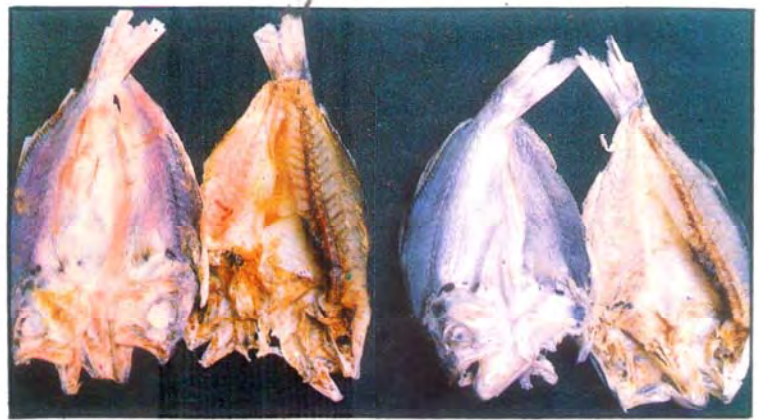




1988 ANNUAL REPORT



Central Institute of Fisheries Technology

(Indian Council of Agricultural Research)

ANNUAL REPORT

1988



Central Institute of Fisheries Technology

(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)

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INTRODUCTION

The Institute continued to record steady progress in the implementation of its varied programmes relating to harvest and post harvest technology of fish. Of the thirty two research projects in hand, twenty six are ongoing projects while six are new projects taken up during the year. Significant findings are given below.

A heavy duty antifouling paint with a fouling free life of two years was developed.

The CIFT developed combination wire rope for rigging bottom trawls for operation from bigger size vessels was commercialised.

Square mesh cod end was found effective as a conservation measure in trawls.

Escapement of fishes was observed only from the last belly region of a trawl net.

Trawl nets fitted with tapering jibs continued to record better catch of shrimps than nets with straight jib.

Encircling mackerel gill nets made of twine 210D/1/2 with 50 mm mesh size were found most effective.

Fresh water fish mrigal canned in natural style rated better than other types of packs.

Beheading and removal of vertebrae significantly retarded yellow discoloration in semi dried dhoma.

Calcium propionate was found equally effective as sodium propionate in preventing 'red' in properly dried and cured fish.

Pyrethrum synergised with piperonyl butoxide was found to be a good insect repellent for cured fish.

Pickle cured and Mediterranean type cured oil sardine kept well for over a year in glazed porcelain/glass jars.

Both HDPE and LDPE were found equally suitable for packing dry fish.

Studies on haemostatic effects of chitosan films for haemodialysis have given encouraging results.

Low cost fresh water fishes could be utilised for manufacture of fish wafers.

Polypropylene tape was found to be a good substitute for conventional strapping materials for unwaxed corrugated fibreboard cartons.

An effective method for predicting losses from prawn meat was standardised.

Method was standardised for estimating indole in prawn meat.

Surgical sutures prepared from fish gut were found to compare well with commercially marketed sutures in their physical properties.

A 'Freezer Temperature Scanner' for studies on temperature penetration/retention properties of fish blocks was developed as also a 'Fishing Log' for remote measurement of important parameters relevant to small boats.

An experimental plant was designed and constructed for production of biogas by anaerobic fermentation of water hyacinth.

Sodium hypochlorite with at least 7% available chlorine has been recommended for process water chlorination.

The idle capacities of fish canning and fish meal plants were estimated.

The economic survey conducted by the Institute has shown that the net additional profit from motorisation of indigenous craft is only marginal.

Steady progress was maintained in carrying out the extension activities including conduct of training and demonstration programmes, conduct of film shows and exhibitions, reply to technical queries and preparation of project reports and extension literature.

Dissemination of technical know-how on a consultancy basis was also initiated during the year under report.

(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 of fishing and fish processing. Research Centres located at Veraval (Gujarat), Kakinada (Andhra Pradesh), Burla (Orissa), Bombay (Maharashtra), Panaji (Goa) and Calicut (Kerala) cater to the specific regional needs.

ORGANISATIONAL SET-UP

The Institute is headed by the Director who is in overall charge of the working of the various Research divisions, Research Centres, general administration and finance.

Research work is carried out by the following Research divisions:-

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

The Administration Division deals with recruitment, service policy, discipline, staff welfare, land and building, procurement of stores, budget expenditure, settlement of claims etc. The Audit and Accounts Section looks after the financial accounting aspects as also internal audit of the Institute.

The Research Centres continued to function in rented buildings. Addresses of the Research Centres are given as APPENDIX-I. List of staff under Scientific, Technical, Administrative, Auxiliary and Supporting categories as on 31-12-1988 is given as APPENDIX-II.

RESEARCH ACCOMPLISHMENTS

FISHING TECHNOLOGY DIVISION

SCIENTISTS / TECHNICIANS ASSOCIATED

K. Ravindran, P. A. Panicker, V. C. George, 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, A. C. Kutappan, Leela Edwin, Saly N. Thomas, K. Radhalekshmy, N. A. George, T. M. Sivan, Varghese Paul.

CHIEF FINDINGS

Design of an aluminium craft for sheltered waters was completed.

Wooden panels treated with water borne copper chrome arsenic composition followed by oil bound creosote and exposed to marine, atmospheric and soil conditions revealed excellent bio-resistance to marine borers and fungi. Physical strength measurements also showed better retention of residual strength in combination treated panels.

A heavy duty antifouling paint with a fouling free life of about 2 years was developed.

The CIFT developed combination wire rope (CWR) was commercialised through M/s Usha Martin (P) Ltd, Calcutta. Test results indicate the rope manufactured by them is comparable to the specifications laid down by the Institute. Standard specifications of different combination wire ropes were also worked out.

Square mesh cod end was found to be effective as a conservation measure for trawls.

Hooks Nos. 7, 8 and 9 were found effective for hand line fishing for *Polynemus*.

RESEARCH PROJECTS HANDLED

1. Development of inshore water aluminium fishing craft
2. Development of dual treatment technology for fishing
3. Studies on the construction and maintenance of medium and large class of fishing vessels in wood and steel for the Exclusive Economic Zone

4. Improvements in the hull maintenance of fishing vessels through heavy duty antifouling coatings
5. Studies on gear materials
6. Studies on demersal trawl
7. Studies on mid water trawl
8. Studies on lines and gillnets, squid fishing gear and its operation and studies on trawling from motorized traditional fishing crafts along the inshore area

REPORT OF WORK DONE

Aluminium fishing craft

Dimensions were finalised for the all aluminium fishing craft for inshore waters of LOA, 4.6m, breadth 1.7m and depth 0.57m. A profile view, half breadth plan and body plan were prepared and based on mechanical strength and welding characteristics, scantlings were also finalised. Trial welding has shown the suitability of alloys D 54 S | 5083, 65 S | 6061 and M. 57 S | 5251 without deleterious effect. A cathodic protection system using ternary aluminium alloy (CIFTAL) has also been developed to fight galvanic corrosion in aluminium craft.

Bioresistance properties of fishing craft material

Studies to assess the bioresistance of timber panels such as mango (*Mangifera indica*), anjili (*Artocarpus hirsuta*), venteak (*Lagerstroemia lanceolata*) and 'Aranjili' (*Antiaris toxicaria*) treated with arsenic copper chrome composition and creosote separately and in combination at different

concentrations when subject to marine, atmospheric and soil conditions were continued. The condition of the treated timbers was evaluated by their resistance to marine borers and fungi. The studies have brought to light the excellent bioresistance properties of combination treated panels when compared to panels treated with creosote and arsenic copper chrome composition separately. A better retention of residual strength was observed in the combination treated panels even after an exposure for 571 days when compared to the non treated controls.

Development of fishing gear for operation on board FORV 'Sagar Sampada'

Experimental fishing operations were carried out of the CIFT - HSDT - III high speed demersal trawl, CIFT bobbin trawl and midwater trawl from FORV 'Sagar Sampada' for their performance evaluation. The pre-commercial feasibility studies of the bobbin trawl and the multi-purpose hybrid trawl were also continued.

Midwater trawls & pelagic trawls

A 23.4m. RMT-6E midwater trawl was designed, fabricated and operated from the IFP vessel 'Klaus Sunnana' and performance evaluation done. A 24m. midwater trawl was also operated from a departmental vessel and the catch per unit effort (CPUE) estimated to be 66 kg. with mackerel catch predominating.

Designs were completed of 18.5m. and 34m. semi pelagic trawls and a 25.2m. rope trawl.

Fishing hooks / floats

Circular hooks were found efficient for perch hand line fishery and few

numbers distributed among fishermen for popularisation at Colachel.

Trials were initiated with canvas flexible floats in place of hard floats for rigging demersal trawls operated in the inshore areas.

Gear mesh studies

Studies were continued on the comparative efficiency of nets rigged with conventional cod end and those with square mesh cod ends and the escapement of juveniles analysed. The studies indicate efficiency of the square mesh cod end as a measure for conservation of species.

Gill net fishing

Gill net fishing, which is at present not very popular in Lakshadweep, was carried out with a view to assessing the feasibility of its introduction in the area. Large mesh gill nets of 180-220 mm mesh size using 2 mm dia. HDPE twine were operated with encouraging results. Catch consisted mainly of sharks, rays, caranx, sub-surface tuna and seer.

As a part of the studies on popularising polypropylene, multi-mesh gill nets of size ranges 30-140 mm were fabricated using polypropylene twines of specification 800|1|2.

RESEARCH CONTEMPLATED

1. Cataloguing of traditional and mechanised fishing craft in India
2. Studies on craft materials with reference to corrosion, fouling and biodeterioration

3. Studies on the cost effective measures in relation to design, construction and maintenance of medium and large class of fishing vessels for the EEZ
4. Photo-oxidation degradation of polyethylene twines of different specifications
5. Tabulation of characteristics of combination wire ropes of different sizes
6. Troll line fishing operations at Lakshadweep and studies on possibility of introduction of fish traps for perches in the area
7. Field trials with multimesh gill nets and semi pelagic and off-bottom trawls
8. Development of demersal trawls and mid water trawls for exploitation of resources in EEZ

FISH PROCESSING DIVISION

SCIENTISTS ASSOCIATED

K. Gopakumar, P. V. Prabhu, K. K. Balachandran, T. K. Govindan, Cyriac Mathen, C. V. N. Rao, K. Krishna Rao, P. Madhavan, M. K. Kandoran, T. S. G. Iyer, K. G. Ramachandran Nair, P. K. Surendran, P. T. Mathew, T. K. Thankappan, A. Lekshmy Nair, A. C. Joseph, A. V. Shenoy, Jose Stephen, T. K. Sreenivasa Gopal, P. A. Perigreen, Jose Joseph, Chinnamma George, Francis Thomas, V. Muraleedharan, P. R. G. Varma, P. T. Lakshmanan, Nirmala Thampuram, V. Narayanan Nambiar, G. R. Unnithan, V. Annamalai, P. K. Vijayan, R. Thankamma, S. K. Bhattacharya, K. P. Antony.

CHIEF FINDINGS

Cultured fishes like catla, rohu and mrigal were found to have a shelf life of 15-17 days when held in crushed ice immediately after catch. Due to presence of low amounts of fat, development of rancidity did not prove a serious problem during iced storage.

The frozen shelf life of minced cat fish is enhanced by 2-3 months at -20°C by using spices like nutmeg, mace and ginger extract.

Studies on the canning characteristics of fresh water fish mrigal have conclusively proved that the fish canned in natural style rated better than the other types of packs.

Formula was developed for preparation of fish balls using 'Kalawa' meat and its canning in a curry medium.

Method was standardised for preparation of patties from minced meat of jew fish.

Treatment with anti-oxidant formulation containing butylated hydroxy anisole (BHA) and butylated hydroxy toluene (BHT) was shown to minimise browning in dried fish including cured mackerel.

Treatment with salt and citric acid considerably improved the appearance and shelf life of sun-dried, whole, thelly prawn.

Dry pickle of fish like anchoviella keeps well for over six months if packed in proper packagings such as polyester polythene, nylon-curlin and metallised polyester-polythene.

Conditions were standardised for producing high viscosity grade chitosan from prawn shell.

Method was developed for increasing the storage stability of chitosan solution for use as adhesive.

Studies on haemostatic effects of chitosan in neurosurgery and properties of chitosan films for haemodialysis have yielded encouraging results.

Technology was developed for making whole prawn powder from small and tiny prawns for use as food flavouring and the same adopted by the industry.

Texturised meat was prepared from *Chlorophthalmus agassizi*, a deep sea species.

Fish wafers and soup powder prepared from the cooked meat of deep sea fishes like perch were found to be bacteriologically safe.

Salmonella farmsen was isolated for the first time in India. Three other serotypes viz. *Salmonella gaminara*, *S. falkensee* and *S. rubislow* were also isolated from frozen shrimp for the first time.

Chlorination of water in prawn processing plants to a residual level of 10 ppm. was found essential for destroying *V. cholerae* organisms. The organism could survive only for 24-48 hours in distilled water at room temperature whereas it could survive for 7 days in ordinary sea water and for about a month in sterile sea water.

Sodium hypochlorite with at least 7% available chlorine is recommended for process water chlorination.

An objective method for predicting thawing losses from prawn meat was standardised.

Method was standardised for estimating indole in prawn meat.

Fish cutlets prepared from perch meat and packed in different packaging materials

like HM-HDPE, LDPE, LLDPE and nylon/polythene could be stored in acceptable condition for a period of four months at -20°C.

Polypropylene tape was found to be a good substitute for conventional strapping materials for unwaxed corrugated fibreboard cartons.

RESEARCH PROJECTS HANDLED

1. Extension of shelf life of chilled and frozen fish and fishery products
2. Canning requirements for fish and fishery products
3. Studies on the use of chitinous waste, fermented fishery products and liver oils
4. Utilisation of deep sea resources for product development
5. Development of diversified, dried and cured fish products
6. Process control and prawn quality
7. Evaluation and improvement of frozen fish and fishery products from retail cold storages and incidence of *V. cholerae* in marine products and environments
8. Studies for upgradation of quality in the seafood industry
9. Enhancement of shelf life and consumer appeal of fish and fishery products by appropriate packages

REPORT OF WORK DONE

Freezing

Effect of storage temperature on frozen shelf life of fatty fishes was studied.

Mackerel frozen as glazed blocks had shelf lives of 6-8 weeks, 6-7 months and 9-10 months when stored at -10° , -20° and -30°C respectively.

Studies were conducted on the frozen storage characteristics of oil sardines frozen in three different forms, viz., 1) as such (i.e. control) 2) whole, treated with antioxidant preparation containing BHA, BHT and citric acid and 3) gutted and treated with the above antioxidant preparation and all the samples stored at -20°C . After six months storage, the control samples became totally unacceptable, whereas the treated samples were in acceptable condition. Rancidity was a little more in the whole treated samples when compared to the gutted and treated samples.

Studies on the effect of spices in extending the frozen shelf life of fish mince were completed. Incorporation of small amounts (0.05-0.2%) of spices like cinnamon, nutmeg, cloves, mace etc enhanced the frozen shelf life of minces from catfish as well as horse mackerel by 2-3 months when stored at -20°C . The treated samples had lower TBA values when compared to the untreated control samples.

Method was standardised for preparation of patties using minced meat from jew fish, potato and seasonings. The patties thus prepared were battered, breaded and flash fried at $175-180^{\circ}\text{C}$ for 30 seconds and stored at -20°C . The product was seen to be in acceptable condition even after six months of storage.

Canning

Study on incidence of histamine as a limiting factor in deciding the ice stored

life of sardine for subsequent canning was continued. Analysis of canned sardine of three different size grades processed after storing in ice for varying periods showed that the histamine present in raw fish was completely retained in the canned samples.

Studies with mackerel have also shown that in fish left at room temperature, development of histamine is not very significant till spoilage sets in. However, with setting in of spoilage as judged by physical, chemical and organoleptic characteristics, the development of histamine is very rapid, reaching around 250mg. per 100g. fish in 14 hours at room temperature, whereas upto 10 hours at room temperature, the histamine formation was only around 7.5 mg. | 100.

Similar studies were also taken up with mackerel tuna and blue fin tuna. As was observed in the case of mackerel and sardine, if the fish is kept well iced, the development of histamine did not reach critical level, even when the fish was declared unsuitable for canning as judged by physical and chemical characteristics.

The histamine content in different species of fresh fish sold in markets in Cochin area was negligible, ranging from nil to around 2mg%.

The overall bacterial profile of fresh fish with special reference to the content of histidine decarboxylating bacteria was studied with respect to different species of fish. The ability of histidine decarboxylating bacteria to produce histamine in *in vitro* systems was further studied. Many of the species produced histamine in fish and histidine media. However, the ability of differ-

ent strains in producing histamine was found to be highly varying.

A formula was developed for preparation of fish balls using kalawa meat and its canning in a curry medium. An acceptable product was obtained and the canned products were subjected to storage study. After six months, the product lost its original texture and became fibrous. However, the colour, flavour, consistency and overall appearance of the curry medium were stable. After nine months, the balls had a slight bitter taste, though the flavour was maintained. Some black spots were also noticed in the can interior. Slight discoloration and toughness of texture were noticed in fish balls prepared from jew fish meat after incorporating salt and citric acid. Incorporation of corn flour and egg white was found effective in improving the texture, but this results in enhancing the extent of discoloration after retorting.

Fish Curing

Experiments were continued on sun drying fresh and iced anchoviella under field conditions at Mandapam. Icing was found suitable if the fish is to be preserved upto 48 hours before drying. It was also seen that anchoviella has to be iced along with some water to prevent breakage. Trays with plastic wire mesh bottom were used to facilitate uniform drying. If the space to keep the trays on raised platform is scarce, they may be kept on stands at different vertical levels. A mild alum treatment minimises the sticking of the fish to the drying surface. To reduce the onset of browning on drying and storage, treatment with antioxidant formulation was found effective. Dipping the fresh fish in warm water for 5mts. was also found to improve the

colour. However, raising the temperature above 45°C resulted in belly bursting and breakage of heads. The repeated experiments have helped to evolve a suitable method of production of sand free dry anchoviella.

Storage studies have revealed that insect attack can be prevented by fumigation with aluminium phosphide and packing the fish in airtight containers. The defect observed during storage is slow discoloration or browning, which can be minimised with antioxidant treatment. At chill storage (4°-10°C) the discoloration can be prevented for a long time (6-8 months). Even cured mackerel treated with antioxidant was only partially brown and was acceptable after 30 weeks storage. Miscellaneous fish could be kept for much longer periods without excessive browning and without rancid taste if treated with antioxidant.

Dry pickle prepared from anchoviella and similar types of fish was found to have water activity of 0.8 and the same could be kept for over 6 months without spoilage if packed in nylon-surlyn, polyester-polythene or metallised polyester polythene. The appearance, taste and bacterial quality were all satisfactory.

Treatment with salt and citric acid was found to improve the quality of sun dried thelly prawns. Fresh prawns treated with salt and citric acid of appropriate concentration prior to drying had more red colour and less blackening. Treated prawns on storage also had better colour than the control samples. Removal of the head before packing the dried product prolonged the shelf life of the product considerably.

Fishery By-products

High viscosity chitosan could be produced from prawn shell by decreasing the concentration of hydrochloric acid used for demineralisation and slightly increasing the concentration of caustic soda for deacetylation accompanied by an increase in the deacetylation time.

Method was developed for increasing the storage stability of chitosan solution for its use as an adhesive. It can be used for pasting paper, which property can be made use of in the application of chitosan in packaging materials.

Though use of chitin as an additive to broiler chicks gave significant increase in weight gain, no such weight gain was observed in albino rats fed on chitin. In the case of broiler chicks, a lowering of fat and cholesterol content in the muscle and liver was observed.

Chitosan was found effective in absorbing copper from solution and bringing down the residual copper content to an insignificant level. It was also found effective in precipitating protein in the preparation of shrimp extract which effected a reduction in the salt content of the product in addition to a saving in the fuel required for its concentration.

Experiments were conducted at the Medical College and Sri Chithira Thirunal Institute of Medical Sciences and Technology, Trivandrum on the medical application of chitosan. In one set of experiments, modified artificial membranes were prepared for haemodialysis and it was observed that chitosan blended membranes had better dialysis properties. Chitosan was also

found effective in stopping bleeding during brain surgery indicating possibility of its use as an haemostatic agent.

Utilisation of deep sea resources for product development

About twenty one species of fish, lobster and prawn caught from the deep seas were got identified and the yield of fish mince and average percentage yield of fillets from a few species determined. Organoleptic quality of the samples ranged from good to fair. Some of the samples were also subjected to detailed examination for proximate composition, amino acid make up, mineral content and bacteriological analysis.

Studies were continued on conversion of deep sea fishes to edible products. Texturised meat in the form of off white coloured granules with good functional proteins was prepared from *Chlorophthalmus agassizi*.

Protein powder could be prepared from deep sea prawn and its proximate composition and amino acid profile determined.

Technology was developed for making prawn powders from whole, tiny prawns for use as food flavouring. This product has since been adopted commercially.

Fish meal was prepared from *Epinula orientalis* and its proximate composition determined.

Fish wafers and soup powder of sound bacteriological quality were prepared from cooked meat of perch.

Studies were continued to develop methods to prepare flakes with smooth

edges to avoid their piercing the packaging material. Two methods were found suitable — 1) spreading the slurry over the dye and then gelatinising it in steam and drying, and 2) gelatinising the slurry after adding sufficient quantity of water and then spreading over the dye followed by drying.

Edible meat was prepared from a few of the deep sea species, minced and dried at 45°-50°C in a tunnel dryer or freeze dried and used for animal feeding studies and mineral and amino acid analysis. The edible powders thus obtained were free from pathogenic organisms, the total plate count being of the order of 10² to 10¹¹ organisms per g.

The PER (protein efficiency ratio) of fish meat powders and fish meals prepared from a few species of fish were carried out using casein as the reference protein. In the case of meat powders of 9 samples of fish | prawn tested, the PER values were higher or comparable to that of casein in all cases except one where a very low PER value was obtained. In the case of fish meals prepared from *Epinnula orientalis*, *Scombrops* sp. and *Holocentrus* sp., the meal from *E.orientalis* recorded low PER value whereas the meals from the other two recorded marginally higher PER values.

Fish sauces conforming to FDA standards were prepared from *Trigla* sp., *Benthosema pterotum* and *Sphyraena* (Barracuda). Of these, Barracuda gave a product with maximum protein content.

Fish Surumi

The effect of various parameters on the yield of quality of surumi from low

cost marine prawn, *Metapenaeus dobsoni* was studied. Studies have led to the conclusion that washing the mince for 1 minute in a wash bath (mince : water in 1:1 ratio) is ideal for the maximum enrichment of the myofibrillar protein fraction and for minimum nitrogen loss.

Packaging of fish and fishery products

Corrugated fibreboard boxes sealed with adhesive polypropylene tape were examined after frozen storage at -20°C for three months. The performance of the tape on waxed cartons was not satisfactory since the adhesion strength was reduced by 50% from that on unwaxed cartons where it can be used as a substitute for the conventional strapping materials.

Consumer packs for dried fish from MXXT/LDPE and bulk packs from HDPE woven sacks developed at the Institute have been readily adopted by more than half a dozen dry fish merchants of Tuticorin for export purposes.

Different styles of corrugated fibreboard box like regular fluting and cross-fluting with different grammages of paper were tested for various physical properties like bursting strength, puncture resistance and compression strength. The container with regular fluting showed better compression strength than that with cross fluting.

Fresh water fish fillets in 100 gm. lots in 12 μ plain polyester/200 gauge polythene in an atmosphere of O₂ and CO₂ in the ratio 1:1 kept well for 21 days at 0-4°C when compared to the 12 days in the case of control samples kept in air.

