

Annual Report 2001-02



CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
(Indian Council of Agricultural Research)

Matsyapuri P. O., Cochin - 682 029

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Central Institute of Fisheries Technology
(Indian Council of Agricultural Research)
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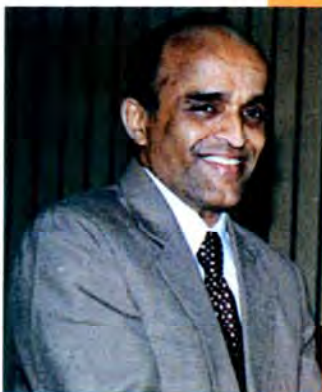
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Preface

The Institute added yet another feather to its cap during the year. A team of Scientists of the Institute was bestowed the ICAR Team Research Award for the period 1999-2000 for excellent work in fish processing technology. This is a recognition of the continuous efforts put in by the scientists and staff of the Institute for the development of fisheries in the country.

The fisheries scenario in the country has been changing very fast. Marine capture fisheries, which was the backbone of the fishing and fish processing industries, has reached a plateau in its growth curve, with an annual landing of around 2.3 million tonnes. The largest foreign exchange earning industry of the country viz. export of processed fishery products, has, till recently, depended mostly on marine capture fisheries, that too mostly prawns. Aquaculture has now taken over and has become the major contributor to this industry. The inland riverine and reservoir sectors and the deep sea sector have also shown considerable improvement.

Inland fish production is at present scattered along the different riverine and brackishwater systems in different parts of the country, which has been a hurdle in its organized industrial utilization. For the development of this sector, there is need for diversification of products and markets. In tune with this change, the Central Institute of Fisheries Technology has reoriented its priorities and programmes and is giving more emphasis on inland, farmed and deep sea resources. The Institute started working on inland and reservoir fisheries since the early sixties by establishing Centres at Nangal in Punjab (since closed), Burla in Orissa and presently, Hoshangabad in Madhya Pradesh.



Projects undertaken by the Institute under the National Agricultural Technology Project (NATP) also give emphasis on research in inland fisheries, including riverine and reservoir resources. Some of the initiatives recently undertaken by the Institute in this direction are survey of major reservoirs of Madhya Pradesh, echolocation studies in Hirakud reservoir in Orissa and Aliyar reservoir in Tamil Nadu and socio-economic studies in Malampuzha reservoir in Kerala. A needs assessment survey was conducted in the North East Hill region by two multi-disciplinary scientific teams of the Institute and technology transfer programmes were formulated for the utilization of freshwater fish resources of this area. Fibreglass canoes for backwater fishing were introduced as a means of socio-economic improvement and as an alternative to wood in the construction of fishing crafts. The Institute designed and constructed fibreglass canoes for the Chellanam Village SC/ST Service Cooperative Society under the Special Component Plan of the Kerala State Fisheries Department. These boats are now in operation in the backwaters of Cochin.

With the development of freshwater aquaculture in states like Punjab and Uttar Pradesh, development of processing methods for freshwater fish has become imperative. The Institute has accordingly developed many value-added products from freshwater fishes, of which, ready-to-eat fish (rohu) curry was the most significant. A National Symposium on Riverine and

reservoir fisheries was also organised by the Institute during the year, jointly with the Society of Fisheries Technologists (India).

Sagarkripa, the fuel efficient steel fishing vessel developed by the Institute, which received wide appreciation, was transferred to Veraval Research Centre for fishing trials and popularization along the Saurashtra coast. Design and popularization of a turtle excluder device and different by-catch reduction devices were some other significant achievements. Square mesh cod ends and V form otter boards were popularized in Gujarat, Orissa and Andhra Pradesh as a part of the efforts to introduce responsible fishing methods.

The Institute continued its linkages with the seafood industry through training and analytical services. The Institute has played a major role in improving the hygienic standards in fish processing industry and helped about 120 factories to qualify for export to European Union countries. It is a matter of pride that the National Accreditation Board for Laboratories has recognized the Institute as a referral laboratory. The Scientists from various disciplines have served in various committees of the Bureau of Indian Standards and other quality certifying agencies. Pesticides and antibiotic residues, polyaromatic hydrocarbons, heavy metals and biotoxins in fish have become major threats to the freshwater and brackishwater fish farming industries. The Institute has considerably strengthened its research in these aspects for which sophisticated equipment such as Fourier transform infra red spectrometer, Ion chromatograph, High performance liquid chromatograph, Atomic absorption spectrophotometer etc. were acquired

Technology for the production of collagen-chitosan membrane developed by the Institute has been taken up by an entrepreneur for its commercial production for treatment in cases of wounds and burns. The Institute has perfected techniques for detecting white spot and yellow head viruses in farmed prawns at a very early stage which has become a boon to fish farmers.

The Agricultural Technology Information Centre of the Institute, inaugurated by the Fisheries Minister of Kerala State, has started functioning. Under the special component plan for SC/ST and women of the IXth Five Year Plan, a six months job oriented National training programme on 'Fish processing and quality assurance' was held for a batch of 20 candidates. Village adoption programmes were also initiated through the Headquarters and Research Centres of the Institute. A Ph.D. programme in Fish processing technology was started during the year while the Institute continued with its M.F.Sc. programme on the same subject.

The Institute received the Rajarshree Tandon Award for its effective implementation of Hindi as official language. A National Seminar in Hindi on 'Women in fisheries' was also held as a part of 'Chetana Maas' celebrations.

This is in brief about the achievements of the Institute during the year 2001 and I proudly present the detailed report to the researchers, industry and the public.



(Dr. K. Devadasan)
Director

CIFT Does it Again!



The team members receiving the award from Shri Ajit Singh, Hon'ble Union Minister for Agriculture, Government of India



Dr J. K. Srinivasa Gopal



Shri J. S. Unnikrishnan Nair



Shri P. K. Vijayan



Dr. C. N. Ravishankar

Executive Summary

- Cerium treatment was found effective in inhibiting corrosion of aluminium and its alloys in marine environment.
- Infestation was seen least in panels treated with coal tar mixed with CNSL and an insecticide.
- Square mesh cod ends were seen to function better than diamond mesh in conservation of juveniles and the techniques were disseminated by training women traditionally skilled in net making.
- High tenacity monofilament gill nets of 30 mm bar mesh size were found superior to nets with other mesh sizes.
- Methods were standardized for preparation of fish curry from *Chanos chanos*, chilly fish from fish fillets, mince and surimi and coated products from freshwater fish rohu.
- Chitin and chitosan incorporated isinglass films when used in maxillofacial surgery were seen to perform better than the conventional material.
- Method was standardized for preparation of frozen fish sticks from small varieties of cheap bony fish.
- Fish calcium could be extracted from rohu scales after deproteinisation.
- Fish protein was found effective in countering the adverse effects of isoproterenol, an agent inducing symptoms of myocardial infarction.
- A simple effluent treatment system was designed to meet the standards of Pollution Control Board.
- Method was developed to prepare bacteriological peptone from the proteins recovered from effluents from fish processing plants.
- A Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) method was perfected for detection of yellow head virus in shrimp.
- A protocol for isolation of bacterial genomic DNA in pure form was standardized.
- Designs were developed of a cage system for culture of fishes in bheels and reservoirs and a sail system for use on board medium vessels for reducing fuel consumption.
- An improved design of a FRP boat for backwater fishing was developed.
- Statistical models were formulated for evaluating the economic viability of trawlers.
- The various technologies developed were transferred to different groups of clientele through training, consultancy and extension programmes.
- Technology transfer programmes were initiated in the NEH region.

The Central Institute of Fisheries Technology (named at the time of its inception as Central Fisheries Technological Research Station) was set up in 1954 following the recommendations of a high power committee constituted by the Ministry of Food and Agriculture, Government of India. The Institute started functioning at Cochin in 1957 under the Department of Agriculture of 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 1 October, 1967.

The Central Institute of Fisheries Technology is the only national center in the country where research in all disciplines relating to fishing and fish processing is undertaken. Research Centres function at Veraval (Gujarat), Visakhapatnam (Andhra Pradesh), Burla (Orissa), Mumbai (Maharashtra), Calicut (Kerala) and Hoshangabad (Madhya Pradesh).

Mandate

The Institute functions with the following mandate:

- ✱ To evolve innovative and cost-effective technologies for fish harvest
- ✱ To develop and standardize various aspects of post-harvest technologies
- ✱ To develop technologies for extraction of biomedical, pharmaceutical and industrial products from aquatic organisms
- ✱ To act as a repository of information on harvest and post-harvest technologies with a systematic data base
- ✱ To conduct transfer of technology through training, education and extension education programmes
- ✱ To provide consultancy services and to popularize the innovations for overall development of the fishery industry

Organisational set-up

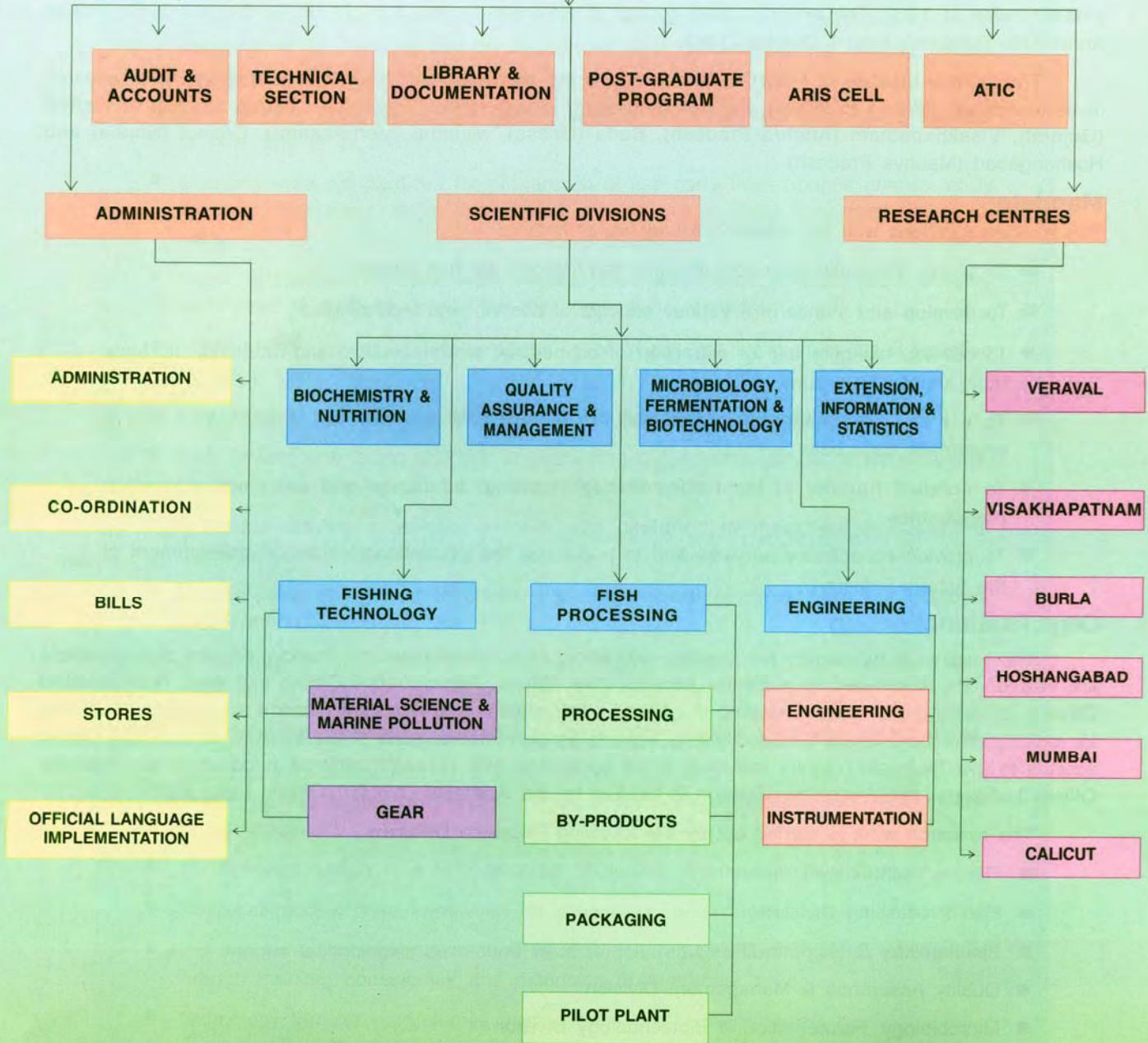
The Institute is headed by the Director with whom all administrative and financial powers of the Institute are vested. He is assisted by a Senior Administrative Officer, Administrative Officer and Asst. Administrative Officers for dealing with matters relating to general administration and Assistant Finance and Accounts Officers for looking after the financial and accounting aspects as also internal audit of the Institute. A Technical Officer attends to the Technical matters including those connected with research projects handled by the Institute. Official Language Implementation Section is headed by the Assistant Director (Official Language).

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

- Fishing Technology Division
- Fish Processing Division
- Biochemistry & Nutrition Division
- Quality Assurance & Management Division
- Microbiology, Fermentation & Biotechnology Division
- Engineering Division
- Extension Information & Statistics Division

Organogram

DIRECTOR



Addresses of Headquarters and Research Centres



- **COCHIN (Headquarters)**
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Ph: 0484-2666845 (14 lines); Fax: 091 - 484 - 2668212
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Telegram: FISHTECH/MATSYAOU DYOGIKI

Statement showing budget grants and actual expenditure for the year 2001-2002

(Rs. in lakhs)

Particulars <i>Budget Head</i>	Non Plan			Plan		
	<i>Sanctioned Budget</i>	<i>Revised Estimate</i>	<i>Expenditure</i>	<i>Sanctioned Budget</i>	<i>Revised Estimate</i>	<i>Expenditure</i>
Estt. Charge	659.10	630.10	628.93	3.00	–	–
O.T.A.	0.40	0.40	0.40	–	–	–
T.A.	7.80	7.80	7.80	10.00	10.00	10.00
Other charges including equipment minor works & repair	136.50	136.50	136.50	204.80	204.80	201.45
Major works	–	–	–	90.00	–	–
Catch up grant						
i. Equipment	–	–	–	75.00	75.00	83.12
ii. Works	–	–	–	55.00	55.00	50.23
TOTAL	803.80	774.80	773.63	437.80	344.80	344.80



A quick glance at past achievements

Sustainable utilization of the marine and inland resources is one of the main aims of the activities of the Institute for which extensive surveys have been conducted by the Institute on-board the DOD owned research vessel *Sagar Sampada* along the entire area from the North-West to North-East coast of the country. Specialized nets including high speed demersal trawl, hybrid trawl, high opening trawl and semi-pelagic trawl, to name a few – have been designed for operation from this vessel. A large number of designs of various types of gear such as gill nets, purse seines, lines and traps have also been developed for exploitation of fishery resources. Development of a combination wire rope for deep sea fishing and design and popularization of Turtle Excluder Device are other notable achievements of the Institute.

Designs of mechanized wooden fishing vessels in the size range 7.67 – 15.25 m OAL have been developed. The CIFT has also embarked upon designing large resource – specific vessels of 20 m OAL and above, in order to meet the ever increasing demand for exploiting the deep sea waters of the country. Painting schedules and methods have been developed for protection of fishing crafts. Designs of fuel efficient steel fishing vessels were also developed and commercialized.

The Institute also developed a number of electronic equipment for monitoring in commercial fisheries, research as well as environmental studies. Some of them were trawl depth meter, solar processing monitor, environmental data acquisition system, freezer temperature monitor, warp load meter, salinity temperature meter and elephant draft power monitor.

Chlorination of water using sodium hypochlorite is normally practised to reduce bacterial contamination. CIFT has developed a chlorine level indicator paper called 'cloritest' for instant reading of chlorine level in process water. Other products developed for the fish processing industry are antiseptic ointment for use by prawn handlers and deodorant for masking the foul odour emanating from processing plants.

To meet the new demands for products and processing techniques, emphasis was shifted from block freezing of fish and shellfish to the develop-

ment of individual quick frozen products like battered and breaded products, including fish fingers, fish cutlet and fish sticks. A number of packagings for various types of fish products including synthetic edible casings for fish sausage as well as technologies for transportation of live fish and shellfish have also been developed at the Institute.

Some of the important value-added products developed by CIFT, which are in demand at present within the country and abroad, are fish wafers, fish soup powder, fish pickles and hygienically dried fish. Shark fin rays is a very expensive commodity, process for extraction of which has been developed at the Institute. Another value added product developed is fish curry processed in flexible pouches which can remain at room temperature without any change for over a year. Other items developed include masmin prepared by repeated smoking of tuna fillets and squalene obtained from oils of certain species of sharks. Process has also been developed and commercialized for processing shark cartilage.

Suitable media for culture of different types of bacteria and methods for their enumeration and isolation have been developed and a technique perfected for detection of white spot disease syndrome in farmed shrimp.

The CIFT has successfully developed pharmacological products from fish waste, a noteworthy one being absorbable surgical sutures from fish gut collagen. Field trials with the product have been very encouraging. Two other important products from fish waste developed by the Institute are chitin and chitosan, which have been adopted both in the national and international levels. Collagen-chitosan membrane is another product, which has found a place in periodontal applications.

Transfer of technology through technical consultancy programmes is a major activity of the Institute. Many entrepreneurs have benefited by the services rendered by the Institute leading to establishment of a number of processing units for fish waste utilization and improvement in fish catch. Outreach programmes such as conduct of training courses and field level extension programmes targeting the weaker sections of the community and rural women were also organized.

Research Achievements

HEADQUARTERS, COCHIN

Fishing Technology Division

Research Projects Handled









- | | |
|--------------------------------|---|
| 1. Title of the project | : Development of gear, accessories and instrumentation for responsible and resource specific variable depth trawling |
| Principal Investigator | : Shri V. Vijayan |
| Location of the project | : Cochin |
| Co-investigators | : Shri Percy Dawson, Dr M.R.Boopendranath, Shri K.Ramakrishnan & Shri M.P.Remesan |
| 2. Title of the project | : Performance evaluation of suitable selective devices for elimination of fish by-catch (BRD) and turtles (TED) in shrimp trawling |
| Principal Investigator | : Shri Percy Dawson |
| Location of the project | : Cochin, Visakhapatnam & Veraval |
| Co-investigators at Cochin | : Shri V.Vijayan, Dr M.R.Boopendranath, Shri P.George Mathai & Shri M.P.Remesan |
| 3. Title of the project | : Studies on traditional fishing gear and methods |
| Principal Investigator | : Shri P.George Mathai |
| Location of the project | : Cochin & Veraval |
| Co-investigators at Cochin | : Shri V.Vijayan, Shri Percy Dawson, Smt Saly N. Thomas, Dr B.Meenakumari & Shri M.P.Remesan |
| 4. Title of the project | : Studies on material protection and marine pollution |
| Principal Investigator | : Dr Leela Edwin |
| Location of the project | : Cochin, Visakhapatnam & Veraval |
| Co-investigators at Cochin | : Smt. Saly N. Thomas & Shri Muhamed Ashraf |
| 5. Title of the project | : Development of fishing gears and techniques for harvesting reservoir fishery resources |
| Principal Investigator | : Dr B. Meenakumari |
| Location of the project | : Cochin & Burla |

Funded Projects

- | | |
|--------------------------------|---|
| 6. Title of the project | : Harvest technology and catch composition of deep-sea fishery resources in the Indian EEZ |
| Principal Investigator | : Dr B. Meenakumari |
| Location of the project | : Cochin |
| Co-investigators | : Smt Sally Simon*, Smt Sherine Sonia Cubelio* & Smt Latha Unnikrishnan* |
| 7. Title of the project | : Validation of IRS P4 OCM data with demersal fisheries |
| Principal Investigator | : Dr B. Meenakumari |
| Location of the project | : Cochin & Veraval |
| Co-investigator | : Shri U.Sreedhar |

**Cr. Research Fellow*

Chief Findings

-  Rubber wood panels exposed to soil conditions recorded greater loss of strength compared to panels exposed to marine and atmospheric conditions. The average decrease in strength of untreated panels on exposure to marine conditions was 0.16N/mm²/day.
-  Cerium treatment was found very effective in inhibition of corrosion of aluminium and its alloys in the marine environment.
-  The corrosion rate of cerium treated aluminium was highest at pH 3 and lowest at pH 9. The corrosion inhibition property of cerium was better in salinity above 25ppt.
-  The fuel efficient 15.5 m steel trawler designed and constructed by CIFT was shifted to Veraval. As the first steel-fishing vessel introduced to Saurashtra coast, it has generated considerable interest in the area. Several enquiries have been received for assistance in constructing such vessels.
-  Integrated fish finder and Navigation Guidance system developed by Bharat Electronics Ltd., (BEL), Bangalore was field tested and report given.
-  Field trials of 51.0m long wing semi-pelagic trawl with 1.5 tonne 'V' form otter boards under varying speeds showed that 4.0 knot trawling speed was optimum for this gear system for harvesting off-bottom resources without affecting the demersal ecosystem detrimentally.
-  The turtle excluder device designed and developed to suit Indian conditions and named as CIFT - TED was extensively demonstrated along the Andhra, Orissa and West Bengal coasts in collaboration with the State Fisheries Departments, MPEDA and WWI to the satisfaction of fishermen and the authorities.
-  No statistically significant difference was found between the strength properties of indigenous and imported (Müstad) fishing hooks.

Report of work done

Material science and marine pollution

The natural durability of rubber wood (*Hevea brasiliensis*) exposed to marine, soil and atmospheric conditions was studied. The loss in strength of untreated samples exposed to field conditions was assessed at the end of 90 and 120 days. The maximum loss in compressive strength (parallel to grain and perpendicular to grain) was recorded in samples exposed to soil condition (graveyard test) followed by marine and atmospheric conditions respectively. The average decrease in strength of untreated panels on exposure to marine conditions was 0.16N/mm²/day.

Preservative treatment studies of rubber wood with synthetic pyrethroids (0.1% cypermethrin) were initiated. Dip treated panels were immersed in estuarine waters along with dual preservative treated and copper chrome arsenic treated panels. Regular observations are being made on the effectiveness of the treatment.

Settlement of biofilm on glass panels immersed in estuarine and oceanic waters and under laboratory conditions was studied. The studies were conducted during pre-monsoon, monsoon and post-monsoon periods. The characteristics of the film were studied by infra red spectroscopy (FTIR).

Samples of monofilament and mult ment polyamide netting materials were exposed to UV radiation under simulated conditions (in Xenotest) to find out the loss in breaking strength and elongation. These parameters were studied using Universal Testing Machine and the extent of degradation of the polymer was studied using IR Spectroscopy.

The mechanical strength properties of indigenous fishing hooks of 26 different sizes were evaluated against imported Mustad hooks of comparable size. Results showed no statistically significant difference between the indigenous and imported hooks in terms of strength properties.

Evaluation of the capacity of lanthanides to inhibit corrosion in metals was continued. The study showed that cerium treatment was very effective in prevention of corrosion of aluminium and its alloys under marine conditions. Corrosion behaviour of cerium treated pure and M 57 S aluminium under varying salinities indicated that the maximum corrosion inhibition was in the environment having salinity above 25 ppt. The corrosion inhibition studied under varying pH showed that the rate of corrosion of cerium treated aluminium was highest at pH 3 and lowest at pH 9.

Studies on the seasonal variations in important physico-chemical parameters and the concentration of pollutants in the marine environments of Cochin were continued.

Analysis of water and sediment samples collected from different stations in and around Cochin at 10m and 20m depths were analysed. The pH and salinity varied respectively between 7.7-8.42 and 22.5-35.93 ppt. Both were highest during post-monsoon months. Total nitrogen (range 0.66-6.38 ppm) was highest during post-monsoon season and phosphate (range 0.1-0.36 ppm) was highest during pre-monsoon season. Sediment pH (range 7.78-8.92) recorded maximum value during post-monsoon season. Organic carbon content ranged between 3.19 and 8.42 % and was highest during post-monsoon season. Narakkal area recorded comparatively higher values.

Phosphate fraction analysis showed that total P, loosely bound P and aluminium bound P were almost nil during pre-monsoon season and were highest during post-monsoon and their concentrations were more at 10 m depth compared to 20 m depth. In densely populated areas like Narakkal, discharges like detergents, household waste etc. appeared to influence the adsorption of phosphates into the sediments. The discharge of these into the sea at a higher level during monsoon may explain their higher levels during post-monsoon season.

Studies carried out have revealed that coastal waters of Veraval Port are seriously affected by different types of debris of anthropogenic

origin, which coupled with uncontrolled and irrational increase in number of trawlers may affect the per capita catch. This has been brought to the notice of the authorities.

Fishing craft design

Design was developed of a 4.57m OAL FRP flat bottom boat for the Burla Research Centre and successful trials carried out in the Hirakud reservoir with the boats constructed as per the design.



4.75m OAL flat bottom FRP boats designed and constructed for Burla Centre

Fishing gear

Experimental fishing conducted during the year with 18.0m RMT 8P semi-pelagic trawl in combination with 1350 x 1000m High Aspect Ratio suberkub doors confirmed the efficiency of the gear system in the capture of off-bottom resources with a high degree of target specificity. The mean CPUE was maximum at 104.0 kg. High value fishes such as *Pampus* sp., *Rastrelliger* sp., and cephalopods accounted for more than 22.5% of the catch. *Megalaspis* sp., *Trichiurus* sp., lesser sardines and carangids were the other major species in the catch. Sciaenids constituted the non-target resources caught by the gear system, accounting for 16.09 % of the catch.

18.8m large mesh semi-pelagic trawl (with 400mm mesh size in the forepart) was field tested and found highly effective in the capture of *Pampus* sp. Average CPUE was 22.0 kg and more than 30 % of the catch consisted of silver pomfrets.

Trawl configuration studies on-board FORV *Sagar Sampada* with 33.0m RMT 6 EL with 800 mm mesh size in the forepart rigged with 1.5 tonne V-form doors and 50.0m double bridles indicated that the gear system could develop 7.4 m vertical opening. In combination with 4.5 m² suberkrub doors, the net could develop a vertical opening of 7.8 m and in both cases the vertical opening developed was more than 20 % of the head rope length, which is considered as optimum.

51.0 m long wing semi-pelagic trawl with 1.5 tonne V-form doors was tested in the depth range of 43.0 to 68.0 m along the Saurashtra coast employing 3 different speeds of tow. A total yield of 3.65 tonnes was realised and the average and maximum CPUE amounted to 123.6 kg and 151.0 kg respectively. 4.0 K trawling speed was assessed to be the optimum for this gear system. The gear was found suitable for harvesting off-bottom resources without detrimentally affecting the demersal eco-system.

As a part of implementation of responsible fishing methods ensuring escapement of juveniles, studies on 'bycatch reduction device' were continued. Young ones of lesser sardines, carangids and sciaenids were found to escape through the 'fish eye' attached to the cod end of the trawl while the adults were retained. The percentage of juveniles that escaped was 51%, 52% and 81% respectively.

Demonstration of fabrication and operation of the turtle excluder device, CIFT-TED, developed at the institute, was carried out for its popularisation in West Bengal (Frasergunj and Shankarpur), Andhra Pradesh (Visakhapatnam and Kakinada) and Kerala (Cochin). The trials were highly successful as CIFT-TED permitted 100% escapement of marine turtles while escapement of fish was as low as 0.24 to 1.4% of the total catch. MPEDA is subsidising and popularising this design as TED is now mandatory in all maritime states.

Studies on fishing gear and harvesting techniques for reservoir fishery resources were continued. Two units consisting of seven trammel nets each of different mesh sizes between 100 to 160 mm were fabricated using inner nylon and outer polypropylene layers. The nets were used for 92

fishing operations. Catch consisted of *Labeo rohita*, *L. fimbriatus*, *Catla catla* and *Cirrhinus mrigala*. The nets of mesh sizes 100, 110 and 140 mm caught more fishes compared to other mesh sizes. Monofilament gill nets were operated as surface, column and bottom nets. Seventythree fishing operations showed that surface set nets were better. The catches comprised mainly of *Silonia silondia*, *L. rohita*, *Mystus seenghala* and *L. fimbriatus*. Analysis showed that 46% of the total catch was from nets of 35mm mesh bar followed by 18% of the catch from nets of 40mm mesh bar.

Two units of monoline consisting of 600 different sizes of hooks were operated. Small fish, prawns and goat intestine were used as bait. The catches mainly comprised of *Mestacemblus armatus*, *Rita chrysea*, *Mystus gulio* and *Glossogobine giuris*. Hooks of number 17 and 20 caught the majority of the catch with small prawn as bait.

Harvest technology and catch composition of deep-sea fishery resources off Indian EEZ

Two fishing cruises were undertaken onboard FORV *Sagar Sampada* along the West Coast of India under the project, 'Harvest Technology and catch composition of deep sea fishery resources in the Indian EEZ'.

Selectivity studies were conducted using trawl nets with square mesh cod ends of 30, 35 and 40mm in comparison with conventional diamond mesh of identical mesh size. During the experiments, the percentage escapement of different length classes of five finfish resources, viz., *Chlorophthalmus* sp., *Nemipterus* sp., *Platycephalus* sp., *Priacanthus* sp. and *Saurida* sp. were worked out. Results indicated that 35 mm square mesh facilitated maximum escapement of juveniles and sub-adults of these species without significantly reducing the catches of adult fishes. The study suggests that 35 mm square mesh can be considered as optimum mesh for management and conservation of the fishes.

Studies were also carried out on the composition of the catch (species wise). In the first cruise, the catch from operations carried out in the

Validation of IRS P4 OCM data carried out by CIFT and Space Application Centre (SAC), Ahmedabad



Juveniles of *Epinephelus diacanthus* that escaped through the 35mm square mesh cod end of the fish trawl HSDT-II

depth range 200-400 m comprised of major deep sea fishes such as *Psenopsis cyanea*, *Cubiceps natalensis*, *Neopinnia orientalis*, *Priacanthus hamrur*, *Chlorophthalmus bicornis*, *C. agassizzi*, *Physiculus capensis* and deep sea shrimps such as *Heterocarpus gibbosus*, *Pleisionicka ensis*, *Heterocarpus woodmasani* and *Nephropsis stewarti*. A total catch of 13584 kg was obtained with a CPUE of 442.92 kg/h. In the second cruise, besides fishes caught in the first cruise, *Nemipterus* sp., *Saurida tumbil* and *Epinephelus* sp. were also caught. The total catch was 7320.5 kg with a CPUE of 238 kg/h.

The analysis for validating the IRS P4 OCM chlorophyll images with the actual sea truth data collected from fishing vessels by CIFT and SAC was carried out in three phases. In the first phase, the data collected at Munambam and operated at depths 28-144m in lat. 9°31' to 13°13' and long. 73°53' to 76°08' was analysed. A total of 24 images covering the period February to May 2000 were analysed with special emphasis on the catches of pink prawns (*Pandalus* sp., *Pleotics* sp., *Heterocarpus* sp., *Aristeus* sp.).

It was observed that in all images where no chlorophyll gradients were seen, catches were either average or poor.

In the second phase, all the images of north Kerala covering the period September to December 2000 collected by the departmental vessel *Sagarkripa* were analysed. No specific gradients were seen in the areas where poor catches were recorded.

During the third phase, the data collected from the mechanised boats engaged in demersal trawling operating from Veraval Port, Gujarat were analysed. All the images of Gujarat and Maharashtra coast for the data period November 2000 to April 2001 were covered in the analysis. No specific chlorophyll gradients were observed when poor catches were recorded.



