proteolytic enzymes. Controlled hydrolysis of the fish fillets with papain before sun drying resulted in products with better texture when compared to the untreated sample. Shelf life studies are in progress.

With a view to enhancing the storage life of cured fish, market samples of cured products were packed in consumer packs made of 200 gauge LDPE along with oxygen and moisture absorber. Shelf life studies are in progress.

Investigations were undertaken on quality assessment of marketed cured fish collected from different places in Orissa. Biochemical, microbial and organoleptic analyses of sixteen samples were carried out. No uniformity in quality was observed in the samples examined.

Research Contemplated

1. Studies on scope of midwater trawling in Hirakud reservoir
2. Introduction of newer fishing gear materials, other than nylon, in reservoirs
3. Scope of light fishing in Hirakud reservoir

4. Spatial distribution of *C. catla*
 5. Studies on salt curing fresh water fish
 6. Development of solar drier
 7. Development of improved dried fish products and consumer packages for processed fish products
 8. Design and fabrication of improved containers for transportation of iced fish
 9. Packaging and shelf life studies of iced cultured prawns
 10. Preliminary studies on prawn feed formulation
2. Studies on technological aspects in the control of biochemical and microbiological changes during processing and storage of less important food fishes

Report of Work Done

Studies were continued on the effective utilization of less important varieties of fish. The yield of edible meat from fishes locally known as "chakshi" and "bokshi" belonging to the family *Mullidae* was found to be 42% and 45% respectively while fishes like "wakdi" belonging to the family *Serranidae* yielded about 37% meat on whole body weight basis. Fishes known as "tambiole" belonging to the *Priacanthidae* family yielded 35% meat.

Studies were carried out on the spoilage microflora of fish and frozen fillets of *Chirocentrus sp.*, *Pellona sp.* and Dhoma. The major flora observed on iced storage were *Pseudomonas*, *Acromobacter*, *Vibrio*, *Flavobacter* | *Cytophage*, *Micrococcus*, *Photobacteria* and *Clostridia*, whereas *Pseudomonas*, *Vibrio spp.*, *Acinetobacter* and *Moraxella* constituted the major flora on frozen storage.

As part of the survey on the hygiene and sanitation in fish processing and landing centres of Bombay, 98 samples comprising fresh fish, shrimp, lobster, squid, cuttlefish, water and ice were studied. *E. coli* and coagulase positive *Staphylococci* were prevalent in these samples. About 5% of the water samples collected were contaminated with *Salmonella*. *V. cholerae* O1 group was not detected in any of the samples, whereas N. A. G. type *V. cholerae* organisms were isolated from fish, shrimp, cuttlefish and

BOMBAY RESEARCH CENTRE

Scientists associated

M. Arul James, H. K. Beri, S. P. Damle & D. K. Garg.

CHIEF FINDINGS

The yield of meat from "Chakshi" and "Bokshi", belonging to family *Mullidae* worked out to 42% and 45% respectively.

Epinephelus diacanthus spp. belonging to the family *Serranidae* could be ice stored in acceptable condition upto fourteen days (in 1 : 1 ratio). The fish frozen stored at - 18°C to - 20°C was observed to be in good condition even after 10 weeks storage as judged by organoleptic characteristics. Proximate composition and essential amino acid content indicate that these fishes are nutritionally good for consumption.

Research Projects Handled

1. Investigations on toxic and pathogenic bacteria associated with marine and cultured fishes

squid. *Listeria monocytogenes* was not detected in any of the samples.

A survey on the occurrence of pathogens like *Salmonella*, *V. cholerae*, *V. parahaemolyticus* and *Listeria monocytogenes* in fish processing environs and frozen fishery products showed the absence of *Salmonella*, *V. cholerae* and *L. monocytogenes*. *V. parahaemolyticus* was present within prescribed limits.

Research Contemplated

1. Further studies on the biochemical and microbiological aspects of frozen fishes belonging to families *Mullidae* and *Serranidae*
2. Studies on occurrence and survival of different pathogenic organisms like *V. cholerae*, *V. parahaemolyticus* and *L. monocytogenes*

CALICUT RESEARCH CENTRE

Scientists associated

Cyriac Mathen, T. S. Unnikrishnan Nair, K. George Joseph, P. Ravindranathan Nair.

CHIEF FINDINGS

A process for preservation of ready-to-cook fresh fish portions at room temperature for 1-4 days was developed.

The preservative treatment for cured fish was modified facilitating more uniform and effective application by dipping.

A method for refining commercially dry cured fish was developed.

Applicability of heat treatment

fo dry cured fish for prevention of insect infestation both in tunnel drier and mini solar tent drier was established.

Hydnocarpus oil was found effective against both beetles and blowflies infesting cured fish, whereas mustard oil and sunflower oil were specifically effective against blowflies.

Preservative treated dry fish packed in conventional bamboo basket or palmyrah leaf basket with an inner lining of polythene sheet with or without pyrethrum treatment on the exterior of the container remained in good condition for a reasonably long period.

An attractive product with excellent flavour and other organoleptic qualities was prepared from tuna by smoke curing.

Research Project Handled

1. Technology of on-board curing, prevention of spoilage in cured fish and development of speciality products.

Report of Work Done

Preservation of ready-to-cook fresh fish portions

Several experiments were conducted to find out whether fresh portions of fish cut in the size suitable for frying or preparation of curry could be preserved at room temperature with the addition of a preservative and condiments usually used in household preparations, apart from salt at low levels. Different salt levels and

combination of condiments with and without the addition of lime juice were tried. Calcium propionate was used as the main preservative. In a few experiments, lime juice was substituted with citric acid. As a result of the experiments, the optimum concentrations of ingredients of a preservative mixture most suitable for treating fresh fish portions were worked out.

Shark, jew fish, black king fish, mullet, tuna, mackerel, oil sardine and milk fish were studied after treatment with the preservative mixture. They kept for 1-4 days depending upon the freshness of the fish as well as species. Bacteriological characteristics and spoilage indices of shark, milk fish and black king fish were also studied in detail during storage.

Simplification of calcium propionate treatment for cured fish

Even though calcium propionate was shown to be good in preventing 'red' attack as well as fungus infestation, its uniform application by sprinkling was found difficult on a large scale. A dip for 2-5 minutes in a bath of saturated calcium propionate in saturated brine was found quite sufficient for providing adequate protection. For serial dips in the same bath, replenishment of the preservative after each dip was necessary.

In fatty fishes, addition of BHA also at the level of 0.5% was found effective in preventing rancidity and browning.

Refining of commercially dry cured fish

A method for refining commercially dry cured fish has been developed. The method involves washing the commercial product in three changes of saturated brine followed by dip treatment in satu-

rated-brine-calcium propionate-BHA bath containing 100 ppm available chlorine. The material is further dried and stored. Commercial cured fish subjected to the refining process were superior to the untreated commercial samples with respect to colour, content of foreign matter, especially sand, and bacterial quality. The shelf life obtained was about six months in the case of refined samples whereas the control samples spoiled within a month.

Heat treatment for prevention of infestation

Applicability of the heat treatment process was tested in a tunnel drier employing lower temperatures (55-60°C) and longer times of exposure depending upon the thickness of the fish.

A 'mini' solar tent drier was also set up and heat treatment carried out.

Insect repellent property of vegetable oils

Hydrocarpus oil was found repellent to both beetles and blowflies whereas mustard oil, gingelly oil and sunflower oil are specifically effective against blowflies. Combined anti-red and anti-insect treatment by incorporation of gingelly oil in the dip solution did not prove useful in preventing insect infestation.

Both gingelly oil and sunflower oil were comparable in their anti-insect property.

Application of natural insecticides

The effect of spraying the pyrethrum formulation, Pyrocon E, on the outer surface of bamboo baskets and palmyrah leaf baskets used commercially for storing and transporting cured fish was studied.

Preservative treated and untreated dry cured silver belly was packed in the insecticide treated as well as untreated containers with and without an internal lining of polythene (200 gauge) sheet. Results have shown that the preservative treated fish stored in treated containers remained in good condition whereas the untreated fish stored in untreated containers spoiled rapidly due to 'red' and blowfly infestation. Storage studies of the preserved fish both in treated and untreated containers are in progress.

Smoked products

An attractive smoked product was prepared from tuna. The fish was salted in the ratio 3:1 for 48 hrs., partially dried for a day and the salted fish smoked for three hours.

Survey on the quality of dry fish sold at retail outlets

Survey on the quality of dry fish sold at the retail outlets located in the remote villages of Calicut district was undertaken. Simultaneously, the retail dry fish merchants were interviewed and information about the trade collected. So far, information about 27 retail merchants have been gathered and 37 representative samples collected and analysed chemically and bacteriologically.

Research Contemplated

1. Control of insect infestation by application of natural oils, natural insecticides, thermal treatment and fumigation
2. Control of red halophiles, fungi and rancidity using harmless chemicals
3. Production of smoked and pickle cured fish and commercial scale application of method developed

for refining commercial cured products

4. Techno-economic aspects of curing and technology of on-board curing
5. Evaluation of commercial pickle curing
6. Losses during production, handling and marketing
7. Processing of Beche-de-mer

GOA RESEARCH CENTRE

Scientists associated

G. Narayanappa, T. Joseph Mathai, M. Syed Abbas.

CHIEF FINDINGS

The platform trawl continued to show efficiency in landing off bottom and column fishes.

A 1:5 scope ratio was found effective for small scale midwater trawls.

Research Projects Handled

1. Studies on demersal trawls
2. Studies on midwater and pelagic trawls

Report of Work Done

Midwater trawls

The platform trawl and the control net were operated in combination with 120 x 60 cm. vertical curved wooden otter boards. Analysis of the data collected showed the platform trawl to be more efficient than the control net in landing off-bottom and column fishes.

Scope ratio studies were continued with the 10.3m unequal panel net operated in combination with 120 x 60cm vertical

curved otter boards. Four different scope ratios were selected for the experiments, viz. 1:3, 1:4, 1:5 and 1:6 and the catches analysed. Best catches were obtained at the scope ratio 1:5. At scope ratio 1:6, the catch was predominated by squilla, crab, cat fish and shark and at 1:5 ratio, by off bottom fishes. At 1:4 scope ratio, the catch was poor and composed mainly of column fishes, while at 1:3 ratio, the catch was negligible.

Research Contemplated

- 1 Further studies on midwater trawls and demersal trawls.

EXTENSION & CONSULTANCY

TRAINING PROGRAMMES / DEMONSTRATIONS

Training programmes were organised in association with MPEDA on Hanging Meat and Vein in Shrimp for the benefit of shrimp handlers in pre-processing centres.

The Institute organised a training programme in fabrication of nets for scheduled caste women from 23-28 January 1989 in association with the Kerala State Fisheries Dept. under their special component scheme. Under this programme, 25 SC women familiarised themselves with various aspects of net fabrication including preservation of cotton and synthetic nets. Under a similar scheme, 50 SC women were trained during the period 16-21 October 1989 in handling and peeling of prawns, manufacture of fish/prawn pickle and wafers, preparation of fish cutlet, dried fish etc.

A demonstration - cum - training on Hygienic Handling of Squid and Cuttlefish was organised at Anjengo, Trivandrum on 9 & 10 March 1989 by MPEDA and CIFT in association with South Indian Federation of Fishermen Societies, Trivandrum.

A training course on Fish Drying Technology was held in collaboration with Overseas Devt. Natural Resources Institute (ODNRI), U. K., in two batches, from 24-28 April 1989 and 8-12 May 1989 in which twenty nine candidates participated. The participants from India, Srilanka and Maldives included middle level management personnel of Fisheries Depts., teaching faculty members of Universities and representatives of fish curing / drying industry.