Preliminary studies on transportation of mussels have shown that the mussels could remain alive at room temperature for 24 hours. As dry pack, the mussels remained alive for 48 hours at 21-22°C with a mortality of less than 7%. Dried mussels with water activity of 0.64 remained in good condition for four months in different packaging materials like LDPE, PP, 300 MXXT/LDPE, Nylon/LDPE, PEST/LDPE and Metallised PEST/LDPE. Sorption isotherm characteristics of mussels revealed that 33.5% moisture equilibrating to 87% RH is critical with respect to the appearance of mould growth.

Cutlets prepared using perch meat and packed in different packaging materials like HM-HDPE, LDPE, LLDPE and Nylon/Polythene and stored at -20°C remained in acceptable condition even after 4 months.

Feed back information was obtained on the polypropylene fibreboard boxes fabricated and handed over for trials. Modifications were effected in the provision of rope handles imparting better strength properties to the boxes.

Quality Control

Out of more than three hundred samples of fishery products analysed during the year, *V. cholerae* 01 could not be detected in any of the samples, though *V. cholerae* non 01 was detected in 21.3% of the cases. Maximum isolation of these strains of bacteria was from samples collected from Mandapam. Contamination was mostly from primary process centres.

Studies on the viability of *V. cholerae* in water have shown that the bacteria can survive only for 24-48 hours in distilled

water and municipal water at room temperature. At refrigerated temperatures, survival was comparatively more. It was also observed that for getting full protection from *V. cholerae*, the process water requires to be chlorinated to a residual level of 10 ppm.

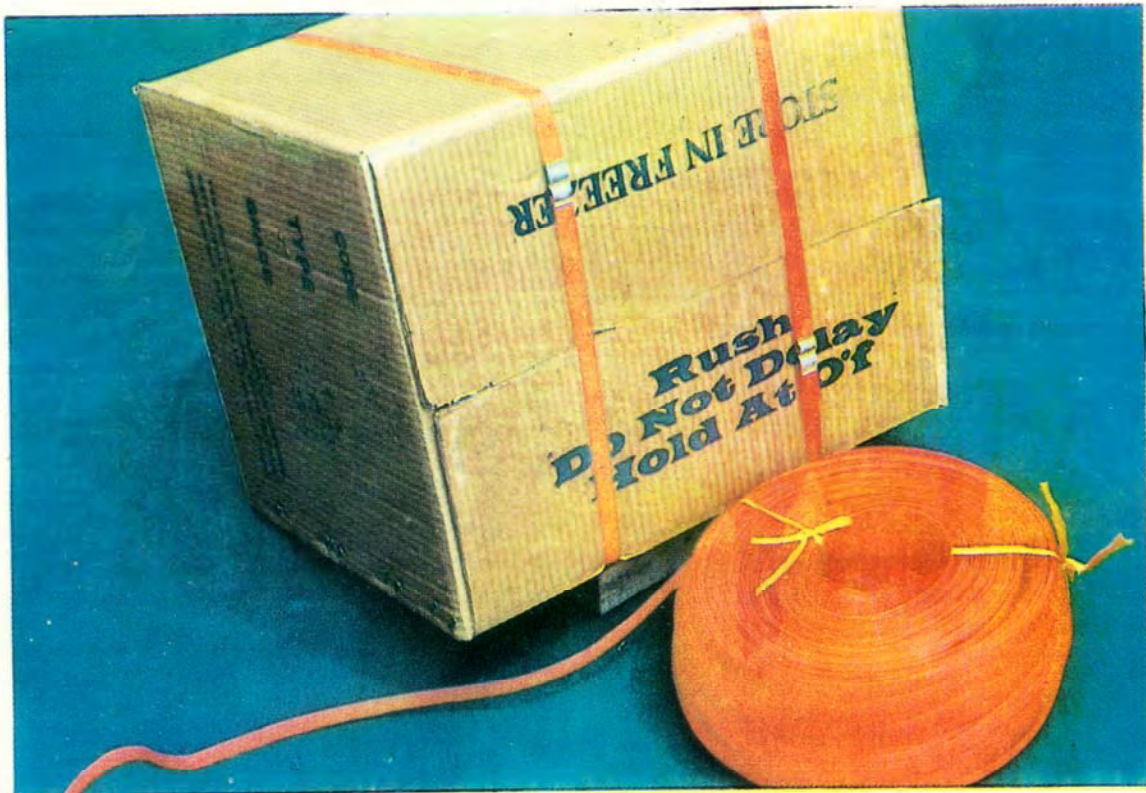
As a part of the study to assess the quality of commercially frozen squid and cuttle fish, seventy commercially frozen samples of frozen products were tested for sensory, chemical and bacteriological parameters. Organoleptically, 60% of the samples were good while 15% were poor. In 25% of the samples, TVBN was more than 20 mg.%, while hypoxanthine was more than 2 micromoles/g in 23% of the samples. Good correlation was observed between hypoxanthine content and sensory evaluation. While Salmonella and *V. cholerae* were absent in all the samples, 2% of the samples had total bacterial count more than 1.0×10^6 /g while 28% showed presence of coagulase positive staphylococci.

The FAO programme on quality control and shrimp hygiene in Asian regions was continued during the year under report. Thirty five samples comprising 14 swabs, 3 water, 3 ice, 9 raw shrimps, 3 raw cuttle fish and 3 frozen shrimps from various stages of production were sampled and tested for bacterial quality. Salmonella could be isolated from 3 samples of frozen shrimps. *S. gaminara*, *S. rubislow*, *S. saintpaul*, *S. hivittingfoss*, *S. roan*, *S. richmond* and *S. falkensee* were the serotypes isolated. Among these there is no previous report of isolation of *S. gaminara*, *S. rubislow* and *S. falkensee* from shrimps. One strain of Salmonella isolated from a sample of water used for shrimp culture was



Dry fish pickle packed in 80 μ nylon/surlyn co-extruded film

Polypropylene tape-a substitute for conventional strapping materials for unwaxed corrugated fibre-board cartons



sent to the International Salmonella Reference Centre at Paris and got serotyped as *Salmonella farmsen*. This is the first report of isolation of this serotype in India.

Sodium hypochlorite with low levels of available chlorine was found to be unsuitable for chlorination of process water as the pH of the water increases by addition of larger volumes of the solution. Hypochlorite with atleast 7% available chlorine is recommended for process water chlorination.

The method of estimating indole in prawn meat was standardised. Fresh, spoiling and spoiled prawn meat were tested for indole. Commercial raw materials as well as finished products showed indole content below the prescribed maximum.

Data on cost of quality control in the processing plants were collected and analysed. The results show that the cost of quality control is nearly 0.25% of the turnover. Of this, 75% represents the salary of the technical staff and the rest, cost of chemicals, glassware etc. The system pays for itself as there is 50% reduction in inspection fee and reduction of rejects. However, only a growing or stable industry can support the quality control system at its own cost, for lower turnover will result in higher cost of quality control.

RESEARCH CONTEMPLATED

1. Effect of storage temperature on frozen shelf life of oil sardines
2. Further studies on iced storage and canning of tuna with special reference to development of histamine

3. Studies on preparation of dry pickles
4. Variables in the production process affecting the properties of chitin and chitosan for different uses
5. Uses of chitinous materials in animal feeds
6. Studies on protein isolates, hydrolysates and fermented products from fish and shell fish
7. Yield and quality of deep sea fishes and their conversion to edible products
8. Development of consumer packages for fishery products/chilled fish and fishery products
9. Transportation of live and processed mussels
10. Improvement in quality of frozen squid and cuttle fish
11. Viability of *V. cholerae* 01 and non 01 under different conditions

BIOCHEMISTRY, NUTRITION AND MICROBIOLOGY DIVISION

SCIENTISTS ASSOCIATED

K. Mahadeva Iyer, K. Devadasan, P. K. Surendran, P. D. Antony, Nirmala Thampuram, Jose Stephen, A. G. Radhakrishnan, V. Narayanan Nambiar, S. Sangeev, M. R. Raghunath, P. T. Lakshmanan, Imam Khasim Saheb, R. Chakrobarti, K. V. Lalitha, K. Ammu.

CHIEF FINDINGS

Freeze drying resulted in the production of more available carbonyls in fish muscle compared to sun drying or hot air drying.

During frozen storage of fish, carbonyl content registered an initial increase followed by a fall and then another increase after storage for 5 months.

Lower fatty acids (below C_{10}) were not detected in fresh tropical water fishes, though in some temperate water fishes, they are reported to contribute to the flavour of the fish.

Tuna red meat could be solubilized to the extent of 28% only by digestion with Brommalein for 4 hours.

Potato starch when used as the sole source of carbohydrates in feed for albino rats, tends to reduce serum cholesterol levels, compared to other starches like tapioca starch, corn starch etc.

Twentyone bacterial cultures isolated from marine sources were screened for their lipase elaboration capacity. Some of the cultures could elaborate lipase enzyme. But none of the strains so far isolated were promising enough to be a commercial source of lipase enzyme.

Salted fishes from Kakinada area often recorded high content of histamine in their muscle. But fishes from Cochin area did not record high levels of histamine.

While fishes of Cochin coast did not record high levels of toxic metals, Kakinada and Vizag areas and Godavari waters near Kovvur, recorded high levels of toxic heavy metals in the fishes. However, whole cuttle fishes caught from waters along Cochin coast also often recorded cadmium levels above 2ppm. But in cleaned fillets, levels of cadmium were within limits, liver being the main site of cadmium accumulation.

Surgical sutures prepared from fish guts were found to be comparable to commercially

marketed sutures in their physical properties and were not found to cause any tissue reactions in test animals.

Pre-rigor icing of the cultured brackish water fish chanos (*Chanos chanos*) had a controlling effect on the growth of *Pseudomonas* spp.

Histamine producing bacteria, isolated from marine fish of local markets were found to belong to the genera *Escherichia*, *Klebsiella*, *Vibrio* and *Pseudomonas*.

Alteromonas putrefaciens was found to produce acid and ammonia from all amino acids except histidine aerobically.

Growth of *Salmonella* cultures isolated from fishery products was found to be restricted between the pH levels of 3.4 and 10.7.

Both Kanagawa positive and negative strains of *Vibrio parahaemolyticus* when exposed to distilled water and municipal tap water, were killed within a few minutes.

Spores of *Clostridium sporogenes* strains isolated from fish survived heating at 100°C for 2 hours.

RESEARCH PROJECTS HANDLED

1. Flavour bearing compounds in fish muscle and the effect of their possible interactions during processing
2. Nutritional and toxicological studies on fresh and processed marine products
3. Investigation on temperature induced changes in the muscles of typical fishes/shell fishes with reference to protein enzyme systems
4. Microbial flora of fishes, fishery products and environs with special reference to associated pathogens and spoilage

REPORT OF WORK DONE

Nucleotide changes

Studies on nucleotide degradation in fresh tilapia muscle during storage at room temperature upto 6 hours showed that ATP got degraded upto the inosine stage rapidly. But though increase in ADP, AMP and inosine was rapid, further degradation to hypoxanthine was very slow. Nucleotide degradation and its possible implications in the overall flavour of fishery products is being studied using HPLC (High performance liquid chromatography) in other species of fishes also during storage under different conditions.

Carbonyl compounds in fish

Changes in the total and major individual carbonyls during frozen storage of raw and cooked muscle of Rohu (*Labeo rohita*) upto 5 months were determined with a view to assess their impact on the overall flavour. Influence of different methods of drying like sun drying, hot air drying and freeze drying on the carbonyls was also studied. Freeze drying was found to result in the production of more available carbonyls in muscle, followed by hot air drying and then sun drying. During frozen storage of fish, carbonyl content showed an initial increase followed by a fall and then another increase after five months. Acetaldehyde and valeraldehyde were the major aldehydes in Rohu muscle whereas 2-hexanone, 2 heptanone and Octanone were the major ketones detected.

Fatty acids below C₁₀ were not detected in the body oils of tropical fresh water fishes in the fresh condition, though

in the case of some temperate water fishes, such lower fatty acids are known to contribute to their flavour.

Lipases and proteolytic enzymes

Twentyone strains of bacteria isolated from marine sources were screened for their lipase elaboration capacity. Some of these strains could elaborate lipase enzyme, but the strains isolated so far were not promising enough to be a commercial source for isolation of this enzyme. Ensilation at acid pH (pH 3.0) was tried for utilizing fish viscera from different fish species. After two days, 87% hydrolysis was achieved in mackerel viscera and the proteolytic activity was present in the viscera even after one month. Tuna red meat was digested with brommalein. But upto 4 hours, only 28% of the red meat solids could be solubilized under the test conditions employed. Improved solubilization employing appropriate reaction conditions is being tried.

Nutritional studies

Amino acid composition of the muscle proteins and fatty acid composition of the body oils of several new deep sea fishes and a few less popular common marine fishes were determined. Deep sea fishes did not show any striking differences in their biochemical composition from pelagic fishes.

Influence of different dietary starches in combination with fish proteins, on the serum cholesterol levels was studied by feeding trials using albino rats. Of the different starches tried, potato starch was the most effective in reducing serum cholesterol levels.

Amino acid retention in albino rats fed on fish proteins (Rohu protein) was studied using carcass analysis methods.

Histamine in fish

Histamine content of common food fishes was studied. When samples were kept chilled, the content of histamine was well below 20 mg% in most cases, though there was considerable variations between samples. However, dry cured and salted samples from Kakinada region showed high levels of histamine, the levels going above 100 mg | 100 gm. in some cases.

Heavy metals and pesticide residues in fish

Accumulation of heavy metals and pesticide residues was studied in fishes from different parts of east and west coast. Incidence of heavy metals in processed fishery products was also surveyed. Mercury, cadmium, lead, zinc, nickel, copper etc. were found to be well below the limits prescribed in most of the samples tested. Cuttle fishes in the whole condition, recorded cadmium above 2 ppm in their muscle. But in cleaned fillets, the levels were much below this, liver being the major site of cadmium accumulation. Fresh water fishes from Cochin area also showed low levels of these metals. Marine fishes from Kakinada coast and fresh water fishes from Godavari near Dowleswaram often recorded high levels of toxic metals. The effluents from chemical factories might have caused the accumulation of high levels of toxic metals in fishes from this region. In frozen and canned fishery products meant for export, levels of all these toxic metals were found to be well within permissible limits.

Surgical sutures

Absorbable surgical sutures were prepared from guts of fresh water carps and strengthened using dialdehydes as well as by a chromicising procedure. Both gave smooth, strong, uniform and pliable sutures which were found absorbable and did not cause tissue reactions in test animals. The samples are being tested on more test animals at Haryana and Punjab Agricultural Universities.

Bacterial profile in cultured Chanos

Effect of pre-rigor and post-rigor icing on the changes of the bacterial flora of cultured chanos (*Chanos chanos*) was investigated. The initial flora of pond fresh chanos, consisting of *Pseudomonas* (24%), *Micrococcus* (20%), *Alcaligenes* (16%), *Moraxella* (8%) and *Enterobacteriaceae* did not show any significant change until 6 days of icing. Subsequently, the *Pseudomonas* gradually increased until it reached 64% of the total in the case of post-rigor iced fish and 54% in the case of pre-rigor iced fish by 19 days of storage, indicating that pre-rigor icing had slowing effect on the relative growth of *Pseudomonas*.

Bacterial profile in dried fish

Studies on the bacterial profile of the dried and cured fish and shell fish from various markets in Ernakulam district showed that based on the incidence of faecal coliforms, faecal streptococci and *Escherichia coli*, the dried | cured fish | prawns from the rural markets were better than those from urban areas.

Rapid enumeration of bacteria

Five plating media, viz. tryptone glucose agar (TGA), plate count agar (PCA),

casein peptone starch agar (CPS), tryptone peptone yeast extract agar (TPE) and tryptone soytone agar (TSA) were compared for the recovery of bacteria from fresh marine fishes. TSA was found to effect the maximum recovery of bacteria. Studies on the application of microscopic count for rapid enumeration of bacteria from fish and fishery products showed that the method could give reliable results only when the bacterial population was more than 10^5 /g. of the fish.

Salmonella

Studies on the effect of pH and sodium chloride on the growth and viability of *Salmonella* serotypes isolated from fish | fishery products showed that growth of *Salmonella* strains in culture media was restricted between the pH levels of 3.4 and 10.7, the growth being the best between pH 6 to 8. *Salmonella* strains showed very good growth upto a NaCl level of 5% and moderate growth upto 7% NaCl. But, NaCl at concentrations of 8% and above were inhibitory. When *Salmonella* cells were frozen after suspending in sea water, distilled water and normal saline, they lost their viability after one month's frozen storage.

Vibrio parahaemolyticus

Of the eight enrichment media evaluated for their efficiency to recover *Vibrio parahaemolyticus* from fish and fishery products, Horie arabinose ethyl violet broth was found to be the best. Studies using 69 strains of *Vibrio parahaemolyticus* showed that all of them were sensitive to chloramphenicol and resistant to penicillin. Kanagawa positive and negative strains of *Vibrio parahaemolyticus* when exposed to

distilled water and tap water, died within a few minutes.

Clostridium

Two hundred and sixteen *Clostridium* strains isolated from fishes and shell fishes were tested for their pathogenicity by bio assay using mice and 170 of them were found to be pathogenic. These cultures were identified as *Clostridium novyi* — type A. The remaining 46 cultures were found to belong to *Clostridium sporogenes* sp. Spores of these cultures were found to be resistant to heating at 100°C for 2 hours.

RESEARCH CONTEMPLATED

1. Influence of nucleotides, lower fatty acids, carbonyls, non-protein nitrogenous constituents etc. on flavour of fishery products
2. Proteinases from fish; isolation and characterization
3. Feasibility of commercial isolation of lipases from marine bacterial sources
4. Nutritional evaluation of newer fish species and fishery products
5. Accumulation of toxic metals, pesticide residues etc. in fresh fish and processed fishery products
6. Toxic amines: accumulation in different fishes under varying storage conditions
7. Absorbable surgical sutures from fish guts — their evaluation as suture material
8. Microbiological investigations on pre-process handling and storage of cultured fresh water fishes

9. Investigations on *Listeria* spp. in fish and shell fish, with particular reference to aquaculture
10. Development of media for enumeration of bacteria from processed fish products
11. Studies on the incidence of bacterial pathogens in cultured fish
12. Effect of handling and processing on *Salmonella* and *Vibrio parahaemolyticus*
13. Enterotoxin production by *Staphylococcus aureus* in fishery products
14. Distribution of *Clostridium* sp. in fishes landed along the Indian sea coasts
15. Studies on lactic acid bacteria for fish preservation

ENGINEERING AND INSTRUMENTATION DIVISION

SCIENTISTS ASSOCIATED

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

CHIEF FINDINGS

A 'Freezer temperature scanner' was developed for specific studies on temperature penetration / retention properties of fish blocks and the efficiency of cold storages and freezers.

Design was developed of a 'Fishing Log' for remote measurement of important parameters relevant to small boats.

An improved version of 'Environmental Data Acquisition System' for acquiring 16 environmental parameters was developed.

Biogas was produced by anaerobic fermentation of minced slurry of water hyacinth.

Design was completed of a one kilogram capacity smoke baker oven based on electro-thermal principle.

Trials with the Kaplan propeller with nozzle gave an improved bollard pull for a 9.75 m. wooden trawler with 52 H.P. engine.

RESEARCH PROJECTS HANDLED

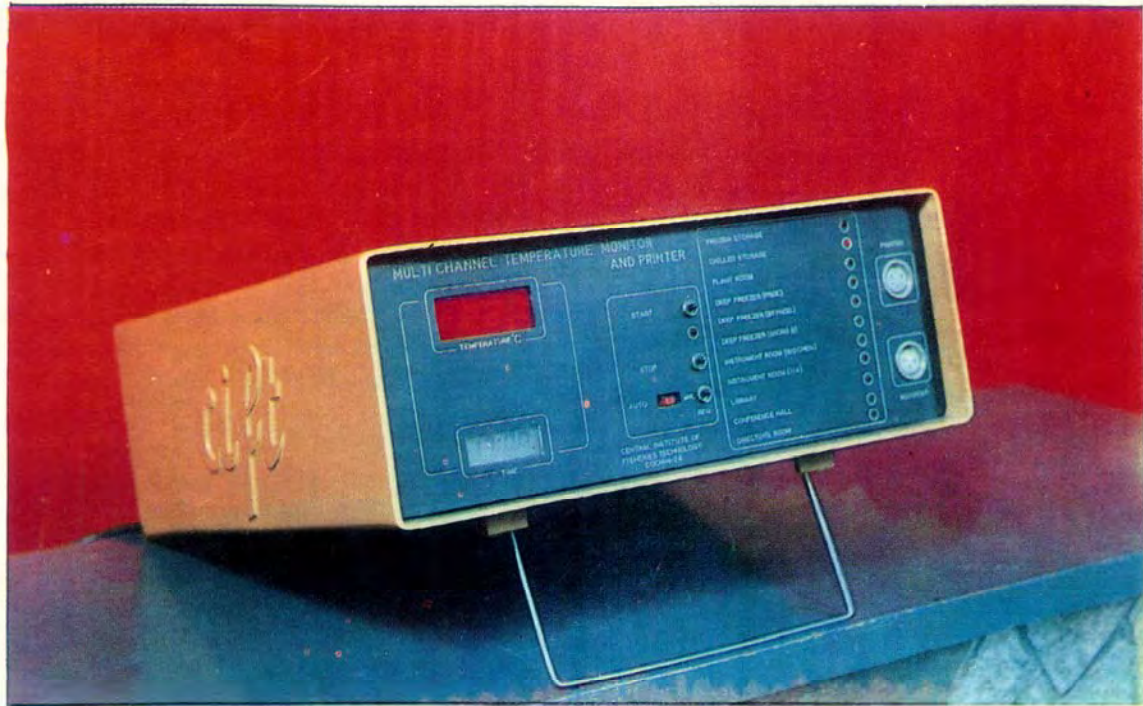
1. Design and development of low cost equipments and machinery for fish preservation and for manufacturing fishery products
2. Design and development of pilot plant equipments for fish processing industries
3. Development and application of alternate energy for fish processing industry
4. Studies on various propulsion systems and their effect on fuel consumption
5. Electronic aids for fishing and fisheries research

REPORT OF WORK DONE

Equipments/machineries for fish preservation and processing

Designing was undertaken of a liquid nitrogen spray system for transportation of frozen fishery products, a low cost flue gas drier-cum-smoke chamber and a machinery for mechanisation of fish cutlet production.

Designing was completed of a 1 Kg. capacity smoke-baker oven for home use.



Multi-channel Freezer Temperature Scanner developed for monitoring of temperature inside cold storages, freezers and also inside fish blocks and other materials under processing

Trolling with CIFT designed artificial jigs at Lakshadweep under the Island Fishery Development Programme



(Report on Page 42)

It consists of a hemispherical chamber with removable lid, electric heating system, thermostatic control, sawdust cartridge with ignition system, fish tray, drip tray etc.

Experiments were carried out for generation of biogas by mincing water hyacinth in a mincer and feeding the slurry into the digester.

Designing was also undertaken of a modified smoke generator with mechanical arrangement for continuous feeding of sawdust and removal of ash to facilitate continuous generation of smoke. A few experiments were also conducted for production of good quality smoked and dried product from oyster meat.

Fabrication and installation of the solar drier was carried out. Several components like double glass plate solar collector, aluminium trays, heat absorber-cum-heat exchanger plate etc. were fabricated and assembled.