*Fish Processing Division***Research Projects Handled**























- | | |
|--------------------------------|--|
| 1 Title of the project | : Development of value added, culinary, fortified and functional fish products, their processing and storage |
| Principal Investigator | : Dr Jose Joseph |
| Location of the project | : Cochin & Mumbai |
| Co-investigators at Cochin | : Shri T.S.Unnikrishnan Nair, Shri A.C. Joseph, Shri P.K.Vijayan & Shri A.V.Shenoy |
| 2. Title of the project | : Development of diversified fishery by-products and their applications |
| Principal Investigator | : Dr K.G. Ramachandran Nair |
| Location of the project | : Cochin |
| Co-investigators | : Mr. P. Madhavan, Dr P.T. Mathew, Dr T.K. Thankappan, Dr T.K. Srinivasa Gopal & Smt R. Thankamma |
| 3. Title of the project | : Environmental friendly feed for ornamental fishes (egg layers, live bearers and nest builders) utilising fishery waste |
| Principal Investigator | : Dr P.T. Mathew |
| Location of the project | : Cochin |
| Co-investigators | : Dr K.G. Ramachandran Nair, Dr Suseela Jose** & Dr M.V. Mohan** |
| 4. Title of the project | : Development of suitable packaging materials for value added and ready-to-serve fish and fishery products |
| Principal Investigator | : Dr T.K.Srinivasa Gopal |
| Location of the project | : Cochin & Calicut |
| Co-investigators at Cochin | : Shri T.S.Unnikrishnan Nair, Shri P.R. Nair, Shri P.K.Vijayan, Dr C.N.Ravishankar, Shri A.V.Shenoy & Shri V.N.Nambiar |
| 5. Title of the project | : Development of technology for processing fish and fish products in aluminium cans and flexible pouches (Ad-hoc project) |
| Principal Investigator | : Dr T.K.Srinivasa Gopal |
| Location of the project | : Cochin |
| Associates | : Shri A.Ansar Ali* & Shri B.Sudhir* |

NATP

- | | |
|--------------------------------|---|
| 6. Title of the project | : Development of value added products from low cost fish and processing wastes from fish and shellfish |
| Principal Investigator | : Dr K.G. Ramachandran Nair |
| Location of the project | : Cochin, Mangalore, Visakhapatnam & Veraval |
| Co-investigators at Cochin | : Dr P.T.Mathew & Shri A.C.Joseph |
| 7. Title of the project | : Development and popularisation of modern technologies for production of convenience foods from fish |
| Principal Investigator | : Shri T.S.Unnikrishnan Nair |
| Location of the project | : Cochin |
| Co-investigators | : Dr T.K.Srinivasa Gopal, Dr C.N.Ravishankar, Shri P.K.Vijayan & Shri A.C.Joseph |

*Sr. Research Fellow **College of Fisheries, Panangad

Chief Findings

-  Formulation of fish curry from *Chanos chanos* was standardized and its frozen storage shelf life evaluated.
 -  Packaging material for fish curry was standardized.
 -  Method of preparation of chilly fish from fillets, mince, surimi and prawns was standardized and the shelf life of chilly fish from surimi and mince evaluated.
 -  Characteristics of fortified products were studied by incorporating natural ingredients such as celery leaves, dried prawn powder, mussel meat powder etc. It was observed that these could be incorporated without affecting the sensory properties of the product.
 -  Method of preparation of coated fish balls from freshwater fish rohu was formulated and the shelf life evaluated.
 -  Fish balls, with shelf life more than a year, was prepared from small squid after adding additives to increase flavour, texture and cohesion.
 -  Technology for production of chitosan of different properties was developed.
 -  Chondroitin sulphate was prepared from shark bones and shark cartilage.
 -  High quality isinglass was developed and technology transferred.
 -  Feed with 30% protein was formulated resulting in good growth in sucker catfish, an ornamental fish.
 -  Silage with 20% protein was prepared from squid waste, mixed with rice bran and fed to piglets.
 -  Fish calcium was isolated from rohu scales.
 -  DDT could be removed from water by passing it through chitosan column.
 -  Chitosan film was found to be very effective in closure of intra oral open wounds and oro-antral communication. Based on this work, one student was awarded MDS by Rajeev Gandhi University of Health Sciences, Bangalore.
 -  Low cost fish such as white bait, *Kowala kowal* and small sardines of average length 8 cm were found suitable for production of coated products in gutted and dressed form.
 -  Formulation was evolved for development of batter mix for coated products.
 -  Standardised process for ready-to-serve prawn curry in retortable pouches.
 -  The frying conditions and other process parameters were standardised for getting a product with good sensory attributes and commercial sterility from rohu.
 -  Ready-to-serve green mussel along with other spices processed in retortable pouches showed very good acceptability for one year at room temperature.
 -  Dried shark had a shelf life of 12 months in air and 15 months under vacuum in 12 μ PEST/300 gauge LDPE laminate pouches under laboratory condition.
 -  Fresh mackerel could be kept in good condition in ice for 14 and 18 days in air packed and vacuum packed pouches, respectively.
 -  Ready-to-serve fried mussels packed under vacuum had very good acceptability up to nine months, whereas, air packed samples had acceptability only for six months.
-

Report of work done

Fish processing

Preparation of fish curry and their frozen storage

Fish curry using a common recipe was prepared from *Chanos chanos* and stored at $-20^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The sample was in acceptable condition for more than 27 months. The major changes noticed in fish curry during frozen storage were dehydration, toughening of the meat and slight reduction in flavour.

Fortification of fish curry with dried prawn powder/powdered dried mussel

Fish curry samples were mixed with sterile prawn powder or dried mussel powder at 0.1 – 0.2% level as a source of calcium. Incorporation of the above powders did not affect the taste or flavour adversely.

Chilly fish from seer

Using a modified recipe imitating preparation of chilly chicken, chilly fish was prepared from seer fish. The samples were quite appealing and palatable. The samples had a high quality shelf life of more than eight months.

Chilly fish from mince

Fish mince was treated with sodium tripolyphosphate, mono sodium glutamate (MSG) and glycerophosphate. It was then partially frozen, cut into pieces of suitable size and chilly fish prepared using the modified recipe used for seer fish. The samples were very good in flavour, taste and appearance and could be stored for more than a year in excellent condition at -20°C . The major changes noticed during storage were in appearance and texture.

Chilly fish from surimi

Chilly fish was prepared from surimi in the same way as from mince. The chilly fish from surimi was found to be better in flavour, texture and appearance than that from minced fish.

Chilly fish was also prepared both from mince and surimi incorporating celery leaves. It was found that celery leaves impart a special appealing flavour to the product.

Coated products

Coated fish balls from rohu were prepared and the method standardized. The muddy odour of the rohu meat was masked by incorporating spices like garlic, ginger and pepper without affecting the flavour of the product.



Coated fish balls

Fish balls were prepared from squid blanched in 1% brine containing 0.1% citric acid after adding additives to increase flavour, texture and cohesion. The balls were cooked in 1% brine for eight minutes and then coated with batter and breaded crumbs. All these samples could be stored for more than one year.

Fish products and by-products from fish and shellfish

Chitosan of varying specifications depending on use can be prepared. For use of high solid content, chitosan of very low viscosity is needed whereas for use as a polymer flocculent, high viscosity material is required. By use of higher concentration of alkali at moderately high temperature in an inert atmosphere at controlled conditions, very low viscosity chitosan could be produced.

For preparing very high viscosity chitosan, deacetylation is carried out at a temperature below 80°C and maintained for a long period, preferably in the presence of nitrogen. The initial hydrolysis of chitin was done with hydrochloric acid and a specific

quantity of sulphuric acid is added. On concentration and crystallisation of the filtrate, glucosamine sulphate was produced.

An important component, a mucopolysaccharide chondroitin sulphate, was extracted from shark bones in 80-85% purity. The process requires further refinement to isolate it in the pure form.

Chitosan and chitin incorporated isinglass films were prepared and tested for their application for animal experiments. When transplanted into animals they were absorbed within six weeks without any adverse symptoms. Chitosan films were used for maxillofacial surgery in Rajiv Gandhi University of Health Sciences, Bangalore and it was observed that this product is better in all respects than the conventional materials used for the purpose.

Chitosan alone and chitosan in combination with BKC were tried for its bacteriostatic activity. One of the formulations was found to be highly active against pseudomonas.

Preliminary studies showed that DDT was retained in chitosan when water containing DDT was passed through the column.

Chitosan glazing on fish and fish fillets was found to increase storage characteristics of oil sardine and rohu fillets during frozen storage.

Fish calcium was prepared from rohu scales after deproteinizing the scales.

In order to exclude potassium metabisulphite with a natural preservative, fish maws were soaked in dilute acetic acid before grinding. Addition of chitosan was found to increase the viscosity and storage life.

Three feeds having 30% protein were formulated for feeding sucker catfish fingerlings. Different natural colouring materials were also incorporated in these feeds. Feeds containing carrot mix and beetroot mix are found to have better feed conversion ratio after feeding for 14 weeks.

A feed for feeding piglets was developed by mixing squid ensilage and rice bran.

Packaging

Sausages in collagen casings were processed at 121°C and stored at room temperature. The product was seen to have a shelf life of six months.

Ready-to-serve rohu curry processed to a F_0 value of 8.5 in retortable pouches had a shelf life of 20 months at room temperature.

Commercially available dried shark is seen to have a limited shelf life of only two months due to its poor quality. Studies carried out to increase its storage life have shown that vacuum packing resulted in improving the shelf life only for another month.

Frozen, battered and breaded rohu fillets had a shelf life of 18 months. There was no significant difference between the indigenous and imported thermoformed containers.

Standardisation of process for ready-to-serve chilly fish and chilly prawn is underway.

NATP – DEVELOPMENT OF VALUE ADDED PRODUCTS FROM LOW COST FISH AND PROCESSING WASTES FROM FISH AND SHELLFISH

Battered and breaded products

Different species of low cost fish were screened for assessing their suitability for development of coated products. Of these, white bait, *Kowala kowal* and small sardines of average length 8cm were found suitable for production of coated products in gutted and dressed form. Presence of fish bones in edible form in the coated products was seen to not only enhance the nutritive value of the products but also reduce the cost factor of the finished product (value addition). In the case of small sardines, pre-frying of the dressed fish before coating was found necessary in order to make the bones in the edible form. The yield of coated products was about 90% for white bait, 80% for *Kowala kowal* and 70% for small sardines.

Fish cutlet from leather jacket

Leather jacket, locally known as 'clathy' – a deep sea variety not normally relished as fresh fish was tried for the production of cutlets. Yield of skinned, gutted and dressed fish was about 46% and that of cooked meat, about 27%.

Formulation of batter mix and bread crumbs

A batter mix used for development of coated products was formulated using locally available raw material.

Bread crumbs used for the study were prepared by a simple process. The product, dried in an electric oven maintained at 70-80°C, had a moisture content of about 5%.

Utilisation of processing wastes

The cuttlefish processing waste collected from factories was analysed for proximate composition. It contained moisture 82-85%, protein 12-15%, fat 1-2% and ash 7-8%. The fish waste was minced well and then mixed with formic acid 3.5% by weight and maintained at a pH 4.

Feeding studies

Processing wastes from tuna, cuttlefish and rohu were collected and silages were prepared by the conventional method. In order to make the handling and transportation easy, the liquid silages were impregnated in rice bran and sun dried. The products were subjected to animal feeding and the albino rats fed on these silage based diets showed better growth than the controls. Cuttlefish and rohu silage based products (rice bran) were handed over to the Veterinary College, Mannuthy for feeding experiments on larger animals. The silage impregnated rice bran was found to contain nearly 20% protein without any characteristic fishy smell.

NATP — DEVELOPMENT AND POPULARISATION OF MODERN TECHNOLOGIES FOR PRODUCTION OF CONVENIENCE FOODS FROM FISH

Rohu curry, prepared and packed in retortable pouches, was processed in over-pressure autoclave by maintaining the retort temperature at

121°C to a F_0 value of 8 minutes and cook value of 82 minutes and storage studies completed. The product was found acceptable up to one year at room temperature.

Kerala style seer fish moli was prepared and thermal processed in indigenously made retortable pouches to a F_0 value of 8 and shelf life studies of the product completed. Samples were drawn at regular intervals and subjected to biochemical and sensory analysis. The samples were seen to be acceptable up to a period of one year. Chemical parameters such as peroxide value and TBA which measures oxidative rancidity and free fatty acid value, which is a measure of hydrolytic rancidity, were studied and it was observed that these parameters increased on storage. All these parameters were however found to be in good correlation with the sensory score and were within the standard limits.



Seer fish moli



Fish curry

Another batch of fish moli was subjected to accelerated shelf life studies keeping the processed pouches at 37°C as well as at room temperature for the determination of Q_{10} value. Biochemical and sensory analysis were carried out at regular intervals to determine the extent of spoilage. Pouches kept at 37°C and at room temperature had good acceptability even after eight months.

Modified atmospheric packaging (MAP) studies were carried out using

a gas mixture of CO₂, N₂ and O₂ in the ratio 40:30:30, using the laboratory model vacuum sealing machine. Studies were carried out using whole pearl spot and prawn which were subjected to MAP and compared with control air packs in laminated see-through pouches made of 12µ polyester and 300 gauge low density polyethylene. Pouches were stored in chill room maintained at 2 – 4°C. Samples were drawn at regular intervals and were subjected to chemical, microbiological and sensory analysis. MAP samples of pearl spot were found to be acceptable up to 20 days and the TBA value, peroxide value, free fatty acid value etc. which shows the extent of rancidity, were within the limits, whereas the control air packed samples were acceptable only up to 11 days. In case of prawn, shelf life of MAP sample and control air packed sample were 18 days and 11 days respectively. In both pearl spot and prawns, packing under MAP has been shown to enhance the shelf life significantly.

Ad-hoc project - Development of technology for processing fish and fish products in aluminium cans and flexible pouches

The physical properties of indigenously manufactured retort pouches are found to be within

the limits prescribed in the standards. The indigenous pouches were seen to be as good as imported pouches for the thermal processing of fish products.

A considerable reduction in process time was observed when tuna in oil and mackerel in oil packed in 8oz. aluminium cans and retort pouches are processed by subjecting the cage of the retort to a rotational speed of 2 rpm compared to without rotation. Of the two packages, retort pouched products gave better results.

Not much difference in process time was observed in the case of mackerel in oil packed either in A2½ - size aluminium or 8 oz aluminium cans. There was also not much difference in process time in the case of mackerel in oil packed in 20 x 17 cm and 30 x 17 cm retort pouches.

After 12 months of storage, tuna in oil processed in aluminium cans and retortable pouches and stored at room temperature as well as at accelerated temperature was found to be very good.

Texture Profile Analysis of sardine canned in oil has shown that, increase in the F₀ value decreased the hardness of the product. The work done also decreased with increase in F₀ value.













Biochemistry & Nutrition Division

Research Projects Handled

- | | | |
|----------|-----------------------------|--|
| 1 | Title of the project | : Biochemical, nutritional and functional properties of fish constituents |
| | Principal Investigator | : Dr P.G.Viswanathan Nair |
| | Location of the project | : Cochin |
| | Co-investigators | : Dr T.V.Sankar, Dr R.Anandan, Smt K.K.Asha |
| 2 | Title of the project | : Nutrients, toxicants, pollutants and growth promoters in aquaculture system and processed marine products |
| | Principal Investigator | : Shri A.G.Radhakrishnan |
| | Location of the project | : Cochin, Visakhapatnam & Veraval |
| | Co-investigators at Cochin | : Dr T.V.Sankar, Dr R.Anandan, Smt K.K.Asha, |
| 3 | Title of the project | : Nutrition and pathology in mariculture |
| | Cooperating Centre | : Dr P.G.Viswanathan Nair |
| | Principal Investigator | |
| | Location of the project | : Cochin |
| | Associate | : Kum Kavitha O.* |

* Sr. Research Fellow

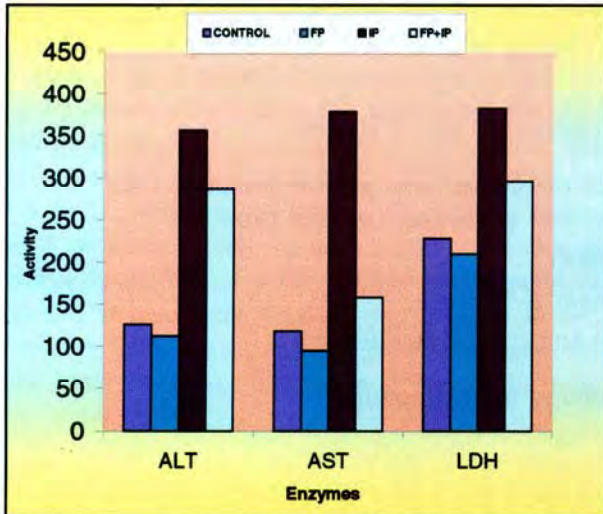
Chief Findings

-  Fish protein was effective in countering the adverse effects caused by isoproterenol, an agent that can induce symptoms of myocardial infarction.
-  The levels of marker enzymes like alanine transaminase (ALT), aspartate transaminase (AST) and lactate dehydrogenase (LDH) were brought under control.
-  Beneficial changes in levels of lipid peroxides and antiperoxidative enzymes were observed.
-  Adverse changes in lipid metabolism were prevented by fish protein.
-  Enzymatic activity of the sarcoplasmic proteins is mostly associated with the fractions precipitated at 40% and 60% saturation of ammonium sulphate.
-  Sarcoplasmic protein of squid, precipitated at 40% and 60% saturation of ammonium sulphate had the highest emulsifying activity.
-  Species specific differences were observed in the electrophoretic patterns of sarcoplasmic protein of fish.
-  Reduced glutathione (GSH) was effective in reducing the effects of oxidative stress in fish.
-  Selenium in water at 0.25 ppm was found to be toxic in fish.
-  Antihepatotoxic properties of chitin and chitosan were confirmed in experimental animals.

Report of work done

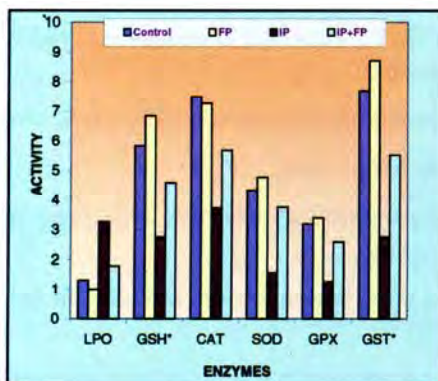
Cardioprotective effect of fish proteins

There was significant increase in the level of the enzymes ALT, AST and LDH in the serum of albino rats treated with isoproterenol (IP), a chemical known to induce myocardial infarction. Incorporation of fish protein in the diet helped in bringing down the levels of these enzymes.



Levels of serum diagnostic marker enzymes ALT, AST and LDH in normal and experimental groups of rats (mean± S.D. for six animals in each group)
(Values expressed: ALT, AST and LDH - μ moles of pyruvate liberated/h/l)

Activities of antiperoxidative enzymes, catalases (CAT and superoxide dismutase (SOD)) and



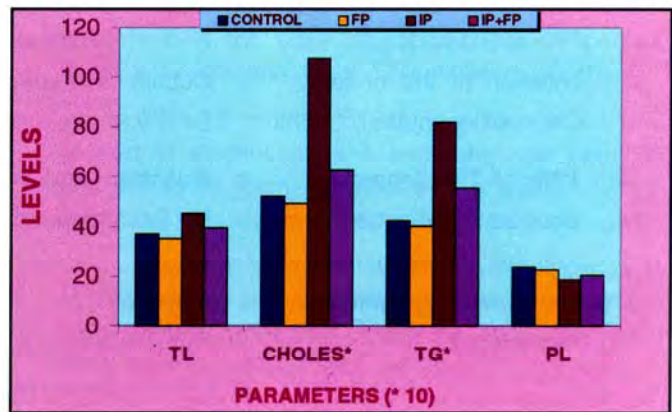
Levels of lipid peroxides (LPO) and GSH and the activities of CAT, SOD, GPX and GST in normal and experimental groups of rats (mean± S.D. for six animals in each group)
(LPO: n moles of MDA/mg protein; GSH-n moles/g tissue*; CAT – moles of H₂O₂ consumed/min mg protein; SOD – units/min/mg protein; GPX-n moles of GSH oxidized/min/mg protein; GST – n moles of CDNB conjugated/min/mg protein*
*Actual value /10)

glutathione dependent antioxidants, glutathione peroxidase (GPX) and glutathione-s-transferase (GST) were also affected by IP treatment. These adverse effects were neutralized to a great extent by fish proteins.

The trend was similar to that observed in the case of the marker enzymes.

Lipid metabolism

IP treatment resulted in elevated levels of total lipids, cholesterol and triglycerides and lower levels of phospholipids. Incorporation of fish proteins in the diet was able to reverse these adverse changes to a significant extent.



Levels of total lipids, cholesterol, triglycerides (TG) and phospholipids (PL) in normal and experimental groups of rats (mean ± S.D. for six animals in each group)
(Values are expressed as mg/g tissue. Cholesterol, triglycerides – actual value x 100)

Similarly, fish protein had a positive effect on HDL levels in the IP treated animals.

All these findings indicate that fish protein can neutralize the adverse effects of isoproterenol and thus can safeguard against myocardial infarction.

Sarcoplasmic proteins from mullet (*Liza subviridis*)

Total water soluble protein was 5.57g/100 muscle. On fractionation with ammonium sulphate, 40% saturated ammonium sulphate precipitated 25.7% of the water soluble proteins, 60% saturated ammonium sulphate precipitated 23.7% and 80% saturated ammonium sulphate, 20.1%. Proteolytic

activity was maximum in the fraction precipitated with 40% saturated ammonium sulphate. Lipolytic activity was, however, maximum in the fraction precipitated both with 40% and 60% saturated ammonium sulphate.

Sarcoplasmic proteins from squid – Emulsifying properties

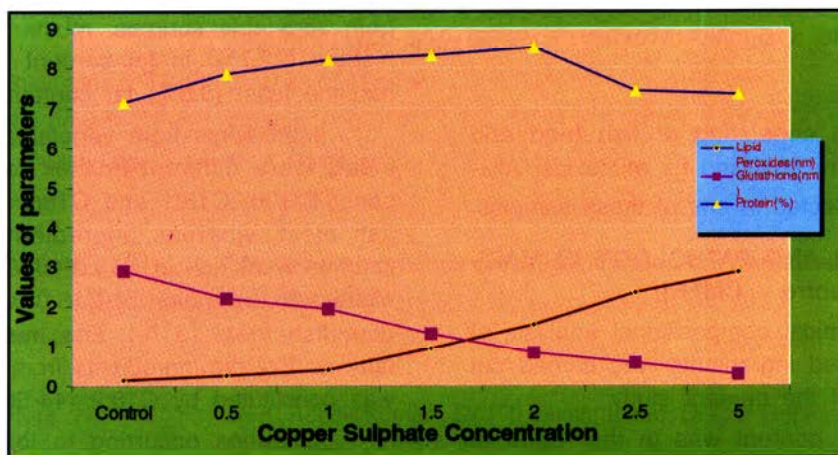
Fraction precipitated with 40% and 60% saturated ammonium sulphate had high emulsion activity (200%) compared to whole sarcoplasmic proteins. Electrophoresis showed that these fractions had the highest molecular weight proteins.

Electrophoretic patterns of sarcoplasmic proteins from 14 species of fish were compared

to find out whether there existed any species specificity in this regard. Some characteristics were observed, but further data are required to confirm this.

Antioxidant effects of reduced glutathione and Vitamin E

A preliminary study on the effect of GSH and Vitamin E was conducted in CuSO_4 -induced oxidative stress in tilapia. CuSO_4 -toxicity resulted in high levels of lipid peroxidation, depletion of GSH and decline in the levels of antioxidant enzymes. GSH prevented these adverse reactions and improved significantly the weight gain.



Levels of lipid peroxides, GSH and protein in CuSO_4 -induced toxicity in the hepatopancreas of tilapia
(GSH was more effective than vitamin in these respects)

Selenium toxicity in fish

Selenium, an antioxidant substitute for vitamin E, was found to be toxic (in rohu). Survival was only for 6 h at 4 ppm of Se, while at 2.0 ppm it was for 60 h. At 0.25, 0.5 and 1.0 ppm levels, the survival was for 96 h.

PAH in fish

Fish samples collected from inshore waters of Vizag fishing harbour are being analysed for presence of PAH. Changes in PAH during different

treatments like cooking in brine, frying etc. are also being investigated.

A few samples of fish from Cochin were analysed for PAH. It was not detected in any of these samples.

Heavy metals in fish

Samples of freshwater fish (Catla, rohu and *Wallago attu*) from Junagadh and Rajkot (Gujarat) markets were analysed to determine the levels of cadmium and lead.

Sample Name	Source	Range of Cd (ppm)	Range of Pb (ppm)
<i>Rohu</i>	Junagadh market	0.027-0.318	0.10-2.26
<i>Rohu</i>	Rajkot market	0.014-0.079	0.137
<i>Catla</i>	Rajkot market	0.022-0.053	ND
<i>Wallago attu</i>	Junagadh market	0.0135-0.040	ND
<i>Catla</i>	Junagadh market	0.013-0.023	ND

Antihepatotoxic effects of chitin and chitosan

Hepatotoxicity was induced in albino rats by feeding high dosages of paracetamol. There was an increase in the levels of serum cholesterol, triglycerides and a decrease in serum HDL cholesterol in these experimental animals. Accumulation of lipids was observed in liver and kidney. Pre-treatment with chitin or chitosan prevented the paracetamol-induced alterations to a significant extent.

Aflatoxins

Fifty samples consisting of fish feed and dry fish samples were analysed for aflatoxins. Aflatoxins were not detected in any of these samples.

NATP - NUTRITION AND PATHOLOGY IN MARI-CULTURE (Lead Centre – CMFRI)

The biochemical compositional analysis of the common fish feed ingredients was carried out during the course of the present study.

The moisture content was in the range of 5-12% in all the ingredients, except Jawala, which was found to contain the highest moisture content (19.3%). There was notable difference in the protein content between the fish meals, an important constituent of fish feed, and ingredients obtained

from vegetable sources. The fish meal protein content ranged from 70-89%, whereas most of the ingredients from vegetable sources were below 20% in protein content.

In fish meal samples, the total fat content was below 10%. Danish fish meal was found to contain the highest fat content (10%), and squid meal the least (0.7%). Among ingredients obtained from vegetable sources, mustard powder was the highest (22.7%) in fat content whereas rice flour had the least (0.5%) fat content.

Ingredients from vegetable sources and fish meals were different in their fatty acid composition. C16:0, C18:1 and C18:2 were prominent in fish meal, whereas, ingredients from vegetable sources were rich in C16:0, C18:1 and C18:2. The highest concentration of C16:0 was observed in Indian fish meal (31%). The major portion of the fatty acid of the ingredients from vegetable sources was constituted by C18:2 (44-58%).

Changes occurring to the major nutritional components (crude fat and amino acid composition) during storage under room temperature were studied. Study on the effect of antioxidants on the quality of fish during storage at ambient temperature is in progress.

Quality Assurance & Management Division

Research Projects Handled

- | | | |
|----------|-----------------------------|---|
| 1 | Title of the project | : Development of improved methods for quality and safety of fish and fishery products |
| | Principal Investigator | : Dr M.K. Mukundan |
| | Location of the project | : Cochin & Mumbai |
| | Co-investigators at Cochin | : Shri P.R.G. Varma, Shri V. Muraleedharan, Dr Francis Thomas, Dr P.T. Lakshmanan, Dr Sanjeev S., Shri K.P. Antony, Dr K. Ashok Kumar and Dr D. Muthuchelvan |
| 2 | Title of the project | : Pilot plant studies on absorbable surgical sutures from fish gut collagen (Ad-hoc project) |
| | Principal Investigator | : Dr M.K. Mukundan |
| | Location of the project | : Cochin |
| | Co-Principal investigator | : Dr K.Devadasan |
| | Co-investigator | : Smt Seema M.K.* |
| 3 | Title of the project | : Studies on incidence of toxic principles and parasites in seafoods (Ad-hoc project) |
| | Principal Investigator | : Dr M.K. Mukundan |
| | Location of the project | : Cochin |
| | Co-investigators | : Dr K. Ashok Kumar , Dr P.T. Lakshmanan, Dr C.P. Gopinath,** Dr V. Kripa**, Kum A. Sona* and Kum Jugnu** |
| 4 | Title of the project | : Occurrence, effect of processing and survival of halophilic pathogenic Vibrios in fishery products of the export trade (Ad-hoc project) |
| | Principal Investigator | : Dr Sanjeev S. |
| | Location of the project | : Cochin |
| | Co-investigators | : Shri P.R.G. Varma, Smt Leejee James* and Smt N.R. Smitha* |
| 5 | Title of the project | : Selective bio-accumulation of toxicants in cephalopods (viz. squid and cuttlefish) and changes in quality, its upgradation and safety of processed products (Ad-hoc project) |
| | Principal Investigator | : Dr P.T. Lakshmanan |
| | Location of the project | : Cochin |
| | Co-Investigators | : Kum Prafulla V.* and Kum Liju Francis* |

* Sr. Research Fellow ** CMFRI, Cochin

Chief Findings

- ▣ All strains of halophilic pathogenic *Vibrios* viz. 18 strains of *V. vulnificus*, 24 of *V. alginolyticus* and 27 strains of *V. cincinnatiensis* isolated from fish and fish products meant for export were found to be sensitive to chloramphenicol.
- ▣ All the six samples of cooked IQF shrimps tested for Staphylococcal enterotoxins by using RPLA technique were found to be free from the enterotoxins.
- ▣ One hundred and twenty four samples of frozen seafood for export were found free from *Vibrio cholerae* and *Listeria monocytogenes*. *Salmonella* was present in two samples out of 124 samples collected. No appreciable quality difference was noticed in samples collected from EU approved and non-EU approved plants.
- ▣ Sulphite residues were determined in about 50 samples of frozen prawns and squids by the Monier-Williams method. The residues were in the range of 0-30ppm. It has been observed that if the sulphite treatment is carried out following GMP, residual SO₂ will never exceed the recommended tolerance limit of 100ppm.
- ▣ In tuna (*Euthynnus* species), the level of Hg, Cd etc. increased with length of fish and was in the range of 0.03 to 0.09 ppm. Interestingly, in yellowfin tuna, Cd, Pb and Zn were totally absent in the edible meat.
- ▣ Lamination with polyester outside the 7 ply carton and insulation with expanded polyethylene were found to reduce the meltage of ice.
- ▣ Evaluated the physical and chemical properties of effluents from seafood processing plants.
- ▣ A simple design for treatment of effluents from fish processing plants was developed to achieve the standards laid down by the Pollution Control Board.
- ▣ A laboratory level method was developed to prepare bacteriological peptone from the proteins recovered from the effluent.
- ▣ A procedure for detection and estimation of Benzo-pyrene and chloramphenicol residue in fishery products by HPLC technique was established.

Report of work done

Bacterial quality of frozen seafoods from EU approved and non-EU approved units

One hundred and twentyfour samples of frozen seafood collected from EU approved plants were tested for the presence of pathogens. Samples comprised of frozen prawns, squid, cuttlefish and finfish. The samples were free from *E. coli*, *Vibrio cholerae* and *Listeria monocytogenes*. 40% samples contained *Staphylococcus aureus*, but within limits. Two samples were positive for *Salmonella*.

Optimisation of GMP for the quality upgradation of masmin based convenience product

By lowering the temperature from 70-80°C to 50-60°C and increasing the air velocity inside the smoking chamber while smoking tuna, the chemical hazard of benzopyrene content could be brought

down to 0.0018 ppm (as per analysis using HPLC). Variation of resident time of fillets from 30 min to 60 min had no particular influence on the benzopyrene content, but the sensory qualities were altered. Sodium chloride content also did not bring about any particular change in the characteristic of the smoked product. Conventional preparations using the quality-upgraded product have been tried and the consumer feed back is being collected.