Three batches of training programmes - one of eight days and two of nine days duration - were organised in collaboration with Export Inspection Agency, Madras on Quality Control Aspects in Seafood Processing for the benefit of the 8th, 9th and 10th batch of technologists attending the Fish Processing Technologists' Training Course. The programmes were held during 17-24 April 1989, 18-26 June 1989 and 4-12 December 1989 in which twenty eight people participated.

A training programme on Seafood Quality Control was organised for technologists working in seafood processing factories from 15-27 May 1989. Five candidates from fish processing establishments in and around Cochin participated.

The method of application of copper creosote on an indigenous craft was demonstrated to a private party at Tiruvalla on 2 August 1989.



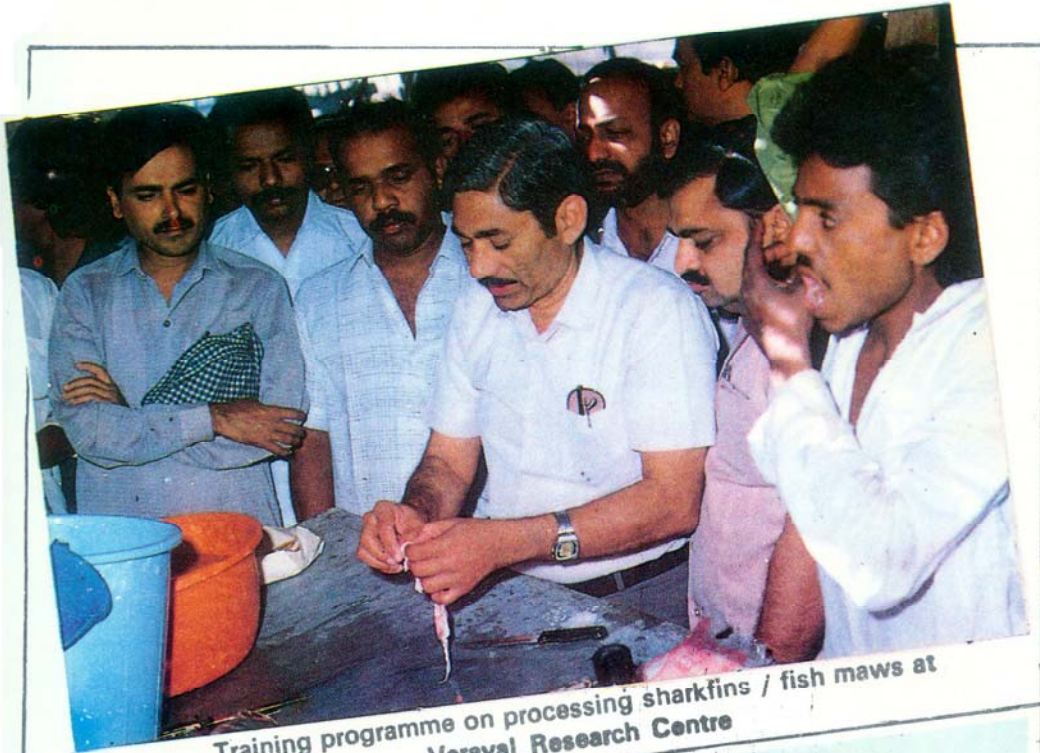
Dr. K. Sakthivel, Director, MPEDA inaugurates the training programme on Fish Drying Technology



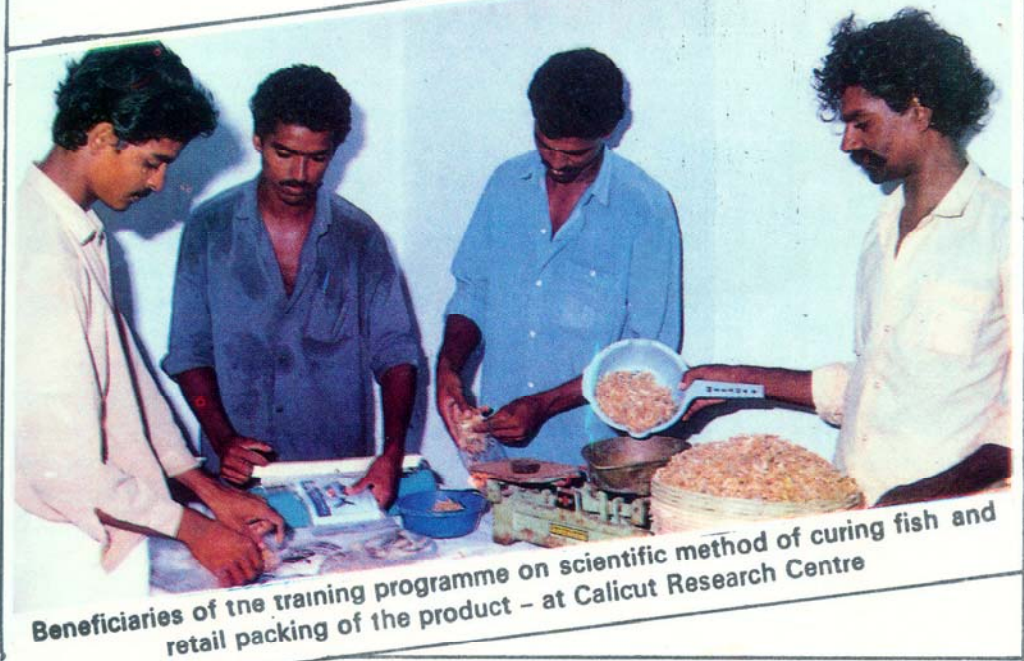
Participants of the training programme on Fish Drying Technology



Women undergoing training in fabrication of nets under the Special Component Scheme of Kerala State Fisheries Department



Training programme on processing sharkfins / fish maws at Veraval Research Centre



Beneficiaries of the training programme on scientific method of curing fish and retail packing of the product - at Calicut Research Centre

A one day training-cum-demonstration programme was organised in collaboration with MPEDA at Quilon on the hygienic handling of squid/cuttlefish and cadmium contamination in these fishes on 31 Oct. 1989. Twenty five supervisors/technologists from fish processing factories in Quilon attended the programme.

An inservice training programme in Quality Control of Seafoods was organised for the Extension workers, Quality supervisors and Investigators of MPEDA on 15 & 16 November 1989. Ten personnel participated.

A similar training programme in Sea food Quality Control was also organised for technologists working in seafood processing factories from 16-29 November 1989 in which five candidates participated.

A training course on Fish Processing Technology was held as part of the training organised by Krishi Vigyan Kendra, Narakkal for two weeks from 11 December 1989 for four State Fisheries Officials. The lecture classes covered handling and preservation of fish, freezing, canning, improved methods of fish curing, fishery by-products and speciality products, packaging of fish and fishery products, microbiology and quality control, fish biochemistry and extension methods.

Training in Laboratory Techniques of Microbiology, including identification of yeasts was imparted to a Research Manager sponsored by M/s Mc Dowell & Co. Ltd., Bangalore from 3-12 January 1990.

Training in fabrication and operation of reservoir fishing gear was conducted

for the benefit of the fishermen of Tripura at the request of the Director of Fisheries, Tripura.

A training programme-cum-refresher course on Microbiology and Quality Control in Fish Processing was organised jointly by the Veraval Research Centre of the Institute and Veraval Regional Office of MPEDA for lab technologists of IPQC / QICA / processing plants during August - September 1989.

The Centre, in collaboration with MPEDA and Fisheries Dept., Govt. of Gujarat, also conducted a training programme on hygienic handling of squid and cuttlefish and hygienic preparation of shark fins and fish maws on 7 & 8 March 1990 for the benefit of the local fishermen and traders.

The Centre also imparted training to two technologists in the microbiological and biochemical analysis of fish and fishery products.

The Kakinada Research Centre organised training programmes on Hygienic Handling of Prawns in Peeling Sheds at Kakinada and Bheemunipatnam in collaboration with MPEDA and State Fisheries Dept. on 6 & 7 November and 5 & 6 December 1989.

At the request of the Chief Warden of Fisheries, Himachal Pradesh, Burla Research Centre organised a training programme on fabrication, designing, rigging and maintenance of fishing gear for the benefit of reservoir fishermen of Gobind-sagar and Pong dam reservoirs of Himachal Pradesh. The programmes were conducted at Bilaspur, Dehragopipur and

Dadasiba in August 1989. About seventy eight fishermen actively participated in the training programmes while about 150 of them were appraised with the design details of the improved gear. The operational techniques of the gear were also explained to the trainees.

The Bombay Research Centre conducted a training programme on Hygienic Handling and Processing of Shark Fins and Fish Maws in association with MPEDA on 12 & 13 February 1990 in which fish processors and traders of Bombay region participated. Proper methods of handling and processing the products were demonstrated at the programme.

The Centre conducted demonstration on the biochemical aspects of handling and processing fish in collaboration with MPEDA and EIA for the benefit of technologists in different fish processing industries.

It also conducted regular training programmes on the organoleptic quality criteria and microbiological aspects for technologists sponsored by process quality control plants situated at Bombay, Goa, Porbander, Veraval and Ratnagiri.

The Calicut Centre imparted training to three youths from Puthiyappa in scientific curing, preservative treatment and retail packing of the cured fish. Of the three trained, two of them have already started packing fish for the domestic market.

FOREIGN PERSONNEL TRAINED

A Somalian student, Mr. Omar Hussein Ali Hussein was given training in fishery technology for a period of four months

from 16 October 1989 to 7 February 1990.

TECHNICAL GUIDANCE / CONSULTANCY

At the request of the BOBP and in consultation with and assistance of Kanyakumari Dist. Fishermens' Sangam Federation, a survey was undertaken of the problems involved in fish handling, marketing and utilisation of small fish in Kanyakumari Dist. with special reference to anchoviella. Based on the observations made, a report was prepared on the processing methods currently followed, problems faced and possible solutions to these problems. Suitable schemes that could be implemented in these areas were also drawn up.

Report on the process details for production of all grades of chitosan was supplied to M/s Chemopol Complex India, Madras.

Consultancy was also undertaken for fabrication of an artificial mini dryer at the request of Rice Research Institute, Vytilla under the Kerala Agricultural University.

Inspection was carried out of a 9.75m. wooden inspection vessel of the Kerala State Electricity Board, Malipuram, sheathed with aluminium magnesium alloy under the technical guidance of the Institute.

The first stage of construction of a 15.25m. vessel being constructed by a private boat building yard at Alleppey was inspected and inspection report furnished.

The final inspection report of a 16.5m. wooden outrigger trawler was also supplied to the concerned boat builder.

The Burla Research Centre fabricated and supplied a galvanised iron box of 30 kg. capacity for transportation of iced fish at the request of the Himachal Pradesh State Fisheries Dept.

The automatic peeling and grading machines installed at M/s Amar Cold Storage, Porbander and M/s Cham Ice and Cold Storage were inspected by the Veraval Research Centre and the inspection reports forwarded to the concerned parties.

The Institute undertook designing of a 7.67m. FRP pole and line fishing vessel for the Union Territory of Lakshadweep at the request of Dept. of Science and Technology.

REPLY TO TECHNICAL QUERIES

Technical queries on various aspects of fishing and fish processing continued to be received from different parts of the country as well as from outside. Some of the informations that were passed on to the interested parties / entrepreneurs are listed below.

Fishing Technology

- i. Twist specifications for 800 d. polypropylene monofilament yarns
- ii. Use of polypropylene ropes for fishing purposes
- iii. Viability report on operation of lobster traps of CIFT design
- iv. Designs of trawl nets and otter-boards suitable for operation from various sizes of fishing vessels
- v. Cost of construction of a 36 ft. wooden trawler

- vi. Electronic equipments suitable for various fishing operations
- vii. Feasibility report in respect of 15.25m wooden vessels for off-shore fishing
- viii. Use of fibreglass as a sheathing material for wooden hulls of fishing vessels
- ix. Aluminium alloy sheathing for wooden fishing boat hulls, quantity of sheet, anodes etc. needed for a 9.75m. vessel, etc.