Fuel saving devices in fishing boats

Tests and trials with the Kaplan propeller-nozzle combinations were carried out. The trials showed an improvement in bollard pull, fuel consumption etc. when compared to the round tipped existing type propeller. However, no increase in rpm of the engine was observed even on full load on account of overloading of the engine due to the Kaplan propeller blade area. The width of the blades of the propeller was accordingly reduced, the propeller filed and finished to give the required pitch, balancing of the propeller carried out and the same re-fitted on to the trawler. Fresh trials are underway.

Instrumentation

Design and development of a 'Fishing Log' for remote measurement of important parameters relevant to operation of small boats, viz. air temperature, water salinity, water temperature, boat speed and warp load was completed. This instrument can be operated in small trawlers by unskilled persons.

An improved version of the 'Environmental Data Acquisition System' was developed for acquiring 16 environmental parameters automatically or manually for application in aquaculture and other agricultural investigations.

RESEARCH CONTEMPLATED

1. Development of:
 - a) Solar processing monitor
 - b) Wireless data telemetry system
 - c) Automatic water quality control for breeding tanks
 - d) Automatic juvenile counter
2. Development of a suitable portable model of bio-gas digester and its accessories
3. Fabrication of smoke baker oven
4. Studies on performance of existing smoke kiln and smoking parameters
5. Further trials with Kaplan propeller
6. Development of equipment and machinery for fish processing industry

EXTENSION, INFORMATION & STATISTICS DIVISION

SCIENTISTS ASSOCIATED

H. Krishna Iyer, M. K. Kandoran,
A. K. Kesavan Nair, Mary Thomas, G. R.

Unnithan, V. Annamalai, R. Thiagarajan, Braj Mohan.

CHIEF FINDINGS

The annual catches of squilla along Kerala coast was tentatively estimated at 12,000 tonnes for the year 1988.

The yields of shark fin rays from dried shark fins were worked out, separately for side fins and tail fins.

Idle capacities in fish canning plants and fish meal plants were estimated.

The net additional profit from motorisation of indigenous craft was found to be only marginal.

RESEARCH PROJECTS HANDLED

1. Adoption of innovations developed at CIFT
2. Survey on the utilisation of export oriented fish and by-catch

REPORT OF WORK DONE

Estimation of squilla catches based on stratified random sampling plan was continued. The work programmes as per the stratified random sampling plan were prepared for each quarter and the quarter-wise catches landed and the catches discarded in the sea were estimated. The annual catches of squilla along the Kerala coast was tentatively estimated at 12,000 tonnes for the year 1988. As in the previous year, in 1988 also, the first and fourth quarters accounted for the bulk (67%) of the annual catch. Centres where squilla is available along the Kerala coast are now known.

Collection of data on production of shark fins from 37 production centres in the

country was initiated and a preliminary estimate on the production was made for the year 1987-88. It was observed that the yield of dried shark fin rays was about 17%, ie. to obtain 1 kg. of fin rays, about 6 kg. of shark fins are required. Yields of side fins and tail fins were worked out separately.

Data on idle capacity of fish canning plants and fish meal plants were collected from different maritime states and the idle capacities were estimated. The causes leading to idle capacity were identified by the processors as shortage of raw material, shortage of power, cost of containers and lack of export market.

A proforma for collection of data on whole weight and meat weight was prepared. The proforma was pretested and modified. Collection of data on whole weight and product weight has been initiated as a part of studies on the quantitative relationship between product weight and weight of raw material.

Under the study on impact of motorisation of indigenous fishing vessels, it was observed that the total investment for a large motorised fishing vessel and fishing nets comes to Rs. 1,00,000/- while for a small vessel and nets it comes to Rs. 60,000/-. On an average, a large motorised craft has an annual return of Rs. 75,000/- and a small craft gets about Rs. 60,000/-. In both cases, the return from motorised craft is about 40% more than that from non-motorised craft. However, about 75% of the additional return from the motorised craft is spent towards variable costs like fuel cost, repairs of motor etc. Thus the net additional profit from motorisation of indigenous craft is only marginal.

Studies continued on socio-economic conditions of fishermen of various parts of Kerala and Tamil Nadu have shown that those who normally adopt improved technologies come from somewhat well-to-do families. Thus non-adopters who are already poor stand to lose further with their relatively less efficient mode of fishing and fish processing methods. There thus exists scope for training the fishermen in improved methods of handling and curing of fish and production of massmin and other traditional products. Studies also revealed the need to provide them with fishing craft and gear and outboard engines on loan | subsidy | grant.

Studies were continued on the learning behaviour of fishermen who participated in the various training programmes held at the Institute. The analysis of data on attitude, knowledge, skill and learning effectiveness showed that majority of the fisherwomen (75%) had high attitude, high knowledge score, high skill score and high learning effectiveness index. The age of the fisherwomen showed negative and significant relationship, whereas education showed positive and significant relationship with attitude, knowledge, skill and learning effectiveness index. The ten independent variables selected showed 49.65 percent variation on attitude, 46.96 per cent variation on knowledge, 44.48 per cent variation on skill and 47.32 per cent variation on learning effectiveness index. Half of the fisherwomen (50%) evaluated the training programmes conducted by CIFT as most useful and 19.57 per cent reported their plans to adopt the processes for preparation of fishery products.

Studies were conducted on influence of fishery technology attributes on innovation decision. The analysis of data indicated that 62 per cent of trained fisherwomen perceived the fishery by products as relatively advantageous. About more than half of the trained fisherwomen (53.00%) perceived that the procedural content to adopt the technology was very easy whereas 41 per cent of the untrained fisherwomen perceived the content as highly difficult. The ten independent variables selected for the study indicated 77.43 per cent variations on perception score and 80.04 per cent variation on perception index. The highly significant value of D^2 indicated that the trained and untrained fisherwomen differed significantly in their perception towards fishery by-products. The content complexity, trialability, physical feasibility, managerial feasibility, risk, marketability and relative advantage are the attributes which showed highly significant difference between trained and untrained fisherwomen on their perception.

RESEARCH CONTEMPLATED

1. Statistical studies on the quantitative relationship between product weight and weight of raw material used for processing
2. Estimation of prawn shell wastes available from peeling sheds in Cochin area.
3. Studies on communication behaviour and decision making behaviour of traditional fishermen
4. Technological changes and their impact on traditional fishermen
5. Role and status of fisherwomen in fisheries

VERAVAL RESEARCH CENTRE

REPORT OF WORK DONE

SCIENTISTS ASSOCIATED

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

CHIEF FINDINGS

A 20 m. long double bridle was found to improve the performance of a 32 m. large mesh trawl.

Lightly salted, semidried dhoma had better organoleptic acceptance than the heavily salted commercial sample. The optimum RH for storing semi dried dhoma has been worked out.

Salted dhoma mince could be converted into good quality flakes, a highly acceptable convenience product.

Beheading and removal of vertebrae significantly retarded yellow discoloration in semi-dried dhoma.

Fins of whale shark, *Rhyncodon typus*, could be utilized for extraction of fin rays.

RESEARCH PROJECTS HANDLED

1. Studies on demersal trawls
2. Studies on midwater trawls
3. Studies on the effect of pre-processing condition on frozen storage characteristics of important varieties of fishes of Saurashtra coast
4. Studies on technological problems of commercial curing of important varieties of fishes of Saurashtra coast

Fishing Gear

Experimental trials were continued for determining the optimum bridle lengths for a 25 m. high opening trawl, a 32 m. large mesh trawl and a bulged belly trawl. A 20 m. long double bridle was found to improve the efficiency of a 32 m. large mesh trawl while studies have shown a bridle length of 30 m. to be a better choice for the 25 m. high opening trawl. Experiments were also carried out to compare the efficiencies of heavy and light bridles in demersal trawl operations.

Designs of a PVC otter board were finalised. Fabrication has been taken up.

Fish Processing

Semi-dried products from dhoma and ray were prepared and their storage characteristics studied. Samples of varying moisture content were kept at different RH conditions and equilibrium moisture levels determined. The relationship between water activity and shelf life of these products was also investigated.

Various methods were tried to prevent or retard discoloration of salted and dried dhoma during storage. As development of discoloration was found to start from the head and vertebral column, beheading and removal of vertebrae were found to be highly effective in retarding the process of discoloration.

Studies were continued on the effect of quality of salt and different methods of salting on the overall quality of cured products.

Investigations were also initiated on various aspects of preparation of salted and pressed products from ribbon fish.

A surimi like base was also prepared from ribbon fish and its storage characteristics at -18°C studied. The product was compared with raw, untreated mince and it was observed that the treated product showed marked improvement both with regard to quality and shelf life. Incorporation of the surimi like base in various products has also been taken up.

Good quality products like flakes were prepared from salted dhoma mince after addition of suitable additives. The product holds good potential as a suitable substitute for dry fish. Further studies are in progress.

Studies were undertaken on the susceptibility of lipids of pomfrets to hydrolytic and oxidative changes during different seasons as well as on associated changes in the protein fractions.

RESEARCH CONTEMPLATED

1. Studies on otter boards fabricated from PVC panels
2. Studies on sputnik shrimp trawls
3. Studies on hybrid trawls for squid
4. Feasibility of diversified products like frozen ray, smoked eel fillets and mince based products
5. Comparative studies on manual and automatic pre-processing activities in production of frozen prawn.
6. Assessment of losses in production of cured fish.

KAKINADA RESEARCH CENTRE

SCIENTISTS ASSOCIATED

C. C. Panduranga Rao, G. Narayanappa, S. V. S. Rama Rao, Sib Sankar Gupta, D. Imam Khasim Saheb, Subrata Basu, R. Chakrobarti, R. Mangayya Naidu, M. M. Prasad, J. Sitarama Rao.

CHIEF FINDINGS

Rope trawls gave relatively higher catch rate than six seam and bulged belly trawls.

Escapement of fishes was observed only from the last belly region of the trawl net.

High opening trawls continued to perform better than six seam trawls.

A dried fish-cereal mixture that can be used for preparation of soup was developed from *Sciaenid* fish.

The survival rate of 24 hours depurated blood clam was found to be considerably more at $10^{\circ} \pm 1^{\circ}\text{C}$ than at ambient temperature.

Black spot in headless tiger, white and brown prawn could be prevented by treatment with 0.3% sodium metabisulphite (89% purity) solution for 30 seconds.

Meat could be easily separated from small fish by using a dense medium of specific gravity 1.218 - 1.221. The yield of meat was found to be about 20% to 26% of the whole raw fish.

Samples of marine fish and shell fish collected from Visakhapatnam and Kakinada contained low levels of total mercury well below hazardous limits.

Histamine content of sun dried, ungutted big white balt was considerably more in summer than in other seasons.

RESEARCH PROJECTS HANDLED

1. Studies on demersal trawls
2. Evolution of improved techniques and transportation of fish, shell fish and fishery waste available in Andhra region
3. Study on operational parameters and techno-economic feasibility aspects of solar driers at Kakinada
4. Studies on the preservation and utilisation of locally important fishes of Andhra Coast
5. Development of products using minced meat from low cost fish available in Andhra Coast

REPORT OF WORK DONE

Fishing Gear

Comparative fuel efficiency studies of three types of trawls, viz. rope trawl, six seam trawl and bulged belly trawl were continued during the year. The rope trawl continued to give better performance when

compared to the other two designs. Further studies are to be carried out to confirm the findings and effect an improvement in the design, rigging and operation.

In order to evaluate the performance of a bulged belly trawl at varying trawling speeds, the net was operated under four different r.p.m.s — viz. 1150, 1200, 1250 and 1300. The catch rate was better at 1300 r.p.m.

Experiments on escapement reaction of fish from trawl nets in operation have shown that the escapement in general was very little, to the extent of 1% of the total catch, mostly from the last belly portion of the net.

Studies were initiated on the effect of wing height on the performance of a trawl. Bulged belly trawls with two different wing heights were tried along with a standard design as control. The catch rate was more or less equal indicating that difference in wing height has no significant effect on the catches.

Survey was conducted of shark long line operated from mechanised boats at Uppada and Kakinada. The specifications of a typical line gear are as follows:

Main line	—	Monofilament 4 mm. dia
Distance between two branch lines	—	27 m. - 30 m.
No. of hooks in each unit	—	5
Snood (i)	—	Polyamide, 3 mm. dia
Length	—	7.4 - 8 m.
Snood (ii)	—	Stainless Steel wire SWG 28
Length	—	(twenty four strands)
Length	—	0.5 - 1.25 m.
Hook No.	—	0/3
Baits used	—	Dolphin meat, tuna meat and other fish

Fish preservation and processing

Three samples of intermediate moisture fish products were prepared from fillets of Rohu using different combinations of glycerol, sucrose, sodium chloride and potassium sorbate. The products remained in acceptable condition for 2 to 3 months on storage at room temperature adjudged by physico-chemical and organoleptic tests.

Efforts to develop dried fish cake and fish-cereal dried mixture from minced meat of *Sciaenid* met with success.

Horse mackerel, frozen on board deep sea vessels, remained in acceptable condition upto 17 days when stored in ice.

In order to determine the optimum temperature for storage of 24 hours depurated blood clam, three temperatures were tried viz $10^{\circ} \pm 1^{\circ}\text{C}$, $18^{\circ} \pm 1^{\circ}\text{C}$ and $30^{\circ} \pm 6^{\circ}\text{C}$. Survival rate of the clams was found to be considerably more at $18^{\circ} \pm 1^{\circ}\text{C}$ than at other temperatures tested.

Studies were carried out to determine the optimum concentration and duration of treatment of penaeid prawns with sodium metabisulphite for prevention of black spot. Treatment of prawns with 0.3% sodium metabisulphite solution for thirty seconds was found most efficient for prevention of black spot with residual sulphur dioxide within permissible limits.

Dense media with varying specific gravities ranging from 1.204 to 1.221 were tried for separation of meat from small fishes like silver bellies, white baits and lesser sardines. A medium with specific gravity 1.218 - 1.221 was found to be best for separation of meat. The separated

meat with about 40% moisture was found acceptable even after three months' storage at ambient temperature.

The histamine content in sun dried, ungutted big white baits was considerably more in summer, ($>100\text{mg./100gm.}$), as compared to the histamine content in the same variety of fish during other seasons.

Salted and pressed *Psenus* was acceptable for human consumption upto 7 weeks of storage. Ready-to-cook convenience foods with storage life upto 4 weeks were also prepared from *Psenus*, horse mackerel, cat fish and *Sciaenids* by incorporating spices.

Characterisation of vibrio isolates from marine fish | shell fish and halophiles from cured fish was carried out and the sensitivity of the red halophiles to different chemicals and spices determined.

Muscle of edible fresh water spiny eel collected from Godawari river near Rajahmundry was found to contain more mercury than other tissues of the same fish such as skin, intestine, gills etc.

RESEARCH CONTEMPLATED

1. Further studies on fuel saving trawls and improved high opening trawls
2. Development of intermediate moisture fish cubes and dried fish-cereal mixtures
3. Development of minced fish patties
4. Development of fish sausage and convenience products from low cost fish
5. Monitoring of marine and inland fish | shell fish for heavy metals and pesticide residues

6. Control of insect infestation in dry fish
7. Studies on the epidermiology and control of red discoloration in cured fish
8. Screening of seafoods for pathogenic vibrios

BURLA RESEARCH CENTRE

SCIENTISTS ASSOCIATED

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

CHIEF FINDINGS

Polypropylene twines were observed to be more effective than nylon and other newer synthetic twines for fabrication of fishing gear.

***C. catla* was found to migrate into the surface zones during winter months.**

Polythene lined bamboo baskets were found to be adequate for storage of iced fish in place of traditional sal leaf lined bamboo baskets used locally for transport of fish.

Treatment with leaf extract of *Mentha viridis* improved the quality of sun dried product from *G. chapra*.

Low cost fresh water fishes could be utilised for manufacture of fish wafers.

RESEARCH PROJECTS HANDLED

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

REPORT OF WORK DONE

Fishing gear for reservoirs

Studies on the availability of fishes at various depths, areas and seasons, different

scope ratio and performance of mid-water trawl were carried out. Analysis of data so far gathered indicate the availability of *R. cotio*, *Mystus* sp. and *Wallago attu* in 10-20 m. depths in winter months and in 0-10 m. in summer months. Other species such as *Sciaenids*, *A. coilea*, *R. chrysea* and *S. silondia* were also caught in abundance in 10-20 m. depth during the winter months, while the presence of these species during summer was negligible.

Scope ratio studies carried out during the period using three different depth warp ratios, viz. 1:2, 1:2.5 and 1:3 indicated the better efficiency of 1:3 ratio when compared to the other two. To improve the performance of the gear further, a false head rope was attached to the net. Studies are in progress.

Experimental fishing with gear made of different materials was continued to assess their relative efficiency. The catch per 1000 sq.m. of net of polypropylene, nylon monofilament, HDPE twisted twine, HDPE yarn and nylon multifilament worked out to 4.32 Kgs., 3.50 Kgs., 1.16 Kgs., 0.77 Kg. and 3.53 Kgs. respectively.

Observations on the availability of *C. catla* at various depths were continued as well as relative data on the effect of lunar periodicity and hydrobiological factors recorded. From the data so far analysed, it was seen that during winter months, surface nets landed 1.82 times more *Catla* than column set nets which may be due to the movement of fish towards the surface regions during this period.

Preservation and processing of fresh water fish

Studies on dry salt curing of fresh water fishes like *R. cotio* and *M. seenghala* were initiated.

Aqueous extract of Pudina leaf (*Mentha viridis*) was seen to have some beneficial effect on the quality of sun dried *G. chapra*.

Investigations were also undertaken on sun-dried products developed from *E. vacha* after blanching the fish in an aqueous extract of *M. viridis*. 5% sodium chloride was incorporated in one batch for further improvement in shelf life.

A method was standardised for manufacture of wafers utilising minced meat from low cost fresh water fishes.

Studies carried out on the possibility of improvements over the traditional bamboo baskets for iced fresh fish transportation have shown that bamboo baskets lined with polyethylene can replace traditional sal leaf lined baskets for the transportation of iced fresh fish.

A multipurpose insulated box was designed and fabricated for use on board fishing vessels as also for transportation of the catch to the market.

RESEARCH CONTEMPLATED

1. Studies on scope of mid-water trawling in Hirakud reservoir
2. Introduction of newer fishing gear materials other than nylon in reservoirs
3. Spatial distribution of *C. catla* in gill nets

4. Studies on light fishing in Hirakud reservoir and development of fishing gear and methods for reservoirs other than Hirakud
5. Studies on salt curing of fish and use of medicinal plants in preservation of dried fish products
6. Survey of packages for fresh, live and processed fishery products available in Orissa and development of alternate packaging systems
7. Design and development of solar fish drier

BOMBAY RESEARCH CENTRE

SCIENTISTS ASSOCIATED

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

CHIEF FINDINGS

'Karkara', a commercially less utilised species belonging to the *Pomadasydae* family could be stored in good condition in ice for thirteen days, adjudged by organoleptic and biochemical parameters.

The yield of edible meat from 'Karkara' was found to be around 50-55%.

Frozen stored fillets of 'Karkara' at -18°C to -20°C remained in excellent condition even after 10 weeks of storage as judged from organoleptic characteristics.

RESEARCH PROJECTS HANDLED

1. Studies on preservation and utilization of commercially less utilized fishes of Maharashtra
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 utilisation of economically less utilized varieties of fish. Fishes belonging to the family *Pomadasydae* and locally known as 'Karkara' remained in good condition in ice stored temperature (0-4°C) for thirteen days as judged by organoleptic and biochemical characteristics, after which rancidity set in. The yield of edible portion of meat from the fish was found to be 50-55%. Fillets obtained were frozen in blocks of 250 gms., stored at -18°C and subject to further studies. The frozen fillets remained in excellent condition even after 10 weeks of storage as based on organoleptic parameters.

Microflora of fresh 'Karkara' fish fillets comprising of *Pseudomonas*, *Vibrio*, *Aeromonas*, *Cytophaga*, *Flavobacter*, *Micrococci* and *Clostridia* showed a reduction in population during iced storage, whereas during frozen storage, *Pseudomonas*, *Vibrio* and *Acinetobacter* were predominant.

As part of a programme of monitoring the hygiene and sanitation in fish processing and fish landing centres in Bombay, 101 samples of fresh fish, shrimp, lobster, squid, cuttlefish, water and ice were studied for presence of faecal indicator organisms and pathogens. *E. coli* and coagulase positive Staphylococci were prevalent in these samples collected from the pre-processing and peeling and landing centres of Bombay. *V. cholerae* O1 group was not detected in any of the fish samples. However NAG type *V. cholerae* were isolated

from fresh shrimp, cuttlefish and squid from local markets. In finished frozen products of commerce, there was no incidence of either *V. cholerae* O1 group or *V. parahaemolyticus* (Kanagava type). Demonstrations were carried out on the use of 10 ppm. chlorinated water for fish processing.

RESEARCH CONTEMPLATED

1. Studies on biochemical and microbial quality of frozen fish belonging to commercially important species of Maharashtra
2. Study on the survival of different pathogenic organisms with reference to Salmonella, *V. parahaemolyticus* and *L. monocytogenes*
3. Monitoring the presence of *V. cholerae* and *V. parahaemolyticus* in fresh and processed fishery products

CALICUT RESEARCH CENTRE

SCIENTISTS ASSOCIATED

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

CHIEF FINDINGS

Calcium propionate was found equally effective as sodium propionate in preventing 'red' in properly dried, cured fish. Uniform application of the preservative could be effected by dip treatment of the cured fish in a solution of the preservative in saturated brine.

Glagelly oil and sunflower oil were found to have insect repellent property when applied to cured fish.

Pyrethrum synergised with piperonyl butoxide was found to be a good insect repellent for cured fish.

Both HDPE and LDPE were found equally suitable for packing dry fish.

Pickle cured and Mediterranean type cured oil sardine kept well for over a year in glazed porcelain / glass jars.

Treatment of commercially cured fish in saturated brine containing 20 ppm. available chlorine improved its bacterial quality and reduced content of extraneous matter, besides imparting better colour and appearance to the product.

RESEARCH PROJECTS HANDLED

1. Development of diversified dried and cured fish products
2. Studies on insect infestation in cured fish and fishery products and their control

REPORT OF WORK DONE

The efficacy of both calcium propionate and sodium propionate to prevent 'red' in cured fish was compared by treatment and storage of the fish with about 40% moisture. Both the calcium and sodium salts were found equally effective, the calcium salt being preferable as this is indigenously available and cheaper. Uniform application of the preservative by dip treatment was tried as dusting/sprinkling was not found feasible on a commercial scale. A saturated solution of calcium propionate (5% approx.) in saturated brine was found suitable. The optimum duration of dip treatment and maximum number of continuous dips in the same solution are being worked out.

Insect infestation after development of 'red' is a major problem in the storage of dry cured fish. This problem was attacked in three ways — by application of oils, natural insecticides and by heat treatment.

a. *Application of oils:* Twelve different oils, viz., gingelly oil, sunflower oil, safflower oil, coconut oil, groundnut oil, palm oil, mustard oil, neem oil, hydrocarpus oil, castor seed oil, rice bran oil and cashewnut shell liquid (CNSL) were tested for their insect repellent properties by coating them on the gunny used for packing cured fish or spraying on the fish. Of the oils tested, only gingelly oil, sunflower oil, rice bran oil and CNSL were found to possess insect repellent properties. However, as CNSL is inedible and rice bran oil attracts insects, only gingelly oil and sunflower oil could be considered for application on the cured fish. Further studies are underway.

b. *Application of natural insecticides:* Three different pyrethrum formulations at different dilutions were tried as dip for cured fish and as spray on the gunny used for packing the cured fish. Preliminary observations show that a formulation containing pyrethrum and piperonyl butoxide repels insects for a considerably long time when sprayed on the gunny.

c. *Application of heat treatment:* Thick varieties of cured fish were subjected to heat treatment at 80°C, 60°C and 50°C for 1, 1½ and 1½ hours respectively, while thin varieties were also exposed to the same temperatures for ½, 1 and 1 hour respectively. The samples on storage in polythene bags revealed the destruction of all insects, including their pupae, larvae and eggs.