Proficiency testing programme on heavy metals

Two series of tests were conducted using tuna fish collected from the Cochin Fisheries Harbour. In the second series, *Thunnus albacore* of large size and average wt. around 6 kg. was used.

The samples were homogenized and tested for homogeneity. The homogeneous samples were

made into blocks of 450 g each and frozen at -40°C . Duplicate samples packed in thermocole box with dry ice were sent to 18 participating laboratories for determining various heavy metals (Hg, Cd, Cu, Zn, Pb, Cr & Ni) following standard methods. Results received from fourteen laboratories were subjected to statistical analysis and Z score calculated.

Z-score value ≤ 3 is considered satisfactory while Z-score > 3 was not acceptable.

Based on the Z score, the proficiency of the laboratories was rated.

Evaluation of liver bound Cd toxicity

Toxicity evaluation of liver bound cadmium in experimental albino rats (histopathological evaluation) revealed that the kidney of experimental albino rats had increased cellularity of glomeruli and noticeable shrinkage of domeruli, probably indicating that the function of the kidney is affected. In the case of liver tissue, there were vacuolisation and degeneration of hepatocytes.



Animal feeding experiment under heavy metal toxicity evaluation

Effluent studies

An efficient effluent treatment system was designed which consisted of an initial filter (25mm) to remove suspended particles, an alum doser and two settling tanks with capacity to store one day's effluent – approximately 50,000 litres. The clear effluent is then allowed to pass through a trickling filter (flow velocity 2 meter per minute). The system effectively reduced BOD, dissolved solids and oil and grease .

Survey on the quality of packaged drinking water

Survey on the quality of packaged drinking water was completed. More than 150 brands of bottled water were collected from all parts of Kerala, Tamil Nadu and Southern Karnataka. About 40% of the samples did not conform to the standards laid down by BIS. The results were compiled and communicated to Director General of Health Services, New Delhi.

Survey on the microbiological quality of packaged food products

Survey on the microbial quality of packaged food products was completed. About 130 samples comprising of protein foods, malted foods, baby foods, carbonated beverages, fruit products etc were collected and analysed for different pathogens. It was found that all samples were free from pathogens. These results were also compiled and communicated to Director General of Health Services, New Delhi.

Studies on incidence of chemical hazards in seafoods

Sulphite residues were monitored in 50 commercial samples of prawns and squid samples using Monier-Williams Method. The sulphite residues in these samples were found to be in the range of 0-30ppm. When GMP is strictly followed in the treatment process, SO_2 levels never exceeded the recommended limits.

Levels of trace metals (ΣHg , Cd, Pb etc) in two species of tuna, viz; *Euthynnus affinis* and *Thunnus albacore* were determined. Total mercury, ΣHg , was in the range of 0.032 to 0.09 ppm, Cd ranged between 0-0.16ppm and Pb was found to be nil in the muscle. Higher levels of Hg (0.03 to 0.16 ppm) and Cd (2.5 to 6.4 ppm) were found in the liver. Heavy metal levels in yellowfin tuna were comparable to that found in mackerel tuna. Interestingly, elements like Cd, Pb and Zn were totally absent in the edible muscle of yellowfin tuna.

Heavy metal levels in red meat were found to be comparatively higher than that found in white meat. The levels increased with length of the *Euthynnus* species.

Ad-hoc project – Occurrence, effect of processing and survival of halophilic pathogenic Vibrios in fishery products of the export trade

Proper washing of fish with potable water followed by icing was found to be very effective in reducing the load of all species of halophilic pathogenic *Vibrio*. Studies have shown that freezing (-40° C) and subsequent cold storage (-20°C) was also very effective against these organisms.

Halophilic pathogenic *Vibrios* are not able to survive even three hours sun drying. Salt curing and sun drying was found to be an effective method for the elimination of all species of halophilic pathogenic *Vibrios*. None of the species could survive blanching for even 30 seconds. Optimum level of sodium chloride for the growth of these organisms viz *V.parahaemolyticus* and *V.vulnificus* was found to be same, i.e.3.0%. Most of the halophilic pathogenic *Vibrio* spp. could survive/grow in a wide range of pH i.e. 5 to 12. Chlorination was found to be very effective in controlling all the above mentioned pathogenic *Vibrios*.

Ad-hoc project - Studies on incidence of toxic heavy metals

The distribution pattern of various metals in the body components of squid and cuttlefish collected from Mumbai, Mangalore, Cochin, Quilon and onboard the research vessel, *Sagar Sampada*, were studied. The important findings are:

- ◆ The highest levels of toxic metals in both squid and cuttlefish were in the liver, gills and ink respectively.

- ◆ In the whole animal, Cd level exceeded the limit of 3 ppm in around 10% of the samples.
- ◆ Mercury content was quite low in samples from all the four geographic locations.

Ad-hoc project -Absorbable surgical sutures from fish gut collagen

Under this Project, the design of a pilot plant for producing surgical sutures @ 1000 sutures / batch was finalised. Based on this design, fabrication of the pilot plant was completed. The unit for testing the tensile strength of sutures was also fabricated and successful trials carried out. The Project came to a close by the end of October 2001.

Ad-hoc project - Studies on the incidence of PSP & DSP in fish and shellfish

Green mussels (*Perna viridis*) and water samples were periodically collected from Pallikkandy, Elathur, Moodadi, Thikkodi, Thalassery and Vizhinjam in Kerala coast. Samples of oysters (*Crassostrea* sp) and clams (*Villorita* sp) were also regularly collected from Ponnani, Chettuva, Munambam and Chellanam.

During the period, around 100 samples were analysed for the presence of PSP and DSP by standard mouse bioassay. The samples were seen free from the toxins.

About 120 samples collected from various fish processing industries were also analysed for PSP/ DSP. Samples included shimps, crabs, baigai, mussels etc. Both PSP and DSP could not be detected from any of these samples.

Microbiology, Fermentation & Biotechnology Division

Research Projects Handled

Title of the project	: Investigations on prevalence of microbial hazards in fish and fishery environments and development of methods for their control
Principal Investigator	: Dr P. K. Surendran
Location of the Project	: Cochin & Visakhapatnam
Co-investigators at Cochin	: Dr Nirmala Thampuran, Shri V. Narayanan Nambiar, Dr K. V. Lalitha, Dr Toms C. Joseph & Shri Rakesh Kumar

🔑 Chief Findings

- 📄 A RT-PCR method was perfected for the detection of yellow head virus in shrimp
- 📄 Tetracycline residues were detected in 18% and chloramphenicol in 3% of farmed and processed shrimp from farms and processing industries.
- 📄 Enteropathogenic *E. coli* O157; H7 was not detected in water, mud and cultured prawn and from fish fillets from retail markets in and around Cochin.
- 📄 *Vibrio cholerae* was not detected in the backwater clams, *Paphia malabarica* and *Villorita cyprinoides*.
- 📄 Entero - toxigenic *Bacillus cereus* was detected in 10 % of the frozen fish samples collected from local retail outlets. 87 % of the strains were found to produce diarrhoeal enterotoxin by the Reversed Passive Latex Agglutination (RPLA) technique.
- 📄 *Salmonella* serotypes were detected in 5 % of the frozen fish samples collected from local retail outlets.
- 📄 ELISA method for the detection of *Salmonella* was found to be sensitive enough to detect even three live cells of *Salmonella* in fish samples.
- 📄 The total bacterial count of eightyseven percent of the frozen fish samples collected from local retail outlets in Ernakulam District was beyond the approved limit of 10^5 per gram.
- 📄 *Yersinia enterocolitica* was not detected in any of the samples of frozen fish collected from local retail markets.
- 📄 The psychrophilic putrefactive bacterium *Shewanella putrefaciens* was isolated from farmed *Macrobrachium rosenbergii* and brackishwater clam meat, which is used as feed in freshwater aquaculture.
- 📄 The frequency of contamination of farmed fish and shrimp by *Clostridium botulinum* was found to be 20% (1/5) and 6 %(1/16) respectively.
- 📄 Seawater had more non-fluorescent *Pseudomonas* while brackishwater and freshwater microflora are mostly dominated by fluorescent *Pseudomonas* strains.
- 📄 A protocol for isolation of bacterial genomic DNA in pure form was standardized.

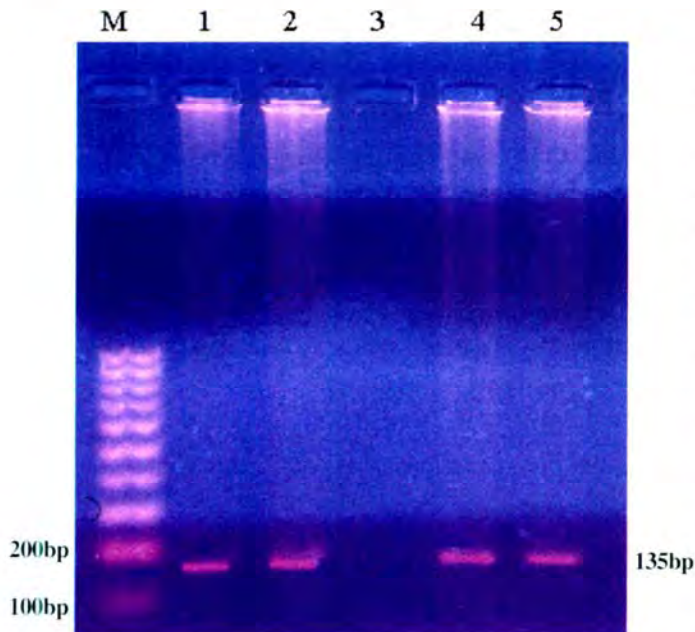
Report of work done

Method developed for detection of Yellow head virus in shrimps

A RT-PCR method has been perfected for the detection of Yellow head virus, which causes the devastating Yellow head disease in farmed shrimps. Yellow head disease principally infects pond-reared black tiger prawn *Penaeus monodon*.

The method used for detection of the virus is based on Reverse Transcriptase Polymerase Chain Reaction (RT PCR). In this technique, complimentary DNA is synthesized from viral RNA, the genetic material of the virus, by a biotechnological method called Reverse Transcription. This complimentary DNA is then amplified many million times by PCR, the amplified product detected by agarose gel electrophoresis and the bands illuminated under UV light.

Yellow head disease is very difficult to detect by conventional PCR method. In the case of white spot syndrome virus, the genetic material is DNA and hence the amplification is easier. But the Yellow head virus has ribo nucleic acid (RNA) as the genetic material and hence chances of interference from tissue RNAses are very high.



Detection of yellow head virus in shrimp by RT PCR
Lane M: 100 base pair (bp) marker
Lanes 1, 2, 4 and 5 are positive for YHV. Lane 3 is negative

This technique can detect the presence of the virus at a very early stage of infection and takes only 4-6 hours for detecting the virus causing Yellow-head disease. The facility is now ready for testing samples from farms and processed shrimps meant for export.

Antibiotic residues in farmed fish/ prawn tissue and farm environments

Samples of farmed, wild and processed shrimps from different regions of the country were analysed for the presence of residues of antibiotics like Chloramphenicol, Oxolinic acid, Tetracycline, Oxytetracycline, Furazolidone, Nalidixic acid, Neomycin, Trimethoprim, Penicillin, Sulphonamides and Nitrofurans derivatives. A total of 942 samples were analysed. Tetracyclines were detected in ten samples of farmed shrimp and 160 samples of processed shrimp. Chloramphenicol was detected in three samples of farmed shrimp and 32 of processed shrimp. Other antibiotics were not detected in any of the samples analysed.

E.coli O157 H7 in fresh and frozen fillets and shellfish

Water and mud samples collected from a brackishwater pond in Chellanam area were tested for the presence of *E.coli* O157 H7. In addition to this, eight samples of frozen fish fillets purchased from the retail outlets comprising of tilapia, pearl spot, tuna and mackerel, eighteen fresh fish samples comprising of prawn and crab from the market and clams (*Paphia malabarica* and *Villorita cyprinoides*) collected from the backwater were analysed by FDA method for the presence of *E.coli* O157:H7. Fifty presumptive colonies were recovered. None of them gave typical reactions of *E.coli* O157:H7.

Vibrio cholerae in fresh and frozen fillets and shellfish

Eighteen samples comprising of prawn and crab from the market and clams (*Paphia malabarica* and *Villorita cyprinoides*) collected from the backwater near Vypeen were analysed by FDA method for the presence of *V.cholerae*. Fiftyone presumptive colonies were isolated from the samples. None of them gave typical reactions of *Vibrio cholerae*.

Toxigenic *Bacillus cereus* in fish / fishery products

Frozen fish samples collected from local cold stores were analysed for the presence of Enterotoxigenic *Bacillus cereus*. Eightyone samples comprising 20 different species were analysed during the period under report. *Bacillus cereus* was detected in eight samples (10 %). The positive samples included *Etroplus suratensis*, *Parastromateus niger*, *Seriolina nigrifaciata*, *Epinephelus melanostigma*, *Mugil cephalus* and *Chirocentrus dorab*. Out of the eight cultures tested for the production of diarrhoeal enterotoxin by the Reversed Passive Latex Agglutination (RPLA) technique, seven (87%) were found to be positive.

Salmonella serotypes in fish / fishery products / environments

Frozen fish samples collected from local retail cold stores were examined for the presence of *Salmonella* serotypes and *Yersinia enterocolitica*. Eightyone frozen fish samples comprising of 20 different species were analysed during the period under report. Four samples (5 %) were found to harbour *Salmonella* serotypes. The positive samples included *Etroplus suratensis*, *Oreochromis mossambica*, *Mugil cephalus* and *Lethrinus frenatus*.

Modern Rapid / ELISA techniques for *Salmonella* in fish / aquaculture environments

The *Salmonella* Rapid Test (SRT) of Oxoid, England and Enzyme Linked Immuno Sorbent Assay (ELISA) of Organon Teknika, USA, were compared with the conventional method for the detection of *Salmonella* serotypes in fish and fishery products. By the ELISA technique *Salmonella* could be detected in four out of the 81 samples analysed, whereas by the SRT method and the conventional method, *Salmonella* could be detected in only three samples. The ELISA method was thus found to be the most sensitive method for detection of *Salmonella* serotypes in fish and fishery products.

Studies were carried out to ascertain the minimum detection level, based on cell count, of the ELISA, SRT and conventional methods. Known numbers of *Salmonella* cells were inoculated into the pre-enrichment media and analysis was carried out by all the three methods. Similar studies were

carried out with artificially inoculated fish samples. It was observed that when the number of cells inoculated were less than 10 (3 cells per 225 ml broth) in the pre-enrichment media, *Salmonella* could be detected by all the three methods in pure culture. But in artificially inoculated fish samples, *Salmonella* could be detected only by ELISA method, when the number of cells was less than 10 per 225ml broth at the pre-enrichment level.

Incidence of *Yersinia enterocolitica* in fish / shellfish

Eighty samples of frozen fish comprising of 20 species collected from local retail markets were examined for the presence of *Yersinia enterocolitica*, recognized as a causative agent for diarrhoeal disease in man. Sixty suspected cultures isolated from the samples were subjected to detailed biochemical tests for the identification of *Yersinia enterocolitica*. Typical *Yersinia enterocolitica* strains could not be detected.

Bacteriological quality of fish in retail trade in Cochin

Samples of frozen fish collected from different retail outlets situated in the Cochin Corporation area were analysed to study their bacteriological quality, with special reference to total viable count, counts of coliforms and *E. coli*, and presence of *Salmonella*, *Bacillus cereus*, and *Yersinia enterocolitica*. Eightyone samples were collected from the local cold stores and analysed. Out of these, 71 samples (87%) were found to have a total viable count more than 10⁶ /g., 39 samples (48%) were found have *E. coli* count more than 100 /g (MPN), 16 samples (20%) were found to have *E. coli* count less than 20 /g (MPN), eight samples (10%) harboured toxigenic *Bacillus cereus* and four samples (5 %) contained *Salmonella* serotypes. The total plate counts and counts of *E. coli* were very high in frozen fish samples even though the incidence of *Bacillus cereus* and *Salmonella* was less. *Yersinia enterocolitica* was not detected in any of the samples.

Evaluation of toxigenic anaerobes including *Clostridium* spp. in aquaculture systems

Finfish and shellfish collected from fish farms and fish / shellfish collected from the retail outlets were screened for the presence of *Clostridium botulinum* type E. Of the 16 samples, one was found to harbour toxigenic *C. botulinum* strains. The posi-

tive sample was identified by neutralizing with botulinum antitoxins. All the mice inoculated with 1:2 and 1:4 dilutions of the sample neutralized with botulinum antitoxins A to E died showing typical symptoms of botulism. Toxin neutralization tests with further dilutions showed that type C is present in the sample.

Of the five samples of finfish and shellfish collected from the retail outlets in Cochin, one sample was found to be positive for *Clostridium botulinum* in the toxicity test in mice, identified by neutralizing with botulinum antitoxins. Trypsinised samples were more toxic than the untreated samples. All the mice inoculated with 1:2 and 1:4 dilutions of the sample neutralized with botulinum antitoxins A, C and D died showing typical symptoms of botulism while the samples neutralized with botulinum antitoxins B and E survived. Of the fifteen presumptive *C. botulinum* colonies isolated from the positive samples from open water farms, three isolates were toxigenic. Type C toxin was detected in one culture supernatant in the toxin neutralization tests. The frequency of contamination of fish/shrimp from retail outlets and farmed fish/shellfish from open water farms by *Clostridium botulinum* was 20% (1/5) and 6% (1/16) respectively.

Microbiological changes during handling and chilled storage of *Macrobrachium rosenbergii*

Spoilage potential of Shewanella putrefaciens isolated from Macrobrachium rosenbergii

Shewanella putrefaciens, isolated from freshwater scampi (*Macrobrachium rosenbergii*) and brackishwater clams were compared with the marine strains isolated from fish (*Lethrinus spp.*, *Sardinella longiceps* and *Scomberomorus commerson*). All the strains showed potential spoilage activity like trimethylamine oxide reduction and off-odour production. Except a few strains from scampi and marine fish, majority of the isolates produced hydrogen sulphide.

The *Shewanella putrefaciens* strains tested were able to grow at mesophilic temperatures. While all the strains tolerated up to 5% sodium chloride, none of them grew at 6% salt. All the strains produced off-odours, like sulphide and rotten egg in sterile fish/clam/ shrimp muscle juice and grew well at 5°C indicating their potential in the spoilage of shrimp/clam/ fish during iced stor-

age. The occurrence of *Shewanella putrefaciens* in farmed freshwater prawn is of concern because its numbers may increase during chilled storage of prawn, contributing to the rapid spoilage of the chilled stored scampi during transport from farm to the processing factories.

Microflora of clams used as feed for Macrobrachium rosenbergii in farms

Clams are used as feed in freshwater shrimp (*Macrobrachium rosenbergii*) farms situated at Vallakom, Kottayam district. The microflora of clams (*Paphia malabarica*) collected from brackishwater near Vaikom, Kottayam district and black clams (*Villorita cyprinoides*) collected both from brackishwater near Vaikom, Kottayam district and Vypeen, Ernakulam district were analysed quantitatively and qualitatively, in order to study the effect on the residual microflora of farmed scampi..

Total microbial population of the clams (*Paphia malabarica*) collected from brackish water near Vaikom at 37°C/30°C was slightly higher than those at 22°C. The psychrotrophic population at 5°C was 1.2×10^3 /g. The count of hydrogen sulphide producers at 30°C was higher than those at 22°C. Faecal Streptococci population was 4.0×10^4 /g and *E. coli* population, 5.0×10^3 /g. *Staphylococcus aureus* was not detected. Total *Vibrio* population was 1.6×10^4 /g. Sulphite reducing clostridia, especially *C. perfringens* were present. Clams were found to harbour *Shewanella putrefaciens*, *C. perfringens* and *Vibrio cholerae* non-01.

Total microbial populations of the clams (*Villorita cyprinoides*) from Vypeen, Perumpadappu and Vaikom at 37°C, 30°C and 22°C were in the range of 10^5 - 10^6 /g. The count of psychrotrophic bacteria at 5°C was in the range of 10^2 - 10^3 /g. Total coliforms, faecal coliforms, *Escherichia coli* and faecal streptococci count were quite high. *Staphylococcus aureus*, *Vibrio* and *Clostridium perfringens* were also present. The count of hydrogen sulphide producers in black clams at 22°C was in the range of 10^4 - 10^5 /g. The hydrogen sulphide producers included non-fermentative and fermentative Gram-negative bacteria. They comprised of *Shewanella putrefaciens* and *Vibrio* spp. exhibiting potential spoiling activity like trimethylamine oxide reduction, hydrogen sulphide production and off-odour production.

Isolation and identification of *Pseudomonas* from aquatic environments

Pseudomonas enrichment media and modified King's B media were used for the isolation of *Pseudomonas* strains from aquatic sources. Seawater is rich in *P. alcaligenes* followed by *P. pseudoalcaligenes* and *P. cepacia*. All the strains are non-fluorescent. *P. fluorescens* and *P. putida* were isolated from the brackishwater of Cochin using modified King's B media after enrichment in acetamide media. *P. alcaligenes* was isolated from pomfret (*Parastromateus niger*) and seer (*Scomberomorus commerson*) from the local market after enrichment in acetamide media. Freshwater samples were collected from Thiruvankulam freshwater farm. Freshwater was dominated by *P. putida*, *P. aeruginosa*, *P. alcaligenes*, *P. cepacia* and *P. pseudoalcaligenes*. Water, sediment and prawn samples were collected from different farms of Kannamaly area. Six different species of *Pseudomonas*, viz. *P. stutzeri*, *P. alcaligenes*, *P. aeruginosa*, *P. cepacia*, *P. putida* and *P. pseudoalcaligenes*, were isolated from these water, sediment and prawns samples. So far, seventy *Pseudomonas* strains have been isolated from aquatic environments.

Protein profile of aquatic *Pseudomonas*

Protein homology of various aquatic *Pseudomonas* has been done by SDS-polyacrylamide gel electrophoresis. The various strains, namely *P. cepacia*, *P. aeruginosa*, *P. fluorescens*, *P. putida*, *P. alcaligenes* and *P. pseudoalcaligenes* were used for the study. All the samples were grown in the modified King's media at 37°C and harvested after 24 hrs incubation. Cell disruption and protein isolation were done as per the Maniatis protocol. Isolated proteins for each sample were run through SDS-polyacrylamide gel electrophoresis. 125 Kda protein band was specific for *P. cepacia*. 51 Kda and 35 Kda protein bands were specific to *P. aeruginosa*, *P. putida* and *P. fluorescens*. 14 Kda protein was specific for *P. fluorescens* and *P. alcaligenes*. 65 Kda, 41 Kda, 25 Kda, 17 Kda and 12 Kda proteins were present in all the strains.

Probiotic bacteria like Lactic Acid Bacteria and *Bacillus* in aquaculture feed and medicine

Twentyfive strains of Lactic Acid Bacteria (LAB) isolated from the intestine of healthy prawns, were tested for inhibitory activity against *Vibrio harveyi* by inoculating LAB strains on lawns of



Protein profile of aquatic *Pseudomonas*

V. harveyi. Out of the 25 strains tested, five strains were found to show inhibitory activity, the maximum inhibitory activity being exhibited by strain S15. This strain will be used for further experiments for use as probiotic.

Screening of shrimps for presence of White Spot Syndrome Virus by a semi-nested PCR method

Mysis, post larvae, juveniles and adults of shrimp were analysed for the presence of White Spot Syndrome Virus (WSSV) by a semi-nested PCR method. A total of 78 samples were analysed during the period. Eighteen of the samples were positive by both steps of the method while 37 samples tested positive only by the second step. The sensitivity of the test was better by the semi-nested method compared to the single step method.

Screening of wild population of shrimps and crabs for WSSV

Fiftytwo *P. monodon* samples from the wild were screened for the presence of WSSV. Five samples were tested positive by the second step while twelve samples were positive by both steps. Of the

Lactic acid bacteria on *Vibrio harveyi*

thirtyeight *P.indicus* samples analysed for presence of WSSV, two were positive by both steps whereas five samples were positive by second step only. Forty three samples of sea crab, *Portunus sanguinolentus* from wild were analysed for the presence of WSSV. None of the samples were positive by first step while four samples were positive by second step. Out of the 18 samples of *Metapenaeus dobsoni* from wild, five were tested positive by second step and none were positive by both steps. The presence of WSSV in wild population of shrimps as well as in wild population of crabs is a matter of concern as these wild populations will act as carriers of the virus. The wild population might have got the infection from infected farmed shrimps. But, as such there is no chance of an outbreak of WSSV in the wild as the virus flares up only in case of stress to the animals. The stress factors associated with shrimp farming is not present in the wild.

Twenty six samples of farmed *Macrobrachium rosenbergii* were screened for presence of WSSV. Some of the prawns showed white spots on the carapace, which is similar to symptoms of WSSV. Out of these, nine were positive for WSSV by both steps while 15 were positive by second step only. Two samples were negative by both steps.

Plasmids in drug resistant bacteria

Twenty strains of *E. coli* were isolated from market samples of fish and plasmid profiling of these strains was done by standard methods. Out of the

twenty strains, four strains had six plasmids each, five strains had four plasmids and six strains, two each. Rest of the strains did not have any plasmids.

DNA based protocol for identification of *Pseudomonas* and *Aeromonas*

A simple method has been standardized for the isolation of high molecular weight genomic DNA from bacteria. The entire process is divided into three main parts; (i) a technique to gently lyse the cells and solubilise the DNA with 10% SDS and TAE buffer, (ii) several enzymatic and chemical treatments (a mixture of phenol, chloroform and isoamyl alcohol) to remove proteins, RNA and other macromolecules and precipitation of DNA by isopropanol, and (iii) final stage to observe the results by running the 0.7% agarose gel electrophoresis.

Environmental microbiology of aquaculture farms

Water, sediment and prawn samples were collected from brackishwater farms of Kannamaly area. These samples were analysed for various microbial and physico-chemical parameters. DO for water was 8 mg/ litre and salinity was 32ppm. Light penetration of the farm, measured by Sacchi disc method, was 24 cm. and pH, 6.7. A detailed study was also carried out of the microbial parameters of farm water, sediment and prawn samples. Total plate counts of sediment was the highest, followed by prawn and water samples. Total coliform, *E. coli*, and *Vibrio* counts of prawn samples were high compared to those in sediment and water samples. Sulphite reducing clostridia for water, sediment and prawn samples were determined and the counts were 140/g MPN for prawn and sediment and 450/100ml MPN for water.

Water, sediment and prawn samples were also collected from the farms of Ezhupunna area where shrimp disease outbreak was reported. These samples were analysed for various microbial and physico-chemical parameters. DO for water was 6.5mg/l. and salinity, only 9ppm. Light penetration of farm was 18 cm and pH, 8.2. A detailed study of the microbial parameters of farm water, sediment and prawn samples was also carried out. Total plate count for water, sediment and prawn samples were 1.7×10^6 /ml, 4.5×10^6 /g, 6.5×10^6 /g, respectively. Coliforms and sulphite reducing clostridia were detected by MPN method.

Engineering Division

Research Projects Handled

- 1 Title of the project : Development of fish processing equipment, deep sea fishing vessels and control and monitoring equipment for Indian fisheries**
- Principal Investigator : Shri P.N. Joshi
 Location of the project : Cochin
 Co-investigators : Shri M. Nasar, Shri K. Ramakrishnan, Smt K. Vijayabharathi
- NATP**
- 2 Title of the project : Mechanisation and production of pearl nucleus**
- Principal Investigator : Shri P.N.Joshi
 Location of the project : Cochin
 Co-investigators : Shri Manoj V.S.*, Shri Maheswaran K.*

* Sr. Research Fellow

🔑 Chief Findings

- 📄 Micro algae concentration monitor was developed for measurement of concentration of marine algae, *Nannochloropsis salina*, in the range 0 – 15 millions/ml.
- 📄 Design was developed of a sail system for use onboard medium class fishing vessels for reducing fuel consumption during free running mode.
- 📄 Design for a cage system for culture of fishes in reservoirs and bheels was developed.
- 📄 Developed the engineering design of a cost effective effluent treatment plant for the sea-food industry.
- 📄 Developed an improved design of FRP boat for backwater fishing.
- 📄 Developed a cutting machine for cutting irregular shaped molluscan shells into uniform sections for production of shell bead nucleus

✍ Report of work done

A micro algae concentration monitor was developed for measuring the concentration of algae *Nannochloropsis salina* in the range 0 – 15 millions/ml. The instrument was calibrated using algae samples from CMFRI, Cochin, by comparing with the reading of haemo-cytometer available at that institute. The data obtained was counter checked by enumerating the algae using the haemo-cytometer available at the MFB Division of CIFT.

A fuel consumption monitor for measurement of fuel (diesel) consumption rate, inflow and return flow, up to 30 litres/hr was developed and the performance evaluation of the instrument in the laboratory conditions, completed.

Fabrication of ERH monitor was completed for measuring Equilibrium Relative Humidity of food samples in the range 30 to 95%.



The micro algae concentration monitor – for measuring concentration of marine algae

A design was developed of a sail system for onboard medium class fishing vessels for reducing fuel consumption during free running mode. The system was designed in such a way that its operation will not hinder the onboard fishing operations or optimum manoeuvrability of the vessel. Construction plans were prepared and steps are being taken for the trial of a prototype onboard a commercial vessel.

A detailed study was conducted in NEH region to identify the engineering inputs required in order to enhance fish production in the area. The study revealed that fish production from reservoirs and bheels are extremely low owing to inadequacy of harvesting gears, tree stumps and weeds. Pen culture introduced limitedly was also not successful due to large fluctuations of water levels. Cage culture was suggested as a remedy to this and a cage system was developed for use in reservoirs and bheels.

A cost-effective engineering design for the treatment of hazardous effluent from seafood industry was developed in collaboration with QAM division. The working drawings and estimates were given to M/s Abad Fisheries, Cochin, on consultancy basis.

An improved design of FRP boat (5.69 m) for backwater fishing was developed. This design has got better motion characteristics, and the maintenance compared to existing wooden vessel, is negligible. The prototype, on testing, was found to excel in performance and presently, 14 FRP boats are being manufactured at the Institute for the fishermen in Chellanam, Cochin.

A flow chart for the process of manufacture of pearl nucleus using indigenous molluscan shells was prepared.

A ball-shaping machine for corner grinding and shaping of molluscan shells nearer to spherical shape was developed and successful trials carried out. A cutting machine for cutting of irregular shaped molluscan shells into uniform sections for production of shell bead nucleus was also developed.

Various samples of nuclei collected from different pearl producing countries were analysed. The diameter of the nuclei was measured at different sections and data analysed to find out the sphericity of shell bead nucleus. It is observed that for first quality Japan nucleus, sphericity varied from 10 to 30 microns whereas for the Honkong nucleus, the variation was from 10 to 40 microns.

The base component of the processing machine for analogue fish products was developed.

Pilot scale studies

A ten channel electronic thermometer was designed, fabricated and calibrated in the range -40°C to $+40^{\circ}\text{C}$ and handed over to QAM Division for measurement of core temperature of iced fish/frozen in connection with fish transportation studies. Time delay units (2 Nos.) were also fabricated for freezers attached to the QAM Division.

One unit of electronic thermometer in the range $0 - 100^{\circ}\text{C}$ was designed and fabricated and handed over to the MFB Division as per their requirement to monitor the temperature of blocks in the thermal cyler used in connection with virus detection.

The electronic thermometer developed by the Division was used for evaluating the performance of the following equipment in the FP Division.

1. Cascade deep freezer
2. Time temperature recorder

A four channel thermometer was also designed and fabricated and provided to MFB Division for measuring the temperature of water baths in the range 0 to 60°C .