Fish Processing Technology

- i. Comments on dehydration in frozen fishery products - causes and remedies
- ii. Percentage of yield and wastage in processing different varieties of shrimp
- iii. Approximate yield of dry salted fish processed from different varieties of wet fish
- iv. On varieties of sharks commonly used for extraction of fin rays and source of production of fish maws
- v. Feasibility of starting units for production of fishery products at Himachal Pradesh
- vi. Proximate composition of fish wastes and cheap varieties of fish
- vii. Comments on use of silage instead of sun dried fish for incorporation in cuttlefish
- viii. On content of omega 3 fatty acids- EPA-(Eicosa pentaenoic) and DHA (Docosa-hexaenoic) - in various species of common food fishes of India
- ix. On hot air drying of fish
- x. Information on preservation of dried fish, processing inland water fish,

- | | | |
|---|-------------------|----|
| smoke drying of fish and preparation of fish curry, fish sausage and fish sauce | Marine paints | 18 |
| | Sediment | 4 |
| | Biological sample | 3 |
- xi. Process of preparation of dried fish-anchoviella-with curry powder
- xii. Comments on points to be observed during manufacture of prawn wafers and pickle
- xiii. On production and utilisation of minced fish and preparation of dehydrated jelly fish
- xiv. On suitability of polyester tracing sheets for use as paper slips for marking codes and grades on frozen products for export

The Veraval Centre analysed 155 samples of water, ice and fish meal while the Calicut Centre analysed 6 samples of water, dried fish, prawn shell powder and sardine oil.

SUPPLY OF DESIGNS / PUBLICATIONS

The various publications and designs brought out by the Institute continued to be supplied to interested parties on request. A list of such designs and priced publications issued during the period is given below.

ANALYSIS OF MATERIALS / PRODUCTS

Samples of fish products, raw materials, fishing craft and gear materials etc. received from indigenous processors and manufacturers were tested to assess their quality and test reports issued to the concerned parties with suggestions for improvement of quality wherever necessary. The samples analysed include:

<i>Product / material</i>	<i>No. of samples analysed</i>
Water	118
Ice	49
Frozen fish and shell fish products	50
IQF products	3
Dried fish products	4
Fish by products	44
Fish speciality products	1
Packaging materials	348
Chemicals	11
Agar agar	2
Fishing gear and gear materials	25
Fishing craft materials	42
Outboard motor	1
Marine engines	9

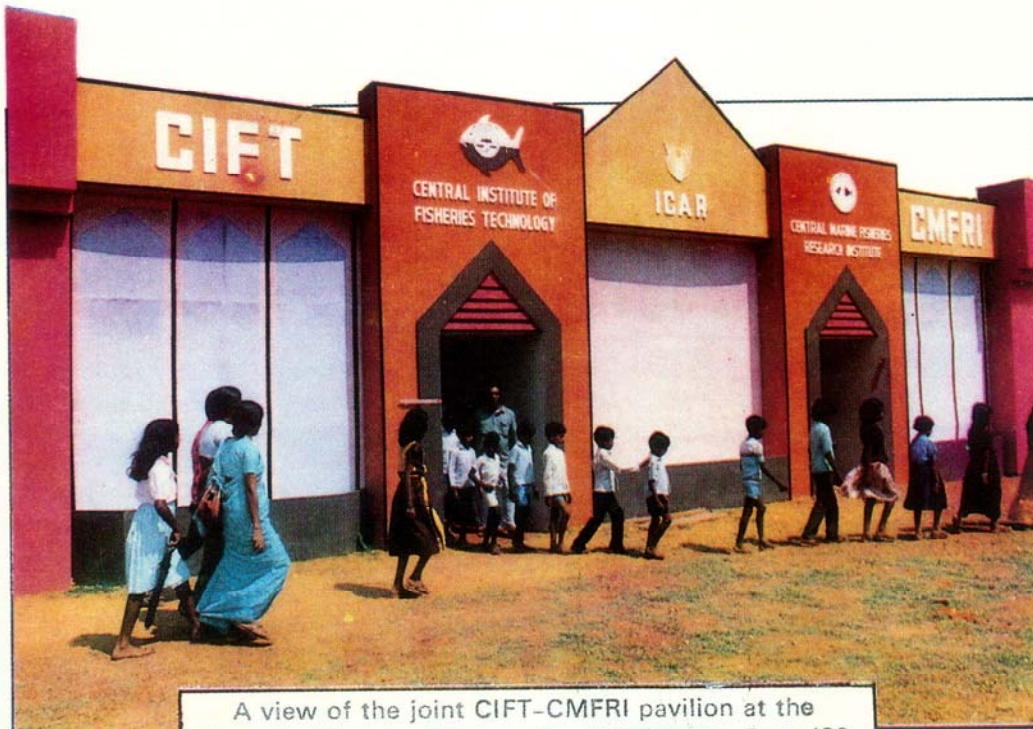
<i>Publication</i>	<i>No. issued</i>
Quality control in fish processing	52
Special Bulletin No. 8 - Abstracts of CIFT Publications	4
Special Bulletin No. 9-Indigenous Marine Fishing Gear and Methods of India-I-Karnataka State.	9

<i>Design</i>	<i>No. issued</i>
Fishing craft	9
Fishing gear	2
Otterboard	4
Tunnel dryer	4
Rotary drum dryer	1

EXHIBITIONS AND FILM SHOWS

A stall was set up jointly with CMFRI at the Tiruvalla Municipal Corporation Exhibition-Expo '89 - which was formally inaugurated on 3 February 1989.

Exhibits were given for display at a Fair organised by the School of Manage-



A view of the joint CIFT-CMFRI pavilion at the Tiruvalla Municipal Corporation Exhibition - Expo '89.



At the exhibition held at Puthuvypu in connection with Jawaharlal Nehru centenary celebrations

ment Studies, Cochin University of Science and Technology in connection with its Silver Jubilee celebrations, 4-6 March 1989.

Samples of chitin, chitosan and dehydrated jelly fish were supplied to MPEDA for display at the Hoteres and Foodex, Japan '89 at Tokyo, 7-11 March 1989.

Exhibits were also given for display at the mini exhibition organised in connection with Seminar on Advances in Fishery Technology conducted by Dept. of Zoology, Maharaja's College, Ernakulam, under the auspices of Mahatma Gandhi University, 16-18 March, 1989.

A number of products, models of fishing nets and photographs pertaining to the various activities of the Institute were sent for display at the National Agricultural Fair organised by the Trade Fair Authority of India, New Delhi, 25 March - 10 April, 1989.

Samples of fish products were sent for display at an exhibition held in connection with National Seminar on Identification of Opportunities for S & T Persons in Balasore organised by Dept. of Science & Technology, 6-7 April, 1989.

A one day exhibition was held at Puthuvypu, a fishing village in Ernakulam District, on 29 June, 1989 in connection with Jawaharlal Nehru Centenary celebrations. The focus of the exhibition was low cost technology developed at the Institute in the field of fish processing that can generate employment potential for fisherwomen.

The Institute participated in the National Seminar - cum - Exhibition on Challenging Opportunities in Science and Technology organised by the Task Force of Science and Technology Entrepreneurship Devt. (STED) Project at Calicut, 29-31 August, 1989. The seminar was sponsored by NSTEDB, Dept. of Science & Technology, Govt. of India.

The Institute also participated in 'Science in Everyday Life' - a demonstration campaign-cum-exhibition - organised by Dept. of Science and Technology at Ottapalam, 1-14 September, 1989. The Institute set up a stall along with five other institutes under a common ICAR Pavilion.

Exhibits relating to prawn and its derivatives were supplied for display at a Science exhibition conducted by a local school, 16-20 October, 1989.

In another instance, samples of fish by-products and speciality products were supplied for display at a locally held exhibition.

A stall was also set up at the Science Expo-ISCEX 90 held at Ernakulam between 28 January - 17 February 1990 in connection with the 77th Indian Science Congress held at Cochin University of Science and Technology.

A mini exhibition of various fish and fishery products was held in connection with the training programme on manufacture of fish products like wafers, pickles etc. and preservation of fish and shell fish organised by the Kerala State Fisheries Dept. at Cannanore under their Special Component Plan, 1989 - 1990.

Samples of prawn and prawn based fish products, fishing gear etc. were sent for display at an exhibition at Sambalpur, Burla, in connection with the meeting of fresh water prawn fishermen and farmers held in March 1990.

The Calicut Centre supplied samples of dried and cured fish for display at an exhibition conducted to commemorate the 40th anniversary of a local college.

A few film shows were also conducted.

SEMINARS / MELAS

A Fisheries Mela was organised on 30th January 1989 at Chellanam, a fishing village near Cochin, in which a large number of fishermen and fisherwomen from Chellanam and nearby fishing villages participated. An exhibition and fisheries seminar was also conjointly held where the various activities and achievements of the Institute were projected. Discussions were held in which the fishermen and fisherwomen keenly participated. The various problems faced by them were discussed and remedial measures suggested.

SUMMER INSTITUTE

A Summer Institute (short course) on Indigenous Instrumentation for Agro-climatological Investigations was held at the Institute from 6-14 June 1989. The course was intended to expose the instrumentation technology developed at the Institute to scientists, engineers and subject matter specialists connected with agroclimatology including fisheries, agriculture, water resources etc. Thirty candidates representing twenty three institutions from different parts of the country participated in the Institute.

RADIO TALKS / PRESS RELEASES ETC.

Seven radio talks by the Institute staff were broadcast over All India Radio Trichur/Trivandrum during the year.

These included:

- a. Talks in Malayalam on 'Preservation of fishing gear-then and now' and 'Innovations in fishing' by Dr. B. Meenakumari.
- b. Talks by Shri M. R. Nair, Director, on 'Modern fish processing methods' and 'Contributions of CIFT to the fisheries industry'.
- c. Talks by Dr. K. Gopakumar, Principal Scientist, on 'Employment opportunities for rural women in fish processing' and 'How to generate entrepreneurship in fish processing.'
- d. Talk on 'Modernisation in fishing techniques' by Shri V. C George, Principal Scientist.

A total of seven press releases were also made during the year under report on the various activities of this Institute.

Theory and practical classes continued to be held for post graduate students of Cochin University, B.F.Sc. students of Fisheries College, Panangad and State Fisheries officials.

Some of the Scientists were also invited to deliver lectures for the benefit of the participants of various training programmes, refresher courses etc. organised by State and Central Govt. organisations.