Commercial dry cured fish after dip treatment in saturated sodium chloride brine containing 20-500 ppm. available chlorine followed by drying and treatment with calcium propionate yielded a hygienically sound product with better appearance.

Mediterranean curing:

Indian oil sardines preserved both by Mediterranean type of curing and pickle curing and stored in glazed porcelain/glass jars kept well for over a year, indicating possibility of home scale preservation of oil sardines.

Microbiological aspects of fish and shell fish:

Studies were continued to assess the seasonal variations in yield of meat and bacteriological and organoleptic qualities of mussel collected from their natural beds. Live mussels collected from one of their natural beds at Moodadi were all found to be bacteriologically sound and free of salmonella, coagulase positive staphylococci and *E. coli*. Coliforms and faecal streptococci were however present, though in very low quantities in a few number of samples. During summer, the bacterial load was slightly higher. The yield of meat on steam shucking also showed seasonal variation ranging from 6% to 19%.

About 74 samples of cured fish were collected from Calicut Central Market and examined for bacteriological and chemical characteristics. Faecal streptococci, fungi and halophiles were present in 95% of the samples, while coliforms and coagulase positive staphylococci were present in 16.2% and 4.1% respectively. *E. coli* was not detected in any of the samples. Most of the

samples were also high in moisture content. All of them got spoiled after 3 months of storage with reddening, fungal growth, rancidity and insect attack.

GOA RESEARCH CENTRE

RESEARCH CONTEMPLATED

1. Control of insect infestation and red halophiles in cured fish
2. Production of smoked and pickle cured products
3. Evaluation of commercial pickle curing
4. Techno-economic aspects of curing

SCIENTISTS ASSOCIATED

G. Narayanappa, T. Joseph Mathai, R. S. Manoharadoss.

CHIEF FINDINGS

A towing speed of 2.5 knots was found optimum for operation of midwater trawls from small vessels.

It has been conclusively proved that nets fitted with tapering jibs are more effective than nets with straight jibs for the capture of shrimps.

Encircling mackerel gill nets made of twine 210/D/1/2 with 50 mm. mesh size were found to be most effective.

RESEARCH PROJECTS HANDLED

1. Studies on demersal trawl
2. Studies on midwater trawl
3. Studies on traditional gear improvement and transfer of technology

REPORT OF WORK DONE

Studies on tapering jibs were completed. A significant difference ($p < 0.05$) was observed between the trawl net fitted with tapering jibs and the control net with straight jibs with regard to prawn catch. Nets with tapering jibs yielded significantly higher prawn catch than the control.

Separator trawl studies were continued. The 6.0 cm. mesh separating panel continued to show better separation of shrimps and fishes than the 5.0 cm. panel fitted to identical 15.0 m. bulged belly trawls.

Studies on platform trawls were continued. Eleven operations were carried out during the year. The platform trawl landed more of column fishes while the control net had a preponderance of bottom dwelling fishes.

A 32.0 m. bulged belly trawl, fabricated and assembled at the Centre was successfully operated from a Fishery Survey of India vessel M. F. V. "Meena Sitara".

Studies on the optimum speed of a 10.3 m. unequal panel midwater trawl have shown a towing speed of 2.5 knots to yield the best results. Scope ratio studies have also revealed the efficacy of a 1:5 depth warp ratio.

Studies on encircling mackerel gill nets were concluded. Of the fifteen combinations tried, the net with 50 mm. mesh in twine nylon 210/1/2 was found most productive. Dusk operations yielded remarkably better catches (76%) than dawn operations (24%).

Studies were initiated on stick held drag nets. Preliminary trials showed the depth at the centre of the net to be insufficient for the effective capture of fishes in the estuarine and inshore areas. Necessary modifications in the design have been effected.

RESEARCH CONTEMPLATED

1. Studies on platform trawl
2. Standardisation of 10.3 m. unequal panel midwater trawl
3. Studies on cod-end mesh selectivity of shrimp trawls
4. Studies on stick held drag net

EXTENSION & CONSULTANCY

TRAINING PROGRAMMES/ DEMONSTRATIONS

Training courses on Inspection of Fish and Fish Products were initiated for Health Inspectors of the Corporation of Cochin. Forty health officers were trained during the year in two batches, one from 11-15 January, 1988 and the other for one week from 14 March, 1988.

Training in Microbiological and Biochemical Aspects of Seafoods was imparted to a candidate from a fisheries organisation from 18 January to 4 February, 1988.

A demonstration-cum-training on Hygienic Handling and Processing Clams was organised by MPEDA in association with CIFT at Quilon on 10 and 11 March, 1988.

In-plant training in Refrigeration and Air-conditioning was given to four candidates sponsored by the Government Polytechnic, Kalamassery from 2 April to 30 June, 1988.

A Refresher Course on Quality Control Aspects of Fishery Products was held from 6-18 June, 1988 in which seven candidates from fish processing establishments in and around Cochin participated.

Demonstration on proper deveining and removal of hanging meat from shrimp was held as part of the training programmes conducted by MPEDA on Hygienic Handling of Shrimps in Peeling Sheds, at Aroor and Ezhuppunna on 15 & 17 November 1988 respectively and at Eramalloor on 20 & 21 December, 1988.

Three batches of training programmes — 2 of ten days and 1 of nine days duration — were organised in collaboration with Export Inspection Agency, Madras, for the benefit of technologists working in fish processing factories. Altogether thirtyfive candidates attended the programme which comprised both lecture and practical classes.

Training in Production of Diversified Fish Products was held in collaboration with the State Fisheries Department under their Special Component Scheme from 15-19 November, 1988, with a view to providing gainful employment to the SC women of Cannanore District. Thirty harijan women participated in this programme.

The Veraval Research Centre took part in conduct of a training-cum-demonstration programme on Fish Handling and

Preservation, organised by MPEDA in association with CIFT and the State Department of Fisheries, Government of Gujarat, during 15-19 February, 1988 at Mangrol (Gujarat). About 150 fishermen and fish traders attended this programme.

The Kakinada Research Centre conducted a training programme on Hygienic Handling of Shrimps for Export in association with MPEDA on 6 & 7 October, 1988 at Kakinada and on 16 & 17 November, 1988 at Visakhapatnam in which a total of 141 and 71 people respectively participated.

A training programme on Processing of Fish Maws was also organised by the Kakinada Centre in association with MPEDA on 3 & 4 October, 1988.

At the request of the Chief Warden of Fisheries, Himachal Pradesh, training was imparted to 16 reservoir fishermen of various Fishermen Co-operative Societies of Zakatkhana fishing village on the bank of Govindsagar reservoir, in designing, fabrication, mending, rigging and operation of improved gill nets during the period 16-25 August, 1988.

A training programme on Harvest and Post Harvest Technology of Fish was organised at Burla, Orissa from 24 October to 5 November 1988 at the request of Integrated Co-operative Development Project, (ICDP) Bilaspur, H.P. Twenty nine fishermen (members of ICDP) attended the programme.

At the Bombay Research Centre, eleven personnel were trained in the general aspects of Quality Control and Microbiological Analysis of Fish and Fishery Products for a period of fifteen days.



Training given to harijan women of Cannanore District in preparation of fish wafers

Participants of the training programme on harvest and post-harvest technology of fish held at Bilaspur, Himachal Pradesh



Demonstration programmes were held in collaboration with Export Inspection Agency for the benefit of fish processing centres on effective removal of pathogens in fresh shell fishes by using 10 ppm. chlorinated water.

Five technologists of IPQC fish plants were trained in detection of *V. cholerae*.

Training in the routine organoleptic quality criteria was also imparted to technologists sponsored by IPQC plants in Bombay, Goa, Porbander and Ratnagiri regions.

Demonstration on re-processing of commercially cured silver belly, its drying, calcium propionate treatment and retail packaging was carried out by the Calicut Centre at the request of a private entrepreneur of Badagara.

The Centre also demonstrated the scientific curing of sole fish, its drying, preservative treatment and packaging to an interested entrepreneur at Puthiappa.

The Goa Research Centre also demonstrated the operations of a midwater trawl to a private fishing vessel owner at Nerul, Goa.

TECHNICAL CONSULTANCY/ GUIDANCE

Two 15.6 m outrigger trawlers were inspected and the report on the technical inspection forwarded to the concerned party. Inspection reports of two 16.5 m. wooden outrigger boats were also forwarded on request.

Technical assistance in processing and packaging deep sea lobsters was given to

two private establishments, viz. M/s. Gautham Constructions & Fisheries Pvt. Ltd., Visakhapatnam, and M/s. Seal Fisheries Private Ltd., Madras. Assistance was also rendered to M/s. Gautham Constructions and Fisheries Private Ltd. in preparation of a project report for setting up a fish processing plant.

The fish meal plant and cold storage of M/s. Amar Fertilizers at Porbander were visited and technical guidance given on production of quality fish meal and setting up a testing laboratory for analysis of the product.

As part of a scheme drawn up between CIFT and Kerala Agricultural University on the use of soil and agrometeorological instruments developed at CIFT for agricultural purposes, sensors of soil temperature, soil moisture and solar radiation were installed at the University farms to study the water requirements of banana plants under different conditions.

The performance of the IQF machinery installed at M/s. Castlerock Seafoods, Veraval, was evaluated and its evaluation report forwarded to the party.

Technical know-how on preparation of prawn powder and fish powder was transferred to M/s. Amalgam Foods, Cochin. The firm has since started production of the prawn powder based on CIFT method for M/s. Food Specialities Ltd., New Delhi.

The Burla Research Centre made an on-the-spot study of the various fishing problems faced by the fishermen of Gobindsagar Reservoir at the request of the

Chief Warden of Fisheries, Himachal Pradesh. The local fishing gear and accessories were studied and modifications suggested.

A consolidated list of equipments/instruments for setting up a mini laboratory for examination of canned and frozen fish products was prepared and given to M/s. Amison & Co., Cochin.

REPLY TO TECHNICAL QUERIES

The Institute continued to receive queries on various aspects relating to fishing and fish processing from different parts of the country as well as from outside. Replies to over 250 such queries were sent during the year.

Most important among the information so passed out to the interested parties/entrepreneurs are listed below.

Fishing Technology

- i. Problems related to installation of 15 HP outboard motor to 25 ft. fibre glass boat
- ii. Fibre glass sheathing of plywood boats
- iii. Electronic equipments suitable for use in lakes for fish detection and instruments available for estimation of thermocline
- iv. Use of Cashewnut shell liquid for manufacture of marine paints
- v. Particulars of equipments required for detection of sharks
- vi. Design of mechanical sprayer system for pole and line fishing

Fish Processing Technology

- i. Processes developed for preparation of canned, frozen, dried and smoked products
- ii. Conversion of miscellaneous fish and fish wastes into useful products/by products
- iii. Guidelines for starting a fish drying unit including different drying methods, different types of dryers and cost of production of dry fish
- iv. Safe levels of heavy metals in fish and processed fish
- v. List of permissible chemicals which could be used to prevent spoilage in frozen fish
- vi. Use of collagen fibres from fish gut
- vii. Handling and transport of live lobsters
- viii. Role of fish diet in prevention of certain fish diseases
- ix. Setting up of chitin/chitosan commercial plants
- x. Mineral composition of common varieties of fresh water, brackish water, offshore and deep sea fishes
- xi. Modified atmosphere packaging of fish
- xii. Preservatives used in canning of fish/shell fish
- xiii. Containers for packaging of fish/fish products
- xiv. Varieties of fish which have found domestic market and those having export potential

- xv. Code of practices for packaging frozen fish, squid, cuttle fish, frozen lobsters and pomfrets for export
- xvi. Preparation of fish powder, prawn powder and prawn paste
- xvii. Requirements of Mini laboratory for examination of canned and frozen fish products
- xviii. Indigenous technologies for generating local entrepreneurial opportunities

The Veraval Centre analysed 39 samples of fish meal/dry fish and 11 samples of water/ice.

The Bombay Centre analysed 10 samples of frozen shell fish products, 2 of dried fish, 9 of water and 14 of ice while the Calicut Centre analysed 3 samples of water in addition to an ultraviolet water treatment system for its efficiency to purify water.

ANALYSIS OF MATERIALS/ PRODUCTS

Samples of fish products, raw materials, fishing craft and gear materials etc. received from indigenous processors | manufacturers were tested and results communicated to the concerned parties with suggestions for improvement wherever necessary. Details of products | materials tested are given below:

<i>Product/material</i>	<i>No. of samples analysed</i>
Water	44
Ice	29
Frozen fish and shell fish products	21
Canned fish and shell fish products	51
AFD products	1
Fish by-products	3
Fish speciality products	2
Canning medium	3
Packaging materials	18
Fishing gear materials	16
Fishing craft materials	5
Marine engine	1
Outboard motor	2
Disinfectant	2
Soil extract	1

SUPPLY OF DESIGNS/ PUBLICATIONS

The various publications of the Institute and designs of wooden fishing craft, fishing gear etc. continued to be in demand. Details of supply are indicated below:

<i>Publications</i>	<i>No. issued</i>
i) Quality control in fish processing	124
ii) Special Bulletin No. 8 — Abstracts of CIFT Publications	4
iii) Special Bulletin No. 9 — Indigenous Marine Fishing Gear and Methods of India - I - Karnataka State.	12
<i>Designs</i>	
i) 25 ft. fishing boat	3 sets
ii) 30 ft. trawler	4 sets
iii) 32 ft. trawler	2 sets
iv) 36 ft. trawler	5 sets
v) 50 ft. combination vessel	6 sets
vi) Bulged belly trawl	1 set
vii) Otter board	1 set

EXHIBITIONS AND FILM SHOWS

Samples of chitosan and dehydrated jelly fish were supplied to the Marine Products Export Development Authority for display at the Hoteres and Foodex Japan, 1988, held at Tokyo, 8-12 March, 1988.

In connection with the Conference on Agrometeorology organised by Indian Agrometeorological Society at Cochin from 28-30 April 1988, an exhibition was held on 'Electronic instruments developed at CIFT and useful for agrometeorological and environmental investigations'. The exhibition was inaugurated by State Minister for Agriculture, Shri V. V. Raghavan.

Samples of dehydrated jelly fish were supplied to MPEDA for display at their stall put up at the Seafood Asia 1988, an exhibition which ran concurrently with a three day International Conference held at Singapore, 8-10 September, 1988.

Samples of fish products, colour negatives and photographs on various research achievements were sent for display at the Science and Technology exhibition held at Pragati Maidan, New Delhi, 14-29 November, 1988.

More than half a dozen film shows were also held for students and trainees of various courses held at the Institute.

OPEN HOUSE/ FISHERIES SEMINAR

As a part of the festivities to mark 40 years of India's Independence and Jawaharlal Nehru Centenary Celebrations, an Open-house was held on 15 October 1988 to give an opportunity for the public

to get acquainted with the various activities pertaining to harvest and post harvest technology of fish. Students from various educational institutions, personnel from fisheries departments and the local public participated in this programme.

An Open-house and Fisheries Seminar was also held at the Institute on 30 December 1988 in which a group of fishermen representing various fishing centres in and around Cochin visited the various laboratories of the Institute and acquainted themselves with its varied activities. They also held discussions with the Director and senior Scientists on the different technological problems faced by them.

RADIO TALKS/PRESS RELEASES ETC.

Eight radio talks by the Institute staff were broadcast over AIR, Trichur/Trivandrum during the year. These included:-

- a. Interview with Dr. K. Devadasan, Scientist S-3 on "Fish as a nutritious food".
- b. Talk in malayalam on "Biodeterioration - various reasons and how it affects our fishery industry" by Kum. B. Meenakumari, Scientist S-2.
- c. Discussion with Dr. K. Gopakumar, Scientist S-4, on "Economics of fish processing".
- d. Talks by Shri. M. R. Nair, Director, on "Employment oriented projects of CIFT" and "Activities and achievements of CIFT".
- e. Talks by Dr. N. Unnikrishnan Nair, Scientist S-2, on "Preservation of



Developments in instrumentation being explained to State Minister for Agriculture, Shri. V. V. Raghavan, at the exhibition organised in connection with Conference in Agrometeorology Fishermen at the Open-House and Fisheries Seminar held at the Institute in connection with Nehru Centenary Celebrations



country craft" and "Methods to increase the efficiency of country fishing boats".

- f. Talk by Shri. K. C. Purushothaman, T-7, on "Employment for coastal women in the fishery industry".

Thirteen press releases were made during the period on the various activities of the 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 senior Scientists were also invited to deliver lectures for the benefit of participants of various training programmes/seminars conducted by State and Central Government organisations.

COLLABORATIVE PROJECTS

SPONSORED PROJECT- 'GAINFUL EMPLOYMENT FOR COASTAL WOMEN'

Under the scheme on Gainful Employment for Coastal Women co-sponsored by the Institute and the Department of Science and Technology, two training programmes, each of three months' duration, were conducted during the year for groups of twentyfive women selected from two fishing villages. The women were given training in preparation of diversified fishery products in a hygienic manner on a large scale and their marketing. With a view to promoting domestic marketing, a retail booth was opened for

selling the various products, viz. fish/prawn cutlet, fish wafers, pickles, dried fishery products etc. under the trade name 'Matsyakanya'. An amount of Rs. 18,841/- was collected as sales proceeds during the period 1-1-1988 to 31-12-1988. A video coverage of the various aspects of the training programmes was also made.

Fish products prepared by the trainees under the scheme were displayed at the Science Congress Exhibition organised by the University of Pune during 7-20 January 1988.

As a follow-up of this scheme, an All India Workshop on 'Gainful Employment for Women in the Fisheries Field' was conducted during 7 - 8 March 1988 in which 21 papers were discussed for identifying priority areas. About 90 delegates participated in the Workshop.

CIFT-ODNRI COLLABORATIVE PROJECT ON FISH PROCESSING

Under this project, Dr. Fuchs, a Senior Microbiologist from ODNRI, London, conducted investigations in the bacteriology lab. of the Institute on the incidence of *Listeria* using FDA methods and *Staphylococcus aureus* using Baird Parker Agar. Samples of marine, brackish-water and fresh water fishes and prawns and frozen and dried fish/fishery products were procured from the market for conducting the necessary tests. A total of 35 samples was thus analysed. No *Listeria monocytogenes* was isolated, though other non-pathogenic species like *L. innocus* were detected in 3 of 10 fresh fish samples and 5 of 14 frozen samples. Dried/cured

fish and prawn were completely free of *Listeria*.

Of the many *Staphylococcus aureus* cultures isolated, only a selected few were studied for enterotoxin production. Toxins A to D were detected in some of the samples studied.

A training course of four days duration on methodology for *Listeria monocytogenes* was conducted for the benefit of the scientists of this Institute, the Export Inspection Agency and the Marine Products Export Development Authority. The participants were given both theoretical and practical training in the methodology of isolation and identification of *L. monocytogenes* from fish and fishery products.

ISLAND FISHERY DEVELOPMENT PROGRAMME

Steady progress was maintained in the various activities under this programme.

At Agati, one of the many Lakshadweep islands, kirby bent, round bent and

swan hooks were operated with tuna head as bait. The catch mainly consisted of oceanic shark, *Isurus sp.*

Gill net fishing, which is at present not much popular in the Lakshadweep islands, was carried out at Kalteni with a view to finding out the feasibility of its introduction in that area. Large mesh gill nets of 180 to 220 mm. mesh size and fabricated using 2 mm. dia. HDPE were operated in the area. The results obtained were quite encouraging. The catch consisted mainly of shark, ray, *Caranx*, sub-surface tuna and seer.

Modifications were effected in the troll line fishing gear in vogue at Lakshadweep (Kadamath) using artificial jigs developed by CIFT and the comparative catch rate recorded. Escapement of hooked fish with CIFT designed jigs was found negligible.

FISHING CRUISES

Particulars of various cruises undertaken during the year on board the research vessel FORV 'Sagar Sampada' are given below:

<i>Cruise No.</i>	<i>Period</i>	<i>Participants</i>
42	3-19 Feb. 1988	K. K. Kunjipalu, S-2 Pravin Puthra, S-1
43	25 Feb. - 10 March 1988	A. C. Kuttappan, S-1
44	14-29 March 1988	Dr. M. D. Varghese, S-2 N. A. George, T-6
47	26 May - 6 June 1988	M. R. Boopendranath, S-2
48	11 June - 5 July 1988	Dr. M. D. Varghese, S-2
50	28 July - 22 Aug. 1988	N. Subramonia Pillai, S-2
53	13-29 Oct. 1988	M. R. Boopendranath, S-2
54	30 Oct. - 16 Nov. 1988	A. C. Kuttappan, S-1



*Dr. Fuchs, the ODNRI Microbiologist, isolating and identifying *Listeria monocytogenes* under the CIFT-ODNRI Collaborative Project on Fish Processing at CIFT Lab*

'Matsyakanya'-the retail booth opened by the women trained under the sponsored project 'Gainful Employment for Coastal Women' at Cochin



REGIONAL COMMITTEE MEETING

The twelfth meeting of ICAR Regional Committee No. 8 met at the Institute on 16 & 17 August, 1988. About ninety delegates participated in this two day meeting. The delegates included the DG (ICAR), Vice Chancellors of Agricultural Universities of Kerala, Tamil Nadu, Bangalore and Dharwar (Karnataka State), Secretaries of Government of India and State Governments and Directors of ICAR Institutes of these three States, who are also members of the Committee.

SYMPOSIA/SEMINARS/ WORKSHOPS ETC. ATTENDED

Shri. M. R. Nair, Director and a few Scientists of the Institute attended the Symposium on Tropical Marine Living Resources organised by Marine Biological Association of India, Cochin, 12-16 January, 1988. Shri. M. R. Nair chaired two Technical sessions on "Fishery Technology" and "Extension and Manpower Development." Eleven papers by the Scientists of the Institute were presented at the Symposium.

Dr. T. K. Sivadas, Scientist S-3, participated in Seminar on Instrumentation for Environmental Assessment and Monitoring of Chilka Lagoon, organised by Orissa State Fisheries Department, in view of conserving Chilka Lagoon, 20-22 January, 1988, and presented a paper.

Dr. P. K. Surendran, Scientist S-2, attended Workshop on Environmental Engineering sponsored by Kerala State

Committee on Science, Technology and Environment, Kothamangalam, 4-6 March, 1988.

A number of Scientists also attended the All India Workshop on Gainful Employment for Women in Fisheries Field organised by Society of Fisheries Technologists (India), Cochin, 7 & 8 March, 1988. Four papers were presented at the Workshop. Shri. M. R. Nair, Director, chaired the plenary session in the Workshop.

Dr. T. K. Sivadas participated in Workshop on Aquacultural Engineering organised by Water Resources Centre of Anna University, Madras, 6-8 April, 1988.

Dr. K. Gopakumar, Scientist S-4, attended seventh session of Indo Pacific Fisheries Commission (IPFC) Working Party on Fish Technology and Marketing, Bangkok, Thailand, 19-22 April, 1988. He was elected Chairman of technical session on 'Processing of Microbiologically Safe Seafoods in Asian Regions'.

Shri. P. K. Chakraborty, Scientist S-3, attended Seminar on Production and Management Techniques in Process Industry organised by Institution of Engineers (India), Cochin 22 & 23 April, 1988.