Field trials

Field trials were undertaken of the modified version of the Integrated Fish Finder and Navigational Guidance System developed by BEL, Bangalore and referred to CIFT for evaluation onboard fishing vessels. The performance of the instrument was evaluated with respect to depth measurement, fins detection and navigational guidance aspects and a detailed report submitted.

Extension, Information & Statistics Division

Research Projects Handled





- 1 Title of the project** : **Studies on human resource development and economic evaluation in fisheries**
- Principal Investigator : Dr S. Balasubramaniam
 Location of the project : Cochin & Visakhapatnam
 Co-Investigators at Cochin : Dr Krishna Srinath, Smt Mary Thomas, Shri V. Annamalai, Dr Braj Mohan & Dr Nikita Gopal
- 2 Title of the project** : **Development of statistical models for evaluating the economic viability of mechanized fishing trawlers**
- Principal Investigator : Dr G.R. Unnithan
 Location of the project : Cochin & Visakhapatnam
 Co-Investigators at Cochin : Dr Nikita Gopal & Shri V. Radhakrishnan Nair

NATP

- 3 Title of the project** : **Assessment of harvest and post harvest losses – marine fisheries**
- Principal Investigator : Dr H.V.L. Bathla, IASRI, New Delhi
 Cooperating Centre : Dr Krishna Srinath
 Principal Investigator :
 Location of the project : Cochin
 Cooperating Centre : Dr G.R. Unnithan, Dr Nikita Gopal
 Co-Principal Investigators : & Shri V. Radhakrishnan Nair
 Associates : Kum K.A. Indu* & Smt M.S. Mumtaz*

*Sr. Research Fellow

Chief Findings

-  Increased fuel cost and profit margin at Visakhapatnam compared to Cochin is attributed to larger duration of fishing and high catch rate at Visakhapatnam.
-  The gross revenue, total variable cost profit/loss etc. of three groups of fishing vessels – small, medium and large - were worked out based on the number of fishing days for each class of vessels.
-  Statistical models for evaluating the economic viability of trawlers were formulated.
-  The second batch of training course on value added fishery products under the component 'Effectiveness of training methods among the target groups' was conducted at Kasaba, Kasaragod. It was found that before training, the mean index scores on knowledge, atti-

tude and skills possessed were 37.22%, 57.68% and 18.05% respectively. After the training, there were significant improvements in all the index scores, which were found to be 65.83%, 68.61% and 54.16% respectively.

- ☐ Results of studies on the component 'Evaluation of training needs of fisheries extension personnel' revealed that the training need index scores varied from 49.52 to 91.42 with a mean score of 70.68 (SD : 10.64).
- ☐ The job satisfaction mean index score of extension personnel was 53.84% with a standard deviation of 9.51. The average role performance index score of extension personnel was 58.43 (SD: 13.88). Most of the sample respondents preferred one week training to two weeks.
- ☐ Fishermen cooperative societies in West Godavari and Visakhapatnam districts were seen to have contributed to the socio-economic improvement of members and for increasing the fish production significantly.
- ☐ Under the component 'Socio-economic conditions of women fish processing workers', it was found that the average number of women employed per pre-processing plant was 58 and the average number of women working in a processing plant per month was 46. The average quantity of raw materials handled by women workers per pre-processing plant per month was 32.21 tonnes and for a processing plant, 71.83 tonnes.
- ☐ In the study on 'Management of income fluctuations in artisanal fisheries', the minimum average income ranged from Rs.300-500 during March-May 2001 and the maximum income was Rs.1,13,420/- in July 2001 for a group of six fishermen.
- ☐ In the study on 'Determination of fish consumption pattern in the coastal and interior areas', the results revealed that the average per day household income ranged from Rs.29 to Rs.1,088. The food expenditure per day of various income classes ranged from Rs.38 to Rs.68. The range of expenditure in fish consumption as a percentage of income for different income groups ranged from 1.90% to 25.50%.

Report of work done

Study on fuel consumption and operational cost of trawlers

Actual fuel consumption by trawlers collected from 448 fishing trips at Cochin was studied. The analysis indicated an average fuel consumption of 1250 litres by larger trawlers (above 48' OAL) for seven-day trip. This expenditure amounting to Rs.22680/- works out to be about 65% of the total operating cost. For small and medium class vessels, fuel cost works out at Rs.6,070/- and Rs.15,060/- respectively which forms just above 60% of the operating cost. Depending upon the design and mode of operation of larger trawlers, the rate of fuel consumption varied from 13.0 to 15.5 litres per hour of operation. Probable reason for this high variation is to be identified by further investigations.

The fuel consumption studies at Visakhapatnam showed an average consumption rate of 4000 litres costing around Rs.70,800/- per 10-20 days of fishing trip. Both the fuel cost and profit margin were estimated to be high at Visakhapatnam compared to Cochin and this was attributed to larger duration of fishing and high catch rate at Visakhapatnam.

Comparative economic efficiency of trawlers

Data collected from 448 fishing trips from Munambam base at Cochin for the fishing period 2001-2002 were analysed for their economic evaluation. The vessels were classified into three groups based on their OAL as upto 40', 40'- 48' and above 48'. The gross revenue, total variable cost (cost of fuel and lubricants, repair and maintenance charges, crew bata and ration, cost of ice, auction charges,

berthing charges, toll charges, unloading and cleaning charges, miscellaneous charges), profit/loss etc. were worked out based on the number of fishing days for each class of vessels. The preliminary analysis showed that the smaller class of vessels engaged in one-day fishing yielded a revenue of Rs. 10120 against its operational expenditure of Rs. 7188. The medium class vessels, 40'- 48' OAL, with an average of three-day fishing trip reported a revenue of Rs. 25105 against an expenditure on Rs. 19700. The larger trawlers brought in a revenue of Rs. 49100 as against expenditure of Rs. 36080 for an average of five fishing days per trip.

Formulation of statistical models for evaluating the economic viability of trawlers

Production function, taking total revenue as the dependent variable and the fishing days, cost of fuel and lubricants and cost of repair and maintenance as independent variables, was worked out pooling all classes of vessels. Other variables found to have a multi-collinear relation were eliminated for model stability. The model is of the form $Y = AX_1b_1 + X_2b_2 + X_3b_3$ and the obtained model is $Y = 37.87 X_1 0.4795 + X_2 0.1305 + X_3 0.4937$, where Y is total revenue and X1, X2 and X3 indicate variables for fishing days, fuel cost and repair cost, respectively. The model was found to be a good fit and all the coefficients were statistically significant at 1% level.

Cost function was worked out taking total expenditure as Y and the fishing days, cost of fuel & lubricants and cost of repair & maintenance as X1, X2 and X3.

$$Y = 669.328 + 889.3869 X_1 + 0.9770 X_2 + 1.429 X_3$$

The model showed that a weightage on total cost was to the tune of 16.5% due to the number of fishing days, 7.28% due to the repair charges and 71.46% due to the fuel cost.

Production function for different classes of vessels is as follows in the logarithmic form:

$$\text{Upto } 40' : Y = 2.381 + 1.071 X_1 + 0.315 X_2$$

(Y=total revenue, X1=fishing days, X2=fuel cost)

$$40'-48' : Y = 0.721 + 0.731X_1 + 0.202 X_2$$

(Y=total revenue, X1=fuel cost, X2=repair charges)

$$\text{Above } 48' : Y = 2.606 + 0.531 X_1 + 0.276 X_2 + 0.113 X_3$$

(Y=total revenue, X1=fishing days, X2= fuel cost, X3=repair charges)

Organisation of training programmes

During the year, out of 35 training programmes, associated with the organization of twenty training programmes of the Institute. Through these training courses, a total of 420 officials, technologists, students, fishermen and entrepreneurs were trained in the various fields of fishery technology. The major subject areas of training included laboratory techniques for identification of bacteria in fish and fishery products, Trainers' training for MPEDA officials, production of fish pickle, production of value added fish products, analysis of packaged drinking water, HACCP concepts in seafood processing, seafood quality assurance, operation and maintenance of air-conditioning equipment and refresher courses on microbiology to seafood processing technologists. The project scientists were also involved in the six months training course for 20 SC/ST and women candidates under the special component plan.

About 250 queries regarding the organization of training programmes were replied during the period.

Effectiveness of training methods

Under the component 'Effectiveness of training methods among the target groups', the second batch of the training course on value added fish products was conducted at Kasaba, Kasaragod. Training methods such as lecture, demonstration and group discussion were used in the training course. The average age of the respondents was 38 years and the number of days of employment was 137 days per year with an average annual income of Rs.12,780/-.Except one, all other respondents were engaged in fresh fish or dry fish marketing with about 18 years experience in marketing of fish. The results revealed that before training, the mean index scores on knowledge, attitude and skills possessed were 37.22%, 57.63% and 18.05% respectively, whereas after training, there was significant improvement in all the three variables (65.83%, 68.61% and 54.16%).

Evaluation of training needs

In this study, mailed questionnaires were used for data collection among the fisheries officials working under the jurisdiction of two Joint Directors of Fisheries viz; Calicut and Ernakulam. The

The average number of years of service in the fisheries department by the extension personnel studied was found to be 16.5 years and the average number of years of experience in the marine sector was 10 years. The analysis of collected data revealed that the training need index scores varied from 49.52 to 91.42 with a mean score of 70.68 (SD : 10.64).

It was also found that the following subject areas were less preferred for training by the extension personnel: (i) Purse seines – designs and operations (\bar{X} : 1.95) (ii) Drying equipment (\bar{X} : 1.95) (iii) Modern analytical techniques in biochemistry (\bar{X} : 1.86) and (iv) Fermentation and biotechnology (\bar{X} : 1.81).

Role of fishermen societies

Under this component, data were collected from Kerala, Orissa, West Godavari and Visakhapatnam district cooperative societies in Andhra Pradesh and NEH region. The data analysis revealed that these cooperative societies had contributed to the socio-economic improvement of members and for increasing the fish production significantly.

Socio-economic conditions of women fish processing workers

Under this new component, research methodology was finalized and interview schedules were developed. Data were collected from 40 pre-processing and nine processing centers. Data were

also collected from women fish processing workers. Tabulation of the data is in progress. The analysis of collected data revealed that the total number of women working in 40 pre-processing plants together per month was 2330 and the total number of women working in the nine selected processing plants per month, 412. The quantity of raw materials handled in these processing plants per month was 64,646 tonnes and the average quantity handled per plant was 71.83 tonnes.

Management of income fluctuations

Under this component, the data from 38 groups in the Matsyafed run Vaddy – Thangasseri Fishermen Development Welfare Cooperative society, Vaddy were updated up to January, 2002. A questionnaire for collecting data on the income and savings of individual households was prepared, pre-tested and finalized. Data were collected from individual households. The results revealed that the maximum net revenue that a group was able to obtain was Rs.1,29,255/- in July, 2000 and the minimum revenue, Rs.500/- during the month of March, 2001. Further data collection is in progress.

Determination of fish consumption pattern

Under this component, data were collected from 133 households in Mulanthuruthy area in Ernakulam, Kerala and 111 households in Hirakud reservoir area, Orissa. The 133 households in Ernakulam District were classified into 11 income groups for simplification of analysis. The average per day household income ranged from Rs.29/- to Rs.1,088/-. Expenditure on food per day of various income classes ranged from Rs.38/- to Rs.68/-. The range of expenditure on fish consumption as a percentage of income ranged from 1.90 to 25.50% for the various income groups. The average number of days per week on which fish is consumed in the households was 4.

NATP — ASSESSMENT OF HARVEST AND POST HARVEST LOSSES — MARINE FISHERIES

Primary and secondary data were collected from fisheries harbours, traditional landing centres, pre-processing centres, processing plants, fish markets and various govern-



Data collection in progress

ment organisations and on the basis of the data collected, sampling frame was designed and sample selected for the study.

Twenty schedules covering four levels of the production system were designed, pre-tested, finalised and printed in local language.

A three day training in data collection was imparted to selected enumerators during 2-5 December, 2001 at the Institute and in the field.



A training programme for the enumerators



Loss at landing centre



Sardines being dried for poultry feed

VERAVAL RESEARCH CENTRE

Research Projects Handled

- 1 Title of the project** : **Performance evaluation of suitable selective devices for elimination of fish by-catch (BRD) and turtle (TED) in shrimp trawling**

Principal Investigator : Shri Percy Dawson

Location of the project : Cochin, Visakhapatnam & Veraval

Co-investigators at Centre : Shri U. Sreedhar & Shri M.P. Remesan
- 2 Title of the project** : **Studies on traditional fishing gear and methods**

Principal Investigator : Shri P. George Mathai

Location of the project : Cochin, Visakhapatnam & Veraval

Co-investigators at Centre : Shri U. Sreedhar & Shri M.P. Remesan
- 3 Title of the project** : **Studies on material protection and marine pollution.**

Principal Investigator : Dr Leela Edwin

Location of the project : Cochin, Visakhapatnam & Veraval

Co-investigator at Centre : Shri U. Sreedhar
- 4 Title of the project** : **Innovations in product development, preservation, process and quality control of traditional fishery products**

Principal Investigator : Shri K. George Joseph

Location of the project : Calicut & Veraval

Co-investigator at Centre : Shri R. Badonia & Shri Zynudheen A.A.
- 5 Title of the project** : **Nutrients, toxicants, pollutants and growth promoters in aquaculture systems and processed marine products**

Principal Investigator : Shri A.G. Radhakrishnan

Location of the project : Cochin, Veraval & Visakhapatnam

Co-investigator at Centre : Shri Zynudheen A.A.

NATP

- 6 Title of the project** : **Development of value added products from low cost fish and processing wastes from fish and shellfish**

Principal Investigator : Dr K.G. Ramachandran Nair

Location of the project : Cochin, Mangalore, Visakhapatnam & Veraval

Co-investigator at Centre : Dr Arnab Sen

📌 Chief Findings

- 📄 Experimental fishing with new generation steel trawler *Sagarkripa* commenced on the Saurashtra coast. During the month of November, good catch of 730 kg of Sciaenids was recorded in a single haul.

- ☐ Infestation was seen least in panels applied with coal tar in combination with Cashew nut shell oil and insecticide (Methyl parathion) compared to other antifouling paints tried.
- ☐ Comparative studies conducted with diamond as well as square mesh cod ends of 35mm have shown encouraging results. About 25.37% of fishes could escape from square mesh as compared to 11.51% from diamond mesh of the same size.
- ☐ Excellent chlorophyll gradients were observed in most of the fishing stations of Gujarat and Maharashtra coast where the catches recorded were more than a tonne/day.
- ☐ *Acetes* sp and other prawn species were dominant among the by-catch from local landing centers contributing 34 % of the total by-catch. Croaker (Dhoma) contributed 28%, followed by *Coilia*, 5.5% and ribbonfish, 4.77%.
- ☐ Cuttle fish and squid were regularly analysed and the level of cadmium in processed fish was found to be in the range of 0.21-2.77 ppm. In whole cuttle fish, the range of Cadmium observed was between 1.32-7.42 ppm. Other heavy metals like lead, mercury and nickel were found in low levels.
- ☐ Processing aspects and composition of threadfin bream, *Nemipterus japonicus*, were studied. Heavy landings were observed of this species which is now the main raw material for surimi industry.
- ☐ Six isolates of *Vibrio parahaemolyticus* were isolated from squid ring and cuttle fish whole fillet. They were identified by biochemical tests and growth on salt containing Alkaline Peptone Water (APW). All these isolates tested Kanagawa negative.
- ☐ Microbiological aspects of commercially important fresh fish and processed products were analysed. Higher count of faecal streptococci was noticed in some samples.
- ☐ Antibiogram pattern of heavy metal adapted strain of *Pseudomonas* revealed resistance to Ampicillin, Trimethoprin, Cephaloxin and Nalidixic acid. Sensitivity was highest to Gentamicin and Ciprofloxacin. A total of eight *Pseudomonas* isolates were tested.

Report of work done

Fishing craft and gear

Design of a Mega mesh rectangular midwater trawl (RMT) was finalised for fabrication for testing on board vessel *FORV Sagar Sampada*. Steps were also initiated for fabrication and subsequent testing of a by-catch elimination device.

Forty numbers of square meshes trawl cod ends of 35 mm were fabricated and distributed to the fishermen of Veraval, Porbandar, Mangrol and Okha for commercial operation in collaboration with State Fisheries Dept. Two sets of V-form otter boards were fabricated and distributed to commercial fishermen for popularization.

Comparative studies with diamond and square mesh cod ends of 35 mm were carried out on board *Sagarkripa*. Both the cod ends were covered with 10 mm cod end cover and attached to a modified 32m demersal trawl. In diamond mesh cod end, 88.54% of fishes were retained and only 11.51% could escape. Sciaenids (70.49%) dominated the catches that were retained, followed by ribbon fish (19.94%). Among the fishes that escaped, majority were ribbon fish (35.04%) followed by lesser sardines (19.72%). In square mesh cod end, about 25.37% fishes had escaped and 74.92% were retained. Ribbon fish (31.95%) dominated the catches retained, followed

by sciaenids (11.13%). Among the fish that escaped, majority were ribbon fish (38.96%) and sciaenids (14.41%).



A good haul of sciaenids on-board the CIFT vessel Sagarkripa (Veraval)

Information on potential fishing zones (PFZ) received from SAC, Ahmedabad were disseminated to the fishermen of Veraval by translating it as approximate area and depth of operation with the help of hydrological chart as most of the vessels from Veraval Port sail without GPS.

Five sets of wooden panels of commonly used timber for boat building viz. 'Bawad' (*Acacia arabica*), 'Sajad' (*Terminalia tomentosa*) and Sal (*Shorea robusta*) applied with commonly used anti-fouling coatings were tested. It is observed that infestation was least in all the three species of panels applied with coal tar mixed with cashew nut shell oil and insecticide (methyl parathion).

Sea truth data was correlated with the satellite images generated by IRS P4 at SAC, Ahmedabad. All the chlorophyll images of Gujarat and Maharashtra coast were analysed for the data period November 2000 to December 2001. At most of the fishing stations of Gujarat and Maharashtra

coast, where the catches recorded were more than a tonne/day, excellent chlorophyll gradients were observed.

Fish processing

Whole cuttle fish samples, analysed for the presence of heavy metals, showed high levels of cadmium and lead. Processed cephalopods had heavy metals within the tolerance level.

Composition and processing aspects of *Nemipterus japonicus* were studied. This fish is the main raw material for the surimi plants. Data on losses during cutting and beheading were collected and quantity of recoverable meat from waste assessed.

Non-scombroid fish like horse mackerel, shark (*Scoliodon* sp.) and squid were seen to contain histamine to the level of 88.34, 3.90 and 4.33 mg /100ml. muscle homogenate. These levels increased during ice storage.

Adaptation of 10 isolates of *Pseudomonas* to increasing concentrations of heavy metals viz., Pb, Cd and As was carried out. The adapted isolates showed good growth at concentrations of 800 ppm of heavy metals.

Prawn samples of the species *Metapeneus kutchensis* were analysed for proximate composition, chemical and microbiological quality. A yield of 45-50 % of PUD was observed. It had high moisture content of 83%, protein, 16% and low fat, 0.15%.

NATP - DEVELOPMENT OF VALUE ADDED PRODUCTS FROM LOW COST FISH AND PROCESSING WASTES FROM FISH AND SHELLFISH

A number of samples of fish meal manufactured locally were analysed for various parameters. Samples were also prepared in the laboratory using different methods and two of the samples sent for feeding trials.

VISAKHAPATNAM RESEARCH CENTRE

Research Projects Handled

- | | | |
|----------|-----------------------------|--|
| 1 | Title of the project | : Performance evaluation of suitable selective devices for elimination of fish by-catch (BRD) and turtle (TED) in shrimp trawling |
| | Principal Investigator | : Shri Percy Dawson |
| | Location of the project | : Cochin, Visakhapatnam & Veraval |
| | Co-investigator at Centre | : Dr G. Rajeswari |
| 2 | Title of the project | : Studies on the effect of experimental installation of FAD for fishery resource enhancement in and around Visakhapatnam Coast |
| | Principal Investigator | : Dr G. Rajeswari |
| | Location of the project | : Visakhapatnam |
| | Co-investigator | : Dr R. Raghu Prakash |
| 3 | Title of the project | : Studies on material protection and marine pollution |
| | Principal Investigator | : Dr Leela Edwin |
| | Location of the project | : Cochin, Visakhapatnam & Veraval |
| | Co-investigator at Centre | : Dr R. Raghu Prakash |
| 4 | Title of the project | : Investigations on post harvest handling and processing of fish and shellfish of Andhra Pradesh |
| | Principal Investigator | : Shri Sibsankar Gupta |
| | Location of the project | : Visakhapatnam |
| | Co-investigators | : Dr D. Imam Khasim Saheb, A.K. Chattopdhyay,
Dr R. Chakrabarty & Dr B. Madhusudana Rao |
| 5 | Title of the project | : Biochemical, nutritional and functional properties of fish constituents |
| | Principal Investigator | : Dr P.G. Viswanathan Nair |
| | Location of the project | : Cochin & Visakhapatnam |
| | Co-investigator at Centre | : Dr D. Imam Khasim Saheb |
| 6 | Title of the project | : Nutrients, toxicants, pollutants and growth promoters in aquaculture systems and processed marine products |
| | Principal Investigator | : Shri A.G. Radhakrishnan |
| | Location of the project | : Cochin & Visakhapatnam |
| | Co-investigator at Centre | : Dr D. Imam Khasim Saheb |
| 7 | Title of the project | : Investigations on the prevalence of microbial hazards in fish & fishery environments and development of methods for their control |
| | Principal Investigator | : Dr P. K. Surendran |
| | Location of the project | : Cochin & Visakhapatnam |
| | Co-investigator at Centre | : Dr B. Madhusudana Rao |

- 8 Title of the project** : **Studies on human resource development programmes and economic evaluation in fisheries**
- Principal Investigator : Dr S. Balasubramaniam
 Location of the project : Cochin & Visakhapatnam
 Co-investigator at Centre : Shri J. Charles Jeeva
- 9 Title of the project** : **Development of statistical models for evaluating the economic viability of mechanized fishing trawlers**
- Principal Investigator : Dr G. R. Unnithan
 Location of the project : Cochin & Visakhapatnam
 Co-investigator at Centre : Sri J. Charles Jeeva

NATP

- 10 Title of the project** : **Assessment of harvest and post-harvest losses – inland fisheries**
- Principal Investigator : Dr H. V. L. Bathla, IASRI, New Delhi
 Location of the project : Visakhapatnam
 Cooperating Centre Principal Investigator : Dr D. Imam Khasim Saheb
 Cooperating Centre : Dr Krishna Srinath, Dr G. R. Unnithan
 Co- Principal Investigators & Sri J. Charles Jeeva
- 11 Title of the project** : **Development of value added products from low cost fish and processing wastes from fish and shellfish**
- Principal Investigator : Dr K. G. Ramachandran Nair
 Location of the project : Cochin, Mangalore, Visakhapatnam & Veraval
 Co-investigator at Centre : Dr Imam Khasim Saheb

🔑 Chief Findings

- 📄 The survey of by-catch landing in commercial trawls was continued at Visakhapatnam landing centre. It was found that 60-70% of the landings is constituted by juveniles of commercially important fishes.
- 📄 Benthic FADs installed at Visakhapatnam coast were monitored and per boat FAD fish catch recorded was found to be 40-50 kg per week.
- 📄 Method of preparation of frozen fish sticks from small varieties of cheap bony fish, a rich source of calcium and phosphorous, was standardised. The product remained in good condition for five months at -18° C.
- 📄 Deep sea surface water (DSW) had almost equal proportions of Gram-ve (22%) and Gram+ve (20%) bacteria whereas deep sea water from 200 mt. depth (DSW₂₀₀) had a high percentage of Gram+ve (46%) bacteria. In deep sea fish, Gram-ve bacteria (24%) were almost double of Gram+ve bacteria (14%). *Pseudomonas* was the predominant bacterial genus in deep sea water samples whereas vibrio was predominant in deep sea fish. DSW₂₀₀ had significant proportions of *Arthrobacter* (24%) and filamentous bacteria (17%). Yeast was detected only in deep sea fish samples.

Report of work done

Fishing gear

By-catch reduction devices were designed and evaluated for elimination of juveniles from shrimp trawls and the by-catch landings monitored regularly at Visakhapatnam landing center. The escapement of catch in TED installed shrimp trawl was found to be 0.24%. The impact of pre and post conservation period of prawn fishery was also monitored.

Benthic FADs installed at Jodugullapalem were monitored. Gill nets and boat seines were operated around the FADs to exploit FAD fishery. The gill net catches recorded were seer fish, mackerel, Carangids, tunas and Engraulids. The catches recorded from boat seine were ribbon fish, Carangids, Engraulids, lizard fish, sardines and *Acetes*. The average catch per boat recorded was 40-50 kgs.



Benthic fish aggregating devices at Visakhapatnam

A preliminary survey was carried out of the different types of wood used in boat construction in Visakhapatnam. The commonly used woods were teak (*Tectona grandis*), sal (*Shorea robusta*) etc. In addition, *Terminalia* sp., *Pterocarpus* sp., *Anogeissus* sp., were also seen to be sparingly used.

Specimens of foulers were collected from two stations, viz:

- (a) Visakhapatnam fishing harbour, and
- (b) entrance channel of fishing harbour.

Macrofoulers mainly comprised of barnacles, bivalves and serpulids. The list of different groups of foulers observed are Annelida (*Merciella enigmatica*, *Serpula vermicularis* and *Hydroïdes norvegica*), Arthropoda (*Balanus amphitrite*, *Balanus tintinnabulum tintinnabulum* and *Chthamalus* sp.), Bryozoans (*Electra bengalensis*, *Zoobotryon verticillatum* and *Bagula neritina*) and Bivalves (*Ostrea* sp., *Modiolus* sp., *Priomia* sp., *Mytilopsis sallei* and *Mytilus edulis*)

Samples of micro and macro foulers were collected periodically from the cooling water intake systems of Visakhapatnam oil refinery (Hindustan Petroleum Corporation Limited). All along the intake water channel, filamentous algae *Enteromorpha* sp. and *Chaetomorpha* sp. were seen. Among benthic micro algae, *Licmorha* sp., *Biddulphia* sp., *Amphora* sp., and *Navicula* sp., were dominant. Other free floating planktonic algae such as *Skeletonema* sp., *Cyclotella* sp. and *Melosira* sp., were also relatively abundant. The zooplankton component was dominated by *Copepoda* and *Cirripidae nauplii*. The bivalve, *Mytilopsis sallei* in the size range of 1-3.5 cm, was a dominant macrofouler.

Fish processing

Monitoring studies

Histamine

The histamine content in the muscle of acceptable fresh tuna (*Euthynnus affinis*) and flying fish (*Cyplselurus Cyanopterus*) increased from 2.4 to 19.6 mg% and 1.6 to 6.0 mg% respectively during storage at ambient temperature for eight hours. TVBN increased from 7.5 to 13 mg% in flying fish and from 9.8 to 25.7 mg% in tuna during the same period. During wet salting and subsequent storage of the carangids (*Atule mate*) and drift fish (*Ariomma indica*) at ambient temperature, histamine content in the muscle decreased slowly.

Fungi in dried fish

Survey on the presence of fungi in the salted and dried fish samples of the upper Visakhapatnam coast was continued. The moisture content and salt content in the samples were 30-

40% and 8-10% respectively. *Aspergillus niger*, *penicillium spp.* and *Wallemia sebi* were found to be the common fungi in salted and dried fish as well as in air. The presence of fungi in seawater was also screened at regular intervals. Identification of the new fungi isolates is in progress.

Fish pathogens in fish/fish products

Fish procured from fish landing centre, fish market and sea food processing plants, water from sea food processing plants, ice samples and swabs from processing table, utensils, freezing trays and workers' hands were analysed for the presence of pathogens and indicator bacteria.

• Total bacterial count

Market sample showed higher total plate count than samples obtained from landing centre. Water samples from processing plant showed very low TPC both at 37° C and 22° C. Ice samples showed some variation; some ice samples showed higher count than the permitted standard limit. The TPC of swab samples collected from processing hall, workers' hands, utensils and freezing tray were within prescribed limit.

• Presence of indicator bacteria

The samples were analysed for the presence of faecal streptococci, MPN total coliforms, MPN faecal coliforms, MPN *E.coli*, total enterobacteriaceae count and sulphite reducing clostridia. The levels of all these indicators are seen higher in market samples than in samples from processing plant and landing centre. The sanitation quality of water and ice used for processing seafood was found to be good as indicated by the absence of indicator bacteria.

• Presence of pathogens

The samples were checked for the presence of *Staphylococcus aureus*, *Vibrio cholerae* and *Salmonella*. Market samples, samples from landing centres and processing plant samples were found positive for the presence of coagulase positive staphylococci but the levels were within acceptable limit. *Vibrio cholerae* and *Salmonella* could not be detected in any of these samples. However, *Salmonella* was detected in one finished product of scampi.

Qualitative microbiological analysis of deep sea water and fish

Gram+ve bacteria were more than Gram-ve bacteria in Littoral Sea Water (LSW) samples (39% g+ve, 29% g-ve) and deep sea water from 200 meter depth (DSW₂₀₀) samples (46% g+ve, 29% G-ve). Deep Sea Surface Water (DSW) had almost equal proportions of Gram-ve (22%) and Gram+ve (20%) bacteria, whereas in fish samples, Gram-ve (26%) were nearly twice that of Gram+ve bacteria (14%). In deep sea fish samples, the major bacterial genus was *Vibrio* (16%) followed by *Pseudomonas* (9%) and filamentous bacteria (6%). *Arthrobacter* (2%), *Acinetobacter* (1%), *Kurthia* (1%) and *Corynebacterium* (1%) were the other bacteria isolated from the fish samples. *Pseudomonas* were predominant in all the water samples (LSW 13%, DSW 7%, DSW₂₀₀ 27%). *Vibrios* were detected only in DSW samples (7%). However, they were present in large numbers in deep sea fish samples (16%). High percentage of *Enterobacteriaceae* was detected only in LSW sample.

Arthrobacter and filamentous bacteria are the common Gram+ve bacteria present in all the samples. Percentage of *Arthrobacter* was seen to be very high in DSW₂₀₀ samples.

Search for better indices for faecal pollution - Faecal bacteriophages

Coliphages were detected in seer fish, *Scomberomorus guttatus*, purchased from local fish market (2pfu/g), silver pomfret, *Pampus argenteus*, obtained from fish landing centre (2pfu/g) and frozen scampi *Macrobrachium rosenbergii*, procured from sea food processing plant (8 pfu/g). Faecal coliforms were detected in market and landing centre samples but were not detected in processing plant samples.

Water from fish landing centres and seafood processing plants were analysed for the presence of indicator bacteria and coliphages. The samples from landing centre had high levels of faecal coliforms (180+/100ml) and faecal streptococci (12/ml). Coliphages were also detected in these samples (160 pfu/100ml).

Monitoring of quality of shrimp and fish feed and feed materials

Monitoring quality of shrimp and fish feed and feed materials collected from different places in Andhra Pradesh was continued by analysing for proximate composition, nutritional and toxic elements. Alfatoxin analysis in selected samples was also done with negative results.

Studies on improving the processing techniques

Studies on storage of live fish

Trials were carried out with the cultured fresh water fish, *Clarius batrachus* (average wt.800gm). The fish were stored in water in large plastic tanks with constant aeration. The effect of variation in pH and temperature during seven days storage of live fish in water was studied.

Technical design of insulated storage units for live fish was finalised and arrangements made to get them fabricated locally.