LAB-TO-LAND

A Lab-to-Land programme on the improved method of fish curing was held



Dr. K. Harsh Gupta, Vice Chancellor, Cochin University of Science and Technology, addressing the participants of the Summer Institute on Indigenous Instrumentation for Agro-climatological Investigations



At the Fisheries Mela held at Cheilanam, a fishing village near Cochin-fishermen show interest in the various products displayed



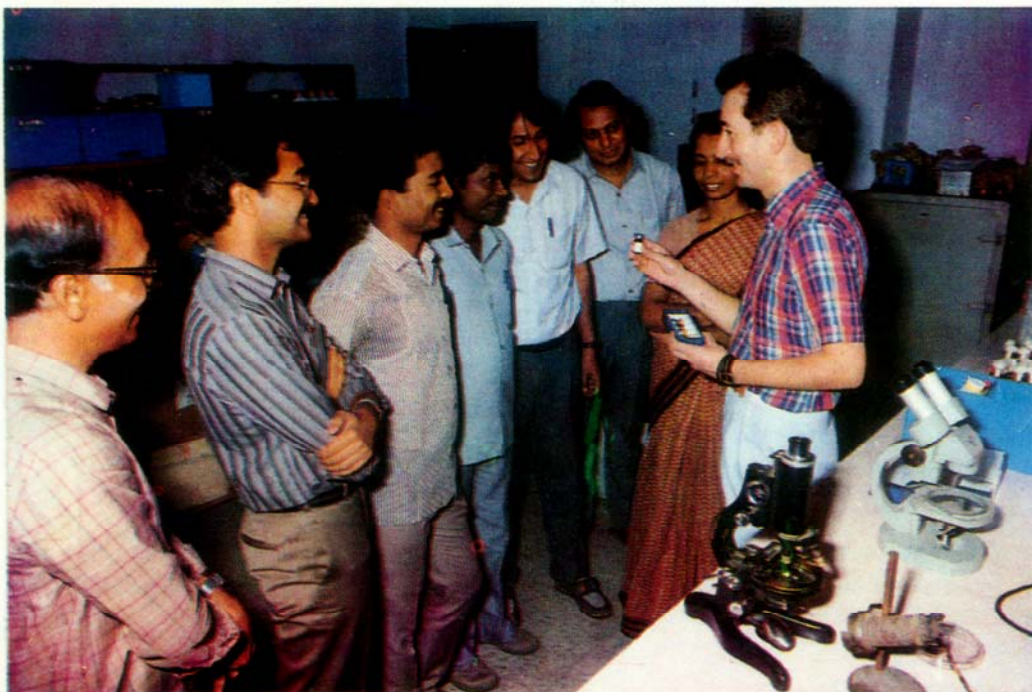
Inauguration of the Lab-to-Land Programme at Quilon - Shri Ansar Rahim, Quilon Municipal Councillor addresses the gathering



Training in the hygienic production of cured fish at Quilon



Training on Dried Fish Mycology –
the participants with Dr. Peter Wareing of ODNRI, U. K.



Dr. Richard Fuchs of ODNRI, U. K. impart training to participants of the training ,
course on Isolation and Identification of *Listeria monocytogenes* from Seafoods

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100. Thiagarajan, R. & Kandoran, M. K. – Relative retentivity of knowledge in fish processing by fisherwomen – *Fish. Technol.* 26 (2) : 144, 1989.
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102. Vijayan, P. K., Balachandran, K. K. & Surendran, P. K. – Preparation of fish pickles from low cost fish – *Recent Trends in Processing Low Cost Fish* : 140, 1989 (a Society of Fisheries Technologists' (India) publication).

Other publications brought out during the period include :-

- 1) Fish Technology Newsletter, Vol. V, No. 5 – 6
- 2) Handling and processing of Anchoviella in Kanyakumari District, Tamilnadu' India — A project report by K. Gopakumar, M. K. Kandoran, Jose Joseph & S. Ayyappan Pillai.

APPENDICES

APPENDIX - I

Telex No. 0885-6440

Telephone : Office No. 6845 (10 lines)

Director (Per.) - No. 6880

(Res.) - No. 361034

Telegram : MATSYAODYOGIKI OR FISHTECH-COCHIN

HEADS OF DIVISIONS

	<i>Upto 31-12-89</i>	<i>From 1-1-90</i>
1. Fishing Technology Division	: Dr. K. Ravindran Principal Scientist	Shri P. Appukutta Panicker Principal Scientist
2. Fish Processing Division	: Dr. K. Gopakumar Principal Scientist	Shri P. Vasudeva Prabhu Principal Scientist
3. Bio-chemistry, Nutrition & Microbiology Division	: Dr. K. Devadasan Principal Scientist	Shri P. D. Antony Principal Scientist
4. Engineering & Instrumentation Division	: Dr. T. K. Sivadas Principal Scientist	Shri S. Ayyappan Pillai Principal Scientist
5. Extension, Information & Statistics Division	: Shri H. Krishna Iyer Principal Scientist	Shri K. Krishna Rao Principal Scientist

APPENDIX - I (contd.)

RESEARCH CENTRES

Sl. No.	Place	Address	Telephone No.	Telegram	Scientist-in-Charge
1.	VERAVAL	Research Centre of CIFT Bunder Road Veraval - 362 265 GUJARAT	Tel: 20297 Telex: 0163-202 CIFT-IN	Matsyaudyogiki	Dr. P. G. Viswanathan Nair, Scientist.(SG)
2.	KAKINADA	Research Centre of CIFT Door No. 2-11-1/4 Venkatnagar Kakinada - 533 003 ANDHRA PRADESH	Tel: 4436 Telex: 0473-229 CIFT-IN	Matsyaudyogiki	Dr. C. C. Panduranga Rao, Principal Scientist
3.	BURLA	Research Centre of CIFT Burla - 768 017 Sambalpur District ORISSA	Tel: 19	Matsyaudyogiki	Shri C. V. N. Rao, Principal Scientist
4.	BOMBAY	Research Centre of CIFT 162-BPT Godown Sassoon Dock, Colaba, Bombay - 400 005 MAHARASHTRA	Tel: 213892 Telex: 011-82464 CIFT-IN	Fishprocess (FT)	Dr. M. Arul James, Principal Scientist
5.	CALICUT	Research Centre of CIFT Beach Road, West Hill, Calicut - 673 005 KERALA	Tel: 50627	Care 'Cadalmín'	Shri Cyriac Mathen, Principal Scientist
6.	GOA	Research Centre of CIFT 2nd Floor, 'Shanta' 18th June Road, St. Inez, Panaji - 403 001 GOA	Tel: 5905	Matsyaudyogiki	Shri G. Narayanappa, Principal Scientist

APPENDIX - II

List of Personnel in CIFT as on 31 March, '90

HEADQUARTERS, COCHIN

SCIENTIFIC PERSONNEL

DIRECTOR

Shri M. Rajendranathan Nair

Principal Scientist

- | | |
|-----------------------------------|----------------------------------|
| 1. Dr. K. Gopakumar | 9. Dr. P. T. Mathew |
| 2. Shri P. Vasudeva Prabhu | 10. Dr. Jose Stephen |
| 3. Dr. K. Ravindran | 11. Dr. N. Unnikrishnan Nair |
| 4. Shri V. C. George | 12. Smt. A. Lekshmy Nair |
| 5. Dr. T. S. Gopalakrishna Iyer | 13. Shri T. K. Srinivasa Gopal |
| 6. Shri P. A. Panicker | 14. Shri V. Narayanan Nambiar |
| 7. Dr. K. Devadasan | 15. Shri T. K. Thankappan |
| 8. Shri P. Madhavan | 16. Shri H. N. Mhalathkar |
| 9. Dr. T. K. Sivadas | 17. Shri A. C. Joseph |
| 10. Shri H. Krishna Iyer | 18. Shri K. V. Mohan Rajan |
| 11. Shri S. Ayyappan Pillai | 19. Shri K. K. Kunjipalu |
| 12. Shri K. K. Balachandran | 20. Dr. B. Meenakumari |
| 13. Shri K. Sreedharan Namboodiri | 21. Smt. Mary Thomas |
| 14. Shri K. Krishna Rao | 22. Shri Vasanth Shenoy A. |
| 15. Dr. M. K. Kandoran | 23. Shri P. N. Joshi |
| 16. Shri P. K. Chakraborty | 24. Shri P. K. Vijayan |
| 17. Shri P. D. Antony | 25. Shri Jose Joseph |
| 18. Shri P. A. Perigreen | 26. Dr. Nirmala Thampuran |
| | 27. Shri Francis Thomas |
| | 28. Shri S. Sanjeev |
| | 29. Dr. P. T. Lakshmanan |
| | 30. Shri V. Muraleedharan |
| | 31. Shri M. R. Boopendranath |
| | 32. Shri N. Subramonia Pillai |
| | 33. Shri G. Rajagopalan Unnithan |
| | 34. Dr. M. R. Raghunath |
| | 35. Smt. K. V. Lalitha |
| | 36. Shri V. Vijayan |
| | 37. Dr. M. D. Varghese |

Scientist (SG)

38. Shri S. K. Bhattacharya
39. Shri K. Ramakrishnan
40. Smt. K. Vijayabharathi
41. Smt. K. Ammu
42. Dr. S. Balasubramaniam

Scientist S - 2

1. Shri K. P. Antony
2. Shri M. Nasar (Naval Architect)

Scientist S - 1

1. Smt. R. Thankamma
2. Shri V. Annamalai
3. Shri A. C. Kuttappan
4. Smt. Saly N. Thomas
5. Smt. Leela Edwin
6. Shri Braj Mohan
7. Shri A. Ramachandran
8. Shri T. V. Sankar

TECHNICAL PERSONNEL

Technician T - 8 (Technical Officer)

- 1 Shri K. S. Ganesan
- 2 Dr. P. J. Cecily
- 3 Smt. K. Radhalakshmy

Technician T - 7 (Technical Officer)

1. Shri K. C. Purushothaman
2. Shri M. S. Fernando
3. Shri Durgacharan Besara

Technician T- 6 (Technical Officer)

1. Shri N. A. George
2. Shri T. M. Sivan

Technician T - 5 (Technical Officer)

1. Shri M. S. Rajan
2. Shri N. Sriharshan
3. Shri V. K. Ibrahim
4. Smt. T. T. Annamma
5. Smt. Annamma Mathew
6. Shri K. Vasudevan Nair
7. Shri K. Bhaskaran

8. Shri Varghese Paul
9. Shri C. Chandrasekharan
10. Shri N. Vareethiah
11. Shri G. Mohanan
12. Shri O. Subramanian
13. Shri P. Ravindranathan
14. Shri T. K. Sayed Ali
15. Shri R. Gopalakrishnan Nair
16. Shri M. V. Baiju

Technician T - 4

1. Shri A. Kassim Kunju
2. Shri M. L. Anslem
3. Shri P. Sadanandan
4. Shri M. K. Sasidharan
5. Shri P. T. Sebastian
6. Shri N. M. Vasu
7. Shri V. Gaspar
8. Shri Thomas J. Memmoottil
9. Shri P. S. Alias
10. Shri B. Anandan

Technician T - 11 - 3

1. Shri G. Ramadas Kurup
2. Shri M. M. Devasya
3. Shri C. R. Gokulan
4. Shri T. K. David
5. Shri V. Gopalakrishna Pillai
6. Shri V. K. Ramachandran
7. Shri V. V. Johni
8. Shri G. Ratnakaran Nair

Technician T- 1 - 3

1. Shri K. J. Augustine
2. Shri A. K. Jaisingh
3. Shri K. E. Mani
4. Shri P. M. Joseph
5. Shri A. R. Dharanædharan
6. Shri K. K. Subramanian
7. Shri E. K. Balakrishnan
8. Smt. K. Sarasamma
9. Shri M. Shanmughavel
10. Shri C. Rajendran
11. Shri Jose Kalathil

12. Shri K. V. Madhavan
13. Shri K. K. Pappukutty
14. Shri T. Gopalakrishnan
15. Shri P. A. John
16. Shri C. C. Sivan
17. Shri T. N. Manibhadran
18. Shri T. K. Bhaskaran
19. Shri K. B. Thilakan
20. Shri T. K. Vasudevan
21. Shri T. K. Aravindakshan
22. Smt. K. K. Sumathy

Technician T - 2

1. Shri P. A. Josi Augustine
2. Shri K. N. Rajagopalan
3. Shri P. N. Sudhakaran
4. Shri K. K. Narayanan
5. Shri V. V. John
6. Smt. G. Usha Rani
7. Smt. T. Sailaja
8. Shri Nobi P. S.
9. Shri N. R. Gopan Nair
10. Shri M. K. Kuttikrishnan Nair
11. Shri Tambi Pillai K.B.