Shri M. R. Nair, Director, Dr. T. K. Sivadas, Scientist S-3, Shri. K. Ramakrishnan, Scientist S-2 and Smt. K. Vijayabharathi, Scientist S-1, attended the International Seminar on Agrometeorology sponsored by Kerala Agricultural University and Indian Agrometeorological Society, Cochin, 28-30 April, 1988.

Shri. P. Madhavan, Scientist S-3, participated in Workshop on Antarctic

Studies conducted by Department of Ocean Development, New Delhi, May 1988.

Dr. T. S. G. Iyer, Scientist S-3, participated in the Fisheries Seminar organised by Kerala Dhivara Sabha, Cochin, 29 May 1988, and presented a paper.

Shri. V. C. George and K. K. Balachandran, Scientists S-3, participated in Seminar on the Impact of Outboard Motors in the Traditional Fisheries Sector of Kerala conducted by South Indian Federation of Fishermen Societies, Trivandrum, 4 June, 1988.

Shri. S. Ayyappan Pillai, Scientist S-3, attended Seminar on Energy Crisis in Kerala organised by Cochin Centre of Institution of Engineers (India), Cochin, 5 June, 1988.

Dr. P. J. Cecily, Technical Officer, attended Seminar on Role of Co-operative Society and its Working Pattern for Fisheries Development, Cochin.

Dr. M. K. Kandoran, Scientist S-3, attended course on Appropriate Technologies for Rural Women organised by National Institute of Rural Development, Hyderabad, 4-9 July, 1988, where, as Resource Person, he gave a talk on the technologies developed for fisherwomen.

Kum. B. Meenakumari, Scientist S-2 attended Summer Institute on Resource Management and Conservation of Inland Capture Fisheries of India at Central Inland Capture Fisheries Research Institute, Barrackpore, 4-23 July, 1988.

Shri. G. Narayanappa, Scientist S-3, participated in All India Seminar on

Marine Fisheries organised by State Bank of India at Benaulim, Goa.

Shri. K. V. Mohan Rajan, Scientist S-2, attended V Consultative Group Meeting of Porbander Base of Fishery Survey of India, 6 August, 1988.

Shri. S. Ayyappan Pillai, Scientist S-3, attended one day Seminar on Import-Export Policy 1988-91 conducted by Indian Institute of Materials Management, Cochin Branch, Cochin, 8 September, 1988.

Dr. K. Ravindran, S/Shri. Sreedharan Namboodiri and S. Ayyappan Pillai, Scientists S-3, attended and delivered lectures at Workshop on Revision of VHSE Curriculum in Fisheries organised by Technical Teachers Training Institute, Extension Centre, Kalamassery, 26-30 September, 1988.

Dr. K. Ravindran also attended Regional Consultation on Fisheries Information-Small Scale Fisherfolk Communities in the Bay of Bengal, organised by FAO/BOBP, Madras, 5-7 October, 1988. He also chaired session No. 5 on Computerised Information System for Fisheries, and session No. 6 on Demonstration of Micro-computer Application and Discussions. He also served as a member of the Recommendation Task Force.

Shri. K. K. Balachandran, Scientist S-3, attended Seminar on Marine Fisheries Research organised by Institute of Food Scientists and Technologists at Humberside College of Higher Education, Grimsby, U.K., 5 October, 1988.

Shri. A. A. Khan, Scientist S-2, participated in Seminar on Status and Prospects



Shri. V. V. Raghavan, Hon. Minister of Agriculture, Kerala, addressing the participants of the Twelfth ICAR Regional Committee

Dr. Ramachandra Dev (Professor, Hindi Dept., University of Cochin) delivering his guest speech on Raj Bhasha Divas & Valedictory function of Hindi Workshop Celebrations



(Report on Page 53)

of Brackish Water Aquaculture in Orissa, Puri, 14 October, 1988.

Dr. K. Ravindran, Scientist S-3, Shri. P. D. Antony and Dr. A. G. Gopalakrishna Pillai, Scientists S-2, attended Seminar on Operation and Maintenance of Atomic Absorption Spectrophotometer and UV-VIS Spectroscopy, organised jointly by GBC Australia and Labtam, India, Cochin, 14 October, 1988.

Shri. K. K. Kunjipalu, Scientist S-2, attended National Workshop on Fishery Resources Data and the Fishing Industry, Visakhapatnam, 14 & 15 October, 1988.

Dr. M. K. Kandoran, Scientist S-3, attended Extension Seminar Involving Systems Approach for the benefit of fishermen of Chavakkad, Trichur District, Kerala, organised in collaboration with CMFRI, 18 November, 1988. Dr. Kandoran gave a talk on the scientific achievements of the Institute with particular reference to technologies developed for fishermen and fisherwomen.

Shri. M. R. Nair, Dr. M. K. Kandoran, and Smt. Mary Thomas, Scientist S-2, participated in International Conference on Appropriate Agricultural Technologies for Farm Women — Future Research Strategy and Linkage with Development Systems, organised by ICAR in collaboration with International Rice Research Institute, Manila, N. Delhi, 30 November - 4 December, 1988. Two papers were presented at the Conference.

Dr. C. C. Panduranga Rao, Scientist S-4 and Shri. C. V. N. Rao, Scientist S-3, attended XI meeting of ICAR Regional Committee V at Hyderabad, November 1988.

Shri. M. R. Nair inaugurated the Training Course on Deep Sea Lobster Processing sponsored by IFP & MPEDA, 14 December, 1988.

Dr. K. Gopakumar attended National Symposium on Aquaculture Productivity organised by Hindustan Lever Research Foundation (Bombay) at India International Centre, New Delhi, 16 & 17 December, 1988.

Dr. M. Arul James, Scientist S-3, Dr. H. K. Beri, S/Shri. S. P. Damle and D. K. Garg, Scientists S-1, attended National Workshop on Sea Farming for Mainland and Inland, CIFE, Bombay, 20 & 21 December, 1988.

Shri. M. R. Nair and Dr. T. K. Sivasadas attended the 2nd National Workshop on Wave Studies and Applications sponsored by Department of Ocean Development at Centre for Earth Science Studies, Cochin, 22 & 23 December, 1988.

Dr. N. Unnikrishnan Nair, Scientist S-2, attended the one day Seminar on Fisheries organised by Indian Bank, Trivandrum, 26 December, 1988.

Shri. M. R. Nair chaired the inaugural session of Fisheries Seminar conducted by Kerala University at Rice Research Station, Vyttila, 26 December, 1988. Shri. V. V. Raghavan, Honourable Minister of Agriculture, Kerala State, was the Chief Guest.

REPRESENTATION IN COMMITTEES

Shri. M. R. Nair, Director, served on the following Scientific and allied bodies.

As Chairman

BIS, AFDC-27, Fish and Fishery Products Sectional Committee

Special Action Task Force for Sea Food Industry constituted by Development Commissioner, Small Scale Industries, New Delhi

As Member

BIS, AFDC-36:9, Metallic Contaminants Sub-Committee

Scientific Panel of Fisheries, ICAR, New Delhi

ICAR Regional Committee No. VIII Task Force, Kerala State Planning Board on Research, Education, Extension & Training

Working group on 'Sagar Sampada'

Panel of Experts for hearing appeals (Export Inspection Agency)

Techno-economic appraisal Committee of MPEDA

Board of Directors, Kerala Fisheries Corporation

Board of Studies, Cochin University of Science and Technology

Board of Studies for DFSc Course of CIFE, Bombay

Board of Examiners, DFSc Course of CIFE, Bombay

Board of Examiners, Inland Fisheries Training Centre of CIFE, Barrackpore

Committee at the level of Ministry of Commerce on problems of quality of marine products meant for export

Committee on mechanisation of boats in the country

Committee on Diversified fishing by the existing fishing vessels

CIFNET Consultative Committee

IFP Consultative Committee

Central Board of Fisheries

Academic Council, Kerala Agricultural University

Working Group for Master Plan for Andaman & Nicobar Islands for development of fisheries

Tamil Nadu State Fisheries Advisory Council

Fisheries Sub-group on Processing, Preservation, Distribution & Marketing of Fish (Ministry of Agriculture)

Committee of Experts on irradiation treatment in marine products

Management Committee, Krishi Vigyan Kendra, CMFRI, Narakkal

Standing Committee at the level of Ministry of Agriculture to co-ordinate the functions of Fisheries Institutes under the Ministry of Agriculture and Indian Council of Agricultural Research

Resources Management Cell, Department of Fisheries, Kerala.

Working Group on Biotechnology programmes in Animal Sciences/Fisheries, ICAR.

The following Scientists also represented the Institute in various Committees.

1. *Dr. K. Gopakumar, Scientist S-4
As Principal Member*

Committee for technical scrutiny of applications received under scheme for extending financial assistance to sea food processors for upgrading the efficiency of freezing units.

As Alternate Member

BIS, AFDC-27:5, Fish Meal Sub-Committee.

Working Group on International Union of Food Scientists and Technologists Association.

Working Group on International Union of Nutrition Scientists Association.

Working Party of Indo Pacific Fisheries Commission on Fish Technology and Marketing, FAO, UN.

Board of Examiners, M.Sc., University of Cochin & University of Mysore

Evaluation Board, Ph.D., University of Cochin, Universities of Agricultural Sciences, Bangalore and Punjab.
2. *Shri. P. V. Prabhu, Scientist S-3
As Principal Member*

BIS, AFDC - 27:5, Fish Meal Sub-Committee.
3. *Dr. T. K. Govindan, Scientist S-3
As Member*

Board of Examiners of Cochin University of Science and Technology (Department of Industrial Fisheries) and Tamil Nadu Agricultural University, Fisheries College, Tuticorin.
4. *Shri. P. Appukutta Panicker,
Scientist S-3*

As Principal Member

BIS, TDC-42, Textile Materials for Fish Net Purposes-Sectional Committee.

As Member

Consultative Committee of Fisheries Survey of India, Cochin Zone.

Working Group of FORV 'Sagar Sampada'

Committee of MPEDA for Exploration of Squid and Cuttle Fish Resources.

Expert Committee of MPEDA on Evaluation of Fishing Vessel Projects of MPEDA.

Committee on Formulating Norms of Import of Deep Sea Fishing Vessels of 100% Export Oriented Scheme of Ministry of Food and Agriculture.

Committee of DOD on Antarctica Krill Programme of FORV 'Sagar Sampada'

As Advisor

UPSC Selection Board for Fisheries.
5. *Dr. K. Ravindran, Scientist S-3
As Subject Expert*

Faculty of Marine Sciences, Cochin University of Science and Technology.

As Member

Marine Cargo Movement and Packaging Division Council (MCPDC, BIS)

Standing Working Committee on Marine Cargo Movement and Packaging (SWCMC, BIS).

- Board of Studies, Department of Industrial Fisheries, Cochin University of Science and Technology.
- Special Committee to Consider Sea Duty Allowance.
- Working Group of FORV 'Sagar Sampada'.
6. *Shri. V. C. George, Scientist S-3.*
As Advisor
- UPSC Selection Board for Fisheries.
As Examiner
Engineer, Fishing Vessels Course at CIFNET.
7. *Shri. S. Ayyappan Pillai, Scientist S-3.*
As Member
- BIS, MCPD-21/A-1 - Sectional Committee on Fishing Vessels
- BIS, MCPD-3-7-Sub-Committee on Machinery for Dredgers, Tugs, Trawler, Hopper, Barges and Mechanised Fishing Boats.
- Advisory Committee constituted by MPEDA for technical scrutiny of subsidy applications for installation of generating sets in seafood processing plants.
- Advisory Committee constituted by MPEDA for technical scrutiny of subsidy applications for procurement and installation of IQF machinery.
- Panel of Experts constituted by MPEDA to prepare the guidelines and standards for the production of IQF products.
- DGTD Sub-Committee on Food Freezing and Preservation on Cryogenic Fluids.
- Panel of Experts constituted by EIA for assessing and approving IQF units.
- Committee on Agro-forestry for afforestation programme.
- Invention Promotion Committee.
- As Associate*
- International collaborative project between CIFT and ODNRI, UK in installation, operation and maintenance of flexible retortable pouch equipment at CIFT.
8. *Dr. T. S. Gopalakrishna Iyer,*
Scientist S-3
As Member
- Panel of Experts for Approval of fish processing factories under IPQC/MIPQC system.
- Expert Committee for Detection of Cholera Organisms in Shrimps Exported to Japan.
- Inter-departmental Team of Experts to assess facilities available in MIPQC Units and EIA laboratories for testing *V. cholerae* in accordance with International standards.
- Expert Committee on Use of Pre-Enrichment Media for Detection of Salmonella.
9. *Shri. Cyriac Mathen, Scientist S-3*
As Member
- Committee constituted to examine and take decisions on the products packed as per buyer's specifications and deviation from the existing specification and procedure, EIA, Cochin.

10. *Dr. T. K. Sivadas, Scientist S-3*
As Member
 Expert Committee for Development of Marine Instruments constituted by Department of Ocean Development, Government of India.
 Expert Committee on Acoustic and Commercial Surveys of Island Development Authority.
 Committee for Promotion of Application of Electronics in Agriculture during VIII Five Year Plan, constituted by Department of Electronics, Government of India.
11. *Shri. K. K. Balachandran, Scientist S-3*
As Principal Member
 BIS, AFDC-27:1, Canned Fish Products Sub-Committee.
As Member
 Vidyalaya Management Committee, Kendriya Vidyalaya, NAD, Alwaye.
 Vidyalaya Management Committee, Kendriya Vidyalaya, Ernakulam.
Research Guide
 M.F.Sc. Processing Technology Programme of College of Fisheries, Panangad.
12. *Shri. K. Sreedharan Namboodiri, Scientist S-3*
As Resource Person
 Training Course conducted by CIFE Bombay on Mechanisation of Traditional Craft by OBMs.
13. *Dr. K. Devadasan, Scientist S-3*
As Examiner
 Ph.D. Programme of Calicut University.
 Different Selection Committees of CMFRI.
14. *Shri. H. Krishna Iyer, Scientist S-3*
As Member
 BIS, AFDC-57. Expert Panel for Preparation of Draft Indian Standards and Methods for Sampling of Fish and Fishery Products.
15. *Dr. M. Arul James, Scientist S-3*
As Member
 State Level Committee for Co-ordination of Work on Marine Fisheries, Maharashtra.
 Panel of Experts for approval of fish processing factories under QCIA and IPQC.
 Inter-departmental team of experts to assess facilities available in IPQC Units and EIA laboratories at Bombay, Goa and Gujarat for testing *V. cholerae* in accordance with international standards.
 Inter-departmental Panel on export of marine products to Belgium, Netherlands and Italy.
16. *Shri. C. V. N. Rao, Scientist S-3*
As Member
 BIS, MCPD-14, Paper and Flexible Packaging Sectional Committee.

17. *Shri. G. Narayanappa, Scientist S-3*
As Member
 Consultative Group of Fishery Survey of India, Mormugao Zonal Base, Goa, set up to review the working of Madras and Visakhapatnam Bases of Fishery Survey of India.
18. *Shri. T. S. Unnikrishnan Nair, Scientist S-2*
As Member
 BIS, AFDC-27:3, Dry Fish Products Sub-Committee.
 Panel of Experts for IPQC/MIPQC Scheme of Export Inspection Agency, Cochin.
19. *Shri. T. Joseph Mathai, Scientist S-2*
As Member
 Consultative Committee of Fishery Survey of India, Mormugao Zonal Base.
20. *Dr. P. T. Lakshmanan, Scientist S-2*
As Supervising Guide
 Ph.D. degree — Faculty of Marine Sciences, Cochin University of Science and Technology.
As Subject Expert
 Doctoral Committee, Faculty of Marine Sciences, Cochin University of Science and Technology.
21. *Shri. A. A. Khan, Scientist S-2*
As Member
 Purchase Committee of Fishing Gear and Boats for Fishermen Co-operative Societies, Hirakud.
22. *Shri. Sib Sankar Gupta, Scientist S-2.*
As Member
 Co-ordination Committee, Federation of Fishermen Co-operative Societies, Hirakud Reservoir, Sambalpur.
 Regional Advisory Committee on Technical Science (RACTS) in the discipline of Fisheries constituted by NABARD, Bhubanewsar.
23. *Dr. N. Unnikrishnan Nair, Scientist S-2*
As Subject Expert
 Panel of Experts for IPQC/MIPQC Scheme for Fish and Fishery Products in Calcutta, Puri and Vizag
 Faculty of Marine Sciences and Faculty of Environment, Cochin University of Science and Technology
As Member
 Task Force on Biological Sciences-State Department of Science, Technology and Environment, Government of Kerala, Trivandrum
 Task Group on Environment, State Committee on Science, Technology and Environment, Government of Kerala, Trivandrum
24. *Dr. P. K. Surendran, Scientist S-2*
As External Member
 Evaluation Board, Ph.D., University of Bombay
As Subject Expert
 Doctoral Committee, Cochin University of Science and Technology

- M.F.Sc. (Processing Technology)
Programme, Kerala Agricultural
University
25. *Shri. K. V. Mohan Rajan, Scientist S-2*
As Member
Consultative Group for Fishery Sur-
vey of India, Bombay and Porbander
Bases
26. *Shri. P. R. G. Varma, Scientist S-2*
As Member
Panel of Experts, Pre- IPQC/MIPQC-
Export Inspection Agency, Cochin
27. *Dr. M. D. Varghese, Scientist S-2*
As Subject Expert
Inter-departmental Panel for Export
of Marine Products to Belgium,
Netherlands, Italy
29. *Smt. K. Radhalakshmi, T-7*
As Alternate Member
BIS, TDC-42, Textile Materials for
Fishing Net Purposes, Sectional
Committee

TRAINING / DEPUTATION OF SCIENTISTS

Within the Country

Dr. M. D. Varghese, Scientist S-2, attended short term training on Sonar for Fishing organised by ICAR, DOE and COSTED at CIFE, Bombay, 16-26 February, 1988.

Shri. P. Appukutta Panicker, Scientist S-3, attended course on Human

Resources Management at NAARM, Hyderabad, 1-12 August, 1988.

Dr. T. S. G. Iyer, Scientist S-3 and Dr. P. K. Surendran, Scientist S-2, were nominated to attend training-cum-demonstration on Isolation and Identification of *Listeria monocytogenes* in Seafoods at CIFT, Cochin, 12-15 September, 1988. The training was conducted by Dr. Fuchs, a Senior Microbiologist from ODNRI, London.

Shri. K. Sreedharan Namboodiri, Scientist S-3, attended training programme on Mechanisation of Traditional Craft by Outboard Engines organised by CIFE at Bombay, October 1988, in the capacity of a resource person.

Dr. M. Arul James, Scientist S-3, attended course on Agricultural Research Project Management at NAARM, Hyderabad, 24 October - 4 November, 1988.

Foreign

Shri. K. K. Solanki, Scientist S-2, was deputed for training in Fish Processing Technology at ODNRI, London for a period of ten weeks from 28 February, 1988.

Dr. A. G. Gopalakrishna Pillai and Shri. P. D. Antony, Scientists S-2, were deputed for training in Operation and Maintenance of Inductively Coupled Plasma (ICP) Emission Spectrometer at Labtam Ltd., Melbourne, Australia from 11-21 July, 1988.

Shri. H. Krishna Iyer, Scientist S-3, has been deputed to U.K. for a period of 8½ months from 28 September, 1988 for training in Fish Marketing at Humberside College of Higher Education, U.K. under

Indo - UK MOU on RNR Research Link between CIFT, Cochin and ODNRI, London.

Shri. K. K. Balachandran, Scientist S-3, was also deputed to ODNRI, London for a special programme on Retort Pouch Technology (Fish Processing) for eleven weeks from 1 October, 1988. The main thrust of the programme was:

- i) Familiarisation with the technology of processing fish in retortable pouches
- ii) Development of technological details of processing a ready-for-table type fish-in-curry, and
- iii) Development of a process for ready-to-serve fish-in-rice 'convenience' food to be processed in pouches

DEGREES / AWARDS

Shri. K. N. Kartha, Scientist S-2, was awarded Ph.D. by the Vikram University, Ujjain, M.P. for his thesis entitled "Studies on experimental trawl fishing in Gandhisagar Reservoir". He conducted his studies under the guidance of Dr. K. S. Rao, Reader, School of Studies in Zoology, Vikram University.

Shri. A. K. Kesavan Nair, Scientist S-2 was awarded Doctorate for his thesis on "Statistical methods in gear selectivity and gear efficiency" by Cochin University of Science and Technology. He conducted his research under the guidance of Dr. K. Alagaraja, Scientist, CMFRI, Cochin.

Shri. M. R. Raghunath, Scientist S-2, was awarded Ph.D. by the University of Saskatchewan, Canada, for his thesis entitled "The nature of autolysis in fish silage

and the use of fish silage as a substrate for the reverse proteolytic (plastein) reaction". He carried out his work under the guidance of Dr. A. R. Mc Curdy, Department of Applied Microbiology and Food Science.

Smt. Nirmala Thampuran, Scientist S-2, was awarded Ph.D. degree by Cochin University of Science and Technology for her thesis entitled "Quantitative and qualitative studies on the bacteriology of frozen fishes and prawns." She was guided in her work by Dr. K. Gopakumar, Joint Director, Central Institute of Fisheries Technology.

NATIONAL SCIENCE DAY

National Science Day celebrations of the Institute were held from 22-28 February, 1988. The week long programmes included a two day Open-house for the public, a four day training class for post graduate students on harvest and post harvest technology of fish and shell fish, group discussions, film shows etc.

PROJECT ADVISORY COMMITTEE

The Project Advisory Committee critically scrutinised the research project proposals submitted by the individual scientists for the year and finalised the proposals which were subsequently approved by the Staff Research Council and the Management Committee of the Institute and the ICAR.

The Committee met at the end of each quarter and reviewed the progress



National Science Day Celebrations at CIFT



made in each project in relation to the activity milestones. The comments of the Project Advisory Committee were communicated to the individual scientists for information and follow-up action.

OFFICIAL LANGUAGE IMPLEMENTATION PROGRAMME

The Institute's Official Language Implementation Programmes were carried out during the year 1988 according to the instructions laid down by the Ministry of Home Affairs.

The Quarterly Official Language Implementation Committee Meetings reviewed the implementation activities of the Institute.

The monthly/quarterly reports on the implementation pertaining to Headquarters and Research Centres were sent to Council and Official Language Department for inclusion in the report to Secretariat.

Hindi Day was celebrated at the Institute's Headquarters on 4 May 1988 with various competitions and cultural programmes. Prizes along with certificates were distributed to the winners of the competitions.

Hindi Workshop Week was conducted from 7 to 13 September, 1988 at the Headquarters. Twenty staff members participated in the Workshop. Certificates and prizes were distributed to the participants of the Hindi Workshop. The Institute also celebrated the 'Raj Bhasha Divas' on 14 September, 1988. Guest lectures were

organised in connection with the 'Raj Bhasha Divas' celebration.

The Institute actively participated in the Joint Hindi Day celebrations under the auspices of Cochin Town Official Language Implementation Committee on 25 and 26 October, 1988.

The Hindi Officer delivered lectures at Hindi Workshops conducted by various Government and Public undertakings in Cochin.