Studies on control of insect infestation in cured and dried fish

- **Treatment with a mixture of STPP + sodium benzoate + Citronella oil**

The treatment of cured and dried fish samples with a mixture of sodium tri poly phosphate (STPP) + sodium benzoate + citronella oil was found to be effective in controlling the four major spoilage problems, namely insect infestation, red halophilic bacterial attack, fungal growth and rancidity development. The treated samples of cured and dried ribbon fish (with STPP + benzoate+ citronella oil) packed in polythene bags were found to be in good condition without red halophiles and insect infestation and fungal growth even after 10 months storage at room temperature, whereas control samples (i.e. only cured with salt) showed red halophilic bacterial attack after five months storage and insect infestation after eight months. The moisture content varied from 26 to 30% in all the samples. The total volatile nitrogen (TVN) content in the control sample was 329 mg/100gm after 10 months whereas the treated samples showed a range of 144 to 155 mg/100gm.

The PV values were comparatively lower in the treated samples. The overall appearance and quality of the treated samples was superior to the control samples after 10 months storage.

- **Efficacy of citronella oil treatment in control of insect infestation**

Sun dried small anchovies without any treatment and samples with citronella oil treatment were stored in polythene bags at room temperature. After six months, the control samples were infected with small dark brown insects whereas there was no insect infestation even after eight months in the treated samples.

Quality of sun dried fish

Cured seer fish and ribbon fish samples dried in solar drier used in a nearby fishing village society were tested for different quality parameters. All the chemical and bacteriological parameters were well within the standard limits even after three and six months storage respectively at room temperature.

Development of a simple process for removal of bones from fish fillets

The presence of bones has become a stumbling block in utilization of fresh water carps, especially for export market. With a view to removing the bones from the fish fillets, one block of specific needles were fabricated and the bones removed using the block manually with little damage to the tissue of the fillet. An overall decrease of around 10% was observed in the weight of the fillet after the bones were removed along with some bone-meal

Studies on product development

Value added products from small sized fish

The frozen storage studies of fish sticks made from thermal processed small varieties of cheap bony fish e.g. *Leiognathus dussumieri* (silver bellies) and other ingredients were completed at - 180C. The fish sticks when battered and fried in oil were found organoleptically acceptable even after five months of storage. To compare the effects of spices, starch and other ingredients on the overall quality of the frozen stored product, frozen storage studies of two different batches of fish sticks were undertaken. The frozen sticks from

both the batches stored up to three months were found organoleptically acceptable when battered and fried in oil. The storage studies are being continued.

Protein fraction from tuna liver

Standardization of the process of preparation of enzymatic soluble protein concentrate and carotenoprotein cake from tuna liver is in progress. 85 to 90% of carotenoid pigment was recovered by using papain. The studies are being continued.

NATP - ASSESSMENT OF HARVEST AND POST HARVEST LOSSES - INLAND FISHERIES

Preliminary visits were made to the various resources of inland fisheries viz. riverine, reservoirs, fresh and brackish water aquaculture ponds, estuaries and lakes and marketing channels viz., wholesale markets, retailers, small scale vendors, pre-processing centres, processing centres, packaging centres and live fish transportation centres to finalize the samples for this study. A document containing the sampling details and the interview schedules for data collection was also prepared.

NATP - DEVELOPMENT OF VALUE ADDED PRODUCTS FROM LOW COST FISH AND PROCESSING WASTES FROM FISH AND SHELLFISH

Survey was carried out on the availability of raw materials such as low cost, small size fishes of different species available at Visakhapatnam Fisheries Harbour. The by-catch from trawlers are seen to be salted immediately after catch, dried in the open under unhygienic conditions and sold to poultry manufacturers at very low price depending upon its quality. The proximate composition and quality of such products were evaluated. Silages were prepared from small dried silver bellies using formic acid, propionic acid and a mixture of both. Steps are under way to procure live cultures of *Lactobacillus plantarum* from NCL, Pune.

Fisheries extension

Studies on HRD programmes

Analysis of data collected for the study on 'Assessment of training needs of fisheries extension personnel' revealed that the 'most needed' training subjects included low energy fishing techniques, fishing regulations and management measures, value added fish products viz. pickles, cutlets, wafers, battered and breaded products etc., and packaging of fish and processed marine products. The data collection has been completed in Visakhapatnam District and the questionnaires have been mailed to the Fishery Development Officers and Assistant Inspector of Fisheries in other Districts of Andhra Pradesh. Data collection is in progress for the components viz., 'Role of fishermen co-operative societies' and 'Socio-economic conditions of women fish processing workers'.

Studies on economics of large trawlers

Preliminary data were collected on the number of fishing vessels operating along the coast, fish landing at Visakhapatnam fishing harbour etc. The programme of work at Visakhapatnam Center, sampling methodology and interview schedule for data collection were finalized. Periodical observations were made during trawl landings and data were collected on fuel consumption, investment expenditure and income particulars for both 40-48 ft OAL and 48 ft. OAL and above category of fishing vessels.










Observation of trawl landings at Visakhapatnam harbour

BURLA RESEARCH CENTRE

Research Projects Handled

- | | | |
|----------|-----------------------------|---|
| 1 | Title of the project | : Development of the fishing gears and techniques for harvesting reservoir fishery resources |
| | Principal Investigator | : Dr B. Meenakumari |
| | Location of the project | : Cochin & Burla |
| | Co-investigator at Centre | : Shri Prem Kumar |
| 2 | Title of the project | : Studies on pollution of the fish and fish curing environments of Orissa |
| | Principal Investigator | : Shri J. K. Bandyopadhyay |
| | Location of the project | : Burla |
| | Co-investigators | : Dr M. M. Prasad
Dr D. Imam Khasim Saheb |

Chief Findings

-  The efficiency of 30 mm. bar mesh size of high tenacity monofilament nylon gill nets was found to be superior to the other mesh sizes.
-  Studies on monoline operation revealed that small prawns were better bait than others in attracting the fishes.
-  A total of twenty-three species of fish and three species of freshwater prawn were identified in the catch from stick-held gill net. In lower reach the catches were dominated by *Macrobrachium spp.*, *Chela becaila* and *Rita chrysea* while *Rohitee cotio*, *Gudusia chapra* and *Silonia silondia* were the dominating species in the middle reaches.
-  It is observed that in all the villages surveyed there is no immediate need for mesh size regulation.
-  The physical quality of freshwater fish sold in wet fish markets in and around Burla/Sambalpur in fresh/iced condition was found to be good.
-  The bacteriological and biochemical quality of commercial smoked fish revealed the need for more number of studies and transfer of technologies developed by the Institute.
-  Socio-economic survey of the fishing villages revealed :
 1. Dominance of women entrepreneurs in smoked fish markets
 2. Willingness to adopt technologies developed by CIFT
 3. Lack of preservation and transportation facilities

Report of work done

Fishing Technology

Trammel nets were fabricated using nylon inner and polypropylene outer layers and 92 experimental fishing operations conducted with these nets. The catches comprised mainly of *Eutropiichthys vacha*, *Silonia silondia* and *Notopterus chitala*.



Trammel net operation in Hirakud reservoir (Burla)

High tenacity nylon monofilament gill nets of different mesh sizes were operated for 98 fishing days. Mesh sizes of 30 and 35 mm. bar showed better performance compared to the other mesh sizes tried. The catches comprised mainly of *E. vacha*, *S. silondia* and *Mystus seenghala*.

Experimental fishing was conducted using monoline with different size of hooks for 66 operations. Small fishes, goat intestine and small prawns were used as baits. Hooks number 19 and 20 with prawn bait gave better performance. The catches comprised mainly of *Mystus gulio*, *Glossogobius giuris* and *Rita chrysea*.

Samples were collected from the catches of stick-held gill nets from the lower and middle reaches of the Hirakud reservoir for catch composition studies. A total of twentythree species of fish and three species of freshwater prawn were identified. In the lower reaches, the samples comprised mainly of *Macrobrachium spp.* (36 %), *Chela becaila*(20 %) and *Rita chrysea* (19%). In the middle reaches *Rohitee cotio* (56%), *Gudusia chapra* (20%) and *Silonia silondia* (18%) were found to be the dominating species.

Fish Processing Technology

Samples of fresh and iced fish were collected from 12 wet fish markets, five mobile vendors and 2 landing centres in and around Sambalpur town and the quality of 351 samples was tested using Inteletron Fish Freshness Tester. Weight of the fish samples ranged from 0.180 to 2.1 kg. The following data were obtained:

Position of Testing	Range of Inteletron Fish Freshness Tester readings
Head region	28 (iced) –78 (fresh)
Middle region	33 (iced) –94 (fresh)
Caudal region	'20 (iced) –98 (fresh)

Twenty-six fresh fish samples were collected from Sambalpur and Burla fish markets for biochemical analyses. The results are as follows:

26 samples of freshwater fish	Moisture %	TVN (mg%)	Alpha amino nitrogen (mg%)
Range	61.00 to 87.21	05.29 to 48.26	37.34 to 138.67
Average	77.07	14.17	76.15
Standard deviation	4.54	7.82	24.00

Ranges of results of the bacteriological and biochemical analyses of the smoked fish samples

Parameters	Ranges
Moisture(%)	13.24 to 25.68
fat (%)	3.71 to 15.08
PV m. eq. per kg flesh	30.33 to 446.02
TVN (mg%)	47.90 to 199.47
Alpha amino nitrogen (mg%)	30.51 to 557.21
TBC (total bacterial count) per gm flesh	61X10 ² to 70X10 ⁴
Faecal streptococci per gm flesh	< 10 ¹ to 3X10 ²
<i>E coli</i> per gm flesh	<10 ¹
TMC (total mold count) per gm flesh	10X10 ³ to 54X10 ⁴

Fortysix samples of freshwater fish collected from various markets were sent to Visakhapatnam Research Centre under iced condition for heavy metals analyses. This included kidney, liver and edible flesh of the samples.

Eleven villages under Thebra, Jarimuli and Lachhipali Primary Fishermen Co-operative Societies were surveyed to study the fish handling and fish curing practices adopted by fishermen. Data were collected on number of active fishermen, fish curers, methods of marketing fresh and cured fish, types and sizes of craft and gear employed, types of fish caught, processing methods followed, alternative sources of income and other details. It was observed that in the villages surveyed, there was no urgent need for mesh size regulation. Fishermen were advised not to adopt the unscientific practices now in vogue, which may pose a severe problem in future.

The following observations were made during the survey:

- (i) Plank built country crafts, stick held dragnet, shore seines, simple gill nets and hook and line were in use in all the villages.
- (ii) Fishermen are bound to sell their catch at very low prices to the middlemen due to lack of transportation and preservation facilities and debt trap.
- (iii) The fisherfolk of seven villages are willing to participate in any extension training programme conducted by CIFT.
- (iv) Kadamdihi, an interior smoked fish market located 120 km. from Burla, was also surveyed. This smoked fish market is manned by nearly 70 women entrepreneurs.
- (v) The source of raw material is the nearby river, which is a tributary of Mahanadi. There is no Society for the welfare of the entrepreneurs.

collected from Kadamdihi market are as follows:

The fish caught from agriculture fields are also smoked and are sold in this market. This practice is confined to monsoon and post-monsoon periods, as the agriculture fields are flooded with rainwater. The dominant varieties sold in the market are - *Mastocembelus* sp., *Rohitee* sp., *Gudusia* sp., *Mystus* sp. and freshwater prawn. March and April are the peak months of sale.

The women entrepreneurs were briefed on the hygienic handling of fish and they have shown keen interest in adopting the technology developed by the Centre.

Extension activities

As per the instructions of ICAR, work was initiated to propose research programmes for the North Eastern Hill (NEH) region. A team was deputed to study the technological needs in fisheries development of Assam, Meghalaya and Arunachal Pradesh.

On the basis of information collected from these states, it is observed that the rivers, bheels, lakes and reservoirs are the main fisheries resources in these states but they are not properly utilized due to non-availability of proper technologies of fishing and fish processing. The traditional methods of fishing diminished the catches from these natural resources. The productivity of these resources could be sustained and subsequently enhanced by adopting a scientific approach of fisheries technology. Therefore, there is an urgent need to disseminate the appropriate technologies among the fishermen through the State Fisheries Departments. State fisheries personnel should be trained through vocational training and demonstrations.




(The Hoshangabad Research Centre existed during the period. But, since its future is still undecided, no significant work was undertaken at the Centre during the period)

CALICUT RESEARCH CENTRE

Research Projects Handled

- | | | |
|----------|-----------------------------|--|
| 1 | Title of the project | : Innovations in product development, preservation, processes and quality control of traditional fishery products |
| | Principal Investigator | : Shri K. George Joseph |
| | Location of the project | : Calicut & Veraval |
| | Co-investigator at Centre | : Kum Bindu, J. |
| 2 | Title of the project | : Development of suitable packaging materials for value-added and ready-to-serve fish and fishery products |
| | Principal Investigator | : Dr T. K. Srinivasa Gopal |
| | Location of Project | : Cochin & Calicut |
| | Co-investigator at Centre | : Kum Bindu, J. |

Chief Findings

-  *Aspergillus glaucus* and *Rhizopus/Mucor* groups continued to lead the table of incidence of fungi in dry fish brought to Calicut Central Market from curing centres outside Kerala.
-  Storage studies on ready-to-fry, dried products from sole and anchovies showed that the samples had a shelf life of more than seven months. Standard Plate Count during the storage period was below $1.00 \times 10^3/g$ while 'total' and "Red" halophiles were absent.
-  Studies on semi-dried mackerel, sardine, shark, silver belly and anchovies collected from Calicut region (Sept. 2000 to Dec. 2001) showed that peroxide value (PV) of the samples was highest in mackerel and lowest in shark while free fatty acid (FFA) content was highest in anchovies and lowest in mackerel and sardine samples. Total volatile base nitrogen (TVBN) value was found to be highest in shark and lowest in anchovies.

Report of work done

Studies on fungi in dry fish

Fortyfive samples of dried/salted and dried fish of various species brought to Calicut Central Market from major curing centres outside Kerala State, viz., Porbunder, Mumbai, Mangalore, Madras, Rameswaram, Orissa coast and Kolkata were analysed for their mycological quality and chemical characteristics.

Water activity (a_w) of the samples showed a range of 0.71 - 0.81.

Two hundred and seventysix fungal cultures were isolated from the samples. These were classified as:

<i>Aspergillus</i> spp.	- 52.90 %
<i>Aspergillus niger</i>	- 9.06 %
<i>Polypaecilum</i> sp.	- 12.32 %
<i>Rhizopus/Mucor</i> group	- 18.11 %
<i>Penicillium</i> spp.	- 7.61 %

Thirteen dried fish samples of diverse species such as cat fish, *Coilia* sp., tuna, horse mackerel, seer, Bombay duck as well as prawn pulp were collected from Veraval market and subjected to chemical and mycological analysis. Chemical characteristics of the samples were also determined.

Fifteen semi-dried fish samples of various species were collected from the market as well as curing yards and the quality assessed. The factors analysed include, moisture, salt, ash, sand, fat, protein, TVBN and a_w .

Mycological studies have shown that *Aspergillus* spp. and *Penicillium* spp. were the predominant mycoflora present in the samples.

Studies of wet cured/semidried samples of local origin

Thirtyfive wet cured samples collected from the Central Fish Market were analysed for total bacterial count, halophilic bacterial count and chemical parameters like proximate composition, PV, total base nitrogen (TBN) and FFA. The water activity of the samples was also determined.



Cured fish at Central Fish Market, Calicut

The samples analysed were:

Mackerel	: 7	Anchovies	: 3
Horse mackerel	: 1	Shark	: 5
Jew fish	: 2	Thrissocles	: 1
Barracuda	: 1	Ray	: 2
Silverbelly	: 5	Miscellaneous	: 1
Sardine	: 7		

The proximate composition of the wet cured samples was as follows:

	Range %	Average %
Protein	18.00 - 31.20	25.70
Moisture	25.00 - 56.00	46.46
Fat	0.22 - 28.00	7.37
Ash	17.28 - 29.21	21.87

a_w of the samples ranged from 0.74-0.80

Standardization of ready-to-eat, condiment incorporated fishery products for internal and export marketing

Storage studies on ready-to-fry, dried products from anchovies and sole were continued. Both the samples remained in good condition for over seven months. While the samples of sole developed rancidity subsequently, anchovies were seen to be in good condition even after twelve months. The studies were extended for two more months. The samples were discarded afterwards due to spoilage. Bacterial load of the samples was generally found to be low.

Standardization of methods of processing, packaging and quality control of traditional fishery products

Dried sardine samples were prepared using the methodology given below and the samples analysed to study the different spoilage factors like rancidity and oxidation. The proximate composition and chloride content were also determined.

Fresh sardines were purchased from the landing centre, eviscerated and washed clean. They were further divided into four portions and then treated as follows:

Salted in the ratio, fish:salt, 5:1 for 24 hours

Salted in the ratio, fish:salt, 4:1 for 24 hours

Brined in saturated

brine in the ratio, fish:brine, 1:2 for 24 hours

Brined in saturated

brine in the ratio, fish:brine, 1:2 for two hours and then dried

The salted samples were then washed in saturated brine, divided into three lots and subjected to the following, before drying.

Dipped in brine containing 1% chitosan for five minutes.

Dried without any treatment.

Dipped in brine containing 3% Calcium propionate.

The dried samples were then packed in polythene covers and kept for storage studies. The samples were analysed to study the different spoilage factors and the proximate composition determined. The samples had a shelf life of only three months during which period they developed rancidity and discoloration and had to be discarded.

Proximate composition of oil sardine during April 2001

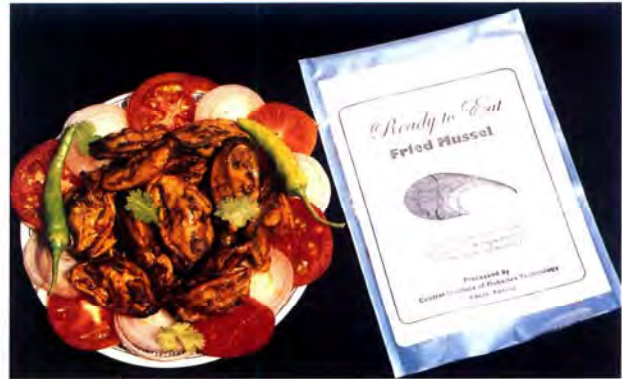
Moisture	Fat	Protein	Ash
24.75	17.08	34.6	22.2

Collection of mussels, seawater and mud

Mussels were collected directly from the harvesting grounds at Thikkodi, Moodadi and Pallikkandi on four occasions, and, mud and water twice and the samples sent to Headquarters in connection with the work on the Project, 'Quality Assurance and Management in Seafoods'. The studies are being continued.

Packaging of ready-to-serve fried mussel meat

Two trials were conducted during the year on preparation and packaging of ready-to-serve fried mussel meat. Boiled and shucked mussel meat was taken to the Headquarters, fried, treated with condiments and packed in plain polyester laminate and aluminium foil (air and vacuum packed). The samples were subjected to storage studies.



Ready-to-serve fried mussel

Ready-to-serve sardine

Trials were conducted on preparation of salted and pressed sardine as packed, ready-to-cook products. Fresh sardines (small size, 10 cm long) were eviscerated and the head cut off. The washed sample was treated with a salt/turmeric powder mixture and packed in a plastic bucket with holes at the bottom to drain off the self-brine and pressed down with weight. After one week, fungal attack was observed on the sample. Packaging part of the experiment could not, therefore, be completed.

Another trial was also initiated along the same line. The sample remained in good condition for 45 days. Further trials are being conducted to evolve a suitable method for elimination of fungal attack.

Data collection for NATP on 'Assessment of harvest and post-harvest losses – Marine Fisheries'



Data are being collected on fishing craft operations based at Puthiyappa Fishing Harbour and also on fish curing activities at Puthiyappa and Vellayil curing centres on a monthly basis by an enumerator. The data, so gathered, are forwarded to headquarters from the Centre.

MUMBAI RESEARCH CENTRE

Research Projects Handled

- | | | |
|----------|-----------------------------|---|
| 1 | Title of the project | : Development of improved methods for quality and safety of fish and fishery products |
| | Principal Investigator | : Dr M. K. Mukundan |
| | Location of the project | : Cochin & Mumbai |
| | Co-investigators at Centre | : Shri D. K. Garg & Shri S. P. Damle |
|
 | | |
| 2 | Title of the project | : Development of value added, culinary, fortified and functional fish products, their processing and storage |
| | Principal Investigator | : Dr Jose Joseph |
| | Location of the project | : Cochin & Mumbai |
| | Co-investigators at Centre | : Shri D. K. Garg & Shri S.P. Damle |

Chief Findings

-  Contamination with faecal *Streptococci* was observed in some samples of ice collected from landing centers indicating poor hygienic conditions.
-  Insect infestation by *Dermestes* spp. was observed in dry anchovies collected from dry fish markets indicating poor drying practice.

Report of the work done

Fish processing

A total of 34 samples of fresh fish belonging to families *Pomadasyidae*, *Carrangidae* and *Sciaenidae* were collected from the landing centers at Sassoon Dock, Ferry Wharf and Turbhe. Quantity of ice used for storing fish at the landing centers was observed to be inadequate. Four samples of fresh fish from the *Carrangidae* family had high TVN value in the range 30-40mg%. As regards bacterial quality, 14 fresh fish samples exhibited TBC more than 1.0×10^5 . TBC of more than 1.0×10^6 was observed in three samples of fresh fish. Faecal organisms were detected in eleven samples. Pathogens like *Salmonella* and *V.cholerae* were absent in all the fresh fish samples.

Water at the landing centers, which is usually supplied by water tankers, is normally of poor quality. Twelve samples each of the water and ice used

at the landing centers were collected for analysis. Mud sedimentation was observed in four samples of water and extraneous contamination in three samples of ice. Likewise, higher TBC was observed in four samples of water and nine samples of ice. Faecal *Streptococci* was detected in six samples of ice.

Twelve samples of dry fish belonging to families *Acetes* and *Mullidae* were collected from the dry fish market at Turbhe and Sewree. Three samples of dry *Acetes* had high sand content (2.3%) and high TVN value (197-215mg%). *Dermestes* infestation was observed in two samples of dry mullets. Insect infestation, high sand and TVN values are indicative of poor and unhygienic drying practices. Pickle preparation from *Mullidae* spp. as per local taste and flavour are being tried.

Transfer of Technology Programmes

NATP - AGRICULTURAL TECHNOLOGY INFORMATION CENTRE (ATIC)

The Agricultural Technology Information Centre (ATIC), under the National Agricultural Technology Project (NATP) which was officially inaugurated by Shri T.K.Ramakrishnan, Hon'ble Minister for Fisheries and Culture, Govt. of Kerala, on 15 January 2001 provides on-the-spot display of the latest available technology for all groups of users – traditional as well as those in search of new technologies for new ventures.

The following are the publications brought out under ATIC during the year under report:

- CIFT Technology Advisory Series on:
 - 1) Technology of coating fish products
 - 2) Biochemical composition of fish and shellfish
 - 3) Frozen squid and cuttle fish
 - 4) Gill nets
- A leaflet on FRP canoe
- ATIC Newsletter
- Folder on ATIC
- Booklet on Value added products from low cost fish (in Malayalam)

Technology transfer programmes initiated at NEH

A programme for transfer of technology aimed at fisheries development of the NEH region was initiated in 2000. A preliminary survey of the region, covering three out of seven states, namely Assam, Arunachal Pradesh and Meghalaya, was carried out during the period 5-20 February 2001 by a team of two Scientists from Burla Centre, Dr M.M.Prasad and Dr Prem Kumar. A second team of six Scientists and a Technical Officer comprising Dr Krishna Srinath, Shri K.P.Antony, Shri M.Nasar and Shri M.V.Baiju from Headquarters and Dr M.M.Prasad and Shri Prem Kumar from Burla carried out a survey of the important fishing village reservoirs, rivers and lakes in these regions during the period 8-23 September 2001. The survey was aimed at identifying areas for transfer of technology and for taking up research projects. The team had detailed discussions with the Directors of Fisheries of the three states, held meetings with

fishermen and visited different sites identified by the concerned fisheries departments. Based on the survey, the following technological programmes were identified for implementation in the NEH region:



A woman selling dried fish at Meghalaya

- Development of suitable cages for cage-aquaculture of freshwater fishes in reservoirs and bheels
- Development of suitable fishing gears for harvest in reservoirs and bheels
- Development of suitable mechanical means for removal of weeds from bheels
- Development of suitable aquaculture engineering practices for bheels
- Development of techniques for processing of freshwater fishes
- Development of designs for hygienic handling of fishes in wet and dry markets
- Development of suitable techniques for fish waste utilization
- Imparting training in relevant aspects of fisheries

FRP canoes for backwater fishing - technology upgradation among small fishermen

Under a collaborative technology programme of the Institute and the Chellanam Village SC/ST Service Cooperative Society, the technology of fibreglass canoes was introduced among backwater fishermen belonging to SC/ST communities. The project costing Rs.3.66 lakhs is financed by the Ernakulam District Administration under the Special Central Assistance to Special Component Plan. The project aims at using fibreglass as an alternative to wood in the fabrication of fishing canoes. Fibreglass is more durable and has resistance to attack by borers. About 20 canoes are proposed to be fabricated under the programme as per the design developed by the Institute. The project will also help upgrading the technology used by fish-

ermen and provide employment to 20 families including 40 men and 20 women. While men go out for fishing, women can be engaged in post-harvest operations. The project is linked with the previous project on fish processing under the Society financed by the Ernakulam District Administration. The Society can buy fish for competitive prices from the fishermen operating the new canoes and directly market them after processing.

Six such canoes have been fabricated at the Institute workshop and handed over to the Society. The Society, in due course, proposes to establish a fibreglass canoe fabrication unit in the village.

The project is being implemented by the Extension, Information & Statistics and Engineering Divisions of the Institute.



Fishing operation from a FRP canoe

VILLAGE ADOPTION PROGRAMMES LAUNCHED

Survey of fishing villages in the neighbourhood of Cochin and Research Centres at Calicut, Visakhapatnam and Burla was carried out and the fishing villages of Azheekal, Kasaba, Peddajalaripettah and Kurumkhel selected for adoption. Situational analyses of the selected villages were conducted and needs identified. The technology transfer programmes that were planned in consultation with developmental agencies and the villagers were implemented and evaluated following extension education procedure.

The programme was officially launched at Azheekal, Cochin, on 9 June 2001 by Dr. M.A.

Kuttappan, Hon'ble Minister for SC/ST and Youth Affairs, Kerala. On the occasion, the Minister handed over fish handling utensils like plastic crates and baskets to the beneficiaries.

The programme for the upliftment of the fisherfolk of Peddajalaripettah village was launched by the Institute through its Visakhapatnam Centre on 18 October 2001. Dr. (Smt.) Pinninti Varalakshmi, MLA, Visakhapatnam-III was the Chief Guest. Smt. Y. Sunanda, Asst. Project Officer (Women) District Rural Development Agency, Visakhapatnam inaugurated the programme.



At the launching of the village adoption programme at Azheekal – Dr M.A. Kuttappan, Minister for SC/ST and Youth Affairs, who inaugurated the programme, hands over fish handling utensils to one of the beneficiaries



Launching of the village adoption programme at Peddajalaripettah village in Visakhapatnam

The village adoption programme, given below, is linked with the special component plan for SC/ST communities and women under the IX Five Year Plan.