Technician T - 1

1. Shri A. A. Kunjappan
2. Shri K. K. Sudhanandan
3. Kum. K. G. Sasikala
4. Shri Omanakuttan Nair G.
5. Smt. K. P. Leelama
6. Smt. V. C. Mary
7. Smt. K. B. Beena
8. Smt. K. S. Mythri
9. Smt. G. Remani
10. Shri P. S. Raman Namboodiri
11. Shri S. Sasikumar
12. Shri P. T. Viswambharan
13. Shri Kirtan Kisan
14. Shri K. D. Jos
15. Shri J. Samarajan
16. Shri Tommy Rebello
17. Shri K. A. Gopinath

ADMINISTRATIVE PERSONNEL

Sr. Administrative Officer

Shri V. K. Sridhar

Asst. Administrative Officer

1. Smt. K. A. Devaky
2. Smt. T. N. Ambujakshy Amma

Hindi Officer

Smt. Jessy Joseph C.

Asst. Finance & Accounts Officer

Shri P. A. Uthup

Superintendent

1. Shri M. George Joseph
2. Smt. Alice M. Joseph
3. Shri S. Naveen Chandra Prabhu
4. Shri M. Subramaniam

Senior Stenographer

Shri K. J. Thomas

Assistant

1. Shri T. M. Padmanabhan
2. Smt. Nafeesa Ali
3. Shri A. George Joseph
4. Smt. N. K. Sulochana
5. Shri R. Anil Kumar
6. Smt. T. K. Sarala
7. Shri R. S. Shanmughan
8. Shri A. L. John
9. Shri M. Gopalakrishnan
10. Smt. M. S. Susanna
11. Shri. V. N. Rajasekharan Nair
12. Shri M. T. Joseph
13. Shri M. J. Sebastian

Stenographer

1. Shri K. Ravindran
2. Smt. N. K. Saraswathy
3. Smt. R. Vasantha
4. Smt. V. P. Vijayakumari

Sr. Clerk

1. Shri A. K. Venugopalan
2. Smt. Annamma Varghese
3. Smt. C. G. Marykutty
4. Smt. N. Prabhavathy Amma
5. Shri C. Ravindran Nair
6. Smt. K. R. Gita Rani
7. Shri T. M. Ramraj
8. Shri G. Somappan
9. Shri K. Bhaskaran
10. Smt. M. Jully
11. Shri Y. Philipose
12. Smt. M. A. Prasanna
13. Shri R. Viswanathan
14. Shri V. R. Kesavan
15. Smt. K. A. Nazeem
16. Shri N. Venugopalan
17. Shri P. K. Sreedharan
18. Smt. T. K. Susannamma

Jr. Clerk

1. Smt. K. Gracy
2. Shri P. V. Venugopal
3. Smt. P. C. Kamalakshy
4. Smt. N. I. Mary
5. Shri P. K. Thomas
6. Smt. P. K. Thankamma
7. Smt. A. A. Cousallia
8. Shri K. K. Sasi
9. Shri P. Padmanabhan
10. Smt. A. R. Kamalam
11. Smt. T. K. Shyma
12. Smt. T. D. Usheem
13. Smt. V. S. Aleyamma
14. Shri V. S. Ambasuthan
15. Shri A. P. Gopalan
16. Shri S. Radhakrishnan Nair
17. Shri K. B. Sabukuttan
18. Smt. G. N. Sarada
19. Smt. P. A. Sathy
20. Shri P. Krishnakumar
21. Shri K. C. Baby
22. Shri C. K. Sukumaran
23. Shri V. C. Sunil

24. Shri P. P. Varghese
25. Shri S. R. Vijayakumar
26. Smt. Lillykutty George

Jr. Stenographer

1. Shri P. K. Raghu
2. Kum. N. Leena
3. Smt. S. Kamamma
4. Shri K. V. Mathai
5. Kum. Anitha K. John

Telephone Operator-cum-Receptionist

Shri P. Bahuleyan

AUXILIARY PERSONNEL

Senior Carpenter

1. Shri V. S. Augustine
2. Shri Philip Durom

Carpenter

Shri P. Joseph Paul
Shri M. Sankara Panicker

Staff Car Driver

1. Shri P. P. Paulose
2. Shri M. G. Narayanan Nair

Driver

1. Shri R. Rengaswami
2. Shri K. V. Mohanan
3. Shri K. Nakulan
4. Shri G. Jyothi Kumar

Plant Attendant

1. Shri C. C. Gandhi
2. Shri N. C. Bhaskaran
3. Shri K. R. Kesavan

Deck Hand

1. Shri K. K. Lakshmanan
2. Shri T. Balan
3. Shri P. K. Pushpangadan
4. Shri T. K. Dasan

5. Shri T. K. Bava
6. Shri E. K. Chinnappan
7. Shri M. K. Asokan
8. Shri D. G. Rao

Cook

Shri E. R. Krishnan

Plumber

Shri V. A. Sudhakaran

Sr. Gestetner Operator

Shri K. K. Appachan

Jr. Gestetner Operator

Shri K. K. Madhavan

Projector Operator

Shri T. Neelakantan

Animal House Keeper

Shri B. Ganesan

Hindi Translator

Smt. K. Sobha.

SUPPORTING PERSONNEL

SSG-IV

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

SSG-III

1. Shri P. A. Thomas
2. Shri K. Balakrishna Pillai
3. Shri P. J. George
4. Shri A. G. Vasu
5. Shri C. A. Subran
6. Shri T. T. Das
7. Shri M. K. Thevan
8. Shri P. M. Pakeer Mohammed

SSG- II

1. Shri S. Rajan
2. Shri T. V. Manoharan
3. Shri T. T. Velayudhan
4. Shri C. A. Krishnan
5. Shri P. A. Shanmughan
6. Shri K. N. Mukundan
7. Shri P. Gopalakrishnan
8. Shri P. D. George
9. Shri K. B. Bhaskaran
10. Shri K. K. Karthikeyan
11. Shri K. A. Kunjan
12. Shri T. T. Thankappan
13. Shri P. R. Unnikrishna Panicker
14. Shri R. Chellappan
15. Shri A. R. John

SSG - I

1. Shri C. N. Raghavan
2. Shri P. N. Sukumaran Nair
3. Smt. P. L. Rosilly
4. Shri K. N. Velayudhankutty
5. Shri T. G. John
6. Shri O. K. Xavier
7. Shri T. Mathai
8. Shri P. T. Anthappan
9. Shri T. K. Viswanathan
10. Shri P. A. Sivan
11. Smt. C.G. Radhamony
12. Shri P. K. Somasekharan Nair
13. Shri N. Krishnan
14. Shri C. D. Parameswaran
15. Shri V. T. Sadanandan
16. Shri P. P. George
17. Shri A. V. Chandrasekharan
18. Shri P. V. Raju
19. Shri M. N. Sreedharan
20. Shri E. Damodaran
21. Shri M. M. Radhakrishnan
22. Shri K. K. Karthikeyan
23. Shri K. D. Santhosh
24. Smt. C. Ammini
25. Shri K. Dinesh Prabhu
26. Shri P. T. Chandran

27. Shri P. Mohanan
28. Smt. P. Ammalu
29. Smt. V. K. Bhanumathi
30. Shri T. A. Kuttappan
31. Kum. Tessa Francis

VERAVAL RESEARCH CENTRE

SCIENTIFIC PERSONNEL

Principal Scientist

Shri K. K. Solanki

Scientist (SG)

1. Dr. P. G. Viswanathan Nair
2. Shri Rajendra Badonia
3. Shri P. George Mathai
4. Shri R. S. Manohar Doss

Scientist S - 1

Shri Puthra Pravin

TECHNICAL PERSONNEL

Technical Officer (T - 7)

Shri K. J. Francis Xavier

Technician T - 4

1. Shri G. P. Vaghela
2. Shri J. B. Paradwa

Technician T - II - 3

Shri D. K. Ukhabhai

Technician T - I - 3

1. Shri S. R. Jethwa
2. Shri Mohammed Jaffar
3. Shri M. M. Vara
4. Shri T. Gangadharan

Technician T - 2

1. Shri K. U. Sheikh
2. Shri D. R. Aparnati

Technician T - 1

1. Shri A. P. Joshi
2. Shri G. M. Waghela

ADMINISTRATIVE PERSONNEL

Superintendent

Shri P. Vasudevan

Sr. Clerk

Shri Veersingh

Jr. Clerk

1. Shri S. B. Purohit
2. Shri M. M. Damodara
3. Shri T. Viswanathan

Jr. Stenographer

Shri Ramesh Kumar Dhirendrapuri Goswami

AUXILIARY PERSONNEL

Hindi Translator

Shri Shitala Prasad Thiwari

Deck Hand

1. Shri G. B. Tandel
2. Shri H. M. Kotiya
3. Shri G. R. Bhogte
4. Shri Malam Bachu Sidi

Cook

Shri G. L. Tandel

Driver

Shri Sida Hanif Ummer Bhai

SUPPORTING PERSONNEL

SSG - III

Shri P. A. Abdul Rahman

SSG - II

1. Shri K. C. Fofandi

2. Shri K. A. Massani
3. Shri N. N. Goswami

SSG - I

1. Shri Harbhajan
2. Shri B.M.A. Khoker
3. Shri D. P. Parmer
4. Shri D. B. Chudasama
5. Shri K. J. Damer
6. Shri P. N. Chudasama
7. Shri M. V. Pungera
8. Smt. Chandrika C. Tank
9. Smt. Gangaben Niran Chorwadi
10. Shri Dodiya Khoda Viram
11. Shri Druba Charan Bhoi

**KAKINADA
RESEARCH CENTRE**

SCIENTIFIC PERSONNEL

Principal Scientist

Dr. C. C. Panduranga Rao

Scientist (SG)

1. Shri Sibsankar Gupts
2. Shri S. V. S. Rama Rao
3. Shri Immam Khasim Sahib
4. Dr. Subrata Basu
5. Shri J. Sita Rama Rao
6. Shri Rupshankar Chakraborty

Scientist

Shri M. M. Prasad

TECHNICAL PERSONNEL

Technician T - 4

1. Shri A. Veeranjeyulu
2. Shri V. V. Ramakrishnan

Technician T - II - 3

1. Shri K. V. S. S. Kusuma Harnath
2. Shri Srihari Babu

Technician T - I - 3

1. Shri K. V. Baladasan
2. Shri Laxmanadu
3. Shri Veera Raju

Technician T - 2

Shri B. Ramaiah

Technician T - 1

1. Shri K. Prakash Rao
2. Shri N. Venkata Rao
3. Shri Ramesh Singh

ADMINISTRATIVE PERSONNEL

Jr. Stenographer

Smt. Satyanarayanamma

Sr. Clerk

1. Shri Satyanarayana
2. Smt. B. Hemalatha

Jr. Clerk

1. Shri Nirmala Raju
2. Shri Kanakaraju
3. Shri Chinna Rao

AUXILIARY PERSONNEL

Deck Hand

1. Shri K. Sarangadharadu
2. Shri Karri Gangaraju

Cook

Shri G. Subba Rao

Driver

Shri M. Venkateswara Rao

SUPPORTING PERSONNEL

SSG - IV

1. Shri B. Suryaprakash Rao
2. Shri Koppada Gandhi

SSG - III

1. Shri Thirupathi Rao
2. Shri N. Gnanaranjana Rao

SSG - II

1. Shri C. Kamaraju
2. Shri V. Kamaraju
3. Shri K. Kameswara Rao
4. Shri Melladi Perraju
5. Shri O. Heman

SSG - I

1. Shri Vasipilli Yelliah
2. Shri K. Appa Rao
3. Shri B. Sivanandham
4. Shri S. Chakram
5. Shri A. Appa Rao
6. Shri Venkata Ramana
7. Shri G. Bhushanam

BURLA RESEARCH CENTRE

SCIENTIFIC PERSONNEL

Principal Scientist

Shri C. V. N. Rao

Scientist (SG)