MANAGEMENT COMMITTEE OF CIFT

CIFT Management Committee functioned with the following members

Chairman

The Director, CIFT

Nominated Scientists of the Institute

1. Dr. K. Gopakumar, S-4
CIFT, Cochin
2. Dr. C. C. P. Rao, S-4,
CIFT, Kakinada
3. Shri. Cyriac Mathen, S-3,
CIFT, Calicut
4. Shri. K. A. Sadanandan, S-2,
CIFT, Cochin

Members

1. Director of Fisheries, Kerala Public Works, Fisheries & Port (L) Department, Trivandrum

2. Shri. M. C. Mohapatra, IAS, Commissioner of Fisheries, Forest, Animal Husbandry & Farm Department. Government of A.P., Hyderabad
3. Dr. M. J. Sebastian, Dean, College of Fisheries, Kerala Agricultural University, Panangad, Cochin - 680506
4. The Asst. Director General (Fisheries) ICAR, Krishi Bhavan, New Delhi - 1
5. The Accounts Officer, CMFRI, Cochin
6. Commadore KMV Nair, AVSM Vr. C. "Laxmi", Kurup's Lane, Sasthamangalam, Trivandrum - 10
7. Shri. Era Anbarasu, Ex-M.P., 18, Anjaneyar Koil Street, Poonamalee, Madras - 56, T.N.

Member Secretary

Shri. V. K. Sridhar, Senior Administrative Officer, CIFT, Cochin

The Committee met twice during the year under report.

RESEARCH AUDIT OF THE INSTITUTE

Shri. M. R. Nair, Director, gave the Research Audit presentation relating to the Institute on 3-2-1988 before a Panel of invited Experts and Senior Scientists/ Officials at the Headquarters of the Council. Director General has conveyed his appreciation of the presentation made by the Dir-

ector and wished that the Scientists would continue to do the good work with greater zeal in future as well.

TECHNICAL SECTION

The Institute's various research projects for the year 1988-89 handled at Institute's Headquarters and Research Centres were compiled as per the recommendations of the Project Advisory Committee, Scientific Meetings, Institute Management Committee, Staff Research Council Meetings etc. Out of the 32 projects implemented, 26 were ongoing projects while six were new projects taken up during the year. The projects were reviewed regularly by the Project Advisory Committee and Staff Research Council.

The Activity Milestones of all ongoing research projects were prepared and progress made by each Scientist every quarter was monitored.

Out of 34 Scientists reviewed for their assessment results for the periods ending 31-12-1980, 31-12-1981 and 31-12-1982, six Scientists got promotion retrospectively, one Scientist got additional advance increment and in the case of nineteen Scientists the Board recommended no change in their earlier recommendations. Results of review of eight Scientists are awaited.

Five yearly assessment/reassessment for the period ending 31-12-'84 in respect of 27 Scientists belonging to various disciplines has been conducted by the ASRB and the results communicated.

The Biodata and Five yearly assessment proformae/Supplementary information proformae in respect of all the eligible

Scientists for the periods ending 31-12-1985 and 31-12-1986 were forwarded to ASRB/Council during the year under report.

Maintenance, updating and submission of project files as well as Project Leaders' files of all ongoing projects were maintained upto date for presenting at the ASRB Assessment Committee and for keeping as permanent record of the Institute.

Materials for monthly/quarterly reports on important activities, significant research findings, exhibitions, training programmes, workshops/seminars/symposia/particulars of visits of dignitaries to the Institute etc. were collected from various Divisions at Headquarters and Research Centres, compiled and sent to Council regularly for inclusion in the report to the Cabinet Secretariat.

Report on the research and extension works carried out at the Institute's Headquarters and Research Centres for the year 1987-88 were compiled and sent to Council for inclusion in the respective Agenda notes for the ICAR Regional Committee meetings of Region No. V (Burla), VI (Veraval), VII (Goa & Bombay) and VIII (Cochin & Calicut).

The Biodata of 108 ARS Scientists of the Institute updated as on 31-1-1988 were sent to Council for computerisation of Biodata of Scientists.

As per request from the Department of Science and Technology, Govt. of India, New Delhi, a questionnaire furnishing

relevant data on the R & D activities pertaining to this Institute for the year 1988 was forwarded to them for compilation.

During the year under report, 78 scientific/technical papers received from Scientists were processed and Director's approval for publication/presentation of 74 papers was conveyed to the respective authors.

Staff Research Council meetings were held on 15-3-1988, 22-6-1988 and 8-12-1988 to review the progress of research projects implemented at this Institute as per Activity Milestones laid down by Scientists.

Monitoring of DOD, ODNRI projects and 'Sagar Sampada' cruises was carried out and reports made available to Director/ICAR.

LIBRARY

The Library system continued to provide library and documentation service to the Scientific and technological staff of the Institute, Research Scholars, students from various Universities, Scientists from other Institutes and technicians from the industry. During the year, 332 books were added to the collection and at present there are 6664 books and 3037 bound volumes of journals. A total of 2330 bonafide readers visited the library and 4300 publications were issued and returned during the period under report. The reprographic unit of the Library made copies and supplied 56006 pages of documents on requisition. The Library continued to issue the "Current Contents on Fishery Technology" (fortnightly) for the benefit of the users.

INSTITUTE JOINT COUNCIL

The Institute Joint Council functioned with the following members.

Chairman

The Director

Official Side Members

1. Dr. K. Gopakumar, S-4
2. Dr. K. Ravindran, S-3
3. Shri. K. S. Namboodiri, S-3
4. Sr. Administrative Officer
5. Asst. Accounts Officer

Official Side Secretary

Shri. K. K. Balachandran, S-3

Staff Side Secretary

Shri. M. K. Kuttykrishnan Nair, T-2

Staff Side Members

1. Shri. P. A. Uthup, Supdt.
2. Shri. V. V. Ramakrishnan, T-4
3. Shri. S. Radhakrishnan Nair, Jr. Clerk
4. Shri. P. A. Thomas, SSG III
5. Shri. K. C. Mehar, SSG I

The Cell met twice during the year,

MONITORING CELL

The Monitoring Cell constituted with the following members continued to function and met twice during the year.

Chairman

The Director

Members

1. Dr. K. Gopakumar, S-4
2. Dr. K. Ravindran, S-3
3. Dr. T. K. Sivadas, S-3

4. Shri. H. Krishna Iyer, S-3
5. Shri. K. Mahadeva Iyer, S-3
6. Dr. M. D. Varghese, S-2
7. Shri. T. K. Srinivasa Gopal, S-2
8. Sr. Administrative Officer
9. Asst. Accounts Officer
10. Asst. Administrative Officer (Bills)

Member Secretary

Asst. Administrative Officer (A)

GRIEVANCE CELL

The General Grievance Cell of the Institute functioned with the following members.

Chairman

Dr. K. Gopakumar, S-4

Members

1. Sr. Administrative Officer
2. Asst. Accounts Officer
3. Shri. M. K. Kuttykrishnan Nair, T-2
4. Shri. P. A. Uthup, Supdt.
5. Shri. P. A. Thomas, SSG III

Non Member Secretary

Shri. K. C. Purushothaman, T-7
(Technical Officer)

The Grievance Cell for Officers of Group A and above also functioned with the following members.

Chairman

The Director

Members

1. Shri. K. M. Iyer, S-3
2. Shri. T. Joseph Mathai, S-2
3. Shri. M. Mukundan, S-2
4. Shri. S. P. Damle, S-1

Member Secretary

Sr. Administrative Officer

PUBLICATIONS

1. Antony, K. P., Rao, C. V. N. & Govindan, T. K. - Bulk packages for storage and transportation of salted and dried fish - *Fish. Technol.* 25 (2): 112, 1988.
2. Badonia Rajendra & Ramachandran, R - Observation on water and ice quality used for fish processing in Veraval - *Seaf. Exp. Jour.*, XX (8): 15, 1988.
3. Badonia Rajendra, Sankar, T. V. & Nair, P. G. V. - Diversification in frozen fish export from Gujarat - *Seaf. Exp. Jour.*, XX (7): 27, 1988.
4. Balachandran, K. K. & Vijayan, P. K. - Development of a process for canning fresh water fish Rohu (*Labeo rohita*) - *Fish. Technol.*, 25 (1): 40, 1988.
5. Chakrobarati, R. - A method to preserve fish muscle pieces and mince from sciaenids - *Fish. Technol.*, 25 (1): 58, 1988.
6. Chakrobarati, R. - Use of dense media to separate meat from small crabs - *International Jour. Fd. Sci. Tech.*, 23 (1): 113, 1988.
7. Chakrobarati, R. & (Chaudhuri, D. R.) - Effect of liquid nitrogen freezing and subsequent storage on survival of *Staphylococcus aureus* and *Streptococcus pyogenes* in treated prawn meat - *Fish. Technol.*, 25 (1): 61, 1988.
8. George Chinnamma & Gopakumar, K. - Canning of crab meat - *Fishing Chimes*, 8 (1): 59, 1988.
9. George Chinnamma & Gopakumar, K. - Spoilage changes in crab muscle (*Scylla serrata*) stored at three different temperatures - *Proc. Indian Fisheries Forum* - Mangalore, 1988.
10. George Chinnamma, Gopakumar, K. & Perigreen, P. A. - Frozen storage characteristics of raw and cooked crab segments, body meat and shell-on claws - Paper presented at Symp. on Tropical Marine Living Resources, CMFRI, Cochin, 12-16 Jan. 1988.
11. George Chinnamma, Gopakumar, K. & Unnithan, G. R. - Mussel meat with reference to age and chemical constituents - *Indian J. Animal Sci.*, 58 (10): 1252, 1988.
12. Gopakumar, K. - Fish products for gainful employment for women - Paper presented at All India Workshop on Gainful Employment for Women in Fisheries Field, Society of Fisheries Technologists (India), Cochin, 7-8 March, 1988.
13. Gopakumar, K. - Utilization of low grade marine fish - Paper presented at National Symp. on Aquaculture Productivity organised by Hindustan Lever Research Foundation (Bombay), India International Centre, New Delhi, 16-17 Dec. 1988.
14. Gopakumar, K. & Madhavan, P. - Technology of Krill processing - Paper presented at Workshop on Antarctic Studies, New Delhi, May, 1988.

15. *Gopakumar, K., Surendran, P. K. & Vijayan, P. K.* - Incidence of histidine decarboxylating bacteria and level of histamine of fish sold at retail markets - Paper presented at 7th Session of IPFC Working Party on Fish Technology and Marketing, Bangkok, Thailand, 19-22 April, 1988.
16. *Govindan, T. K., Rao, C. V. N., Srinivasa Gopal, T. K. & Antony, K. P.* - Packaging of frozen, cured and iced fish products - *Fishing Chimes*, 8(1): 64, 1988.
17. *Govindan, T. K. & Srinivasa Gopal, T. K.* - A novel method of fresh fish preservation - *Fishing Chimes*, 8(6): 22, 1988.
18. *Govindan, T. K. & Srinivasa Gopal, T. K.* - Packaging of fish - based convenience foods - *Fishing Chimes*, 8(2): 38, 1988.
19. *Iyer, T. S. G.* - *E. coli* and faecal streptococci in shrimps - *Export Inspection J.*, V(1): 6, 1988.
20. *Iyer, T. S. G.* - Fish preservation - Paper presented at Fisheries Seminar organised by Kerala Dhivara Sabha, Cochin, 29 May 1988.
21. *Iyer, T. S. G.* - Work on technological research upgradation of quality in seafood industry carried out at CIFT, Cochin - *Ind. Food Packer*, 42(4): 21, 1988.
22. *Iyer, T. S. G., (Gangadharan, P. & Shenoy, A. S.)* - Method for the detection of *V. cholerae* in fishery products and processing environments - Report of CIFT - EIA - MPEDA Joint Study Group, Cochin, 1988.
23. *Iyer, T. S. G. & Gopakumar, K.* - Problems and prospects of shrimp processing for export - Paper presented at National Symp. on Aquaculture Productivity organised by Hindustan Lever Research Foundation (Bombay), India International Centre, New Delhi, 16-17 December, 1988.
24. *Iyer, T. S. Gopalakrishna & (Shrivastava, K. P.)* - Incidence and low temperature survival of coagulase positive staphylococci in fishery products - *Fish. Technol.*, 25(2): 132, 1988.
25. *Iyer, T. S. Gopalakrishna & Varma, P. R. G.* - Isolation of *Salmonella agona* (4, 12: f, g, 5:-) from commercial frozen boiled clam meat - *Fish. Technol.*, 25(1): 81, 1988.
26. *Iyer, T. S. G., Varma, P. R. G., (Agnes Joseph, M., Shaji Zaccharia, Geetha Joseph, C. & Augustine, K. T.)* - CIFT - MPEDA Joint Report on Research Scheme on *V. cholerae.*, Cochin, 1988.
27. *Iyer, T. S. G., Varma, P. R. G., & Gopakumar, K.* - Report on the FAO Project on shrimp hygiene and quality control - *FAO Fish. Tech. News*. No. 11, Aug. 1988: 5.
28. *Iyer, T. S. G., Varma, P. R. G., (John, P. C., Jayasheela, M. & Saxena, S. N.)* - Isolation of *Salmonella wentworth* (11: Z10: 1, 2) for the first time in India - *J. Com. Dis.*, 19: 425, 1987 (published in 1988)

29. Joseph, A. C., Balachandran, K. K. & Prabhu, P. V. - Improvement in quality and shelf life of whole dried prawns - *Fish. Technol.*, 25(2): 117, 1988.
30. Joseph Jose, Chinnamma George & Perigreen, P. A. - Studies on minced fish storage and quality improvement - Paper presented at Symp. on Tropical Marine Living Resources, Cochin, 12-16 Jan. 1988.
31. Joseph Jose & Perigreen, P. A. - Studies on frozen storage of cuttle fish fillets - *Fish. Technol.*, 25(1): 32, 1988.
32. Joseph Jose, Perigreen, P. A. & Gopakumar, K. - Prevention of black spot in deep sea lobsters - *Fishing Chimes*, 8(5): 23, 1988.
33. Joseph Jose, Perigreen, P. A. & Madhavan, P. - Production and utilisation of minced fish - *Fishing Chimes*, 7 (12): 58, 1988.
34. Joseph Jose, Surendran, P. K. & Perigreen, P. A. - Studies on iced storage of cultured rohu (*Labeo rohita*) - *Fish. Technol.*, 25(2): 105, 1988.
35. Joseph, K. George, Muraleedharan, V., Unnikrishnan Nair, T. S. & (Kalaimani, N.) - Quality of cured fish from the Maharashtra coast - *Fish. Technol.* 25(2): 120, 1988.
36. (Joseph, K. J., Nambisan, P. N. K., Shynamma, C.S.) & Lakshmanan, P. T. - Studies on phytoplankton in polluted water - *J. Mar. Biol. Assn. India*, 26(1 & 2): 42, 1988.
37. (Joseph, M. T., Rajagopal, V.) & Krishna Rao, K. - Pattern of rejection of frozen shrimp at Cochin - *Fishing Chimes*, 8(4): 36, 1988.
38. Kalaimani, N., Gopakumar, K. & Unnikrishnan Nair, T. S. - Quality characteristics of cured fish of commerce - *Fish. Technol.*, 25(1): 54, 1988.
39. Kunjipalu, K. K. - Development in fishing gear technology - the role of CIFT - Paper presented at National Workshop on Fishing Resources Data and Fishing Industry, Visakhapatnam, 14 & 15 October, 1988.
40. Lakshmanan, P. T. - Levels of cadmium in seafood products - *Fish. Technol.*, 25(2): 142, 1988.
41. Lakshmanan, P. T., Francis Thomas, Varma, P. R. G. & Cyriac Mathen - Comparison of sensory characteristics and biochemical parameters in commercial frozen prawns - *Fish. Technol.*, 25(1): 47, 1988.
42. Mathen Cyriac & Francis Thomas - Solid loss and weight gain in prawns during storage in ice - *Fish. Technol.*, 25(2): 110, 1988.
43. Meenakumari, B. & Panicker, P. A. - A need based programme of training in gear fabrication and gainful employment scheme for fisherwomen - Paper presented at All India Workshop on Gainful Employment for Women in Fisheries Field, Cochin, 7-8 March, 1988.

44. Meenakumari, B. & Panicker, P. A. - Import substitution of combination wire rope - Part I - Design, production and evaluation of a prototype combination wire rope - *Fish. Technol.*, 25(1): 8, 1988.
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46. Mukundan, M. K. & Devadasan, K. - Nutritional evaluation of some deep sea fishes - *Indian J. Animal Sciences*, 58(9): 1131, 1988.
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52. Nair, M. R., Kandoran, M. K. & Mary Thomas - Technology for coastal women - Paper presented at International Conference on Appropriate Agricultural Technologies for Farm Women - Future Research Strategy and Linkage with Development Systems, organised by ICAR in collaboration with International Rice Research Institute, Manila, N. Delhi, 30 Nov. - 4 Dec., 1988.
53. Nair, M. R., Kandoran, M. K., Mary Thomas & Thiagarajan, R. - Technology transfer programmes for coastal women - Paper presented at International Conference on Appropriate Agricultural Technologies for Farm Women, N. Delhi, 30 Nov. - 4 Dec., 1988.
54. Nair, N. Unnikrishnan - Age and growth in *Crassostrea madrasensis* (Preston) - *Advances in Aquatic Biology and Fisheries*, Prof. N. Balakrishnan Nair Felicitation Vol., Dept. of Aquatic Biology & Fisheries, University of Kerala, Trivandrum: 117.
55. Nambiar, V. N., Valsan, A. P., Garg, D. K. & Damle, S. P. - Value added consumer products from non-penaeid prawns (*Acetes indicus*) of Maharashtra coast - *Ind. Fd. Packer*, XXXXII (5): 12, 1988.

56. Namboodiri, K. Sreedharan - Modified water spray chumming system for pole and line fishing of tuna - *Fish. Technol.*, 25(1): 69, 1988.
57. Perigreen, P. A. & Gopakumar, K. - Handling and transportation of cultured fish - Paper presented at National Symp. on Aquaculture Productivity organised by Hindustan Lever Research Foundation (Bombay), India International Centre, New Delhi, 16-17 Dec., 1988.
58. Perigreen, P. A., Jose Joseph & Chinnamma George - Studies on freezing and storage of *Psenopsis cyanea* - *Fish. Technol.*, 25(1): 44, 1988.
59. Pillai, A. G. Gopalakrishna & Ravindran, K. - Hydrography of the Cochin Harbour - *Fish. Technol.*, 25(2): 83, 1988.
60. Prabhu, P. V., Jose Joseph & Madhavan, P. - Utilization of jelly fish - *Fishing Chimes*, 7(10): 45, 1988.
61. Radhalekshmi, K. - Numerical classification for synthetic netting yarns - Paper presented at World Fishing Gear Symposium, Canada, November, 1988.
62. Rajan, K. V. Mohan - Growing acceptance of FRP as boat building material in Gujarat coast - *Fishing Chimes*, 8(3): 50, 1988.
63. Rajan, K. V. Mohan & George Mathai, P. - Operation of coloured gill nets off Saurashtra coast - *Fishing Chimes*, 8(2): 30, 1988.
64. Rajan, K. V. Mohan, Meenakumari, B. & Kesavan Nair, A. K. - Development of an efficient trap for lobster fishing - *Fish. Technol.*, 25(1): 1, 1988.
65. Ramachandran, A. & (Tunuja R.) - Whale shark fishing at Veraval - *Fishing Chimes*, 8(5): 29, 1988.
66. Ramachandran, A., Sankar, T. V. & Rajendra Badonia - Present status of fish processing in Gujarat - *Seaf. Exp. Jour.*, XX (9): 11, 1988.
67. Ramachandran, A. & Solanki, K. K. - Studies on the processing and storage characteristics of semidried products from dhoma - Paper presented at Symp. on Tropical Marine Living Resources, CMFRI, Cochin 12-16 Jan., 1988.
68. Rao, K. K. & Iyer, T. S. G. - Frozen weight - drained weight relationship in block frozen shrimp - *Indian J. Fish.*, 34: 329, 1987 (published in 1988)
69. (Rao, K. S.), Kartha, K. N., (Gupta, D. R., Pandya S. S.) & Iyer, H. K. - Studies on morphometry and hydrology of Gandhisagar Reservoir with special reference to its fisheries - *Fish. Technol.*, 25(1): 21, 1988.
70. Sadanandan, K. A., Kartha, K. N., George, T. P. & Krishna Iyer, H. - Economics of gill netting and two boat midwater trawling - *Fish. Technol.*, 25(1): 5, 1988.

71. Sanjeev, S. & Mahadeva Iyer, K. - Antibiotic resistance of *Staphylococcus aureus* strains isolated from fish processing factory workers - *Fish. Technol.*, 25(2): 139, 1988.
72. Sankar, T. V. & Viswanathan Nair, P. G. - Effect of pre-processing iced storage on deteriorative changes in lipids of silver pomfret stored at -18°C - *Fish. Technol.*, 25(2): 100, 1988.
73. Shenoy, A. Vasanth, Thankamma, R., Lakshmy Nair, A. & Gopakumar, K. - Texturised meat from low cost fish - *Fish. Technol.*, 25(2): 124, 1988.
74. Sivadas, T. K. - Instrumental approach to environmental monitoring for agricultural engineering - Paper presented at Workshop on Agricultural Engineering organised by Water Resource Centre of Anna University, Madras, 6-8 April, 1988.
75. Sivadas, T. K. - Instrumentation for environmental assessment and monitoring of Chilka Lagoon - Paper presented at Seminar on Instrumentation for Environmental Assessment and Monitoring of Chilka Lagoon organised by Orissa State Govt., 20-21 Jan., 1988.
76. Sivadas, T. K. & Ramakrishnan, K. - Performance evaluation of trawl system through multi-parameter data link - Paper presented at the World Symposium on Fishing Gear and Fishing Vessel Design, Canada, 21-24, Nov., 1988.
77. Sivadas, T. K., Ramakrishnan, K. & Vijayabharathi, K. - Instrumentation for agrometeorological and environmental investigations based on the technology developed in CIFT - Paper presented at Conference on Agrometeorology conducted by Indian Agrometeorological Society, Cochin, 28-30 April, 1988.
78. Solanki, K. K. & Rajendra Badonia - Quality of fishmeal produced at Veral - *Fishing Chimes*, 8(3): 58, 1988.
79. Surendran, P. K. - Environmental pollution from fish processing industries and its control - Paper presented at Workshop on Environmental Engineering organised by Kerala State Committee on Science, Technology and Environment, Kothamangalam, 4-6 May, 1988.
80. Surendran, P. K. & Gopakumar, K. - Microbiology of cultured fishes - Paper presented at National Symp. on Aquaculture Productivity organised by Hindustan Lever Research Foundation (Bombay), India International Centre, New Delhi, 16-17 Dec., 1988.
81. Surendran, P. K., Iyer, K. M. & Gopakumar, K. - Bacterial flora of tropical fish and prawn and their changes during iced storage - Paper presented at Symp. on Tropical Marine Living Resources, organised by Marine Biological Assn. of India, Cochin, 12-16 Jan., 1988.
82. (Tanuja, R.) & Ramachandran, A. - Ghol fish and its utilisation - *Seaf. Exp. Jour.* XX (4): 75, 1988.

83. *Thampuran Nirmala & Gopakumar K.* - Impact of handling practices on the microbial quality of shrimp (*Metapenaeus dobsoni*) - Paper presented at 7th Session of IPFC Working Party on Fish Technology and Marketing, Bangkok, Thailand, 19-22 April, 1988.
84. *Thiagarajan, R. & Kandoran, M. K.* - Effect of demonstration in transferring fish processing technology - *Fish. Technol.*, 25(2): 147, 1988.
85. *Thiagarajan, R., Kandoran, M. K. & Mary Thomas* - Study on the relative effectiveness of extension methods in educating fisherwomen - *Fish. Technol.*, 25(1): 72, 1988.
86. *Varma, P. R. G., Iyer, T. S. G., (Agnes Joseph, M. & Shajy Zaccharia)* - *Vibrio cholerae* 01 and non 01 in shrimp "vein" - 'A preliminary study to assess any possible incidence - *Curr. Sci.*, 57 (20): 1138, 1988.
87. *Varma, P. R. G., Iyer, T. S. G. & Cyriac Mathen* - Quality of commercially frozen boiled clam meat - *Fish. Technol.*, 25(1): 36, 1988.
88. *Vijayan, P. K., Surendran, P. K. & Balachandran, K. K.* - Incidence of histamine in marine fishes sold in retail markets in relation to their content of histidine decarboxylating bacteria - Paper presented at Symp. on Tropical Marine Living Resources, organised by Marine Biological Assn. of India, Cochin 12-16 Jan., 1988.