Village adopted	Technology transferred	No. of persons covered
Cochin		
<i>Azheekal</i>	Maintenance of fishing craft, fabrication of square mesh cod end, hygiene and sanitation in fish handling, rack drying of fish, preparation of value added products, preparation of vermicompost, formation of self help groups	120
<i>Kandakadavu</i>		
<i>Chellanam</i>		
Calicut		
<i>Kasaba</i>	Rack drying of fish, improved method of fish curing	80
Visakhapatnam		
<i>Peddajalaripettah</i>	Rack drying of fish, preparation of value added products, hygiene and sanitation	120
Burla		
<i>Kurumkhel</i>	Benchmark survey carried out, technologies identified and proposal finalized	
Veraval	Survey of fishing villages for adoption	



Survey in connection with village adoption programme at Azheekal



Fabrication of square mesh cod end



Traditional method of smoking of fish at Kurumkhel

Fishing Cruise

Cruise No. & period	Participant(s)	Objective
Cruise No.191 8 – 25 January 2001	Shri M.P. Remesan Dr B. Madhusudana Rao Smt Sally Simon Smt Sherine Sonia Cubelio Smt Latha Unnikrishnan Kum Prafulla Puthra Shri P.S. Nobl	To conduct selectivity studies using 30 mm, 35 mm and 40 mm square mesh cod ends (under the project on Harvest technology and catch composition of deep sea fishery resources off Indian EEZ)
Cruise No.197 6 – 25 August 2001	Shri M.P. Remesan Dr G. Rajeswari Dr R. Raghu Prakash Shri Francis Xavier Shri P.A. John	

Training programmes conducted

Subject	No. of participants	Venue and date
General microbiology	1	Cochin 1-3 January 2001
Hygienic salt curing and drying and production of value added products from fish/prawn	30 fishermen and women	Anakapalli 3-4 January 2001
Preparation of fish pickle and drying of fish	40 participants representing 30 Self-Help groups	Adimalathurai and Vizhinjam 7 January 2001
Estimation of cadmium, phosphate and sulphite residues in seafoods	2	Cochin 8-12 January 2001
Estimation of pesticides using gas chromatography	1	Cochin 8-20 January 2001
Drying of fish and preparation of fish pickle	40 members of Fisheries Resource Management Society, Kerala	Vizhinjam 17 January 2001
Biochemical analysis of fish feed	2 scientists from CARI, A & N Islands, Port Blair	Cochin 18-25 January 2001
Analysis of water	2	Cochin 29 January - 9 February 2001
Post harvest technology of fish	80 fisherwomen of Rajayappet Village, Nakkapalli Mandal	Visakhapatnam 30-31 January 2001
Value added fishery products	4 candidates sponsored by Thuravoor Grama Panchayat, Chertalla	Cochin 5-7 February 2001
Seafood quality assurance	1	Cochin 23 February-9 March 2001
Post harvest technology of fish	60 fisherwomen of Nagamalleyapalem (Bheemunipatnam)	Visakhapatnam 28 February-1 March 2001
Post harvest technology of fish	60 fisherwomen of Thimmapuram and Mangamaripeta in Bheemunipatnam Mandal	Visakhapatnam 8-9 March 2001
Laboratory techniques for identification of bacteria in fish and fishery products	9	Cochin 19-31 March 2001

Subject	No. of participants	Venue and date
Post harvest technology of fish/prawn	30 fisherwomen	Balipatna Village, Orissa 15 April 2001
Analysis of packaged drinking water	1	Cochin 26-31 March 2001
Post harvest technology of fish/prawn	30 fisherwomen	Rehana Village in Jagatsinghpur Dt. 16 April 2001
Laboratory techniques for identification of bacteria in fish and fishery products	7 (sponsored by Assumption College, Changanacherry)	Cochin 16-28 April 2001
Laboratory techniques in food microbiology	2	Cochin 16 April-16 May 2001
Post harvest technology of fish/prawn	25 fisherwomen	G.P. Amepal Village in Kendrapara (Orissa) 17 April 2001
Quality assurance and bacteriology in fish and fishery products	30 (newly recruited fisheries officers in the Gujarat Fisheries Dept.)	Veraval 3 weeks in 3 batches
Preparation of diverse products from mussel meat	1	Calicut 24-26 April 2001
Laboratory techniques for identification of bacteria in fish and fishery products	10	Cochin 14-26 May 2001
Physical and chemical analysis of mineral water	1	Cochin 15-21 May 2001
General bacteriology	12	Visakhapatnam 15-30 May 2001
Analysis of mineral water and packaged drinking water	11 officials sponsored by Ministry of Health, Govt. of India	Cochin 21-25 May 2001
Laboratory techniques in general microbiology	1	Cochin 28 May-8 June 2001
Chemical analysis of water, feed and shrimp	3	Visakhapatnam 1-16 June 2001
Mineral water analysis	2	Cochin 5-6 June 2001
Bacteriological analysis of fish products	1	Cochin 5-16 June 2001
General bacteriology	12	Visakhapatnam 8-23 June 2001
Water analysis	3	Visakhapatnam 18-27 June 2001

Subject	No. of participants	Venue and date
Production of value added fish products	13 officials sponsored by MPEDA under Trainers' Training programme	Cochin 18-29 June 2001
Chemical analysis of mineral water	1	Cochin 2-7 July 2001
Production of fish pickle	1	Cochin 5-7 July 2001
Preparation of chitin/chitosan from prawn shell waste	3	Visakhapatnam 12-16 July 2001
MPN method for coliform bacteria and enumeration of total enterobacteriaeae in fish	2	Visakhapatnam 17-21 July 2001
Square mesh cod end fabrication	20 women (under Special Component Plan)	Chellanam, Cochin 25-27 July 2001
Analysis of packaged drinking water	1	Cochin 30 July-13 August 2001
Production of value added fish products	10 (sponsored by District Rural Development Agency, Kanyakumari)	Cochin 6-10 August 2001
Analysis of packaged drinking water	2	Cochin 6-13 August 2001
General bacteriology	8	Visakhapatnam 20 August-5 September 2001
Modern analytical equipment in biochemistry	6	Cochin 21-25 August 2001
HACCP concepts in seafood processing	1	Cochin 26-28 August and 3-5 September 2001
HACCP concepts	6	Cochin 27-30 August 2001
Analysis of packaged drinking water	1	Cochin 3-17 September 2001
Fabrication, operation and installation of CIFT-TED	200 fishermen	Frasergunj and Sankarpur West Bengal 6-10 September 2001
Fabrication, operation and installation of CIFT-TED	fishermen, net makers, boat owners and fishery officials	Visakhapatnam 12-14 September 2001
Scientific preparation of dried fish and re-processing commercial dry fish	25 rural women	Kasaba, Kasaragod 25-27 September 2001
Demonstration of drying/salting fish	Participants of seminar on Hygienic handling of fresh fish and drying/salting fish	Dhamra, Orissa 28 September 2001
Sanitation and hygiene in pre-processing centers	13 fishermen	Veraval 1-6 October 2001

Subject	No. of participants	Venue and date
Sanitation and hygiene in pre-processing centers	13 fishermen	Veraval 8-13 October 2001
Operation and maintenance of air-conditioning equipment/machinery	5	Cochin 1-20 October 2001
Microbiological techniques	9 fisheries officials	Veraval 15-17 October 2001
Design, fabrication and installation of CIFT-TED	2 officials (sponsored by Andhra Pradesh and Tamil Nadu State Fisheries Depts.)	Cochin 15-20 October 2001
Operation and maintenance of air-conditioning equipment/machinery	4	Cochin 23 October-12 November 2001
Testing methods for chemical and microbiological analysis of packaged drinking water as per IS 14543	2	Cochin 5-9 November 2001
Incidence of bacteria of public health significance in <i>Macrobrachium rosenbergii</i> and the effect of chlorination on them	1	Cochin 1 December 2001-1 February 2002
Hygiene and sanitation	Pre-processing and processing workers of 12 processing plants	Veraval
Isolation and identification of <i>Vibrio parahaemolyticus</i> and sulfite reducing clostridia	12	Veraval 3-7 December 2001
Seafood quality assurance	12	Cochin 3-14 December 2001
Advanced microbiological methods	3	Cochin 3 December 2001-2 January 2002
Post harvest fish handling and preservation techniques	14 fishermen	Veraval 10-15 December 2001
Analysis of pesticide residues and heavy metals	2	Cochin 10-22 December 2001
Fish processing and quality assurance	19 (M.F.Sc students from Dept. of Applied Aquaculture, Barkatullah University, Bhopal)	Veraval 10-24 December 2001
Post harvest fish handling and preservation techniques	14 fishermen	Veraval 17-22 December 2001
General bacteriology	2	Visakhapatnam 18 December 2001-3 January 2002
Seafood quality assurance	3	Visakhapatnam 18 December 2001-5 January 2002



Pesticide residue analysis



General bacteriology – at Visakhapatnam Centre



Laboratory techniques for identification of bacteria in fish and fishery products



Hygiene and sanitation in fish processing centres – at Calicut Centre



Production of value added fish products – at Kannur



Analysis of drinking water



Production of value added fish products



Microbiological techniques – at Veraval Centre



Fabrication of TED

Training scheme sponsored by the Dept. of Food Processing Industries, New Delhi

The Dept. of Food Processing Industries, New Delhi sponsored a scheme on 'Training of traditional fisher persons for skill upgradation in fish processing' at CIFT, Cochin and its Research Centers. The scheme has a budget of Rs.8.1 lakhs. Under this scheme, three training courses such as post-harvest fish handling and preservation techniques, hygiene and sanitation in fish processing centers and production of value added fish products are to be organized at four regional centers such as Cochin, Calicut, Veraval and Visakhapatnam. The scheme envisages the training for 400 trainees from five regional centers in 30 batches. During this year, about 250 candidates were trained at the four regional centers.

Training to foreign officials

Training in handling, processing and development of value added products from freshwater fish were imparted to two officials sponsored by Network of Aquaculture Centres in Asia Pacific (NACA), Bangkok, Thailand, from 14 – 26 May 2001.



NACA officials undergoing training in production of value added products from freshwater fish

National Training Programme

A six month National Training Programme on Fish handling, processing and quality assurance for SC/ST under the special component plan and women component as per IX Plan EFC was conducted from 23 April 2001. Twenty candidates attended the programme. The training programme was formally inaugurated on 8 May 2001 by Shri K. Jose Cyriac IAS, Chairman, MPEDA.



Demonstration of construction, installation and operation of TED at Sankarpur, West Bengal



National Training Course on fish handling, processing and quality assurance in progress



Demonstration of TED

CIFT scientists visited Orissa, during the month of February 2001, at the invitation of Directorate of Fisheries, Government of Orissa, for demonstration of fabrication and operation of CIFT-TED, a simple top exiting single grid hard TED (Turtle Excluder Device), developed by CIFT for the small mechanized trawler fleet, predominating in Indian waters. TEDs prevent incidental death of turtles by drowning, during trawling operations. Training programmes of CIFT-TED were conducted at three centers viz., Bhubaneswar, Paradeep and Dhamra, in Orissa, for the benefit of fishermen, net makers, entrepreneurs, conservationists and State fisheries officials. TED-installed trawling demonstrations off Agaranasi (Paradeep, Orissa) proved the efficiency of CIFT-TED in facilitating 100% escapement of Olive ridley turtles (*Lepidochelys olivacea*) which entered the trawl, with minimum catch loss. Overall catch loss was only 1.2% and that of shrimp 0.62%, thus allaying the fears of fishermen regarding large-scale catch losses during TED-equipped trawling operations.

Technologies assessed and transferred

- Designs of twelve different types of wooden fishing vessels in the size range of 7.6 m – 15.2 m.
- Designs of steel fishing vessels of size 15.5 m, 20 m and 24 m OAL
- Designs of aluminium craft for inshore waters and FRP pole and line fishing vessels for Lakshadweep
- Substitution of wooden boats by FRP canoes for use in backwaters and near-shore waters
- Dual preservative treatment for low valued species of timbers for boat construction and formulation of indigenous preservatives for traditional fishing craft
- Painting schedules for aluminium magnesium alloy and FRP sheathing for underwater hulls of fishing vessels
- Development of toxic wood plastic composites (TWPC)
- Antifouling and anticorrosive paints for protection of fishing craft
- Mercury free anodes for cathodic protection of fishing craft
- Protective coating for cast iron propeller
- Specifications for different types of synthetic materials for fabrication of different types of fishing gear
- Designs of different types of fishing gear such as trawls for demersal, pelagic and semi-pelagic applications, gill nets, purse seines and traps for exploitation of the different fishery resources
- Otter boards of different sizes and designs to suit demersal trawl fishing operations and variable depth fishing
- V-form steel otter boards for demersal trawls
- Combination wire rope for deep sea fishing
- By-catch reduction devices such as square mesh cod end and fish eye for reduction of by-catch, especially juveniles and young ones, in shrimp trawls
- Turtle excluder device (TED) for conservation of marine turtles
- Designs of dryers such as tunnel dryer, rotary fish meal dryer and electrical fish dryer for cottage scale operation
- Designs of deep fat fryer, cutlet moulding machine, inboard/outboard drive, electro thermal smoke kiln, mechanized processing table and mechanical fish cleaner for sprats
- Fuel efficient propeller for fishing vessels
- Other fuel saving devices such as propeller nozzle
- Biogas plant from water hyacinth
- Fishing accessories including trawl winch, power-take-off clutch and gurdy
- Refrigerated sea water plant of 150 kg capacity

- Design of shark liver oil/fish oil plant to handle 1000 kg raw material per day
- Specific requirements in setting up fish processing plants
- Electronic instruments for application in fishing technology, fish processing technology, aquaculture, marine environmental monitoring, agricultural investigations etc.
- Improved methods for freezing, freeze drying, canning, drying and curing different types of fish and shellfish
- Hygienic drying of anchoviella on raised platform
- Cleaning schedules for fish processing establishments and boat decks and preparation of deodorant and antiseptic ointment
- Method for economic utilization of low grade fish and conversion of fish wastes into useful by-products
- Methods for production of value added products such as wafers, pickles and soup powder from fish/shellfish
- Ready-to-use isinglass from fish maws
- Chlorine level indicator paper for instant reading of chlorine level in water used in fish processing plants
- Specifications for various types of seafood, process water and ice
- Procedure for implementation of HACCP
- Methods for extraction of chitin/chitosan from prawn shell waste and their application in textile and poultry industry and in the medical field
- Pilot plant for production of chitosan
- Method for extraction of shark fin rays and processing shark cartilage
- An 18 h depuration method to eradicate pathogenic bacteria and grit from bivalves, especially clams and mussels
- High gel strength agar from sea weeds
- Improved packaging materials for transportation and storage of fish
- Collagen chitosan film from fish skin, bone and air bladder for treatment of burns and as a barrier material in guided tissue regeneration (GTR) in dentistry
- Fine grade absorbable surgical sutures from fish gut
- Bacteriological culture media for 1) direct detection and enumeration of the potent spoiler bacterium *Alteromonas putrefaciens* and 2) estimation of total plate count of cured/semi preserved/salted fishery products by preventing swarming of *Bacillus* sp.
- Polymerase Chain Reaction (PCR) technique for detection of white spot disease syndrome in farmed shrimp
- Method for isolation of squalene from shark liver oil for use in cosmetics
- Method for preparation of n-3 polyunsaturated fatty acid concentrates from fish oils
- Device for drawing uniform samples from frozen fish blocks for microbiological evaluation

Outreach Programmes

Replies to queries

As in previous years, the Institute continued to reply to technical queries received from various quarters on topics related to almost all aspects of fishing, fish processing and allied fields including training. During the year, nearly 400 such queries were replied.

AIR-CIFT Farm and Home Series

As a part of the outreach programmes of the Institute, the All India Radio, Cochin, in collaboration with the Institute, broadcast a series of talks in Malayalam under their 'Farm and Home' series 'Matsyam oru amoolya sambath' as given below:

Topic	Presented by
Deep sea is not an irreplaceable source	Shri K.K. Kunjipalu
Hook and line fishing	Shri P. George Mathai
Responsible fishing	Dr B. Meenakumari
Conservation of fuel in fishing	Dr M.R. Boopendranath
Preservation of timbers for marine application	Dr Leela Edwin
Fuel efficient fishing vessels	Shri M. Nasar
Processing of low cost fish into value added products	Shri T.S. Unnikrishnan Nair
Value addition in fish products	Shri A.C. Joseph
Heat processing of fish	Shri K.K. Balachandran
Fish products	Dr K.G. Ramachandran Nair
Nutritional properties of fish proteins	Dr T.V. Sankar
Nutritional properties of fish oils	Dr P.G. Viswanathan Nair
Biochemical composition of fish	Smt Suseela Mathew
Effect of processing on the nutritional quality of fish	Smt Suseela Mathew
Fishery industry and environmental pollution	Dr P.G. Viswanathan Nair
Disease free shrimp farming	Dr P.K. Surendran
Cleanliness in fish marketing	Shri V. Narayanan Nambiar
PCR technique for detection of white spot syndrome disease	Dr Toms C. Joseph
Botulism intoxication in fishery products	Dr K.V. Lalitha
Masmin	Shri P.R. Nair
Surimi from low cost fish	Shri V. Muraleedharan
Hygiene in fish processing plants	Shri P.R. Girija Varma
Growth and development of the fishery industry	Dr G.R. Unnithan
Economic aspects of fishing	Shri V. Annamalai
Extension activities in the field of fisheries	Dr Krishna Srinath

In addition to the above, the following radio talks were also broadcast.

Hygienic preparation of quality dried fish – useful hints (<i>in Telugu</i>)	Dr D. Imam Khasim
Traditional fishing gears – improved methods (<i>in Telugu</i>)	Dr G. Rajeswari
Fish aggregating devices – conservation	Dr G. Rajeswari

Exhibitions

The Institute actively participated in the following exhibitions during the period:

- Exhibition in connection with Indian Science Congress at Visakhapatnam (Theme : Food, nutrition and environmental security), 3-7 January 2001
- TECHNOQUEST - 2001 conducted by Dept. of Instrumentation, CUSAT, 1-3 February 2001
- India – International Seafood Show at Visakhapatnam, 9-11 February 2001



Shri Venkaiah Naidu, Hon'ble Union Minister of Rural Development, at the India — International Seafood Show at Visakhapatnam

- Exhibition in connection with National Science Week at Munambam, March 2001
- Swadeshi Mela organised by CBMD (Centre for Bharathiya Marketing Development) at International Stadium, Cochin, 16-22 May 2001



Swadeshi Mela at Cochin

- AGRI INTEX 2001 - Second Agricultural International Exhibition organised by Tamil Nadu Agricultural University and CODISSIA (Coimbatore District Small Industry Association),

at Coimbatore. Fair inaugurated by Hon'ble Minister Thiru R. Jeevanandham, Minister for Agriculture, 1-7 August 2001



AGRI-INTEX 2001 – at Coimbatore

- Shrimp 2001 organised by INFOFISH and FAO – Globefish, along with MPEDA and SEAI – at Chennai, in connection with Fourth World Conference on the Shrimp Industry, Trade and Buyer – Seller Meet, 27-29 September 2001
- Exhibition in connection with International Symposium on Fish for nutritional security in the 21st century, organised by CIFE at Mumbai, 4-6 December 2001



Exhibition in connection with International Symposium on 'Fish for nutritional security in the 21st century' at Mumbai – Prof. M.G.K. Menon, former Scientific Advisor to Govt. of India and Dr. K. Gopakumar, DDG (Fy.) proceed towards CIFT stall

- Exhibition held in connection with XVIIIth ICAR Regional Committee meeting (Region No.8) at CTCRI, Trivandrum, 14-15 December 2001
- Stall set up in connection with Workshop on Deep sea fishery and fishery resources of Maharashtra coast, organised by Mumbai Base of FSI at Ratnagiri

Analytical services

The Institute undertook testing of different types of raw materials and products received from organizations, individuals and entrepreneurs and issued reports on their quality. These included samples of fresh and frozen fish products, water, ice, by-products, chemicals, swabs, IQF products, packaging materials and marine

engines. A number of food products were also tested for their bacteriological quality. Calibration of more than fifty thermometers of various ranges was undertaken. A total of 3306 such samples were tested/reports issued during the period from the Institute's headquarters at Cochin and its Research Centres.

Academic programmes

Officer-in-charge, PGP
Scientist associated
Associated Admn. staff

: Dr Jose Joseph
: Dr T.V. Sankar
: Shri R.D. Goswami

The second batch (1999-2001) of students, listed below, carried out their post graduate studies leading to M.F.Sc. in Post Harvest Technology at the institute. This P.G. course, under the Deemed University of CIFE, Mumbai, started functioning at CIFT during September 1998. Like the previous batch, this year's students also came out with flying colours.

Name of Students

1. Shri Jyotiranjana Nayak
2. Shri Sathyanand Kumaran
3. Kum Rajalekshmi Mukkalil
4. Shri Rajesh
5. Kum K. Rekha Devi
6. Kum Nadia Mahmud Omar

The students undertook their dissertation work under various Divisions of CIFT on the following topics:

- Lipase activity in different tissues of lean and fatty fishes
- Studies on the effect of various disinfectants on the bacteria associated with fish and fish products
- Studies on the effect of vacuum packaging on shelf life of chilled fish
- Application of chitosan as an additive in glaze in the frozen storage of fish
- Incidence of indicator and pathogenic organisms in seafoods for export and sources of contamination

- Correlation between volatile bases and indole during spoilage

The third batch (2000-2002) of M.F.Sc. students as shown below joined the Institute on 1 March 2001 for their 2nd semester studies.

1. Shri Boban Gopinathan
2. Shri Ramraman Patra
3. Shri Shine Kumar C. S.
4. Kum Sini T. K.
5. Kum Teresa Neelima Giles

A Ph.D. programme in Post Harvest Technology was started at the Institute in September 2001. Seven students are presently accommodated in the programme.



Dr Jose Joseph, co-ordinator of the programme addresses the Ph.D students

Award/Degree/Recognition

☞ CIFT was the proud recipient of the **Sardar Patel Outstanding ICAR Institute Award for the year 2000**. Dr K.Devadasan, Director received the award from Shri Nitish Kumar, Hon'ble Union Minister for Agriculture, at a function held at Vigyan Bhavan, New Delhi on 16 July, 2001.

☞ The Institute also bagged the **Rajarshi Tandon Rajbhasha Puraskar, 2000-2001** for best implementation of Official Language among ICAR Institutes for the year. Dr K. Devadasan, Director, CIFT, received the award from Dr Ramesh Chandra Tomar, Member of Parliament at a function held in the Conference Hall of ICAR on 6 November, 2001.



Dr K. Devadasan, Director, receiving the Rajarshi Tandon Award from Dr Ramesh Chandra Tomar, M.P. Dr Jessy Joseph, Asst. Director (O.L.) looks on

☞ Dr Krishna Srinath, Head, Extension, Information and Statistics Division, who was selected for the **National Award for Women's Development through Application of Science and**

Technology for the year 2000, received the award from Shri Murli Manohar Joshi, Union Minister of Science and Technology, Human Resource Development and Ocean Development, at a function held at Vigyan Bhavan, New Delhi on 8 March 2001.

☞ Dr Leela Edwin (Sr. Scientist), was awarded the **Jawaharlal Nehru Award for Post Graduate Agricultural Research-2000**. She received the award from Shri Nitish Kumar, Hon'ble Union Minister for Agriculture at a function held at Vigyan Bhavan, New Delhi on 16 July, 2001.

☞ Dr B. Madhusudana Rao, Scientist, was awarded the **Dr S. Vancheeswara Iyer Memorial Award** by The Indian Veterinary Association for his article entitled 'An indirect IgM – Elisa for diagnosis of sheep pox virus infection' published in December 1999 (vol. 76 (12):1050) issue of Indian Veterinary Journal.

☞ Dr M.R. Boopendranath, Principal Scientist, was awarded **Ph.D. for his thesis entitled 'Studies on energy requirement and conservation in selected fish harvesting system'** from Cochin University of Science and Technology. He carried out his studies under the guidance of Dr M. Shahul Hameed, Prof. (Retd.), School of Industrial Fisheries, CUSAT.

☞ Dr M.K. Mukundan, Head, Quality Assurance and Management Division, who underwent training as Assessor at the Indian Institute of Quality Management, Jaipur, from 19 – 25 May 2001, got the approval as **National Accreditation Board for Laboratories (NABL) Assessor**.

Interaction and linkages

Local Institutions in the area (Other than ICAR Institutes)

- Marine Products Export Development Authority
- Export Inspection Agency
- Naval, Physical and Oceanographic Laboratory
- Fishery Survey of India
- National Institute of Oceanography
- Central Institute of Fisheries, Nautical Engineering and Training
- Matsyafed
- Integrated Fisheries Project
- Kerala State Pollution Control Board

National Institutes & Agricultural Universities

- Agricultural Universities
- Ministry of Agriculture
- Ministry of Food Processing Industries
- Dept. of Ocean Development
- Dept. of Biotechnology
- Dept. of Science and Technology
- Dept. of Electronics
- Indian Institute of Technology, Chennai/ Kharagpur
- State Fisheries Departments
- Union Territory of Lakshadweep
- Kerala Water Authority
- ICAR Institutes
- Science and Technology Entrepreneurship Development Project (STED)
- Bureau of Indian Standards
- Industries Department, Andaman & Nicobar Admn

International Institutions

- Natural Resources Institute (NRI), U.K
- Food and Agriculture Organization (FAO), Rome
- Bay of Bengal Programme (BOBP)
- Asia Pacific Fisheries Commission (APFIC)
- University of Bristol (U.K)
- INFOFISH

Extension & Development Agencies

- Central Social Welfare Board
- Kannur Dist. SC/ST Women Industrial Fish Products Mfg. Co-op. Society Ltd.
- South Indian Federation of Fishermen Societies, Trivandrum (SIFFS)
- Amala Mahila Samajam, Puthuvypu, Cochin
- AFPRD, Hyderabad
- Kanyakumari Dist. Fishermen Sangam's Federation
- Madonna Rural Development Society, Kumarakom
- Centre for Research and Training in Poverty Alleviation and Women Welfare (CRATPAW)
- Centre for Management Development, Trivandrum
- Bharat Sevak Samaj, Trivandrum
- Small Industries Development Bank of India (SIDBI)
- Matsya Mahila Vedi, Chellanam
- Alleppey Diocesan Charitable and Social Welfare Society, Alleppey
- Vanitha Matsya Thozhilali Bank, Neendakara
- Kerala Industrial and Technical Consultancy Organisation (KITCO)
- Avani Agro Society, N.Paravur, Ernakulam
- Common Facility Service Centre, Changanacherry
- Kerala State Women's Development Corpn. Ltd., Trivandrum
- Chellanam Panchayat SC/ST Co-op. Society
- Fishermen Youth Welfare Association, Gangavaram P.O
- Development Action through Self Help Network (DARSHN)

On-going Research Projects

Institute projects

1. Development of gear, accessories and instrumentation for responsible and resource specific variable depth trawling.
2. Performance evaluation of suitable selective devices for elimination of fish by-catch (BRD) and turtles (TED) in shrimp trawling.
3. Studies on traditional fishing gear and methods
4. Studies on material protection and marine pollution
5. Development of fishing gears and techniques for harvesting reservoir fishery resources
6. Development of value added, culinary, fortified and functional fish products, their processing and storage
7. Development of diversified fishery by-products and their applications
8. Environmental friendly feed for ornamental fishes (egg layers, live bearers and nest builders) utilising fishery waste
9. Development of suitable packaging materials for value added and ready-to-serve fish and fishery products
10. Biochemical, nutritional and functional properties of fish constituents
11. Nutrients, toxicants, pollutants and growth promoters in aquaculture system and processed marine products
12. Development of improved methods for quality and safety of fish and fishery products
13. Investigations on prevalence of microbial hazards in fish and fishery environments and development of methods for their control
14. Development of fish processing equipment, deep sea fishing vessels and control and monitoring equipment for Indian fisheries
15. Studies on human resource development and economic evaluation in fisheries
16. Development of statistical models for evaluating the economic viability of mechanized fishing trawlers
17. Innovations in product development, preservation, process and quality control of traditional fishery products
18. Studies on the effect of experimental installation of FAD for fishery resource enhancement in and around Visakhapatnam Coast
19. Investigations on post harvest handling and processing of fish and shellfish of Andhra Pradesh
20. Studies on pollution of the fish and fish curing environments of Orissa

ICAR Ad-hoc Projects

21. Development of technology for processing fish and fish products in aluminium cans and flexible pouches
22. Pilot plant studies on absorbable surgical sutures from fish gut collagen
23. Studies on incidence of toxic principles and parasites in seafoods
24. Occurrence, effect of processing and survival of halophilic pathogenic Vibrios in fishery products of the export trade
25. Selective bio-accumulation of toxicants in cephalopods (viz. squid and cuttlefish) and changes in quality, its upgradation and safety of processed products

NATP

26. Development of value added products from low cost fish and processing wastes from fish and shellfish
27. Development and popularisation of modern technologies for production of convenience foods from fish
28. Nutrition and pathology in mariculture (*Lead Centre - CMFRI*)
29. Mechanisation and production of pearl nucleus (*sub-project under NATP on Breeding and culture of pearl oysters and production of pearls - Lead Centre, CMFRI*)
30. Assessment of harvest and post harvest losses – marine fisheries
31. Assessment of harvest and post harvest losses – inland fisheries
32. Agricultural Technology Information Centre

Collaborative

33. Validation of IRS P4 OCM data with demersal fisheries (*CIFT-SAC, Ahmedabad*)

Externally funded projects / programmes

34. Harvest technology and catch composition of deep-sea fishery resources in the Indian EEZ (*DOD funded*)
35. In-service training programmes in molecular biology for Fisheries Scientists (*DBT sponsored*)
36. Survey on microbiological surveillance of various food articles (*GOI, Ministry of Health sponsored programme*)
37. Survey of mineral water and packaged drinking water (*GOI, Ministry of Health sponsored programme*)
38. Proficiency testing of heavy metals in fish (*NABL (DST) sponsored programme*)

Technical guidance / consultancy

Technical guidance and consultancy were offered to interested entrepreneurs on various topics

related to harvest and post harvest technology of fish and associated aspects as given below:-

Consultancy offered	Beneficiary
<ul style="list-style-type: none"> ■ Design of effluent treatment plant 	M/s Abad Fisheries, Cochin
Technical Guidance	Beneficiary
<ul style="list-style-type: none"> ■ Standardised process for packing sugarcane juice in retortable pouch 	CFTRI, Mysore
<ul style="list-style-type: none"> ■ Processing crab, shrimp and mushroom in 6 oz tin free steel (TFS) cans 	M/s D.N.I. International Inc., Bangalore
<ul style="list-style-type: none"> ■ Production of fish pappad 	M/s Indotech Services, Howrah
<ul style="list-style-type: none"> ■ Identification of blowflies on cured fish 	M/s Integrated Coastal Management, Kakinada

The scientists and technical officers of the Institute were also called upon on several occa-

sions to deliver guest lectures at Universities, educational institutions and training institutes.



Consultancy on effluent treatment plant

Committees

Grievance cell

The Grievance Cell, constituted in March 1998, functioned with the following members during the year under report.

Chairman — Director, CIFT

Members

1. Dr P.K. Surendran,
Head, Division of Microbiology, Fermentation and Biotechnology
2. Sr. Administrative Officer
3. Asst. Finance & Accounts Officer
4. Shri G. Ratnakaran Nair,
T-4 (Technical)
5. Shri C. Ravindran Nair,
Assistant (Administrative)
6. Shri T.A. Gopalakrishnan,
Bearer (Auxiliary)
7. Shri P.A. Thomas,
SSG IV (Supporting)

Nominated Member Secretary

Shri R.S. Shanmughan,
Asst. Admn. Officer

Management Committee

Chairman — Director, CIFT, Cochin

Members

1. Director of Fisheries,
Govt. of Kerala,
Vikas Bhavan, IVth Floor,
Trivandrum-695003.
2. Director Fisheries,
Govt. of Karnataka,
Mahaveer Complex, K.G. Road,
Bangalore-9, Karnataka
3. The Dean,
Faculty of Fisheries,
Kerala Agricultural University,
College of Fisheries, Panangad P.O.,
Cochin-682506.

4. Dr A.D. Diwan,
Asst. Director General (MFy), ICAR,
Krishi Bhavan, New Delhi.
5. Shri Ran Vijay Bahadur Singh,
Advocate, Civil Court,
Distt. Remur, Bhabhua, Bihar.
6. Shri Sunil Kumar Choudhry,
Narayani Bhavan,
Anugrah Narayan Road,
Murarpur, (Gaya), Pin-893 001.
7. Sr. Finance and Accounts Officer,
Central Marine Fisheries Research Institute,
Cochin-682014.
8. Dr P.K. Surendran,
Head, Division of Microbiology,
Fermentation and Biotechnology,
CIFT, Cochin.
9. Dr Imam Khasim Saheb,
Sr. Scientist, Visakhapatnam Research
Centre of CIFT,
Visakhapatnam-530 003, Andhra Pradesh.
10. Shri M. Nasar,
Sr. Scientist, CIFT, Cochin.

Member Secretary

Sr. Administrative Officer,
CIFT, Cochin.

The Committee was reconstituted on 21-12-2001 with the following members:

Chairman — Director, CIFT, Cochin

Members

1. Director of Fisheries,
Govt. of Kerala,
Vikas Bhavan, IVth Floor,
Trivandrum-695003
2. Director of Fisheries,
Govt. of Karnataka,
Mahaveer Complex, K.G. Road,
Bangalore-9, Karnataka
3. Dr D.D. Nambudiri,
Dean, Faculty of Fisheries,

Kerala Agricultural University,
College of Fisheries, Panangad P.O.,
Cochin-682506.

4. Dr A.D. Diwan,
Asst. Director General (Mfy),
ICAR, Krishi Bhavan,
New Delhi
5. Shri Sunil Kumar Choudhry,
Narayani Bhavan,
Anugrah Narayan Road,
Murarpur, (Gaya) Pin-893001
6. Shri A.V. Joseph,
Sr. Finance and Accounts Officer,
Central Marine Fisheries Research Institute,
Cochin-682014.
7. Dr M.K. Mukundan,
Head, Division of Quality Assurance and
Management, CIFT, Cochin
8. Dr K.G. Ramachandran Nair,
Head, Division of Fish Processing,
CIFT, Cochin
9. Dr B. Meenakumari,
Head, Division of Fishing Technology,
CIFT, Cochin
10. Dr P.G. Viswanathan Nair,
Head, Division of Biochemistry & Nutrition
CIFT, Cochin

Member Secretary

Sr. Administrative Officer,
CIFT, Cochin

Institute Joint Staff Council

The IJSC functioned with the following members:

Chairman

Dr K. Devadasan,
Director, CIFT, Cochin

Members (Official side)

1. Dr M.K. Mukundan,
Head, Division of Quality Assurance and
Management
2. Dr B. Meenakumari,
Head, Division of Fishing Technology

3. Shri A.G. Radhakrishnan,
Pr. Scientist
4. Sr. Administrative officer
5. Shri P.A. Uthup,
Asst. Finance & Accounts Officer

Secretary (Official side)

Shri T.S. Unnikrishnan Nair,
Pr. Scientist

Members (Staff side)

1. Shri V.V. Ramakrishna, Technical Officer, T-5
2. Shri T. Gopalakrishnan, T-II-3
3. Shri T.M. Ramaraj, Assistant
4. Shri V.S. Ambasuthan, Sr. Clerk
5. Shri P.A. Thomas, SSG IV
6. Smt C.G. Radhamoney, SSG II

Secretary (Staff side)

Shri M.K. Kuttikrishnan Nair,
Technical Officer, T-5

Project Advisory Committee

The Project Advisory Committee with the following as members met twice during the period and reviewed the progress of the work under the various research projects.

Chairman

Dr M.K. Mukundan
Head, Division of Quality Assurance and
Management

Members

1. Dr P.G. Viswanathan Nair,
Head, Division of Biochemistry
& Nutrition
2. Dr P.K. Surendran,
Head, Division of Microbiology, Fermentation
& Biotechnology
3. Dr B. Meenakumari,
Head, Division of Fishing Technology
4. Shri T.S. Unnikrishnan Nair
Head-in-Charge, Division of Fish Processing

Member Secretary

Dr Krishna Srinath,
Head, Division of Extension, Information &
Statistics

Research Advisory Committee

The Research Advisory Committee of CIFT functioned with the following as members:

Chairperson

Dr (Mrs) Rugmini Sankaran
89-B, Gokulam, 2nd Stage,
Near J. K. Nursing Home,
12th Cross, V. N. Mohulla,
Mysore-570 002.