1. Shri Anwar Ahmed Khan
2. Shri A. K. Chathopadhyay
3. Shri K. N. Kartha
4. Shri J. K. Bandhopadhyaya
5. Shri Percy Dawson

Technical Personnel

Technician T - II - 3

1. Shri Baikunta Pradhan
2. Shri Binod Kumar Pande
3. Shri Ashok Kumar Panigrahi

Technician T - I - 3

1. Shri Gurudas Ram
2. Shri P. M. Pattanayak

Technician T - 2

1. Shri Radhu Pandey
2. Shri Sathrugan Kumara

Technician T - 1

1. Shri Damodar Rout
2. Shri Ashok Kumar Naik
3. Shri Rabinarayanan Sahoo

ADMINISTRATIVE PERSONNEL

Assistant

Shri Jatindra Kumar Mishra

Sr. Clerk

Shri G. C. Adhikari

Jr. Clerk

1. Shri Udekar Pande
2. Shri Laxminarayan Badi

AUXILIARY PERSONNEL

Driver

Shri Narasingh Pande

SUPPORTING PERSONNEL

SSG - IV

Shri Gajendra Karali

SSG - III

1. Shri Laba Nag
2. Shri K. C. Mahar

SSG - II

1. Shri Ratan Chand
2. Shri Sathrugan Seth
3. Shri K. C. Nayak
4. Shri S. C. Mehar
5. Shri G. C. Mehar

SSG - I

1. Shri Badrinarain Guru
2. Shri Jaisingh Oram
3. Shri Sathyanarayan Mirdha
4. Shri P. K. Bhangaraj

5. Shri Premlal Pande
6. Shri Dibyalochan Pattanayak
7. Shri Godabari Mahanandia
8. Shri Surjananda Dishri
9. Shri Santosh Banchor
10. Shri Korfulla Bag

GOA RESEARCH CENTRE

SCIENTIFIC PERSONNEL

Principal Scientist

Shri G. Narayanappa

Scientist (SG)

Shri T. Joseph Mathai

Scientist

Shri Sayed Abbas

TECHNICAL PERSONNEL

Technician T – 1 – 3

Shri A. B. Varghese

Technician T – 2

1. Shri Koruthu George
2. Shri Aravind S. Kalungatkar

ADMINISTRATIVE PERSONNEL

Sr. Clerk

Shri A. B. Rodrigues

Jr. Clerk

Shri S. K. Dhabarde

AUXILIARY PERSONNEL

Driver

Shri Umesh D. Arosker

SUPPORTING PERSONNEL

SSG – III

Shri D. D. Naik

SSG-II

1. Shri R. D. Padnekar
2. Shri Vadudev G. Kubal
3. Shri Menino Souza
4. Shri P. S. Morajkar
5. Shri C. B. Shirodhkar

SSG-I

1. Shri V. P. Halernekar
2. Shri Gopienkar Chodankar
3. Shri Chandrakanth Kolvalkar

BOMBAY RESEARCH CENTRE

SCIENTIFIC PERSONNEL

Principal Scientist

Dr. M Arul James

Scientist (SG)

1. Shri S. P. Damle
2. Shri. Dinesh Kumar Garg
3. Shri H. K. Beri

TECHNICAL PERSONNEL

Technician T-II-3

1. Smt. S. S. Patnekar
2. Smt. Thriveni

ADMINISTRATIVE PERSONNEL

Assistant

Shri Milind S. Bhatkar

Sr. Clerk

1. Shri Y. W. Mhadgut
2. Smt. Smita K. Shirishkar

AUXILIARY PERSONNEL

Driver

Shri B. B. Pinjari

SUPPORTING STAFF

SSG-III

Shri A. T. Waghmare

SSG-II

1. Shri B. S. Tambe
2. Shri B. M. Ghare

SSG-I

1. Shri Vinod S. Salvi
2. Shri Prakash B. Bait
3. Shri Bandu Nini Patel

CALICUT RESEARCH CENTRE

SCIENTIFIC PERSONNEL

Principal Scientist

Shri Cyriac Mathen

Scientist (SG)

1. Shri T. S. Unnikrishnan Nair (S-3)
2. Shri P. Ravindranathan Nair
3. Shri K. George Joseph

TECHNICAL PERSONNEL

Technician T-4

Shri T. John

Technician T-2

Smt. Tara Karupalli

Technician T-1

Smt. N. K. Sreelekha

ADMINISTRATIVE PERSONNEL

Sr. Clerk

Shri M. Ravindran

Jr. Clerk

Shri K. P. Velayudhan

AUXILIARY PERSONNEL

Driver

Shri T. P. Balakrishnan

SUPPORTING PERSONNEL

SSG-IV

Shri E. Gangadharan Nair

SSG-III

Shri C. M. Gopalan

SSG-I

1. Shri K. K. Lakshmanan
2. Smt. M. V. Valsala

ON DEPUTATION

<i>Sl. No.</i>	<i>Name</i>	<i>Deputation with</i>	<i>Designation</i>
1.	Dr. M. K. Mukundan Scientist S-2	Kerala Agricultural University, Panangad	Professor

APPENDIX - III
BUDGET / EXPENDITURE STATEMENT FOR THE YEAR 1989 - 90

Particulars	NON PLAN			PLAN		
	Budget Estimate	Revised (*) Estimate	Expenditure	Budget Estimate	Revised (*) Estimate	Expenditure
Establishment Charge	1,73,60,000	2,21,04,700	2,21,02,818	1,00,000	20,000	19,942
Travelling Allowance	3,50,000	3,50,000	3,49,989	1,50,000	1,34,900	1,34,841
Other Charges	31,00,000	40,45,300	40,45,300	70,50,000	51,45,100	51,45,188
TOTAL	2,08,10,000	2,65,00,000	2,64,98,107	73,00,000	53,00,000	52,99,971

(*) Figures - after Reappropriation

भूमिका

इस वर्ष के दौरान लिए गए विभिन्न अनुसंधान परियोजनाओं और विस्तार कार्यक्रमों में संस्थान स्थायी प्रगति बनायी रखी है। कुछ प्रमुख उपलब्धियों का संक्षिप्त विवरण नीचे दिया गया है।

लक्षदीप के लिए 7.6 एम ओ ए एल फाइबर गिलास अपिन नाव की अभिकल्पना ड्यौर को अन्तिम रूप दिया गया।

15.25 एम की एक काष्ठीय यान जिसकी संरचना संस्थान में हो रही है, का नौतल लगाया गया।

मा त के सं विनिर्देशों के अनुसार कलकत्ता के एक निजी संघटन ने संयुक्त तार रस्सी के वाणिज्योत्पादक व विपणन की जिम्मेदारी ली।

जालीकरण सूतों के संख्यात्मक वर्गीकरण विकसित किया और इसके आधार पर नाइलोन डोरों के व्यवस्थित स्थिति को तालिकाबद्ध की।

नाइलोन जालों के समान पोली प्रोपिलीन क्लोम जाल भी तुलनात्मक रूप में प्रभावकारी दिखाई पड़ी।

भरे हुए स्क्रिबड की तैयारी की तरीके को मानकीकृत किया।

मछली कीमा से सुरमी उत्पादन का अनुकूलतम शर्तों की तैयारी की।

बहुत कम लसीलापन के कैटोसन के उत्पादन के लिए तरीका को विकसित किया।

नालीदार तन्तु बोर्ड उपयोग प्रद संवेष्टन कागज कैटोसन को एक प्रमुख चपेदार निर्माण प्रक्रिया में निर्धारित किया गया है।

मा त. के सं. के वैज्ञानिकों की तकनीकी सहायता से "मत्स्यफेड" द्वारा कोलम जिले की नोंडकरा में 10 की. ग्राम परिसरित उत्पाद बेच उत्पादन क्षमता से युक्त एक कैटोसन संयंत्र की स्थापना की गयी। संयंत्र का औपचारिक उद्घाटन माननीय मात्स्यकी राज्य मंत्री श्री. टी. के. रामकृष्णन द्वारा 30-3-1989 को किया गया था।

तंत्रिका शल्यचिकित्सा दन्त्य शल्य चिकित्सा में, कैटोसेन फिलम और कैटोसन से संसेचित जाली एक अनुयोज्य हेमोस्टाटिक अभिकारक दिखाई पडा।

यंत्र से छीले गए झींगी की अपेक्षा हस्त छीलित झींगी के सभी गुण श्रेष्ठ दिखायी पडा।

वाणिज्य रूप में शुष्क संसाधित मछली के शोधन की तराका को विकसित किया ।

भ्रूंग या फूँकने वाली माखियाँ दोनों के कीडाणु बाधा के विरुद्ध हाइड्रोकारपस तेल प्रभावकारी है जब की सरसों का तेल और सूर्य मुखी का तेल फूँकनेवाले, माखियों, के विरुद्ध प्रभावकारी है ।

ड्यूणा से अच्छे गुण के संसाधित उत्पादों को तैयार किया ।

समुद्री खाधों से पहली बार सालमोनेला ओसलो ओठ एस भरबाना की वियुक्ति की गयी ।

अनमीकृत सूर्य शुष्कित पूरी मछली की अपेक्षा हिस्टामिन अंश नमीकृत सूर्य शुष्कित पूर्ण सफेद बेट में कम होता है ।

मछली और मछली उत्पादों से लिस्टीरिया को प्राप्त करने के लिए लिस्टीरिया सेलवटीक अगार (ओक्सफोर्ड रूपायन) (एल. ए) और पोलीमिक्सिन लिथियम बलारोइड सेप्टासिडिन असुलिन मानिटोल अगार (पालकम) प्रभावकारी दिखाई पड़े ।

द्विबांदिन अचारित व संसाधित मछली उत्पादों के जीवाणुविज्ञानीय प्रतिचयन के लिए एक माध्यम का रूपायन किया जो संवर्द्धन प्लेटों में जीवाणु को रोकेगा ।

विकसित पॉलीथीन और पोलीस्टेरिन दोनों के लिए सोधित सामग्री के रूप में प्रयुक्त एक श्रेष्ठ एचजी है पोली युर-थेन ।

पारंपरिक शोल पत्तों से लाइन किए गए बॉस टोकरी की अपेक्षा पॉलीथीन लाइन किए गये बॉस टोकरी की 20% थेरमल प्रभावकारिता है ।

मात्स्यकी उत्पादों के हिमीकरण के लिए धोल नाइट्रजन फुहार की अभिकल्पना की पुर्ति हुई ।

कटलेट गढ़न यंत्र को विकसित किया और परीक्षणों को विजयप्रद रूप में संचालित किया ।

पारंपरिक प्रक्रिया से तिगुनी तेजी सयुक्त सभी मौसम में प्रयुक्त करने वाले एक दुगुना ग्लास प्लेट सूखे शुष्कक को विकसित किया ।

वाणिज्य रूप में प्रमुख विविध झींगियों के उत्पन्न दर को आकलित किया और उनके आकार और क्षेत्रीय ढंग के विभिन्नताओं को नोट किया ।

तमिलनाडु के कन्याकुमारी जिल्ला को विशेष उल्लेख देकर ऑकोवियला के पकडाव, संसाधन, विपणन में निहित समस्याओं का सर्वेक्षण संचालित किया । कृषि - वातावरणीय अनुसंधान के लिए देरशी यंत्रीकरण पर संस्थान में जून 1989 में एक प्रौद्योगिकीय संस्थान संचालित किया ।

शुष्क मछली कवक विज्ञान और समुद्री खाधों से लिस्टीरिया मोनोसैलाजनों के वियुक्तीकरण और पहचान पर प्राकृतिक स्त्रोत संस्थान, लंडन के सहयोग में प्रशिक्षण पाठ्यक्रम संचालित किया ।