Other publications brought out include:-

1. A technical report: Technology for production of prawn powder for flavouring.
2. Fish Technology Newsletter:
 - Issue Vol. IV No. 8-10.
 - Issue Vol. IV No. 11-12 and Vol. V, No. 1-2.
 - Issue Vol. V, No. 3-4.
3. Booklet in Malayalam on salt curing of fish.

VISITORS TO THE INSTITUTE

Several dignitaries, students from fisheries training Institutes and colleges, Scientists from research organisations and others connected with the fishery industry visited the Institute during the year. The visitors included:

1. Dr. P. Das, Director, National Bureau of Fish Genetic Resources, Allahabad
2. Dr. R. P. S. Tyagi, Member, ASRB and Dr. V. S. Bhatt, Director (P&I), ICAR, New Delhi
3. Dr. John C. Caygill, Head, Meat and Animal Section, ODNRI, UK
4. Shri Hari Krishna Shastri, Hon. Minister of State for Agricultural Research and Education, Govt. of India
5. Dr. S. S. Khanna, Adviser (Agri.), Planning Commission, New Delhi
6. Mr. D. Halliday, ODNRI, UK
7. Mr. J. Prado, Gear Technologist, FAO, Rome
8. Dr. D. J. Rao, Director of Fisheries, Andhra Pradesh
9. Mr. J. P. de Longueau Saint-Michel, Dy. Director, International Affairs, French Research Institute for Exploitation of Ocean Resources
10. Dr. A. V. Embi, Tekka Runba Sin Ltd., Malaysia
11. Dr. Arisol B. Alimuniar, Universiti Kebangsaan, Malaysia
12. Mr. Richard J. Ronk, Director, Centre for Food Safety and Applied Nutrition, US FDA
13. Dr. A. K. Bandyopadhyaya, Director, Central Agricultural Research Institute for Andaman & Nicobar Group of Islands, Port Blair
14. Mr. R. Swaag, Environmental Engineer from Netherlands, attached to Office of Indian Director, Kuttanad Water Balance Study Project
15. Ms. Annette Poiesz, ODA/BOBP
16. Dr. J. P. Coulter, ODA Consultant, World Bank, British High Commission
17. Mr. Sumio Takahashi, Chief of Sanitation Division, Yokohama Quarantine Station, Japan
18. Mr. Hideo Mizuta, Chief of Laboratory, Naha Quarantine Station, Japan
19. Dr. S. Z. Qasim, Secretary, Department of Ocean Development, New Delhi



Shri. Hari Krishna Shastri, Hon. Minister of State for Agricultural Research and Education, Govt. of India, being briefed on the various developments of the Institute by Shri. M. R. Nair, Director

Members of the Sub-committee of Committee of Parliament on Official Language at Cochin



APPENDIX - I

HEADQUARTERS

CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
WILLINGDON ISLAND, MATSYAPURI P.O.
COCHIN - 682029, KERALA

Telex No. : 0885-6440

Telephone: Office No. 6845 (10 lines)

Director (Per) - 6880
- 69727

(Res) - 361034

Telegram: MATSYAODYOGIKI OR FISHTECH — COCHIN

HEADS OF DIVISIONS

1. Fishing Technology Division .. Dr. K. Ravindran, S-3
2. Fish Processing Division .. Dr. K. Gopakumar, S-4
3. Bio chemistry, Nutrition & Microbiology Division .. Dr. K. Devadasan, S-3
4. Engineering & Instrumentation Division .. Dr. T. K. Sivadas, S-3
5. Extension, Information & Statistics Division .. Shri. H. Krishna Iyer, S-3

APPENDIX - I (Contd.)
RESEARCH CENTRES

Sl. No. 1	Place 2	Address 3	Telephone/Telex 4	Telegram 5	Scientist-in-Charge 6
1.	VERAVAL	Research Centre of CIFT, Bunder Road, Veraval - 362265, GUJARAT.	Tel: 20297 Telex: 0163-202 CIFT-IN	MATSYAODYOGIKI	Dr. P. G. Viswanathan Nair, Scientist S-3
2.	KAKINADA	Research Centre of CIFT, Door No. 2-11-1/4, Venkatanagar, Kakinada - 533003, ANDHRA PRADESH.	Tel: 4436 Telex: 0473-229 CIFT-IN	MATSYAODYOGIKI	Dr. C. C. Panduranga Rao, Scientist S-4
3.	BURLA	Research Centre of CIFT, Burla - 768017, Sambalpur District, ORISSA.	Tel: 19	MATSYAODYOGIKI	Shri. C. V. N. Rao, Scientist S-3
4.	BOMBAY	Research Centre of CIFT, 162 BPT Godown, Sassoon Dock, Colaba, Bombay - 400005, MAHARASHTRA.	Tel: 213892 Telex: 011-2464 CIFT-IN	FISHPROCESS (FT)	Dr. M. Arul James, Scientist S-3
5.	CALICUT	Research Centre of CIFT, Beach Road, West Hill, Calicut - 673005, KERALA.	Tel: 50627	CARE 'CADALMIN'	Shri. Cyriac Mathen, Scientist S-3
6.	GOA	Research Centre of CIFT, 2nd Floor, 'Shantia', 18th June Road, St. Inez, Panaji - 403001, GOA.	Tel: 5905	MATSYAODYOGIKI	Shri. G. Narayanappa, Scientist S-3

APPENDIX - II

LIST OF PERSONNEL IN CIFT AS ON 31-12-1988
HEADQUARTERS, COCHIN

SCIENTIFIC PERSONNEL

DIRECTOR

Shri. M. Rajendranathan Nair

S-4

1. Dr. K. Gopakumar
2. Shri P. Vasudeva Prabhu

S-3

1. Dr. K. Ravindran
2. Shri V. C. George
3. Dr. T. S. Gopalakrishna Iyer
4. Dr. K. Devadasan
5. Shri P. Madhavan
6. Shri P. A. Panicker
7. Dr. T. K. Sivadas
8. Shri H. Krishna Iyer
9. Shri S. Ayyappan Pillai
10. Shri K. K. Balachandran
11. Shri K. Sreedharan Namboodiri
12. Dr. M. K. Kandoran
13. Shri K. Krishna Rao
14. Shri P. K. Chakraborty

S-2

1. Shri P. D. Antony
2. Shri P. A. Perigreen
3. Dr. A. K. Kesavan Nair
4. Shri K. A. Sadanandan
5. Shri P. R. Girija Varma
6. Dr. A. G. Gopalakrishna Pillai
7. Shri A. G. Radhakrishnan
8. Dr. Chinnamma George

9. Dr. P. K. Surendran
10. Dr. K. G. Ramachandran Nair
11. Shri P. T. Mathew
12. Dr. Jose Stephen
13. Dr. N. Unnikrishnan Nair
14. Smt A. Lakshmy Nair
15. Shri T. K. Srinivasa Gopal
16. Shri V. Narayanan Nambiar
17. Shri T. K. Thankappan
18. Shri H. N. Mhalathkar
19. Shri A. C. Joseph
20. Shri K. K. Kunjipalu
21. Kum. B. Meenakumari
22. Smt Mary Thomas
23. Shri A. Vasanth Shenoy
24. Shri P. N. Joshi
25. Shri P. K. Vijayan
26. Shri Jose Joseph
27. Dr. Nirmala Thampuran
28. Shri Francis Thomas
29. Shri S. Sanjeev
30. Dr. P. T. Lakshmanan
31. Shri V. Muraleedharan
32. Shri M. R. Boopendranath
33. Shri N. Subramonia Pillai
34. Shri G. Rajagopalan Unnithan
35. Dr. M. R. Raghunath
36. Smt K. V. Lalitha
37. Shri V. Vijayan
38. Dr. M. D. Varghese
39. Shri S. K. Bhattacharya

S-1

1. Shri K. Ramakrishnan
2. Smt. K. Vijayabharathi
3. Smt. K. Ammu
4. Shri S. Balasubramaniam
5. Shri K. P. Antony
6. Smt. R. Thankamma
7. Shri V. Annamalai
8. Shri A. C. Kuttappan
9. Shri. R. Thiagarajan
10. Smt. Saly N. Thomas
11. Smt. Leela Edwin
12. Shri Braj Mohan

TECHNICAL PERSONNEL

T-8, Technical Officer

1. Shri K. S. Ganesan
2. Dr. P. J. Cecily

T-7, Technical Officer

1. Shri K. C. Purushothaman
2. Shri M. S. Fernando
3. Smt. K. Radhalakshmy

T-6, Technical Officer

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

T-5, Technical Officer

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

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. Mammoottil
9. Shri P. S. Alias
10. Shri B. Anandan

T-II-3

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

T-I-3

1. Shri K. J. Augustine
2. Shri A. K. Jaisingh
3. Shri T. S. Bhaskara Menon
4. Shri K. E. Mani
5. Shri P. M. Joseph
6. Shri A. R. Dharaneedharan
7. Shri K. K. Subramanian
8. Shri E. K. Balakrishnan
9. Smt E. Sarasamma
10. Shri M. Shanmughavel
11. Shri C. Rajendran
12. Shri Jose Kalathil
13. Shri K. V. Madhavan
14. Shri K. K. Pappukutty

15. Shri T. Gopalakrishnan
16. Shri P. A. John
17. Shri C. C. Sivan
18. Shri T. K. Bhaskaran
19. Shri K. B. Thilakan
20. Shri T. N. Manibhadran
21. Shri T. Neelakantan
22. Shri T. K. Vasudevan
23. Shri T. K. Aravindakshan
24. Smt. K. K. Sumathy

T-2

1. Shri P. K. Damodaran
2. Shri P. A. Josi Augustine
3. Shri P. N. Sudhakaran
4. Shri K. N. Rajagopalan
5. Smt. G. Usha Rani
6. Shri K. K. Narayanan
7. Shri V. V. John
8. Kum. T. Sailaja
9. Shri P. S. Nobil
10. Shri N. R. Gopan Nair
11. Shri M. K. Kuttykrishnan Nair

T-1

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

ADMINISTRATIVE PERSONNEL

Sr. Admn. Officer

Shri V. K. Sridhar

Asst. Admn. Officer

1. Smt. K. A. Devaky
2. Shri S. Sadanandan
3. Smt. T. N. Ambujakshy Amma
(on ad-hoc basis)

Hindi Officer

Smt. C. Jessy Joseph

Superintendent

1. Shri P. A. Uthup
2. Smt. Alice M. Joseph
3. Shri M. George Joseph
4. Shri S. Naveen Chandra Prabhu
5. Shri T. M. Padmanabhan
(on ad-hoc basis)

Senior Stenographer

Shri K. J. Thomas

Assistant

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

Stenographer

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

Hindi Translator

1. Smt. K. Sobha

Senior Clerk

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

Junior Clerk

1. Shri P. V. Venugopal
2. Shri K. P. Velayudhan
3. Smt. P. C. Kamalakshy
4. Shri K. Rajappan Pillai
5. Smt. N. I. Mary
6. Shri P. K. Thomas
7. Kum. P. K. Thankamma
8. Smt. A. A. Cousallia

9. Shri K. K. Sasi
10. Shri P. Padmanabhan
11. Smt. A. R. Kamalam
12. Smt. T. K. Shyma
13. Smt. T. D. Usheem
14. Smt. V. S. Aleyamma
15. Shri V. S. Ambasuthan
16. Shri A. P. Gopalan
17. Kum. G. N. Sarada
18. Shri S. Radhakrishnan Nair
19. Shri K. B. Sabukuttan
20. Smt. P. A. Sathy
21. Shri P. Krishnakumar
22. Shri K. C. Baby
23. Shri C. K. Sukumaran
24. Shri T. C. Vinod
25. Shri V. C. Sunil

Junior Stenographer

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

Telephone Operator-cum-Receptionist

Shri P. Bahuleyan

AUXILIARY PERSONNEL

Senior Carpenter

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

Carpenter

1. Shri P. Joseph Paul
2. 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 G. Jyothi Kumar

Plant Attendent

1. Shri C. C. Gandhi
2. Shri N. C. Bhaskaran
3. Shri K. R. Kesavan
4. Shri E. S. Balachandra Pai

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

SUPPORTING STAFF

SSG IV

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

SSG III

1. Shri P. A. Thomas
2. Shri K. Balakrishna Pillai
3. Shri P. J. George

4. Shri [REDACTED]
5. Shri A. G. Vasu
6. Shri C. A. Subran
7. Shri K. X. Joseph
8. Shri T. T. Das
9. Shri M. K. Thevan
10. Shri P. M. Pakeer Mohammed

SSG II

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

SSG I

1. Shri R. Chellappan
2. Shri A. R. John
3. Shri C. N. Raghavan
4. Shri A. Ravindran Nair
5. Shri P. N. Sukumaran Nair
6. Smt. P. L. Rosilly
7. Shri T. K. Rajappan
8. Shri K. N. Velayudhankutty
9. Shri T. G. John
10. Shri O. K. Xavier
11. Shri T. Mathai
12. Shri P. T. Anthappan
13. Shri T. K. Viswanathan
14. Shri P. A. Sivan
15. Smt. C. G. Radhamony
16. Shri P. K. Somasekharan Nair
17. Shri N. Krishnan
18. Shri C. D. Parameswaran

19. Shri V. T. S. [REDACTED]
20. Shri P. P. George
21. Shri A. V. Chandrasekharan
22. Shri P. V. Raju
23. Shri M. Shanmughavelu
24. Shri E. Damodaran
25. Shri M. M. Radhakrishnan
26. Shri K. K. Karthikeyan
27. Shri K. D. Santhosh
28. Smt. C. Ammini
29. Shri K. Dinesh Prabhu
30. Shri P. P. Varghese
31. Shri P. T. Chandran
32. Shri P. Mohanan

T-I-3

1. Shri S. R. Jethwa
2. Shri Mohammed Jaffar
3. Shri N. J. Tandel
4. Shri M. M. Vara
5. Shri T. Ganagadharan

T-2

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

T-1

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

VERAVAL RESEARCH CENTRE

SCIENTIFIC PERSONNEL

S-3

1. Dr. P. G. Viswanathan Nair
2. Shri K. K. Solanki

S-2

1. Shri K. V. Mohan Rajan
2. Shri Rajendra Badonia
3. Shri P. George Mathai
4. Shri R. S. Manohar Doss

S-1

1. Shri A. Ramachandran
2. Shri T. V. Sankar
3. Shri Pravin Puthra

TECHNICAL STAFF

T-7, Technical Officer

Shri K. J. Francis Xavier

T-4

Shri G. P. Vaghela

T-II-3

1. Shri J. B. Paradwa
2. Shri D. K. Ukhahbai

ADMINISTRATIVE STAFF

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

1. Shri Ramesh Kumar Dhirendrapuri Goswami

AUXILIARY STAFF

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 STAFF

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. Parmar
4. Shri D. B. Chudasama
5. Shri K. J. Damer
6. Smt. Chandrika C. Tank
7. Shri P. N. Chudasama
8. Shri H. V. Punjera
9. Smt. Gangaben Niran Chorwadi
10. Shri T. A. Francis
11. Shri Girish Kumar Monani
12. Shri Harjabhai Ranabhai Maru
13. Shri Dodiya Khoda Viram

KAKINADA RESEARCH CENTRE

SCIENTIFIC PERSONNEL

S-4

Dr. C. C. Panduranga Rao

S-2

1. Shri Sibsankar Gupta
2. Shri S. V. S. Rama Rao

3. Shri Imam Khasim Sahib
4. Shri Subrata Basu
5. Shri J. Sitarama Rao

S-1

1. Shri Rupshankar Chakrobari
2. Shri M. M. Prasad

TECHNICAL STAFF

T-4

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

T-II-3

1. Shri K. V. S. S. Kusuma Harnath
2. Shri Sriharibabu

T-I-3

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

T-2

Shri B. Ramaiah

T-1

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

ADMINISTRATIVE STAFF

Jr. Stenographer

Smt. Satyanarayanamma

Senior Clerk

1. Ch: Satyanarayana
2. Kum. B. Hemalatha (ad-hoc basis)

Junior Clerk

1. Shri Nirmala Raju
2. Shri Kanakaraju

AUXILIARY STAFF

Deck Hand

1. Shri K. Sarangadharadu
2. Shri Karri Gangaraju

Cook

Shri G. Subba Rao

Driver

Shri M. Venkateswara Rao

SUPPORTING STAFF

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 G. Chinna Rao
6. Shri O. Heman

SSG I

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

BURLA RESEARCH CENTRE

SCIENTIFIC PERSONNEL

S-3

Shri C. V. N. Rao

S-2

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

TECHNICAL STAFF

T-II-3

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

T-I-3

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

T-2

1. Shri Radhu Pandey
2. Shri Sathrugan Kumara

T-1

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

ADMINISTRATIVE STAFF

Assistant

Shri Jatindra Kumar Mishra

Senior Clerk

Shri G. C. Adhikari

Junior Clerk

1. Shri Udekar Pande
2. Shri Laxminarayan Badi

AUXILIARY STAFF

Driver

Shri Narasingh Pande

SUPPORTING STAFF

SSG IV

Shri Gajendra Karali

SSG III

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

SSG II

1. Shri G. C. Meher
2. Shri Rathan Chand
3. Shri Sathrugan Seth
4. Shri K. C. Nayak
5. Shri Kirtan Kisan
6. Shri S. C. Meher

SSG I

1. Shri Badrinarain Guru
2. Shri Jaisingh Oram
3. Shri Satyanarayan 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

BOMBAY RESEARCH CENTRE

SCIENTIFIC PERSONNEL

S-3

Dr. M. Arul James

S-1

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

TECHNICAL STAFF

T-II-3

Smt. S. S. Patankar

ADMINISTRATIVE STAFF

Assistant

Shri Milind S. Bhatkar

Senior Clerk

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

AUXILIARY STAFF

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

Shri Vinod S. Salvi

CALICUT RESEARCH CENTRE

SCIENTIFIC PERSONNEL

S-3

Shri Cyriac Mathen

S-2

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

TECHNICAL STAFF

T-4

Shri T. John

T-2

Smt. Tara Karupalli

T-1

Smt. M. K. Sreelekha

ADMINISTRATIVE STAFF

Senior Clerk

Shri M. Ravindran

AUXILIARY STAFF

Driver

Shri T. P. Balakrishnan

SUPPORTING STAFF

SSG IV

Shri E. Gangadharan Nair

SSG III

Shri C. M. Gopalan

SSG I

Shri K. K. Lakshmanan

GOA RESEARCH CENTRE

SCIENTIFIC PERSONNEL

S-3

Shri G. Narayanappa

S-2

Shri T. Joseph Mathai

S-1

Shri Sayed Abbas

TECHNICAL STAFF

T-I-3

Shri A. B. Varghese

T-2

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

ADMINISTRATIVE STAFF

Senior Clerk

Shri A. B. Rodrigues

Junior Clerk

Shri S. K. Dhabarde

AUXILIARY STAFF

Driver

Shri Umesh D. Arosker

SUPPORTING STAFF

SSG III

Shri D. D. Naik

SSG II

1. Shri R. D. Padnekar
2. Shri Vasudev 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

ON DEPUTATION

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

**DETAILS OF SANCTIONED BUDGET ESTIMATE / REVISED ESTIMATE
FOR 1988—1989**

	NON-PLAN		PLAN	
	Sanctioned Budget Estimate	Revised Estimate	Sanctioned Budget Estimate	Revised Estimate
Establishment charges	1,38,00,000	1,51,00,000	1,00,000	1,00,000
Travelling allowances	3,50,000	3,85,000	50,000	1,00,000
Other charges	31,00,000	30,65,000	18,50,000	18,00,000
TOTAL	1,72,50,000	1,85,50,000	20,00,000	20,00,000

ABBREVIATIONS

ADP	Adenosine di phosphate
AFDC	Agriculture and Food Products Division Council
AMP	Adenosine mono phosphate
ASRB	Agricultural Scientists Recruitment Board
ATP	Adenosine tri phosphate
BIS	Bureau of Indian Standards
CIFE	Central Institute of Fisheries Education
CIFNET	Central Institute of Fisheries, Nautical & Engineering Training
COSTED	Committee on Science and Technology in Developing Countries
DGTD	Director General of Technical Development
DOD	Department of Ocean Development
DOE	Department of Electronics
EEZ	Exclusive Economic Zone
EIA	Export Inspection Agency
FAO	Food and Agriculture Organisation
FORV	Fisheries Oceanographic Research Vessel
HDPE	High density polyethylene
HM-HDPE	High molecular — high density polyethylene
IFP	Integrated Fisheries Project
IPFC	Indo Pacific Fisheries Council
IPOC	In-plant quality control

IQF	Individually quick frozen
LDPE	Low density polyethylene
LLDPE	Linear low density polyethylene
MCPD	Marine Cargo and Packaging Division
MIPQC	Modified in-plant quality control
MPEDA	Marine Products Export Development Authority
NAARM	National Academy of Agricultural Research Management
NABARD	National Bank for Agriculture and Rural Development
NAG	Non agglutinating
OBM	Out board motor
ODNRI	Overseas Development Natural Resources Institute
PER	Protein efficiency ratio
PEST	Polyester
PP	Poly propylene
RH	Relative humidity
TBA	Thio barbituric acid
TDC	Textile Divisional Council
TVBN	Total volatile base nitrogen
UN	United Nations
UPSC	Union Public Service Commission
UV-VIS	Ultra violet — Visible
VHSE	Vocational Higher Secondary Education.