Members

1. Dr N. C. Ganguli,
Secretary,
National Academy of Agricultural Sciences,
New Delhi
2. Dr K. R. Prasad
President
Confederation of Indian Aquaculture
Industry Welfare Organisation,
Visakhapatnam
3. Prof. P. S. Rao,
7 Steps, Block No. 279, J. P. N Nagar,
Miyapur, Hyderabad - 500 050
4. Shri M. Swaminathan,
20/583, Varshi, Dilkush Lane,
Thrissur - 680 004.
5. Shri K. M. Iyer,
Retd. Principal Scientist, CIFT
Sreekrishna, 13th Cross Road, Girinagar,
Cochin - 20
6. Dr R. A. Selvakumar,
Asst. Director General M.Fy),
ICAR Representative
7. Dr K. Ravindran,
Then Director, CIFT

Member Secretary

Dr K. Devadasan, Then Head,
Division of Biochemistry and Nutrition, CIFT



The Committee which met on 16-3-2001 was re-constituted on 21 September 2001 with the following as members:

Chairman

Prof. N. Balakrishnan Nair
Retd. Chairman
Dept. of Science & Technology
(Govt. of Kerala), Trivandrum

Members

1. Dr Bongirwar
Head, Dept. of Food Technology
BARC, Mumbai
2. Shri P.V. Prabhu
Retd. Pr. Scientist
CIFT, Cochin
3. Dr R.K. Baisya
Professor
Dept. of Management Studies
IIT, Hauz Khaz
New Delhi
4. Shri Y. Sreekrishna
Retd. Pr. Scientist, CIFT
P.101 Vijay Park
Near Jangid Complex
Meera Road (East)
Thane Dist. 401 102

Member Secretary

Dr P.K. Surendran
Head, Division of Microbiology,
Fermentation and Biotechnology

All Heads of Divisions attended the meeting as special invitees.

The Research Advisory Committee meeting in progress

Participation in training programmes

Trainings attended	Venue and date	Name(s) of participant(s)
Within the country		
Designing and developing web pages for Agricultural Technology Information Centres (ATICs)	NAARM, Hyderabad 17-19 January 2001	Shri V. Radhakrishnan Nair
Recent advances in the analysis of survey data (sponsored by Centre for Advanced Studies, Agricultural Statistics and Computer Applications)	New Delhi 6-26 February 2001	Shri V. Radhakrishnan Nair
International Training Course on Remote sensing of ocean colour: Techniques and applications (sponsored by ISRO, IOCGG and POGO)	Space Application Centre, Ahmedabad 12-23 February 2001	Shri U. Sreedhar
Summer School on Recent advances in agricultural research project management	NAARM, Hyderabad 18 April – 18 May 2001	Kum K.K. Asha
Summer School on Advances in fish and crustacean nutrition and aquafeed biotechnology	CMFRI, Cochin 6-26 June 2001	Dr T.K. Thankappan Dr R. Anandan
Recent trends in transfer of agricultural technology (conducted by Directorate of Extension Education, Tamil Nadu Agrl.University)	Coimbatore 14-23 May 2001	Shri J. Charles Jeeva
Summer Short Course on Participatory planning and appraisal (organized by Dept. of Agrl. Extension, Chandrasekhar Azad University of Agriculture & Technology, Kanpur)	Kanpur 19-28 June 2001	Dr Braj Mohan
Training conducted by MPEDA for fish processing factory workers	Mumbai	Shri S.P. Damle (as faculty)
Intellectual property rights (IPR) (organized by ICAR)	DRR/DOR, Hyderabad 10-12 July 2001	Dr T.V. Sankar
Refresher training course on O& M reforms in administrative and financial management	NAARM, Hyderabad 23-31 July 2001	Shri P.A. Uthup Shri V.N. Rajasekharan Nair
Training programme for Ministerial Staff Unit, Commissionerate of Income-tax	Cochin 3 August 2001	Dr Krishna Srinath(as faculty)
Summer School on Environment impact assessment and management of coastal zone – An integrated approach	CIFE, Mumbai 7-27 August 2001	Smt Saly N. Thomas

Trainings attended	Venue and date	Name(s) of participant(s)
Assessors' course, IIQM (organized by NABL, Dept. of Science & Technology, New Delhi)	Jaipur 20-24 August 2001	Dr M.K. Mukundan
Waste minimisation circle facilitator training programme (conducted by National Productivity Council under sponsorship from Ministry of Environment and Forests)	New Delhi 3-7 September 2001	Shri M. Nasar Dr K. Ashok Kumar
Paints for corrosion protection	CECRI, Karaikudi 3-8 September 2001	Shri P.T. Sebastian
Winter School on Geographic Information System (GIS) for land resource data management	Bangalore 3-23 October 2001	Dr G. Rajeswari
Summer Institute on Participatory extension methods and approaches	New Delhi 20 November–10 December 2001	Dr Braj Mohan

Abroad

Dr M.M. Prasad, Sr. Scientist and Smt Suseela Mathew, Scientist (Sr. Scale), were deputed for training in 'Fish processing and quality and safety of fishery products' at the Institute of Fish Processing Technology, College of Fisheries & Ocean Science, University of Philippines in the Visayas, Miagao, Philippines (FAO sponsored ICAR – AHRD Fellowship) for a period of three months from 5 April – 26 June 2001. While there, they also visited the following organisations:

- South East Asian Fishery Development Center (SEAFDEC)
- Bureau of Fisheries and Aquatic Resources (BFAR)
- Food Development Center (FDC)
- Food and Nutrition Research Institute (FNRI)

- International Center for Living and Aquatic Resources Management (ICLARM)
- Philippines Fisheries Development Authority (PFDA)
- International Rice Research Institute (IRRI)



Smt Suseela Mathew and Dr M.M. Prasad (third and sixth from left) at the Philippines Fisheries Devt. Authority (PFDA)

Participation in Workshops/Seminars/Symposia etc.

Name of seminar/workshop/ symposium etc.	Venue and date	Name(s) of participant(s)
National Symposium on Fishery technologies and their commercialization	CIFE, Mumbai 11 – 12 January 2001	Dr M.K. Mukundan Dr Krishna Srinath Dr P.T. Lakshmanan Dr T.K. Srinivasa Gopal Shri K.K. Kunjipalu Dr Braj Mohan
Seminar of NATP project on Breeding and culture of pearl oysters and production of pearls	CMFRI, Tuticorin 12 January 2001	Shri P.N. Joshi
Workshop on Use of farm made aquafeeds for sustainable development of freshwater prawn farming	CUSAT, Cochin 15 January 2001	Dr P.K. Surendran Dr P.T. Mathew
Workshop on Monsoon rainfall potential and its judicious utilization	CUSAT, Cochin 16-17 January 2001	Shri K. Ramakrishnan Shri V. Muraleedharan
National Workshop on Aquaculture medicine (organised by School of Environmental Studies, CUSAT)	Cochin 18-20 January 2001	Dr P.K. Surendran Dr K.V. Lalitha Dr Toms C. Joseph Dr B. Madhusudana Rao
Awareness Workshop on Biotechnology based programmes for women and rural development (organised by Society for Promotion of Integrated Coastal Areas Management (SPICAM))	Kakinada 29-30 January 2001	Dr G. Rajeswari
Workshop on Code of conduct of responsible fisheries with special reference to Kerala (organised by Dept. of Fisheries, Kerala)	Cochin 30 January 2001	Dr M.R. Boopendranath
Open-House in connection with TECHNOQUEST 2001 (conducted by Dept. of Instrumentation, CUSAT)	Cochin 1-3 February 2001	Smt K. Vijayabharathi
International Conference on Advanced technologies in fisheries and marine sciences (organised by Marine Biotechnology Laboratory, ICAS, M.S. University, Nagercoil)	Thuckalai, Nagercoil Dt. 2-4 February 2001	Dr Toms C. Joseph Shri K. Ramakrishnan
Seminar on Packaging (organised by Kerala Corrugated Box Manufacturers' Association, Cochin)	Cochin 10 February 2001	Dr T.K. Srinivasa Gopal (as resource person)
Mid-term appraisal Workshop on DOD-MLR Project on Benthic productivity	Visakhapatnam 15-16 February 2001	Dr R. Raghu Prakash

Name of seminar/workshop/ symposium etc.	Venue and date	Name(s) of participant(s)
Workshop on Procurement of equipment for NATP	SBI, Coimbatore 15-16 February 2001	Shri T.S. Unnikrishnan Nair Shri P.A. Uthup Shri R. Anil Kumar
Seminar to educate entrepreneurs (organised by Kerala Infrastructure Devt. Authority in association with UNIDO and Confederation of Indian Industry)	Cochin 20 February 2001	Dr T.K. Srinivasa Gopal Shri A.C. Joseph
Workshop on Polymerase chain reaction based methods for diagnosis (conducted by Dept. of Animal Biotechnology, Madras Veterinary College, Chennai)	21 February – 7 March 2001 Chennai	Dr Toms C. Josedph
Symposium in Official Language (conducted by Small Scale Industries Service Institute, Trichur and Cochin Town Official Language Implementation Committee)	Cochin 23 February 2001	Dr Jessy Joseph Shri P. Shankar
Workshop of Non-Hindi speaking and neo-Hindi writers (jointly organised by Visakha Hindi Parishad and Central Hindi Directorate, Ministry of HRD, New Delhi)	Visakhapatnam 28 February – 4 March 2001	Shri Santhosh Alex
National Workshop on GOI-UNDP sea turtle project	Bhubaneswar 9-10 April 2001	Shri Percy Dawson
Workshop on Utilization of OCM payload on IRS P4 (organised by Space Application Centre, Ahmedabad)	Ahmedabad 29 April 2001	Dr B. Meenakumari Shri U. Sreedhar
Workshop on Application of remote sensing and GIS (organised by CED, Cochin)	Cochin 10 May 2001	Shri M.P. Remesan
Launching/interactive workshop on NATP project – Assessment of harvest and post harvest losses	IARI, New Delhi 11 May 2001	Dr Krishna Srinath Dr G.R. Unnithan
Seminar on Recent developments in optical technologies on ICP-AES and AAS (organised by M/s. Lab India Instruments, Trivandrum)	Trivandrum 21 June 2001	Shri P. Muhamed Ashraf
Workshop on Globalisation and seafood legislation – their effect on poverty in India	Visakhapatnam 21-22 June 2001	Shri Sib Sankar Gupta Dr D. Imam Khasim
National Seminar on Marine coatings (organised by Southern Naval Command, Cochin)	Cochin 5-6 July 2001	Dr B. Meenakumari Shri P. Muhamed Ashraf

Name of seminar/workshop/ symposium etc.	Venue and date	Name(s) of participant(s)
International Workshop on Aquaculture and environment (organised by CUSAT and IMCOZ in association with Technical University of Dept. of Agril. University, Wageningen, Netherlands)	Cochin 13-14 July 2001	Dr B. Meenakumari Dr M.R. Boopendranath Dr P.K. Surendran
National Workshop on Fisheries in India (in connection with Conference of National Association of Fishermen)	Cochin 21-22 July 2001	Dr M.K. Mukundan
Seminar on 20 th Century literary principles (organised by Bharatiya Sahitya Pratishthan)	Cochin 28 July 2001	Dr Jessy Joseph
Workshop on Turtle excluder device (organised by SIFT, Dept. of Fisheries, Andhra Pradesh)	Kakinada 26-27 August 2001	Shri K.V.S.S.K. Harnath
Sensitization Workshop	Bangalore 30-31 July 2001	Dr K.G. Ramachandran Nair
Workshop on Global ballast water management (organised by Dredging Corporation of India)	Visakhapatnam 30 August 2001	Shri Sib Sankar Gupta Dr G. Rajeswari
One day Seminar on Chromatography Forum 2001	Cochin 7 September 2001	Dr T.V. Sankar
Popularization of TED (organised by MPEDA and CIFT)	Visakhapatnam 12-14 September 2001	Dr G. Rajeswari
Workshop on Development of marine fishery along West Bengal coast (sponsored by FSI and Dept. of Fisheries, Govt. of West Bengal)	Diamond Harbour and Digha 12-14 September 2001	Shri Sib Sankar Gupta
Workshop on Implications of WTO on fisheries sector (organised by Dept. of Fisheries, Govt. of Andhra Pradesh)	Visakhapatnam 13 September 2001	Dr G. Rajeswari Dr R. Raghu Prakash
First Workshop of NATP on Harvest and post-harvest losses	New Delhi 13-15 September 2001	Dr G.R. Unnithan Shri V. Radhakrishnan Nair Dr D. Imam Khasim Shri J. Charles Jeeva
Seminar at Trainers' Training Centre, Emchi, Papam Pare Dist.	Arunachal Pradesh 14 September 2001	Dr M.M. Prasad
National Seminar on Marine and coastal ecosystems: Coral and mangrove – Problems and management strategies (organised by SDMRI, Tuticorin)	Tuticorin 26-27 September 2001	Dr B. Meenakumari
Shrimp 2001 – Fourth World Conference	Chennai 27-29 September 2001	Dr K. Devadasan

Name of seminar/workshop/ symposium etc.	Venue and date	Name(s) of participant(s)
Seminar on Fish processing industry and hygienic production of dry fish (organised by Orissa Assembly of Small and Medium Enterprises)	Dhamra, Orissa 28-29 September 2001	Dr M.M. Prasad Shri J.K. Bandhyopadhyay Shri Prem Kumar
Seminar on Samakaleen Hindi Upanyas (organised by Bharatiya Sahitya Pratishthan)	Cochin 29 September 2001	Dr Jessy Joseph
Intellectual property rights in biotechnology	Hyderabad 10-11 October 2001	Dr Toms C. Joseph
Seminar on Use of Hindi in ICAR fishery research institutes	CMFRI, Cochin 12 October 2001	Dr Jessy Joseph
Conference on Maritime 2001 (organised by International Maritime Organisation)	Mumbai 11-13 October 2001	Shri V. Vijayan
NABL (National Accreditation Board for Laboratories) sponsored Workshop on Proficiency testing programme	Kolkata	Dr M.K. Muxkundan
Popularization of TED (organised by MPEDA and Dept. of Fisheries, Govt. of Andhra Pradesh)	Kakinada 22 October 2001	Dr G. Rajeswari
11 th Swadeshi Science Congress	KFRI, Peechi 7-9 November 2001	Shri M.P. Remesan
National Conference on Strategies for safe food production	KAU, Trichur 22 November 2001	Dr D. Muthuchelvan
Symposium on Post harvest technology for agricultural produce and prospects for the food processing industry in Konkan region	Goa 23-24 November 2001	Shri T.S. Unnikrishnan Nair
Workshop on Coastal zone management (organised by Integrated Coastal Management, Kakinada)	Visakhapatnam 27 November 2001	Shri Sib Sankar Gupta Dr D. Imam Khasim Dr R. Chakraborti Dr G. Rajeswari
Conference on Agricultural processing and value addition (organised by College of Agricultural Engineering and Technology, Gujarat Agricultural University)	Junagadh 2 December 2001	Shri Rajendra Badonia

Name of seminar/workshop/symposium etc.	Venue and date	Name(s) of participant(s)
Workshop on Value added meat products (organised by Kerala Agricultural University, Mannuthy at Centre of Excellence in Meat Products)	Trichur December 2001	Dr M.K. Mukundan
International Symposium on Fish for nutritional security in 21 st century	CIFE, Mumbai 4-6 December 2001	Kum K.K. Asha Shri S.P. Damle Dr R. Anandan Shri D.K. Garg
First International Conference on Women in fisheries – Social equity and empowerment	Mumbai 11-12 December 2001	Dr Krishna Srinath(as co-convener)
Workshop on Deep sea fishing and fishery resources of Maharashtra coast (organised by Mumbai Base of Fishery Survey of India)	Ratnagiri	Shri D.K. Garg
National Symposium on Perspectives on animal experimentation in science and education in India	SCTIMST, Trivandrum 15 December 2001	Dr R. Anandan
Workshop on Marine fisheries of Karnataka – Resources and development opportunities (organised by FSI)	Mangalore 21-22 December 2001	Shri Puthra Pravin
Workshop on Immunodiagnosics (under auspices of Madurai Kamaraj University)	Madurai 21-31 December 2001	Shri Rakesh Kumar
ICAR Directors' Conference	New Delhi 27-28 December 2001	Dr K. Devadasan
Workshop on The impact of applications of radiation on food and agriculture	Vellanikkara, Trichur 27-28 December 2001	Shri P.K. Vijayan Dr C.N. Ravishankar

Study visit abroad

Dr C.N Ravishankar, Sr. Scientist, visited the National Aquatic Resources Research and Development Agency (NARA), Colombo, Sri Lanka during the period 12-18 February 2001 as part of a work contract between ICAR and Sri Lankan Council for Agricultural Research Policy (CARP) for the year 2000-2001. He also delivered a talk on 'Value added fish products of India' at NARA. While there, he visited:

- ◆ Heruwala fishing harbour
- ◆ Embilipitiya Food Processing Training Centre
- ◆ Udawalawa reservoir
- ◆ Aquaculture Development Centre
- ◆ M/s Alpex Marines (P) Ltd.

Special Days and Events

National Productivity Day

The National Productivity Day was celebrated at the Institute's Headquarters at Cochin on 15 February 2001. At a function held at the Govt. Regional Fisheries Technical Higher Secondary School, Thevara, Cochin, the role of electronic instruments in fisheries and allied fields was popularized among the students. The programme was chalked out in cognizance with the theme for the year - 'Bring in the 3 Es (environment, energy and electronics) and swing in productivity'.



National Productivity Day celebration at Cochin — Dr S. Balasubramaniam, Principal Scientist addressing the students

At Visakhapatnam Centre, the Day was celebrated on 13 February 2001. Talks were delivered on marine pollution and environmental impact assessment, impact of pollution on the aquaculture sector, eco-friendly trawling and role and contribution of the three Es in national productivity. Scientists, technologists, research scholars and post graduate students from organizations/institutions in and around the Centre participated in the programme.

The Burla Centre also observed National Productivity Day on 14 February 2001.



National Productivity Day at Burla — a session in progress

Inauguration of ATIC

The Agricultural Technology Information Centre, ATIC, was formally inaugurated on 15 January 2001 by Shri T.K. Ramakrishnan, Hon'ble Minister for Fisheries and Rural Development, Govt. of Kerala.



Shri T.K. Ramakrishnan, Hon'ble Minister for Fisheries & Rural Devt., Govt. of Kerala, delivers the inaugural address

The Minister also handed over four FRP canoes of length 5.78 m. built to CIFT design to the traditional sector on the occasion.

Release of technology / publications

On the occasion of inauguration of ATIC, the Minister for Fisheries and Rural Development, Govt. of Kerala, Shri T.K. Ramakrishnan, released the technology of fuel efficient steel fishing vessel SAGARKRIPA for the mechanized sector, a few leaflets, four in the CIFT Technology Advisory Series and a text book on 'Post harvest technologies from fish and shellfish' compiled by Shri K.K. Balachandran, retired Principal Scientist, CIFT.

The first issue of the CIFT house magazine in official language, 'Jaladhi', was also released by



Dr Babu Joseph, Vice Chancellor, Cochin University, releases the journal Jaladhi. Also seen are Dr Mohan Joseph Modayil, Director, CMFRI and Dr K. Devadasan, Director, CIFT

Dr. Babu Joseph, Vice Chancellor, Cochin University of Science and Technology on the occasion of inauguration of National Science Week celebrations on 28 February 2001. Dr Mohan Joseph Modayil, Director, CMFRI, received the first copy.

Special Fish Farmers' Day

The Special Fish Farmers' Day was celebrated on 10 July 2001 as per Govt. of India's directives. A Fish Farmers' Meet and Workshop on Fish farming – Problems and solutions was held at the Institute under the joint auspices of CIFT, CMFRI, Fisheries College, Panangad, BFFDA and FFDA. Shri K.V. Thomas, Minister for Fisheries and Tourism, inaugurated the programme. Felicitations were offered by Shri T. Thankappan IAS, Director of Fisheries, Kerala, Prof. D.M. Thampi, Dean, Fisheries College, Panangad and Dr N.G.K. Pillai, Head, Pelagic Fisheries Division, CMFRI. Eightyfive fish farmers, including women, from different parts of Ernakulam Dist. participated.



Shri K.V. Thomas, Minister for Fisheries and Tourism, inaugurates the Special Fish Farmers' Day celebration at Cochin.

National Science Day/Week

The Institute observed the National Science Week during the period 28 February – 2 March 2001, in accordance with the theme for the year - 'Information technology for science education'. The programmes were inaugurated on 28 February at the Institute's Headquarters at Cochin by Dr Babu Joseph, Vice Chancellor, Cochin University of Science and Technology, when he delivered his talk on 'Chaos theory'.

A class on electronic instruments developed for navigation, safety and efficient fishing operation was arranged at Munambam in which about

thirty people including boat owners and operators participated.

An elocution competition, essay competition and an IT show were also arranged for the benefit of school children.



At Cochin – A young talent has his say

The Visakhapatnam Centre celebrated National Science Day on 7 March 2001. The celebrations included a Science Quiz for school children and an exhibition.



At Visakhapatnam – Dr Imam Khasim Saheb, Principal Scientist, distributes prizes to the winning team

National Seminar

A National seminar on **Riverine and reservoir fisheries – Challenges and strategies**, jointly organized by CIFT and the Society of Fisheries Technologists (India), was held on 23 and 24 May 2001. Shri N.V. Madhavan, IAS, Principal Secretary for Fisheries to Govt. of Kerala, inaugurated the seminar. Sixtysix papers were presented at the seminar in which one hundred and fortythree delegates participated.



Shri N. V. Madhavan, IAS, Principal Secretary for Fisheries to Govt. of Kerala, inaugurates the seminar on 'Riverine and reservoir fisheries – challenges and strategies'

Vessel dedicated

Dr K. Gopakumar, Dy. Director General, (M.Fy), dedicated the 15.5 m fuel efficient steel fishing vessel, SAGARKRIPA, designed and fabricated at CIFT, to the Veraval fishery industry at a function held at Veraval Fishing Harbour on 30 December 2001. This is the first medium class steel fishing vessel to be introduced in Saurashtra waters. The vessel was successfully popularized in Kerala coast, before being transferred to Gujarat.



Dr K. Gopakumar, DDG (Fy.), dedicating the fuel efficient fishing vessel *Sagarkripa* to the Veraval fishing industry

Winter School

A Winter School on **Advances in microbiological and biotechnological methods for detection of pathogenic microorganisms and their toxins in fish and fishery products** was held at the Institute during 5 – 25 November 2001. Thirtyone participants from different states including scientists

from ICAR Institutes, teachers from Agricultural Universities and colleges affiliated to State Universities attended the school. The curriculum included advanced microbiological and biotechnological methods for detection of pathogenic microorganisms in fish and fishery environment, detection of bacterial toxins by immunological methods like reversed RPLA, ELISA and DNA methods like PCR for detection of white spot syndrome virus causing white spot disease in shrimp etc. Electrophoresis mapping of proteins and DNA was also carried out. Prof. D.M. Thampi, Dean, Fisheries College, Panangad, inaugurated the Winter School.



Dr D.M. Thampi, Dean, Fisheries College, Panangad, inaugurates the Winter School

Awareness Programmes

An awareness programme-cum-workshop was organized at Munambam in collaboration with Greenseas (Centre for Fisheries Study and Manpower Development) on 17 February 2001 on treatment for melanosis in shrimp. Twentysix personnel, representing various segments of the industry like fishing boat owners, managers, active fishermen and allied workers, participated.

An awareness programme for fishermen was conducted at Veraval Centre on use of satellite data as a tool for fishery forecast. The programme was conducted in collaboration with Satellite Application Centre (ISRO), Ahmedabad and State Fisheries Dept. An awareness programme was also conducted on 5 May 2001 at the Centre to emphasise the need for new generation fishing vessels. The programme was attended by representatives from the fishing community, fishing industry and officials from State and Central Fisheries Dept.



Awareness programme on 'Need for new generation fishing vessels' – at Veraval

Inauguration of staff quarters

At a function held on 17 October 2001, the residential complex of Visakhapatnam Research Centre of CMFRI and CIFT was inaugurated by Dr K. Gopakumar, Dy. Director General (Fisheries), ICAR.



Dr K. Gopakumar, DDG, inaugurates the CMFRI — CIFT staff quarters at Visakhapatnam

One Day Meet on Retort Pouch Technology

A one day Meet on retort pouch technology was held at the Veraval Centre on 20 December 2001 at which different aspects of the technology were explained to over fifteen processors and exporters from Veraval and Porbunder who participated in the deliberations.

Surveys

An in-depth survey was conducted at Hirakud reservoir, near Burla, during 20-26 February 2001 for taking stock of the echolocation of the reservoir.

A survey was carried out of the landing centers Navabunder and Goghla to study the Bombay duck fishery and fish drying practices in the area. Improved techniques of drying fish on racks and storage at chilled temperature were studied.



Drying of fish at Veraval

Women in Agriculture Day

'Women in Agriculture Day' was celebrated at Visakhapatnam Centre at a programme held at Peddajalaripettah village on 4 December 2001. An exhibition was organised in this connection at which charts, photographs and various products developed at the Institute were displayed.

A good number of people attended the programme and showed keen interest in the activities of the Centre.



Participants of the 'Women in Agriculture Day' at Visakhapatnam

Scientific/Technical Talks

The following scientific/technical talks were organized during the year under report:

Speaker	Topic	Date
Shri Josy Palliparambil, Programme Coordinator, Greenseas – Centre for Fisheries Studies, Munambam	Activities and programmes of the Centre	27 January 2001
Shri Prem Kumar, Scientist, Burla Research Centre of CIFT	Geoinformatics for coastal management	3 March 2001
Prof. Dr N.C. Ganguli (Retd.), NDRI, Karnal	Fascinating fish (in Hindi)	17 March 2001
Dr C.N. Ravishankar, Sr. Scientist, CIFT	Experiences of visit to National Aquaculture Resources Research and Devt. Agency, Colombo, Sri Lanka	22 March 2001
Dr K. Ashok Kumar, Sr. Scientist, CIFT	Waste water treatment and management in fish processing plants	30 March 2001
Dr Uma Shankar, Waters (India) Ltd.	LC – M.S. and its application	28 June 2001
Dr K.S. Chang, Professor of Food Engg., Korea	Past and present status of food technology in Korea	19 July 2001
Smt Suseela Mathew Scientist (Sr. Scale), CIFT	Experiences of training undergone in fish processing technology at Philippines sponsored by FAO	19 July 2001
Shri Rajendra Badonia, Principal Scientist, CIFT	Fishery resources of Madhya Pradesh and their utilization	23 August 2001
Shri Prem Kumar, Scientist (Sr. Scale), Burla Research Centre of CIFT	Aquaculture site selection by remote sensing	23 August 2001
Shri Prem Kumar, Scientist (Sr. Scale), Burla Research Centre of CIFT	Fish and fisheries of Hirakud reservoir	27 August 2001
Smt M.K. Seema, Sr. Research Fellow, CIFT	Purification and properties of fish collagens	24 September 2001

Speaker	Topic	Date
Shri S. Sreenatha, Director of Technologies, DNI International INC, Bangalore	Recent trends in canning technology	6 October 2001
Dr S.A.H. Abidi, Member, ASRB, ICAR, New Delhi	Technical education in Hindi	12 October 2001
Dr V. Somnath, Neurologist, Cochin Hospital, Cochin	Neurological disorders and their causes	20 October 2001
Shri Anil Agarwal, Principal Scientist, ICAR	Organisational and operational infrastructure for fisheries research	2 November 2001
Dr Mohan Nair, Chief, Oncology Dept. Lakshmi Hospital/Krishna Nursing Home, Cochin	Cancer – Incidence and prevention	22 December 2001



Dr K. S. Chang



Dr V. Somnath

Administration

The Administration Division deals with recruitment, service and policy matters, discipline, staff welfare, land and building, procurement of stores, budget expenditure, settlement of claims etc.

The Research Centres at Burla, Hoshangabad and Calicut continued to function in rented buildings. Research Centres at Mumbai, Veraval and Visakhapatnam functioned in their own buildings.

During the period under report the following Committees met as shown below:

1. Departmental Promotion Committee : 6 times
2. Departmental Selection Committee : once
3. Assessment Committee : 6 times
4. Placement Committee : once
5. Compassionate Appointment Committee: once

Cases considered by the Departmental Promotion Committee

Category	Promotion	Declaration of probation	Confirmation	Assured Career Progression (ACP) Scheme
Scientific	63	4	4	-
Technical	19	4	6	-
Administrative	8	3	7	4
Auxiliary	-	-	-	5
Supporting	17	2	2	-

Technical Section

During the reported period, the Technical Section monitored the following technical matters of the Institute.

Compilation of Research Project Programmes document

The Research Project Programmes of the Institute for the year 2001-2002, consisting of two new projects, 19 ongoing projects and five ICAR ad-hoc projects, were compiled as per the recommendations of the Project Advisory Committee and Research Advisory Committee and brought out on the due date. The document contains details of all the new / ongoing / ad-hoc projects in addition to summary of three projects completed during 2000-2001.

Preparation and submission of technical reports

Monthly report to ICAR

Monthly report on the important activities of the Institute, significant research findings, training programmes, seminars/symposia/workshops etc. conducted and participated by the staff, important policy decisions taken, information on new projects / programmes initiated, visit of officers abroad and visit of foreign delegates to the Institute, details of extension activities etc. were compiled and sent to ICAR regularly for inclusion in the ICAR monthly report to the Cabinet Secretariat.

Report for the ICAR Regional Committee Meetings/ Directors' conference

Detailed report on the research and extension activities carried out at CIFT Headquarters and Calicut Research Centre (Regional Committee, Region No.8) for the last two years (1999-2001) was compiled and sent to ICAR for presentation in the XVIII meeting of ICAR Regional Committee No.8, during Dec. 14-15, 2001 at CTCRI, Trivandrum.

The Action Taken Report on the recommendations of the previous meeting of the Regional Committee was also prepared and furnished to the concerned Member Secretary of the Regional Committee, Region No.8.

Report on the agenda items pertaining to the Institute was prepared and furnished to Council for inclusion in the Agenda Notes of ICAR Directors' Conference held during 27-28 December, 2001 at New Delhi.

Report for the performance budget of DARE/ICAR (2002-03)

Detailed report of the scientific achievements of the Institute for the year 2001-02 and technical programmes for the year 2002-03 were furnished to Council for the preparation of the Document-Performance Budget of DARE/ICAR (2002-2003).

Ad-hoc/collaborative projects

Half yearly and Annual progress reports of the various AP Cess fund and NATP projects were collected from the respective Principal Investigators and forwarded. Besides, a few new project proposals were also processed and forwarded.

Publication of scientific papers

During the reported period, 21 papers including research notes, popular articles etc. were received from scientists for Director's approval for publication. The scientific papers were arranged for presentation before the Scrutiny Committee and 18 papers were approved for publication.

Participation of scientists in seminars/symposia/workshops/short term training course

Requests for participation of scientists in various seminars, symposia, workshops and short term training courses were processed and papers routed through the Technical Section.

Staff Research Council

Arrangements were made for conducting the Staff Research Council meeting on 26.6.2001 to review the progress achieved in the ongoing research projects handled at the Institute Headquarters and Research Centres for the year 2000-2001 and to discuss the research project proposals for the year 2001-2002.

Dr A. D. Diwan, ADG (M.Fy), ICAR attended the meeting as Council's representative. Shri V. Narayanan Nambiar, Principal Scientist, continued to be the Member Secretary of the SRC.