ह/-

एम. आर. नायर

निदेशक

मुख्य उपलब्धियाँ

मत्स्यन तकनॉलजी डिवीज़न

संश्लेष वैज्ञानिक / तकनीशयन

पी. ए. पणिकर, वी. सी. जोर्ज, के. रवीन्द्रन, के. ए. सदानंदन, एन. उष्णकृष्णन नायर, ए. जी. गोपालकृष्णा पिल्लै, के. के. कुन्जीप्पालु, बी. मीनाकुमारी, एन. सुब्रह्मण्य पिल्लै, एम. आर. भूपेन्द्रनाथ, वी. विजयन, एम. डी. वर्गीस, एम. नासर, ए. सी. कुट्टणपन लीला एड्विन, साली एन. थॉमस, एन. ए. जोर्ज, टी. एम. शिवन, वर्गीस पोल, के. राघालक्ष्मी, एम. वी. बैजू ।

लक्षद्वीप के लिए 7.6 एम. ओ. ए. एल के फाइबर गिलास खुला नाव का सामान्य प्रबन्ध विनिर्देशन ओर रूप रेखा की पूर्ति की । 11 से 28 एम एम रेंज व्यास 18 से 187 के एन टूटन शक्ति के लगभग 190 संयुक्त तार रस्सि विनिर्देशनों को 0.50 से 1.00 एम एम डायामीटर की विभिन्न तनन शक्ति के इस्पात रस्सियाँ को विकसित किया । इन में से रेश कोड और इस्पात कोड प्रत्येक से 18 को और 140 और 160 तनन निर्देश से युक्त इस्पात रस्सी को मानव चुन लिया । चुन लिए गए तंतु संरचानायें हैं 6 (8 एफ), 6 (12 एफ), 6 (9/6/एफ) और 6 (15/9/एफ) मात्स्यकी तकनॉलजी केन्द्रीय संस्थान के

विनिर्देशनों के अनुसार 16 एम एम संयुक्त तार रस्सी के वाणिज्योत्पादन और विपण मेकेर्स उपा मार्टिन, कलकत्ता द्वारा लिया गया ।

इस वर्गीकरण के अनुसार नाइलॉन डोरों, एच डी पी इ युग्मित डोरों, और पी पी डोरों के क्रमबद्ध स्थिति का निर्धारण किया गया ।

कठिन स्थानीय प्रवाह में तलमज्जी टारों के लिए पी वी सी लेपित नाइलॉन के नम्य तिरौंदा एक अनुयोज्य हेड लाइन उथापन युक्ति अनुयोज्य दिखाई पडा ।

किशोरों को बचाने में 30 एम जाली के चत्वर जाली कोड अधिक प्रभावकारी दिखाई पडा और इसलिए इसको एक संरक्षण मापन की गणना के लिए योग्य है ।

एक 11 एच पी बहिर्वोड इजन में फिट किये गए 8.4 एम डोंगी से बने गए 56 × 25 सी एम विस्तृत आयतीय उद नावों के साथ 12.77 एम के दो सीवन टार जालों को संचालित किया । सदृश आमदनी वृद्धि के साथ (करीब 37%) झींगी उत्पाद में एक 31.5% वृद्धि दिखाई पडा

एम वी सरस्वती से नये रूप में अभि-कल्पित 33.7 एम आर एम टी 6 इ और 36.4 एम आर एम टी 8 पी जालों का संचालन किया, यूनिट यत्न के पकडाब क्रमश 825 की ग्रा और 645 की ग्रा थे ।

मत्स्य संसाधन डिवीज़न

-20 सी से -30 सी तक संग्रहण तापमान को कम करने पर तेल सारडीन की हिमीकृत शेल्फ जीविका को दृगुना और लेकिन वांगडा की डेढ हो जाते थे ।

भरे हुए स्किवड की तैयारी की तरीका को मानकीकृत किया ।

“चावल में मछली” — एक खदिए और पौष्टिक उत्पन्न और मछली संवेष्टन के लिए संशोधित कटी माध्यम-भभका भट्टी संसाधन कार्यक्रम के अंतर्गत दो आकर्षक उत्पन्नो को विकसित किया ।

मछली के सोलहवीं जातियों से कीमा तैयार की । इन जातियों के कीमा उत्पादन और अवशिष्ट का परिमाण और रासायनिक संयोग आदि को निर्धारित किया । कीमा का उत्पादन 30 से 50% तक परिवर्तित थे । गंभीर समुद्री जल मछली पेन्टाप्रियण से अधिकतम और कैट मछली से लघुतम ।

शीतित जल से मछली कीमा की धुलाई रंग को सुधारता है और उत्पन्न के वसा अंश को कम करता है ।

कीमा से सुरमी उत्पादन के अनुकूलतम व्यवस्थाओं की तैयारी की ।

गंभीर समुद्री मछलियों जैसे पेन्टाप्रियण और लपिडोड्रिगला से तैयारित मछली खाद्य ने अच्छे वृद्धि सहायक गुणों को दिखाया है जिसके द्वारा मृग प्रोटीन का अच्छे स्रोत के साबित करता है । पकाने के पहले

कच्चे मांस को नमक में उपचारित करके तद्वारा उत्पादन की 25-30% वृद्धि करते हुए सुदृढ़ संरचना के कटलेट को तैयार किया जा सकता है ।

नालीदार तन्तु बोर्ड निर्माण प्रक्रिया में कैटोसन एक चपेदार उपयोगप्रद संवेष्टन कागज़ निकला ।

बॉयलर चूज़ों के खाद्य के रूप में कैटीन आहार, वसा और कौलस्ट्रोल स्तर को कम, दिखाया गया ।

गंभीर समुद्री झींगों से तैयार किए गए प्रोटीन पाउडर जोबला झींगों की तुलना में श्रेष्ठ हैं ।

संपुटन के लिए कैटोसन से तैयारित सूक्ष्म संपुटित मछली खाद्य मछली घर की मछलियों के लिए स्वीकार्य निकला ।

वहुत निम्न विस्कासिता कैटोसन उत्पादन की तरीका को विकसित किया ।

तंत्रिका शल्यचिकित्सा, दन्त्य शल्य चिकित्सा में कैटोसन फिल्म और कैटोसन से संसेचित जाली एक अनुयोज्य हेमोस्टाटिक अभिकारक दिखाई पडा ।

हिमीकृत स्किवड ओर कतला मछली के रंग व गठन के सुधार के लिए एक सरल तकनीकी को निष्पादित किया ।

सिकवड और कतला मछली के इन्द्रियग्राही गुणों और हाइपोजैन्थिन स्तर के बीच अच्छे सहसम्बन्ध दिखाई पडा ।

समुद्री खाद्यों से पहली बार सालमोनेल्ला ओस्टो और एस अरबाना की वियुक्ती की गयी ।

झींगी में कौलरा को संरोपित करके करीब 5 महीनों तक 23 सी में सुरक्षित रखा जा सकता है ।

कोष्ठ तापमान की तुलना में हिमशीतित तापमान में समुद्री जल में निलंबित वी. कौलरा को अधिक जीवतक्षमता है ।

10 हफ्ते तक परिवेशी तापमान में 90-100 एल डी/बीएस/नाइलॉन/बीए/प्रिमाकोर में संवेष्टित रखने पर भी शुष्कित थेली झींगों को अच्छी तरह संग्रहित किया जा सकता है ।

संवेष्टन हिमशीतित कटलेटों को शेल्फ जीविका को गणनात्मक रूप में सुधारा और एच एम एफ डी पी ई, शेल्फ जीविका को विकसित करने में एस एल डी पी ई और नाइलॉन पॉलीथीन संवेष्टन सामग्रियों के, समान प्रभाव है । वायु में 12 दिनों तक 22 के गए गुण नमूनों की तुलना में 0.4 सी में रखे गये । 1:1 और 1:4 अनुपात में 0 और 0 वातावरण में 12 यू साधारण पालीस्टर, 230 गेज पालीथीन के 100 ग्राम टुकड़ों में संवेष्टित कतला कतला के मछली फिल्टों क्रमशः 21 और 29 दिनांक तक स्वीकार्य अवस्था में रखा जा सकता है ।

वर्तमान हिमीकृत मात्स्यकी उत्पादों के लिए प्रयुक्त पेपर, कोट पर्विसों के स्थान

पर पालीस्टर ट्रेसिंग कागज़ अच्छी एवजी दिखाई पडी ।

12 यू धातुमिश्रित पालीस्टर 200 गेज निम्न सांद्रता के पोलिथीन और 12/यू साधारण पालीस्टर/200 गेज एल डी पी ई और 85/यू नाइलोन/सरिलिन सहः निस्त्रावित से लेपित शुष्क मछली आचार कावेला कावेला को अच्छी अवस्था में एक वर्ष तक रखा जा सकता है । काकिनडा, वेरावल और कोचिन के हिमशीत झींगी व्यवस्था एल डी पी ई फिल्मों और एम एच डी पी ई फिल्मों के कुल प्रवास अवशिष्ट निर्धारित सीमा के अंतर्गत दिखाई पडा । विकसित पोलिथीन या पोलिस्टेरिन के बदले एक श्रेष्ठ एवजी है पोलियुरेथेन ।

जैव रसायन, पोषण, सूक्ष्मजीव विज्ञान डिवीज़न

ड्यूणा के लाल मांस के उच्चतम विलयन ब्रोमालिन द्वारा 40 सी तापमान में पी एच 5.5 में संपन्न होता है ।

निर्यक्षित आहार (1.94 अलनिन/प्रोलीन अनुपात के मछली प्रोटीन से खिलाए गए मूषिकों ने 19 और 38 के समायोजित अलनिन/प्रोलीन अनुपात मछली प्रोटीन परीक्षण आहार खिलाए गए मूषिकों की अपेक्षा कम सीरम कोलस्ट्रॉल दिखाया ।

अनमीकृत सूर्य शुष्कित मछली की अक्षापे अनमीकृत सूर्य शुष्कित पूर्ण सफेद बेट में हिस्टामीन अंश कम होता है ।

आधा तट के समुद्री मछलियों की अपेक्षा डोलेखरम और काक्कर के पास की गोदावरी नदी से पकड़ी गयी ताजे मछलियों में संतुलन से अधिकविषैली धातु संचित है। यह अन्य मछलियों की अपेक्षा स्निपनी ईलों में अधिक दिखाई पड़ता है।

रिबन मछली विसेरा को साइलों में रखने के लिए भावश्यक उच्चतम पीएच 4.3 दिखाई पडा और दो प्रोटीनेपसों के वियुक्ती और शुद्धीकरण किया गया यानी अम्ल और क्षारीय प्रोटीनेस। इसमें क्षारीय प्रोटीनेस का बिगाड शोध संभव था। क्षारीय प्रोटीनेस डिप्सिन को प्रतिबिंबित करते हैं।

समुद्री और ताजे जल मछलियों से वियुक्त किए गए तट संवर्द्धनों में पाँच संवर्द्धन लैपालिटिक क्रियात्मकता को दिखाते हैं। बाणीज्य स्रोतों के रूप में लैपेस की जीवनक्षमता आगे बढ़ती जा रही हैं।

तुलना किए गए पाँच विभिन्न माध्यम में मछली, मछली उत्पत्तों से लिस्टीरिया प्राप्त करने के लिए लिस्टीरिया सेलकटीव अगर (आक्सफोडे रूपायन (एल ए) और पोलिमिकिसन आकरी प्लाविन लिथियम क्लोराइड सेप्टासिजि असुलिन मानिटोल अगर (पालकम) तुलनात्मक रूप में श्रेष्ठ दिखाई पडा। स्थानीय बाजारों की चीजे और सीपी मछलियों से लिस्टीरिया इनोकवा, एल सीलिगरी और एल. इवानोवी को वियुक्त किया गया।

अचारित / संसाधित / डिब्बाबन्धित मात्स्यकी उत्पत्तों के सूक्ष्म जीवविज्ञानीय प्रतिचयन के दौरान जीवाणु का उमडाव माध्यम संवर्द्धन में मण्डल