भूमिका

संस्थान ने मत्स्य के पैदावर और पशु पैदावर तकनॉलजी से संबंधित विभिन्न कार्यक्रमों के कार्यान्वयन में स्थायी प्रगति बनाए रखना प्रारंभ किया। लिये गये बत्तीस प्रोजेक्टों में से छब्बीस प्रोजेक्ट चल रहे हैं और इस वर्ष के दौरान छः नये प्रोजेक्ट लिए गए हैं।

महत्वपूर्ण उपलब्धियाँ नीचे दी गयी है :—

दो वर्ष के दूषण जीविका से मुक्त एक भारी प्रतिदूषण पेन्ट को विकसित किया गया है।

मा. त. के. सं. द्वारा विकसित बड़े आकारों के यानों से, पैदा ट्रालों के रिगन के लिए संचालन के संयुक्त रस्सी तार को व्यापारिक बनाया गया।

ट्राल के संरक्षण माप के रूप में चत्वर जाली कोड का अग्र भाग सक्षम दिखाई पड़ा।

झीलों के अच्छे पकड़ के लिए गुण्डाकार जिब से युक्त ट्राल जाल सीधे जिब से युक्त जाल की अपेक्षा श्रेष्ठ दिखाई पड़ा है।

50 एम एम आकार से युक्त 210 डी/1/2 के यमल से बनाए गए वलयन वांगडा जाल अधिक प्रभावकारी दिखाई पड़ा।

प्राकृतिक तौर पर डिब्बाबन्धित शुद्ध जल मछली मृगल अन्य प्रकार के संवेष्टों से श्रेष्ठ निकला।

कशेरुक के हंडन और दूरीकरण, अर्ध शुष्कित डोम में पीले अपवर्णन को सार्थक रूप में मंदित करता है।

ठीक तरह से सुखाए और संसाधित मछलियों में "लाल" को रोकने के लिए सोडियम प्रोपियनेट के समान कालसियम प्रोपियनेट भी उचित प्रभावकारी है।

संसाधित मछली के लिए पिपेरॉनल बटोक्साइड से योगवाहित पाइरेथ्रम, एक अच्छा कीट विकर्षक निकला।

संसाधित अचार और मेडिटरेनियन तरीके संसाधित तेल वांगडा को काचित पॉसिलेन/ग्लास, मर्तबानों में एक वर्ष से अधिक समय तक अच्छे रूप में सुरक्षित रखा जा सकता है।

शुष्क मछली के संवेष्टन के लिए एच डी पी इ और एल डी पी इ दोनों तुल्य रूप में अनुयोज्य दिखाई पड़ा।

तंत्रिका शल्य चिकित्सा में कैंटोसन के हेमेटोस्टाटिक प्रभाव पर किए गए अध्ययन और हेमोडायालिसिस के लिए कैंटोसन फिल्म के गुण का प्रोत्साहक परिणाम निकला है।

मछली वेफरों के उत्पादन के लिए निम्न दाम के शुद्ध जल मछलियों का उपयोग किया जा सकता है।

अमोमित वलीयित रेशा गत्ता कार्टनों के लिए प्रयुक्त पारंपरिक संग्रथन वस्तुओं के स्थान पर पॉलीप्रापिलीन टेप एक एवजी निकला है।

झींगे मांस के पिघलन नष्टों की भविष्यवाणी करने के लिए एक सक्षम रीति को माननीकृत किया गया।

झींगी मांस में होने वाले इंडोल का आकलन रीति का माननीकरण किया गया।

मछली आंतों से तैयार किए गए शल्य सीवन, व्यावसायिक तौर पर बिकनेवाले सीवनों से उनकी भौतिक विशेषताओं के साथ तुलनीय है।

मत्स्य ब्लॉकों के तापमान भेदन/अवरोधन गुणों के अध्ययन के लिए एक हिमकारी तापमान स्कान और छोटे नावों के आवश्यक प्रमुख पैरामीटरों के दूरवर्ती मापन के लिए एक "मत्स्यन लॉग" का विकास किया गया।

जल हायासिन्ध के अनाक्रोबिक किण्वन द्वारा जैव गैस के उत्पादन के लिए एक परीक्षात्मक संयंत्र के अभिलेख और संरचना हुए।

जल क्लोरीकरण प्रक्रिया के लिए कम से कम 7% क्लोरीन से युक्त सॉडियम हैपोक्लोरेट का सिफारिश किया गया।

मत्स्य डिब्बाबन्दन और फिशमील संयंत्रों के लिए आदर्श क्षमता का आकलन किया गया।

संस्थान द्वारा संचालित आर्थिक सर्वेक्षण से देखा गया है कि देशी यानों के यंत्रीकरण से प्राप्त कुल अतिरिक्त लाभ नाममात्र है।

विस्तार कार्यकलापों में प्रशिक्षण व निदर्शन कार्यक्रमों का संचालन, फिल्म प्रदर्शन व प्रदर्शनी का संचालन, तकनीकी पूछताछों का उत्तर देना और प्रोजेक्ट रिपोर्टों और विस्तार साहित्य की तैयारी आदि में स्थायी प्रगति बनायी रखी है।

रिपोर्ट के दौरान इस वर्ष की अवधी में परामशिता के आधार पर एक तकनीकी जानकारी प्रचार करने का भी प्रारंभ किया गया।

(ह/-)

एम. आर. नायर

निदेशक

मत्स्यन तकनाँलजी डिवीज़न

मुख्य उपलब्धियाँ

परिरक्षित जल के लिए एक अलुमिनियम क्राफ्ट के अभिकल्प की पूर्ति हो गयी।

जलोढ़ ताम्र क्रोम आरसनिक संयोग से और फिर तेल बढ़ी क्रियासअट से उपचारित और समुद्रीय, वायुमण्डलीय एव मिट्टी की अवस्थाओं के लिए खुले रखे काठ के पैनल, समुद्री वेधकों और कवकों के बहुत अच्छा जैव-प्रतिरोधक निकले हैं।

संयुक्त उपचारित पैनलों में भौतिक शक्ति मापें भी अवशिष्ट शक्ति के अच्छे अवरोधन दिखाते हैं।

एक भारी प्रतिदूषक पेन्ट, जिसके लगभग 2 वर्ष की दूषण मुक्त जीवन है, को विकसित किया गया।

मा. त. के. सं. द्वारा विकसित संयुक्त तार रज्जू (CWR) का मेसेर्स उषा मार्टिन (प्रा.) लिमिटेड, कलकत्ता द्वारा बाजार में लाया गया। परीक्षण परिणाम यह सूचित करता है कि उनके द्वारा बनाया गया रज्जू संस्थान द्वारा रखे गए विनिर्देशनों से तुलनीय है। विविध संयोग के तार रज्जुओं के मानक नमूनों का भी परीक्षण किया गया।

ट्राल संरक्षण के रूप में चत्वर जाली कोड का अग्र भाग सक्षम निकला है।

संख्या 7, 8 और 9 के कंटिया पॉलिनोमस हेन्ड लाइन मत्स्यन के लिए प्रभावकारी निकले हैं।

मत्स्य संसाधन डिवीज़न

मुख्य उपलब्धियाँ

पकड़ाव के तुरंत बाद रोड़े बर्फ में रखें तो संसाधित मछलियाँ, जैसे कतला, रोहु और मृगाल के 15 से 17 दिन तक की शेल्फ जीविका होती है।

रेनुडटी के चर्बी वृद्धि के कम उपस्थिति होने के कारण बर्फी गोदाम के दौरान कोई मुख्य समस्या नहीं है।

मसाले जैसे नदमेग, मैको और अदरक के रस का प्रयोग करके 20° सेन्टीग्रेड में 2-3 महीने रखने से कीमा कर दिए कट्टिल मत्स्य की शेल्फ जीविका की बढ़ायी हो जाती है।

ताजा पानी मछली मृगाल के डिब्बाबन्दन की विशिष्टताओं पर की गई अध्ययन ने यह स्थापित किया कि प्राकृतिक तौर पर डिब्बाबन्दन किए मत्स्य, अन्य प्रकार से डिब्बाबन्दन किए मत्स्यों से भी अच्छे हैं।

“कलवा” मांस से फिश बॉल्स और उसके डिब्बाबन्दन एक करी माध्यम में तैयार करने का फारमुला विकसित किया गया।

ज्यू फिश के कीमा मांस से पैटिक्स तैयार करने के तरीके मानकीकृत किया गया।

प्रति ऑक्सिकारक संरूपण, जिसमें ब्यूटिलित हैड्रोक्सि ऐनिसोल (बी. एच. ए.) और ब्यूटिलित हैड्रोक्सि टोलुविन (बी. एच. टी.) है, का उपचार सूखे मछलियों में, संसाधित मैकरोल को भी शामिल करके, भूरेपन कम करके दिखाते हैं।

नमक और सिट्रिक अम्ल से उपचार किए और धूप में सूखे, तेल्ली झींगियों का प्रकटन और शेल्फ जीविका काफी सुधरी हुई होती है।

मछली के सूखे अचार, जैसे ऐन्कोविल्ला ठीक पैकेजिंग जैसे पॉलिस्टर पॉलीथीन, नाइलॉन स्वीलन और लोहीकृत पॉलिस्टर पॉलीथीन में पैक किया जाए तो छः महीने से सी ज्यादा समय संरक्षित रहता है।

झींगे शल्कों से उन्नत लसीछापन ग्रेड के कैंटोसेन का उत्पादन की उपाधियों का मानकीकरण किया गया।

चेपदार के रूप में प्रयुक्त करने के लिए कैंटोसेन थोल के, गोदाम स्थिरता बढ़ाने के तरीके विकसित किए।

तंत्रिका शल्य चिकित्सा में कैंटोसेन के हैमेटो-स्टाटिक प्रभाव पर किए गए अध्ययन और हैमोडायलिसिस के लिए कैंटोसेन फिल्म के गुण का प्रोत्साहक परिणाम निकला है।

आहार के सुवास करने के लिए छोटे एवं बहुत छोटे झींगियों से बनाए गए झींगी चूर्ण की तकनालजी को विकसित किया और उसे उद्योग धन्धे ने स्वीकार भी किया।

क्लोराथलामस आक्वा से एक गहरी समुद्री जाती से संव्यूतित मांस तैयार करते हैं।

पेरच जैसे गहरी समुद्री मछलियों के पकाए मांस से तैयार किए गए मत्स्य परत और मूष जीवण्वीय स्तर पर संरक्षित है।

भारत में पहली बार सालमोनोल्ला फारमसेन वियुक्त किया है। अन्य तीन सेक्सोटाइप, यानी सालमोनोल्ला गमिनक्सा और एक. फाल्कनसे व एस. नबिसलो, पहली बार जमाए गए झींगियों से वियुक्त किए।

10 पी. पी. एम. के अवशिष्ट स्तर तक झींगे संसाधन संयंत्रों में क्लोरीनित जल का प्रयोग वी. क्लोरिया जीवों को नष्ट करने के लिए आवश्यक महसूस हुआ है। यह जीव कमरे के तापमान में आसवन पानी में केवल 24.48 घण्टे तक जीवित रह सकता है जब कि वह साधारण समुद्री जल में 7 दिन तक जी सकता है और अणुरहित समुद्री जल में एक महीने तक जी सकता है।

क्लोरीनीत पानी के संसाधन के लिए कम से कम 7% क्लोरिन युक्त सोडियस हाइपोक्लोराइट का सिफारिश किया जाता है।

झींगी मांस से हिमद्रवण नष्ट का प्रागूक्त करने के लिए एक वस्तुनिष्ठ रीति का मानकीकरण किया गया।

झींगी मांस में होनेवाला इंडोल की आकलन रीति का मानकीकरण किया गया।

पेरच मत्स्य से तैयार किए मत्स्य कटलट, और जो विविध पैकेजिंग वस्तुएँ जैसे एच. एम. एच. एच. डी. पी. ई., एल. डी. पी. ई., एल. एल. डी., पी. ई. और नाईलॉन/पॉलिथीन में पैके किए गए हैं, स्वीकारीय स्थिति में, -20° सी. में, चार महीने की अवधि तक रख सकते हैं।

मोम न किए गए वलीयित रेशा गत्ता कार्टन के लिए प्रयुक्त पारंपरिक संग्रथन वस्तुओं के स्थान पर पॉलीप्रोपिलीन टेप एक अच्छा प्रतिस्थापि है।

जैव रसायन, पोषण व सूक्ष्म जीव विज्ञान डिवीजन

मुख्य उपलब्धियाँ

सूर्य शुष्कन या गरम वायू शुष्कन की अपेक्षा शीतीकरण शुष्कन, में मत्स्य पेशियों में अधिक कार्बोनिल का उत्पादन दिखाई देती है।

जमायी गयी मछली के संग्रहण के दौरान, कार्बोनिल की मात्रा प्रारंभिक वृद्धि दिखाती है, जो फिर कम हो जाती है, और फिर से तीन महीने के संग्रहण के बाद बढ़ जाती है।

निम्न वसा अम्ल (सी. 10 से कम) उष्ण-कटिबन्धी ताजा जल मछलियों में नहीं दिखाई देते, यद्यपि संयमी जल मछली, मछली को सुवास करने के लिए अंशदान देते हैं।

ब्रोमालेटिन के साथ 4 घण्टे पाचन करने से टूना के लाल मांस केवल 28% तक विलयित किया जा सकता।

आलिबनो चूहों के आहार में मुख्य कार्बोहाइड्रेट के रूप में आलू कलफ दे तो, अन्य कलफ जैसे टैपियोका कलफ, मक्के का कलफ की अपेक्षा, सीरम को कोलेस्टेरॉल का स्तर कम करता है।

समुद्री स्रोत के वियुक्त किए इक्कीस जीवाण्वीय समूहों को उनके लिपेस विस्तरण की क्षमता को उनके लिपेस के लिए जांच की गई। कुछ समूह लिपेस किण्वक विस्तरण दिखा सकती है। लेकिन अब तक वियुक्त किए किसी भी प्रभेद लिपेस किण्वक के व्यावसायिक स्रोत के रूप में आशाजनक नहीं निकला है।

काकिनडा क्षेत्र के नमकीकृत मछली हमेशा उनके पेशियों में उन्नत मात्रा में हिस्टोमैन दिखाते हैं, लेकिन कोचिन क्षेत्र के मछलियाँ हिस्टोमैन का उन्नत स्तर नहीं दिखाते।

जब कि कोचिन तट की मछलियाँ, टॉक्सिक धातुओं के उन्नत स्तर नहीं दिखाते, काकिनडा और विसाख और गोदावरी के नज़दीक के कोवूर में मछलियों में उन्नत मात्रा में टॉक्सिक भारी धातुएँ

दिखाई देती हैं। जो भी हो, कोचिन तट के पानी से पकड़े गए कट्टिल मछलियों में अक्सर 2 पी पी एम से अधिक काडमियम स्तर दिखाते हैं। लेकिन शुद्ध किए फिल्टरों में काडमियम का स्तर सीमा के भीतर है, क्योंकि काडमियम संचयन का मुख्य स्थान कलंजा है।

मछली आँतों से तैयार किए गए शल्य सीवन, व्यावसायिक तौर पर बिक्री किए जाने वाले सीवनों से उनके भौतिक विशेषताओं के साथ तुलनीय है और पशुओं पर इसका परीक्षण करने पर कोई कोश अभिक्रिया नहीं दिखाती।

संसाधित खारा जल मछली केनोस (केनोस केनोस) के पूर्व रिंगर बर्फीकरण करने से स्यूडोमोनास एस पी जी की वृद्धि में नियंत्रणात्मक प्रभाव होती है।

क्षेत्रीय बाजार के समुद्री मत्स्य से वियुक्त हिस्टमैन उत्पादन करने वाला जीवाणु एसबरिकिया, क्लोबसिल्ला, विब्रियो और स्यूडोमोनास के जीनस में आती है।

हिसटिडैन आइरोबिकली को छोड़कर बाकी सभी अमिनो अम्ल से अलटेरोमोनास पुट्रोफेसिनस अम्ल और अमोणिया का उत्पादन करते दिखाई देती है।

यह देखा गया है कि मात्स्यकी उत्पन्नों से वियुक्त सालमोनल्ला समूहों की वृद्धि 3.4 और 10.7 के बीच के पी. एच. स्तर तक नियंत्रित किया जाता है।

विबियो पाराहीमोलिटिक्स के कनगावा के घनात्मक और ऋणात्मक दोनों प्रभेदों को जब आसुत पानी और मुनसिप्पल टेप पानी में रख दिया जाए तो कुछ मिनटों में मर जाते हैं।

मछली से वियुक्त किए गए क्लोस्ट्रिडियम स्पोरोजेनस प्रभेद के बीजाणु 2 घण्टे तक 100° सेन्टीग्रेड में तापन करने पर भी जीवित रहते हैं।

अभियांत्रिकी और यंत्रिकीकरण डिवीज़न

मुख्य उपलब्धियाँ

मत्स्य खण्डों के तापमान भेदन/अवरोधन और बर्फीकरण गोदामों और हिमकारियों की क्षमता पर

विशेष अध्ययन करने के लिए एक हिमकारी तापमान स्कानेट का विकास किया गया।

छोटे नावों के आवश्यक प्रमुख पैरामीटरों की दूरवर्ती मापन के लिए एक "मत्स्य लॉग" का आरेखन किया गया।

16 पर्यावरण पैरामीटरों की प्राप्ति के लिए "पर्यावरण डाटा प्राप्ति प्रणाली" के सुधरे रूप विकसित किया।

जल हायासिन्थ के कीमा मसाले के ऐनाइरोबिक किण्वन से जैव गैस का उत्पादन होता है।

इलक्ट्रो-थर्मल तत्व पर आधारित एक किलोग्राम क्षमता की धुआँ बेकर चूल्हा की अभिकल्प पूरा किया गया।

विस्तार, सृचना व सांख्यिकी डिवीज़न

मुख्य उपलब्धियाँ

वर्ष 1988 के लिए केरल तट के स्क्वल्ला के वार्षिक पकड़ाव लगभग 12,000 टन आकलित किया गया है। सूखे शार्क पख अर का उत्पाद, दोनों भागों के अर और पूँछ के अर का अलग से हिसाब किया।

मत्स्य डिब्बाबन्दन संयंत्रों और फिशमिल संयंत्रों के लिए आदर्श क्षमता का आकलन किया।

यह देखा गया है कि पारंपरिक यानों पर मोटोर लगाने से कुल अतिरिक्त लाभ नाममात्र है।

वेरावल अनुसंधान केन्द्र

मुख्य उपलब्धियाँ

32 एम. बडा मेश ट्रॉल के निष्पादन 20 एम. लम्बे ब्रिडिल से सुधरित हो जाती है।

बहुत अधिक नमक लगाए व्यावसायिक नमूनों से कम नमक लगाए, आधा सुखाए धामा की अच्छी इन्द्रियग्राही स्वीकार्यता है। आधा सुखाए गए धोमे

की संग्रहण के लिए अनुकूलतम आर. एच. भी निकाला गया। नमक लगाए कीमा की अच्छे गुणवाले परतों में बदल सकते हैं, एक उन्नत स्वीकार्य सुविधाजनक उत्पन्न।

सिर काटने और कशेरु के हटाने से आधा शुष्कित धोमे में पीले दिवर्णन को कम कर देता है।

पख अर की प्राप्ति के लिए तिमिंगल षार्क रैनोडोन टैपस का उपयोग की जा सकती है।

काक्किनडा अनुसंधान केन्द्र

मुख्य उपलब्धियाँ

छः सीवन एवं उभरे पेट के ट्रॉलों से रस्सा ट्रॉल आपेक्षित तार पर उन्नत पकड दर देता है।

ट्रॉल जाल के अंतिम भाग से मछलियों को बच जाते हुए देखा है।

छः सीवन ट्रॉलों से उच्च विवृत ट्रॉल अच्छा काम करते आ रहे हैं।

स्काइनेड मछली से सूखे मछली—अनाज मिश्रण, जो सूप तैयार करने के लिए प्रयुक्त किया जा सकता है, को विकसित किए।

परिवेश तापमान से अधिक 18° सेन्टीग्रेड $\pm 1^{\circ}$ सेन्टीग्रेड में 24 घंटे तक शुद्ध किए गए सीपी मछली का उत्तरजीवन दर अधिक होती है।

0.3% सोडियम मेटार्ब्सलपगइट (89% शुद्धता) घोल में 30 सेकण्डों के लिए उपचार करें तो भाग, श्वेत और भूरे सिरहीन झींगियों के काले बिन्दुओं को रोक लिया जा सकता है।

विशिष्ट घनत्व 1.218-1.221 के सघन माध्यम का प्रयोग करके छोटी मछलियों से मांस अलग कर सकता है। पूरे कच्चे मछली से इस प्रकार 20% से 26% मांस प्राप्त होता है।

विशाखपट्टनम और काक्किनडा से इकट्ठे किए समुद्री मछली और सीपी मछली के नमूनों में खतरनाक सीमा से भी कम स्तर के कुल मरकुरी स्तर है।

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अन्य मौसमों से बढ़कर ग्रीष्म में सूर्य शुष्कित अपांत्रण न किए गए श्वेत चारे में हिस्टमैन मात्रा अधिक है।

बुरला अनुसंधान केन्द्र

मुख्य उपलब्धियाँ

मत्स्यन गिअर बनाने के लिए नाइलॉन और अन्य नए कृत्रिम धागों से अधिक प्रभावकारी पॉलीप्रोपिलीन धागा है।

शीतऋतु के महीने में सौ. कतला ऊपरी क्षेत्रों की ओर प्रवास करता है।

मत्स्य की यातायात के लिए क्षेत्रीय तौर पर प्रयुक्त किए जाने वाले पारंपरिक सैल पत्ते लगाए बांस की टोकरियों के स्थान पर बर्फीकृत मत्स्य की संग्रहण के लिए पॉलीथीन लगाए बांस की टोकरियाँ अधिक उपयोगी हैं।

मेनता विरिडय के पत्ते की निचोड से उपचार करने पर सौ. चापरा के सूर्य शुष्कित उत्पन्नों का गुण सुधरता है।

मत्स्य परतों की निर्माण के लिए कम दाम के अलवणजल मत्स्यों का उपयोग की जा सकती है।

बंबई अनुसंधान केन्द्र

मुख्य उपलब्धियाँ

योसाइसेरो परिवार के करकारा, जो व्यावसायिक तौर पर कम प्रयुक्त किए जानेवाला जानुस है, को तेरह दिन तक अच्छी स्थिति में बर्फ में संग्रहित कर सकता है और इन्द्रियग्राही और जैव रसायन पैरामीटरों से न्यायनिर्णय किया जाता है।

करकारा से प्राप्त खाने योग्य मांस लगभग 50-55% है।

इन्द्रियग्राही सविशेषताओं के निर्णय के अनुसार -18° सेन्टीग्रेड से -20° सेन्टीग्रेड में संग्रहीत हिमशीतित करकारा कतलें 10 हफ्ते के बाद भी अच्छी स्थिति में रहती है।

केलिकट अनुसंधान केन्द्र

मुख्य उपलब्धियाँ

ठीक तरह से सुखाए, संसाधित मत्स्यों में "लाल" रोकने के लिए कैल्सियम प्रोपियोनेट के समान ही सोडियम प्रोपियोनेट भी प्रभावकारी है। संसाधित मछली का संरक्षण के संतृप्त विलयन में निमग्न उपचार करने पर संरक्षक का एकसमान प्रयोग हो सकता है।

संसाधित मत्स्य में तिल का तेल और सूरजमुखी का तेल लगाने से कीड़ाणु विकर्षक विशेषता दिखाती है।

संसाधित मत्स्य के लिए पिराथरम सैनरगेड, पिपेरनिल ब्यूटोक्सैड के साथ एक अच्छा कीड़ाणु विकर्षक सिद्ध किया है।

शुष्कित मत्स्य के पैकिंग के लिए एच. डी. पी. ई. और एल. डी. पी. ई. दोनों समान रूप से प्रयुक्त किया जा सकता है।

चमकीले पोरसलाइन/काँच के मर्तबान में, संसाधित अचार और मेडिटारनियन तरीके संसाधित

तेल सारडीन, एक वर्ष से अधिक समय तक रख सकता है।

बाजारू संसाधित मछली का 20 पी पी एम के क्लोरिन निहित संतृप्त लवणजल में उपचार करने से उसको जीवाण्विक गुण सुधरता है और असंगत वस्तुओं को कम करता है, इस के अलावा उत्पन्न को अच्छे रंग और रूप भी प्रदान करता है।

गोवा अनुसंधान केन्द्र

मुख्य उपलब्धियाँ

छोटे यानों से मध्य जलीय ट्रॉल्लों के प्रचालन के लिए 2.5 नॉट का धार्मिक गति अनुकूलतम देखा गया है।

अन्तिम रूप से यह भी सिद्ध किया गया कि झींगी पकडाव के लिए टेपरिंग जिब लगाए जाल, सीधे जिब लगाए जाल से अधिक प्रभावकारी है।

रस्सा 210/डी/112, 50 एमएम मेश तार के साथ बनाए गए घेर करने मेकरॉल गिल जाल अधिक प्रभावकारी सिद्ध हुआ है।

संकलन सहयोग: श्रीमती जेसी जोसफ सी.

„ जी. एन. शारदा

„ शोभा के.