फैलाने का कारण बन जाता है जिसने बासिलस सबटेलिस बी काभगुलन्स बी आलवी और बी सरकुलन्स आदि दिखाई पड़ता है।

डिब्बाबन्धित अचारित और संसाधित मात्स्योत्पत्तों के जीवाणुविज्ञानीय प्रतिचयन के लिए संवर्द्धन प्लेटों में जीवाणु के उमडाव को रोकने के लिए एक माध्यम का रूपायन किया गया।

अभियांत्रिकी और यंत्रीकरण डिवाइज

मात्स्यकी उत्पत्तों के हिमशीतन केलिये नाइट्रोजन धोल फुहार प्रणाली की अभिकल्पना की गयी।

कटलेट गढ़न यंत्र को विकसित किया और परीक्षणों को विजयप्रद रूप में संचालित किया।

पारंपरिक सूर्यशुष्कन से तिगुनी तेजी के सभी मौसम में प्रयुक्त करने केलिये एक दुगुना ग्लास प्लेट सूर्य शुष्कक को विकसित किया।

संशोधित कपलन प्रॉपलर टॉंटी सयोग में औसत इंधन उपभोग 6 लिटर / घण्टे दिखाई पडा जो अग्र भाग वृत्ताकार साधारण प्रॉपलर टॉंटी सयोग की अपेक्षा 25% कम है।

पर्यावरणीय ऑकडा अर्जन प्रणाली क्षेत्रीय विनिर्देशन के लिए एक वाह्य माध्यम संरचना की।

सूचना प्रसारण व सांख्यिकी डिवीज़न

वाणीज्य रूप में प्रमुख विविध झींगों के उत्पन्न दर को आकलित किया और उनके आकार और क्षेत्रीय ढंग के विभिन्नताओं को नोट किया। सिकवड और कतला मछली के उत्पादन आकलन को भी तैयार किया गया। कोचिन मात्स्यकी हारबर में अवतारित मछलियों के मूल्य, मौसमिक उतर-चढ़ाव के आकार पर है संसाधन यूनिटों पर पहले जानेवाली मछलियों की अपेक्षा उपभोक्त बजारों में सीधे जानेवाली मछलियों में मूल्य परिवर्तन परीमाण मात्रा में सुस्पष्ट है। खरीदारों को आकर्षित करने के लिए अवतारित मात्रा बहुत कम होने पर भी साधारणतः मछली को कम दाम पर बिकता है। यह मूल्य और अवतारित मात्रा के बीच उल्टे अन्योन्य संबंध के सामान्य रचना के विरुद्ध है।

उत्पत्तों के वाणीज्यीकरण के लिए विकसित मात्स्यकी उत्पत्तों के विपणन अनुसंधान को तीव्र किया जाय।

एक दीर्घ अवधी परिप्रेक्ष्य के द्विबाबन्धन की अपेक्षा भ्रमक भट्टी संसाधन अधिक लाभदायक दिखाई पडा संसाधित मछली और मात्स्यकी उत्पत्तों के लिए यह तकनोलजी को अभिग्रहित किया जाय।

गुण नियंत्रण पर प्रशिक्षण कार्यक्रम के संघात का अध्ययन दिखाया कि इस में 98% संदर्भों में, प्रशिक्षित लोग गुणवान उत्पत्तों के उत्पादन में उपयोगप्रद निकले।

केरल के छिल्का रोडों में संसाधित झींगों के पकड़ाव, के लिए गुण मापनों के अभिग्रहण पर बहुत कम निकला।

माध्यमिक झोतों की अपेक्षा मछुवारों के बीच संस्थानीय और गैर संस्थानीय झोतों का संप्रेषण अधिक श्रेष्ठ निकल पडा।

वेरावल अनुसंधान केन्द्र

नाइलोन क्लोम जालों के समान पोली-प्रोपिलीन क्लोम जाल भी समान रूप में प्रभावकारी दिखाई पडा।

वजनदार लगाम के साथ एक हल्का लगाम को बदले में रखे गये 25 एम उन्नत खुलाव और 32 एम दीर्घ जाल तलमज्जी ट्राँलें-गियरों की प्रभावकारिता में विशेष सुधार को नहीं देता है।

मछली के लिपिड अंश ओर मौसम के अनुसार आक्सीकरण के सीधे पोम्फ्रेट के लिपिडों की अतिसंवेदनशीलता भिन्न होती है। मछली में लिपिड अंश जितना कम होता है पेरोकसाइडों के रूपायन दर में उतनी वृद्धि होती है।

हिमशीतिकरण के पहले फिलेटों के यूरिया के स्तर को कम करने पर हिमशीतित संग्रहित रे फिलेटों की स्वीकार्यता के गणनात्मक रूप में वृद्धि होती है।

यूरिया के दूरीकरण से अर्धशुष्कित और शुष्कित रे फिलेटों के गुण का सुधार भी किया जा सकता है।

हस्त छीलित झींगी के गुणों की अपेक्षा यंत्र से छीले गए झींगी की सभी गुण कम दिखाई पडा। लेकिन उत्पन्न में अच्छे सूक्ष्म जीव विज्ञानीय गुण होता है। यंत्र छीलित झींगी के बाहरी प्रकृति, इन्द्रियग्राही गुण निम्न होते हैं और कम जल विलेय घटक और उन्नत अनुपात के निम्न ग्रेड सामग्री होते हैं।

नमीकृत और शुष्कित डोमा के ब्राउन अपवर्णन, नमीकरण के लिए प्रयुक्त लवण जल के सांद्रण के साथ उलटा संबन्ध के कारण है।

ईल फिलेटों के धूमीकरण हिमीकृत फिलेटों की शेल्फ जीविका की कोई विशेष स्तर की वृद्धि नहीं करती है।

कम दाम के मछली से दीर्घ शेल्फ जीविका के कीमा से बने शुष्कित उत्पन्नों की तैयारी की गयी।

काकिनडा अनुसंधान केन्द्र

वर्ष के दौरान संचालित मत्स्यन संचालन में रस्सी टूल का लगातार अच्छा निष्पादन हुआ।

उन्नत खुलाव टूल की नयी अभिकल्पना की तैयारी की गयी। गियर की संरचना हुई संचालित क्षेत्रीय परीक्षणों ने प्रोत्साहनजनक परिणामों को दिया।

52-57% आद्रता अंश और 2-3 महीनों तक परिवेशी तापमान में संग्रहण

के लिए वशवर्ती एक मध्यवर्ती आद्रता मछली उत्पन्न को विकसित किया।

सुधरे स्वभाव से युक्त शुष्क मछली केक को विकसित किया।

नमक को प्रयुक्त करके पकाये और कीमायित किये गये मांस से 8 महीनों की शेल्फ जीविका के गठित मछलि कणिकाओं को विकसित किया। उपादानों के मिश्रण और दबाव की रीति अंतिम उत्पन्न के बनावट पर असर डालता है।

नमकीकृत, दबाव किए गए और वायु रिक्त किए गए संवेष्टित सेनस उपवेशी तापमान में लगभग चार महीनों तक स्वीकार्य दिखाई पडा।

पेल्लोना, सिल्वर बेल्ली, सियानिड और छोटे शुष्क झींगों से सुगन्ध द्रव्यों को समावेशित करके, पकाने के लिए सरल उत्पन्नों को तैयारित किया।

बुरला अनुसंधान केन्द्र

नाइलोन मल्टीफिल्मेन्ट और एच डी पी ई डोरों में से संश्लिष्ट डोरों की अपेक्षा नाइलोन मोनोफिल्मेन्ट एच डी पी ई डोर पाली प्रापिलीन डोरें क्लोम जालों को पकडाव क्षमता की श्रेष्ठता को बनाए रखें।

शीतकाल में 10-15 एम रेंज की गहराई में मध्यजलीय, टार्लिंग संचालित करने

पर आर कोटिये, मिस्टस स्पी, डब्ल्यू अहू एस सिलॉनडिया आदि की प्राप्ति होती है जहाँ आर किसिया 15-28 एम गहराई में खूब दिखाई पडती है ।

शुष्क नमीकृत ताजे मछली एम-सीनगाला को कम सांद्रण (150 गेज) पोलीथीन भट्टी में उपवेशी तापमान में आठ और आधे महीनों तक अच्छी तरह संग्रहित रखा जा सकता है । पारंपरिक साल पत्तों से लाइन किए गए बॉस की उपेक्षा पोलीथीन लाइन किए गये बॉस टोकियों की थेरमल प्रभावकारिता 20% है ।

बंबई अनुसंधान केन्द्र

मुल्लिडे कुटुम्ब की चक्की और बक्की से उत्पन्न मांस 42% और 45% दिखाई पडा ।

सेरानिडे कुटुम्ब से संबन्ध रखनेवाली एपिनेफिलस डयकन्तस स्पी. को चौदह दिनों तक (1:1 अनुपात में) स्वीकार्य अवस्था में बर्फ संग्रहित रखा जा सकता है । 18° सी से 20° सी में संग्रहित हिमीकृत मछली इन्द्रियग्राही विशेषताओं के कारण 10 हफ्ते के संग्रहण के बाद भी अच्छी अवस्था में दिखाई पडा । प्रत्यक्ष सरचना और आवश्यक अमिनो अम्ल अंश ने

सूचित किया कि इन मछलियों उपभोग के लिए पौष्टिक रूप में अच्छा है ।

कालिकट अनुसंधान केन्द्र

ताजे मछलियों के भागों को तत्काल पकाने के लिए कोष्ठ तापमान में 1-4 दिनों तक सुरक्षित रखने की प्रक्रिया विकसित की ।

संसाधित मछली के लिए संरक्षणात्मक उपचार को डुबाव द्वारा एक समान और अधिक प्रभावकारी प्रयोग द्वारा सुसाध्य बनाकर बदल दिया ।

वाणीज्य रूप में शुष्कित संसाधित मछली को सुसंस्कृत बनाने की तरीका विकसित की ।

शुष्क संसाधित मछली पर कीडाणु बाधा को रोकने के लिए टनल शुष्कक और लघु सूर्य टेन्ट शुष्कक दोनों में ताप उपचार की उपयुक्तता को विकसित किया ।

भृग या फूँकनेवाली मक्खियाँ दोनों की कीडाणुबाधा के लिए हाइटाकार्पस तेल प्रभावकारी है जब कि सरसों और सुरजमुखी का तेल विशेषरूप में फूँकनेवाली मक्खियों को रोकने के लिए प्रभावकारी है ।

पोलीथीन शीट द्वारा आन्तरिक लाइनिंग किए गए पारंपरिक बॉस टोकरी या पनई ताड़ पत्ते की टोकरी में संवेष्टित परिरक्षकों द्वारा उपचारित शुष्क मछली को पात्र के बाहरी भाग में पाइटेथ्रम से उपचार करके या उसके बिना अच्छी अवस्था में दीर्घ कालावधि तक रखा जा सकता है।

धूम संसाधन द्वारा ट्यूना से श्रेष्ठ सुवास और अन्य इन्द्रियाग्रही गुणों से युक्त आकर्षक उत्पन्न को तैयार किया।

गोवा अनुसंधान केन्द्र

संबन्ध वैज्ञानिक

जी नारायणप्पा, टी जॉसफ मथार्ड,
एम सय्यद अब्बास

मुख्य उपलब्धियाँ

प्लाटफाम टूल ने भीतरी और कोलम मछलियों के अवतारण क्षमता को लगातार दिखाया।

लघुतम मापदण्ड के मध्यजलीय टूल के लिए एक 1:5 स्कॉप अनुपात प्रभावकारी दिखायी पडा

संकलन सहयोग : श्रीमती जेसी जोसफ सी.
,, जी. एन. शारदा
,, शोभा के.