Five Yearly Assessment of ARS Scientist

The biodata and career information forms and Five Yearly Assessment Proformae for the period ending 31-12-1983 and Supplementary Information Proformae for the periods ending 31-12-1984 and 31-12-1985 in respect of a retired S-1 grade Scientist (which was pending due to disciplinary proceedings), were processed and forwarded to Council for consideration for merit promotion to the grade S-2 by assessment.

Updating project files

Project Leaders' files of all the ongoing research projects of the Institute were maintained up-to-date by collecting the consolidated quarterly / annual / final reports from the concerned Principal Investigators for the relevant periods.

Publication of quarterly Fish Technology Newsletter

Four issues of Fish Technology Newsletter (bilingual) were published during the period.

Other technical matters

The Technical Section answered queries on various technical matters received from other organizations. Besides, matters relating to awards / fellowships / tour reports of scientists etc. were also monitored.

Further, material for ICAR News / ICAR Reporter / Agri News / Fishing Chimes / MPEDA Newsletter etc. were compiled and forwarded regularly, many of which have already been published.

Official Language Implementation

During the period under report, the Institute carried out various activities as per the directives of the Department of Official Language, Ministry of Home Affairs, Govt. of India and the Indian Council of Agricultural Research, New Delhi for the year 2001-2002 for implementation of the Official Language Policy of the Union.

Official Language Implementation Committee meetings

The quarterly OLIC Meetings of the Institute reviewed the official language implementation activities of CIFT. The committee consisted of the following members:

Chairman

Dr K. Devadasan, Director

Members

Dr M.K. Mukundan, Head, Divn. of Quality, Assurance and Management

Dr Krishna Srinath, Head, Divn. of Extension, Information and Statistics

Dr P.K. Surendran, Head, Divn. of Microbiology, Fermentation and Biotechnology

Dr B. Meenakumari, Head, Divn. of Fishing Technology

Dr P.G. Viswanathan Nair, Head, Divn. of Biochemistry and Nutrition

Dr K.G. Ramachandran Nair, Head, Divn. of Fish Processing

Shri Ravi Kumar, Sr. Admn. Officer

Shri P.A. Uthup, Asst. Finance and Accts. Officer

Member Secretary

Dr Jessy Joseph.C., AD(OL)

Four quarterly meetings were conducted on 03.01.2001, 07.04.2001, 28.06.2001 and 29.10.2001.

Technical reports

Quarterly reports and annual report pertaining to the activities of Official Language at the Headquarters and Research Centres were forwarded to the Council. Reports were also sent to Official Language Directorate, Delhi, Official Language Regional Implementation Centre and Cochin Town Official

Language Implementation Committee.

Hindi Chethana Maas

The Institute celebrated Hindi Chethana Maas during the period August 14 to September 14. Competitions were held in drafting proposals, letter writing, precis writing, translation, word matching, terminology, extempore speech and technical report writing. Hindi Chethana Maas was inaugurated by Shri K. Shankaran, Secretary, Coconut Development Board, Cochin, on 14 August 2001. Prof. M. Thomas Mathew, Director, Kerala Language Institute, Trivandrum was the Chief Guest for the valedictory function on 14 September 2001.



Shri K. Sankaran, Secretary, Coconut Development Board, Cochin, inaugurates the Chethana Maas

At the Burla Research Centre, Hindi Day was celebrated on 14 September 2001, while the Veraval Centre observed Hindi Week during 7-14 September 2001. The Visakhapatnam Centre celebrated the Week from 20-26 August 2001.



Celebration of Hindi week at Veraval

The Institute has always strived to keep up the status of Official Language as envisaged in the constitution. Active measures were taken to publish the scientific and technical literature relating to the Institute in Hindi in order to promote better dissemination of information relating to the activities of the Institute. Several scientific and technical lectures and seminars in Hindi were organised as given below:

Subject & Date	Speaker
Tender coconut (14 August 2001)	Shri K. Shankaran Secretary Coconut Development Board, Cochin
FRP boat for reservoir fishing (16 August 2001)	Shri M.V. Baiju Technical Officer CIFT, Cochin-29
Fishing in Sagar island (27 August 2001)	Dr Prem kumar Scientist, Burla R.C. of CIFT
Quality criteria for aquaculture and its products (28 August 2001)	Dr M.K. Mukundan Head, Divn. of Quality, Assurance and Management CIFT, Cochin

National Seminar on Women in Fisheries in Official Language

A National Seminar on Women in Fisheries in Official Language was held on 24 August 2001. Dr B.N. Choudhary, Asst. Director General (Extension), ICAR, New Delhi inaugurated the Seminar. Felicitations were offered by Dr Mohan Joseph Modayil, Director, CMFRI, Cochin and Shri Sisodiya, Asst. Commissioner (Fisheries), Ministry of Agricul-



Dr B.N. Choudhary, Asst. Director General (Ext.), ICAR, inaugurates the Hindi seminar

ture, New Delhi. Keynote address on the subject was presented by Sister Alice, a noted Social worker in the field. Dr K. Devadasan, Director, presided over the inaugural session. Seventeen scientific papers were presented at the Seminar. Dr Jessy Joseph was the Convener of the Seminar.

Creative writing camp

A creative writing camp in Official Language was conducted at the Institute on 25 August 2001. Faculty support was given by Shri Anil Kumar Dubey, Director (Hindi), ICAR, New Delhi. Heads of Divisions, Principal Scientists and Scientists-in-Charge of all the Research Centres participated in the camp.

National Symposium on Technical Education in Hindi

A National Symposium on 'Technical education in Hindi' was held on 10 October, 2001. Keynote address was delivered by Dr S.A.H. Abidi, Member, Agricultural Scientists Recruitment Board, New Delhi. Dr Mohan Joseph Modayil, Director, CMFRI, Cochin and Dr Sugunan, Director-in-Charge, CICFRI, Barrackpore also participated in the discussions.



Dr S.A.H. Abidi, Member ASRB, delivering the keynote address

Publications in Hindi/bilingual

The following Hindi/bilingual publications were brought out during the period:

1. House Journal 'Jaladhi'
2. Annual Report
3. Fish Technology Newsletter
4. Folders on
 - Fish soup powder
 - Fish cutlets
 - Fish wafers
 - Fish ensilage
 - Smoked fish
 - Fish fingers
 - Fish balls
 - Fish pickle
 - Fish maws

Library

Acquisition

The library purchased a total of 118 books during the year. Forty foreign and 36 Indian scientific periodicals were subscribed to during the period. International Databases like ASFA (Aquatic Science Fisheries Abstracts), FSTA (Food Science and Technology Abstracts), AGRIS (International Information System for Agricultural Sciences and Technology) and Current Contents, both on Agriculture, Biology and Environmental Sciences and on Life Science on CD-ROM were also acquired. At present, the library holds 8876 books, 5324 bound volumes of journals and 80 CD-ROMs.

Automation

Automation of in-house library activities using SLIM++ Library Package was done during this period. Major activities like accessioning, catalogu-

ing, circulation and serial control have been fully automated. Bar coding of library books is almost completed.

Services

During the year, 4125 bonafide readers visited the library and 2024 books were issued and retrieved. Reprographic unit of the library supplied copies of 50,000 pages of documents on requisition. CD-ROM based information access facility through LAN was provided. Issues of current contents were brought out fortnightly. Lists of monthly additions of books were circulated among various divisions and research centres of the Institute. The library, in association with NIO, Goa, continued to act as a national input centre of ASFA database.

Representation in Committees

The following officials represented the Institute in various Committees / Board panels etc in different capacities.

Dr K.Devadasan, Director

As Chairman

- ❖ Organising Committee, National Seminar on Riverine and reservoir fisheries – Challenges and strategies, jointly organised by SOFT(I) and CIFT

As Expert Member

- ❖ ASRB Boards

As Member

- ❖ Academic Council of CIFE, Mumbai
- ❖ Senate of Cochin University of Science and Technology
- ❖ Extension Council of CIFE, Mumbai
- ❖ Governing Body of National Institute of Administration and Management, Ernakulam
- ❖ Organising Committee, International Symposium on Freshwater prawn organised by College of Fisheries, Panangad

Dr M.K. Mukundan, Head, Quality Assurance and Management Division

As Principal Member

- ❖ Supervisory Audit Team constituted by Govt of India for monitoring performance of Inter Departmental Panel and approval of fish processing establishments for export to European Union
- ❖ Bureau of Indian Standards for fishery products

Dr Krishna Srinath, Head, Extension, Information and Statistics Division

As Member

- ❖ High level committee on extension and training constituted by MPEDA
- ❖ Working group on fisheries, Corporation of Cochin

Dr P.K. Surendran, Head, Microbiology, Fermentation and Biotechnology Division

As Member

- ❖ Supervisory Audit Team constituted by Govt of India for monitoring performance of Inter Departmental Panel and approval of fish

processing establishments for export to European Union

As special invitee

- ❖ Extension Council, CIFE, Mumbai

Dr B. Meenakumari, Head, Fishing Technology Division

As Chairperson

- ❖ Fisheries Committee to study impact of stake nets, Govt. of Kerala.

As Principal Member

- ❖ Textile Material for Marine Fishing Purpose Sectional Committee TX18, Bureau of Indian Standards, New Delhi

As Member

- ❖ Sub-group on Marine Fisheries under the working group on Fisheries for 10th Five Year Plan
- ❖ Fisheries Resource Management Society, Fisheries Sub-committee for Master Plan, Govt. of Kerala

As Co-opted Member

- ❖ Sub group on Fisheries under the working group on Fisheries for 10th five year plan proposals

Shri T.S. Unnikrishnan Nair, Principal Scientist

As Member

- ❖ Subsidy Committee of MPEDA, Cochin

Shri P.R.G. Varma, Principal Scientist

As Principal Member

- ❖ *Inter Departmental Panel for approval of seafood plants in Kerala, Tamil Nadu and Karnataka regions for export to EU*

As Alternate Member

- ❖ Committee constituted by MPEDA for scrutinizing applications for releasing subsidy to pre-processing plants
- ❖ BIS Sectional Committee on fish and fishery products

As Member

- ❖ Committee constituted by Ministry of Health and Family Welfare, New Delhi for formulation of PFA standards for fish and fishery products

Dr Jose Joseph, Principal Scientist

As Co-opted Member

- ❖ Academic Council, CIFE, Mumbai

Dr P.T. Lakshmanan, Principal Scientist

As Member

- ❖ Inter Departmental Panel for assessment of seafood plants for EU approval for Kerala, Tamil Nadu and Karnataka regions
- ❖ Committee for aquaculture inputs, MPEDA

Dr T.K. Srinivasa Gopal, Principal Scientist

As Member

- ❖ Sub-group on 'National Food Policy' of Ministry of Food Processing, New Delhi
- ❖ Collaborative project of MPEDA, CIFT and IIP on upgradation of seafood packaging

Dr Imam Khasim Saheb, Principal Scientist

As Alternate member

- ❖ Inter Departmental Panel for approval of fish processing plants and factory vessels for export to European Union

Shri Sibsankar Gupta, Principal Scientist

As Member

- ❖ Inter Departmental Panel for approval of fish processing plants and factory vessels for export to European Union

Shri P.N. Joshi, Principal Scientist

As Technical Expert Member

- ❖ Subsidy committee constituted by MPEDA for modernising the seafood processing industry in India

Shri V. Narayanan Nambiar, Principal Scientist

As Member

- ❖ Inter Departmental Panel of the Export Inspection Council of India for assessing fish processing establishments for approval for export of fishery products to European Union

Dr Sanjeev, S., Principal Scientist

As Member

- ❖ Inter Departmental Panel for assessment of seafood processing plants for EU approval for Kerala, Tamil Nadu and Karnataka regions

Dr S. Balasubramaniam, Principal Scientist

As Member

- ❖ High level committee on extension and training constituted by MPEDA

Shri S.P. Damle, Senior Scientist

As Member

- ❖ Inter Departmental Panel for assessing fish processing establishments for export of fish and fishery products to European Union
- ❖ Regional Committee of MPEDA for evaluation of assistance in acquisition of GPS, Fish Finder, Radio Telephone and Fish holds for fishermen of Mumbai

Shri A.C. Joseph, Principal Scientist

As Member

- ❖ Core group to identify various value added marine products for export - Committee constituted by MPEDA

As Alternate member

- ❖ FAD 45 – Food hygiene sectional Committee – Bureau of Indian Standards

Shri R. Badonia, Principal Scientist

As Chairman

- ❖ Nagar Rajya Bhasha Karyanayan Samithi (TOLIC), Veraval, of Dept. of Official Language

As Member

- ❖ Inter Departmental Panel of Experts for approval of seafood processing plants for European Union

Shri D.K. Garg, Senior Scientist

As Member

- ❖ Consultative committee for Mumbai base of Fishery Survey of India

Dr C.N. Ravishankar, Senior Scientist

As Member

- ❖ Collaborative project of MPEDA, CIFT and IIP on upgradation of seafood packaging

Shri V. Vijayan, Principal Scientist

As Member

- ❖ Procurement Committee for purchase of fishery and oceanographic research vessel for ICAR marine fishery research Institutes, CIFT, CMFRI and CIFE
- ❖ Procurement Committee for purchase of a 15.5 m fishing vessel for Visakhapatnam
- ❖ Aquarian reforms Committee, Govt. of Kerala.

As Director's representative

- ❖ Expert group entrusted with task of formulation of national marine fisheries policy.

Shri M. Nasar, Principal Scientist

As Principal Member

- ❖ Transport Engineering Division Council of Bureau of Indian Standards

As Member

- ❖ Expert Committee to draw up a Fisheries Master Plan for Kerala

Dr M.R. Boopendranath, Principal Scientist

As Member

- ❖ Committee of experts under the MPEDA scheme for extending financial assistance for installation of fish finder, GPS, radio telephone and fish hold
- ❖ Task Force, DOD-MLR Project on Resource assessment and biology of deep sea fisheries along the continental slope of Indian EEZ
- ❖ Expert Committee, Lakshadweep Devt. Corporation Ltd. for evaluating tenders received for tuna long line

Smt Saly N. Thomas, Scientist (Selection Grade)

As Alternate member

- ❖ Textile Material for Marine Fishing Purpose, Sectional Committee TX18, Bureau of Indian Standards, New Delhi

CIFT Women's Cell

The Women's Cell continued to function with the following members:

1. Smt R. Thankamma, Liaison Officer
2. Smt T.T. Annamma, Member
3. Smt Gita Rani, Member
4. Smt C.G. Radhamoney, Member

A health care programme was organized by the Women's Cell on 23 February 2001. Dr Harish Kumar, Head, Dept. of Endocrinology, Amrita Institute of Medical Sciences, Cochin, gave a lecture on 'Health care programme for the millennium', which was followed by a talk and demonstration on various health care exercises by Shri Bill Doss, Physiotherapist, AIMS and Dr P.J. Cecily, Retd. Technical Officer, CIFT.

The Cell observed International Women's Day on 8 March 2001. Smt Susan John, Lecturer, Maharaja's College, Ernakulam, who was Chief Guest of the day, gave a talk on 'Sthree Sakthi'.



Smt. Susan John, Lecturer, Maharaja's College, Ernakulam, speaks on 'Sthree Sakthi'

The Women's Cell also felicitated Dr Krishna Srinath, Head, EIS Division for having been conferred the National Award for Women's development through application of Science and Technology for the year 2000 by the Science and Society Division, Dept. of Science and Technology, Govt. of India.

ICAR Sports



Dr T. K. Thankappan & Smt Saly N. Thomas, Managers of the CIFT contingent along with Director, Dr K. Devadasan, receive the overall championship from Shri George Thomas, Manager (Marketing), Bharat Petroleum Corporation

The Institute hosted the ICAR Inter-Institutional Tournament Zone III at Cochin during 4-9 Dec. 2001. Dr Jacob Thomas IAS, Chairman, Cochin Port Trust, inaugurated the Meet on 4 December. CIFT won the overall championship and also bagged the trophies for Best Institute – Games and March Past. CPCRI, Kasargod was selected Best Institute – Athletics. Shri George Thomas, Manager (Marketing), Bharat Petroleum Corporation, gave away the prizes on 9.12.2001 at the valedictory function.

Visitors

The following are some of the dignitaries who visited the Institute during the year:

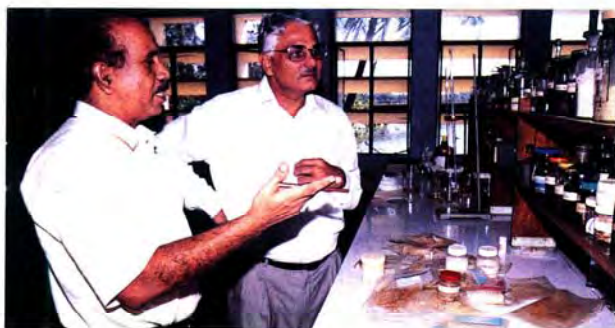
- Mr. Peter Maple, AQIS, Canberra, Australia
- Mr. Ron Southgate, AQIS, Canberra, Australia
- Mr. Kyu Seob Chang, Professor, Chungnam National University, Korea
- Ms. Neerja Rajkumar IAS, Jt. Secretary (Fisheries), Ministry of Agriculture, Dept. of Animal Husbandry & Dairying, Govt. of India
- Mr. T.R.K. Murthy, National Research Centre on Meat, Chengicherla, R.R. Dist., Hyderabad
- Dr Devendra Sharma and Ms. Usha Rai, renowned journalists
- Ms. Sashi Sareen, Director, Export Inspection Council, New Delhi (*Veraval Centre*)
- Mr. Pathak, Director (Finance), ICAR (*Veraval Centre*)
- Mr. S.M. Nayyar, Dy. Director (O.L.), ICAR (*Veraval Centre*)
- Prof. Amarinder Singh Bawa, Director, Defence Food Research Lab., Mysore



Mr. Peter Maple & Mr. Ron Southgate



Ms. Usha Rai



Dr T. R. K. Murthy



Mr. Debendra Sharma

Publications

- (Alok Jha), Srinivasa Gopal, T.K. (Patel, A.A.) and Ravishankar, C.N. (2000 – issued in 2001) – Suitability of retort pouches for the manufacture of long life rice kheer – *Ind. J. Dairy and Biosciences*, 11:75
- ✓ (Alok Jha, Patel, A.A.), Srinivasa Gopal, T.K. and Ravishankar, C.N. (2000 – issued in 2001) – Heat penetration characteristics of rice kheer during in-pouch processing in a rotary retort – *Ind. J. Dairy and Biosciences*, 11:50
- Anandan, R., Asha, K.K., Ammu, K and Nair, P.G.V. (2001) – Biochemical studies on the effects of peroxidised PUFA on isoproterenol induced myocardial infarction in rats – Paper presented at the International Symposium on Fish for nutritional security in 21st century, at CIFE, Mumbai, 4-6 December
- ✓ Ansar Ali, A., Sudhir, B., Srinivasa Gopal, T.K. and Vijayan, P.K. (2001) – Properties of indigenous and imported retort pouches for the thermal processing of freshwater fish – *Proc. National Seminar on Riverine and reservoir fisheries - Challenges and strategies*, organized by Society of Fisheries Technologists (India) and CIFT at Cochin, 23 – 24 May : 316
- Antony, K.P., Muraleedharan, V. and Mukundan, M.K. (2000 – issued in 2001) – Mas fingers and mas granules – products from masmin – *Fish Tech.. Newsletter XI(2)*
- Antony, K.P., Muraleedharan, V. and Mukundan, M.K. (2001) – Quality assured, dried shell-on prawns – *Fish Tech. Newsletter, XII(2):5*
- Asha, K.K., Anandan, R. and Radhakrishnan, A.G. (2001) – Biochemical studies on the protective effect of chitin and chitosan on lipid metabolism in acetaminophen intoxicated rats – Paper presented at the International Symposium on Fish for nutritional security in 21st Century, at CIFE, Mumbai, 4-6 December
- Ashok Kumar, K., Francis Thomas, Varma, P.R.G. and Mukundan, M.K. (2001) – Technology for the production of safe chilled fish for export – Paper presented at National Symposium on Fishery technologies and their commercialization, organized by CIFE at Mumbai, 11-12 January
- Badonia, R. and George Ninan (2001) – Fishery technologies for rural women in Madhya Pradesh – Paper presented at National Seminar (in Hindi) on Women in fisheries, organized by CIFT at Cochin, 24 August
- Badonia, R and Qureshi, T.A. (2001) – Dried and smoked prawns from freshwater fish and prawn – *Applied Fisheries and Aquaculture*, 1(1):99
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Other publications

Other publications brought out during the period include:

- An illustrated fish handling guide (in Gujarati)
- Hand-out on 'Sagarkripa' (in Gujarati)
- Report on Technological needs for fisheries development of Assam – Prem Kumar
- Report on Technological needs for fisheries development of Meghalaya – Prem Kumar
- Report on Technological needs for fisheries development of Arunachal Pradesh – Prem Kumar
- Report on Fisheries of Arunachal Pradesh : A preliminary survey – M.M. Prasad
- Report on Fisheries of Assam : A preliminary survey – M.M. Prasad
- Report on Fisheries of Meghalaya : A preliminary survey – M.M. Prasad
- CIFT Technology Advisory Series:
 - CIFT-TED (Turtle Excluder Device) – Construction, installation and operation – Percy Dawson & M.R. Boopendranath
 - Wood preservation for marine application – Leela Edwin & Saly N. Thomas
 - Nutritional significance of fish proteins – T.V. Sankar & P.G. Viswanathan Nair
- Fish Technology Newsletter
 - Vol. XI, No.3
 - Vol. XII, No.1



A few CIFT publications



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(as on 31.12.2001)

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Fishing Technology Division	: Dr (Mrs) B. MEENAKUMARI
Fish Processing Division	: Dr K. G. RAMACHANDRAN NAIR
Biochemistry & Nutrition Division	: Dr P. G. VISWANATHAN NAIR
Quality Assurance & Management Division	: Dr M. K. MUKUNDAN
Microbiology Fermentation & Biotechnology Division	: Dr P. K. SURENDRAN
Engineering Division	: Dr M. K. MUKUNDAN, (Head -in-Charge)
Extension Information & Statistics Division	: Dr (Mrs) KRISHNA SRINATH

Scientist/Officer-in-Charge of Research Centres

Veraval Research Centre	: Shri RAJENDRA BADONIA
Visakhapatnam Research Centre	: Shri SIB SANKAR GUPTA
Burla Research Centre	: Shri J. K. BANDYOPADHYAY
Hoshangabad Research Centre	: Shri MOKA SWAMY KUMAR (Technical Officer)
Calicut Research Centre	: Shri K. GEORGE JOSEPH
Mumbai Research Centre	: Shri DINESH KUMAR GARG

Administration & Accounts

Senior Administrative Officer	: Shri RAVI KUMAR
Assistant Finance & Accounts Officer	: Shri P. A. UTHUP

Other Personnel

HEADQUARTERS, COCHIN

Scientific Personnel

Principal Scientist

1. Shri T.S. Unnikrishnan Nair
2. Dr P.T.Mathew
3. Dr T.K.Srinivasa Gopal
4. Shri A.C.Joseph
5. Dr Jose Joseph
6. Shri A.G. Radhakrishnan
7. Shri P.R.Girija Varma
8. Shri A. Vasantha Shenoy
9. Shri P. N. Joshi
10. Shri V. Muraleedharan
11. Shri P.K. Vijayan
12. Dr T.K. Thankappan
13. Dr Nirmala Thampuran
14. Shri P. George Mathai
15. Dr Francis Thomas
16. Shri V. Narayanan Nambiar
17. Smt. Mary Thomas
18. Dr M. R. Boopendranath
19. Dr S. Sanjeev
20. Dr P.T.Lakshmanan
21. Shri P. Ravindranathan Nair
22. Shri V. Vijayan
23. Shri K. Ramakrishnan
24. Smt. K. Vijayabharathy
25. Dr G. Rajagopalan Unnithan
26. Shri Percy Dawson
27. Dr K. V. Lalitha
28. Dr S. Balasubramaniam
29. Shri K. P. Antony
30. Smt K. Ammu
31. Shri M. Nasar

Senior Scientist

1. Dr Leela Edwin
2. Dr C.N. Ravishankar
3. Dr K. Asok Kumar
4. Dr Braj Mohan
5. Dr T. V. Shankar

Scientist (Selection Grade)

1. Smt. R. Thankamma
2. Smt Saly N. Thomas
3. Shri Pravin Puthra

Scientist (Senior Scale)

1. Smt Suseela Mathew
2. Shri M.P. Remesan

Scientist

1. Dr Toms C. Joseph
2. Shri Muhamed Ashraf
3. Dr Nikita Gopal
4. Dr R. Anandan
5. Shri V. Radhakrishnan Nair
6. Shri Rakesh Kumar
8. Smt K.K. Asha
7. Dr D. Muthuchelvan

Technical Personnel

T-9 (Technical Officer)

Shri K.J.Francis Xavier

T-8 (Technical Officer)

1. Shri K.S. Ganesan
2. Dr A.R.Sasindranatha Menon

T-7 (8) (Technical Officer)

Smt T.T. Annamma

T-7 (Technical Officer)

Shri M.S. Rajan

T-6 (Technical Officer)

1. Shri C. Chandrasekharan
2. Shri P. Ravindranathan
3. Shri M.V. Baiju

T-5 (Technical Officer)

1. Shri Thomas J. Mammoottil
2. Shri P.T Sebastian
3. Shri N. M. Vasu
4. Shri P.S. Alias
5. Shri M. K. Sasidharan
7. Shri M. K. Kuttykrishnan Nair
8. Shri C.R.Gokulan
9. Shri V. Gopalakrishna Pillai
10. Shri M.M. Devasya
11. Shri G. Ramadas Kurup
12. Shri G. Ratnakaran Nair

T-4

1. Smt K. B. Beena	:	Technical Assistant
2. Smt K. Sobha	:	Senior Hindi Translator
3. Shri E.K. Balakrishnan	:	Senior Draughtsman
4. Smt K. Sarasamma	:	Senior Draughtsman
5. Smt P.K. Shyma	:	Wireless Operator
6. Shri M. Baiju	:	Technical Assistant
7. Smt G. Usha Rani	:	Laboratory Technician
8. Shri P.M. Joseph	:	Machinist
9. Shri A.B. Varghese	:	Bosun
10. Shri T. Gopalakrishnan	:	Metal Maker
11. Shri P.A. John	:	Cockswain
12. Shri Jose Kalathil	:	Refrigeration Mechanic
13. Shri T. K. Bhaskaran	:	Junior Laboratory Assistant
14. Shri K.B. Thilakan	:	Junior Laboratory Assistant
15. Shri P. Bahuleyan	:	Telephone Operator
16. Shri T. N. Manibhadran	:	Tindal
17. Smt K.K. Sumathy	:	Laboratory Technician
18. Shri P.A. Josi Augustine	:	Refrigeration Mechanic
19. Shri K.N. Rajagopalan	:	Refrigeration Mechanic
20. Smt T. Silaja	:	Junior Library Assistant
21. Shri K.B. Thampi Pillai	:	Draughtsman
22. Smt V.C. Mary	:	Junior Laboratory Assistant
23. Smt A. Indira Devi	:	Technical Assistant
24. Shri C. Rajendran	:	Refrigeration Mechanic
25. Shri C.C. Sivan	:	Welder-cum-Blacksmith
26. Shri M.K.Asokan	:	Deckhand
27. Shri K.A.Gopinath	:	Engine Driver
28. Shri K. D. Jos	:	Field Assistant

T-II-3

1. Shri K.E. Mani	:	Senior Mechanic
2. Shri K.K.Narayanan	:	Boilerman

T-3

1. Shri P.T. Viswambharan	:	Electrician
2. Shri P. Sankar	:	Hindi Translator
3. Shri B. Ganesan	:	Animal House Keeper
4. Smt K.G. Sasikala	:	Junior Laboratory Assistant
5. Smt K.K.Kala	:	Technical Assistant
6. Shri Sibasis Guha	:	Photographer-cum-Artist
7. Shri P.S. Babu	:	Senior Field Assistant
8. Smt Ancy Sebastian	:	Technical Assistant
9. Shri G. Omanakuttan Nair	:	Junior Laboratory Assistant
10. Smt G. Remani	:	Junior Laboratory Assistant
11. Shri J. Samarajan	:	Field Assistant
12. Shri Philip Durom	:	Senior Carpenter
13. Shri T. Balan	:	Deckhand
14. Shri P.N. Sudhakaran	:	Net Making Supervisor
15. Shri E.K. Chinnappan	:	Deckhand
16. Shri Aravind S. Kalangutkar	:	Senior Field Assistant
17. Smt K.P. Leelamma	:	Junior Laboratory Assistant

18. Shri P.S.Raman Namboodiri	:	Junior Laboratory Assistant
19. Shri A.A. Kunjappan	:	Field Assistant
20. Shri Subhash Chandran Nair C	:	Projector Operator

T-I-3

1. Shri Tomy Rebellow	:	Boiler man
2. Smt K.S. Mythri	:	Junior Laboratory Assistant
3. Shri P.S. Nobi	:	Net Making Supervisor

T-2

1. Shri T. Mathai	:	Junior Laboratory Assistant
2. Shri M. Sankara Panicker	:	Senior Carpenter
3. Smt N. Lekha	:	Junior Laboratory Assistant
4. Shri P.N. Sukumaran Nair	:	Field Assistant
5. Shri P.D. Padmaraj	:	Junior Laboratory Assistant
6. Smt P.K. Geetha	:	Junior Laboratory Assistant
7. Shri N. Sunil	:	Plant Attendant
8. Shri Sajith K. Jose	:	Draughtsman
9. Shri P.V. Sajeevan	:	Draughtsman
10. Smt P.A. Jaya	:	Junior Laboratory Assistant
11. Shri Gokul Chandra Meher	:	Oilman
12. Shri V.K.Siddique	:	Refrigeration Mechanic

T-1

1. Shri R. Rangaswamy	:	Driver
2. Shri V. A. Sudhakaran	:	Plumber
3. Shri Umesh D. Aroskar	:	Driver
4. Shri K.V. Mohanan	:	Driver
5. Shri K. Nakulan	:	Driver
6. Shri G. Gopakumar	:	Carpenter
7. Shri T. B. Assise Francis	:	Driver
8. Shri K.S. Babu	:	Turner
9. Smt Bindu Joseph	:	Media Assistant
10. Shri C.K. Suresh	:	Machine Operator
11. Smt N.C. Shyla	:	Field Assistant
12. Shri N. Krishnan	:	Junior Laboratory Assistant
13. Shri V.T. Sadanandan	:	Junior Laboratory Assistant
14. Shri K.D. Santhosh	:	Junior Laboratory Assistant
15. Shri K. Dinesh Prabhu	:	Plant Attendant
16. Shri P.D. George	:	Tindal
17. Smt Tessy Rony	:	Field Assistant
18. Shri P.A. Shanmughan	:	Tindal

Administrative Personnel

1. Smt. K. Usha	:	Administrative Officer
2. Shri R. Anilkumar	:	Asst. Administrative Officer
3. Shri R. S. Shanmughan	:	Asst. Administrative Officer
4. Shri A. George Joseph	:	Asst. Administrative Officer
5. Shri M. Gopalakrishnan	:	Asst. Administrative Officer
6. Shri V. N. Rajasekharan Nair	:	Asst. Administrative Officer
7. Shri H. Ganesh	:	Asst. Finance & Accounts Officer
8. Dr (Smt) C. Jessy Joseph	:	Asst. Director (Official Language)
9. Shri K. Ravindran	:	Private Secretary

Assistant

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

Personal Assistant

1. Smt N.K. Saraswathy
2. Smt R. Vasantha
3. Smt V.P. Vijayakumari
4. Shri P.K. Raghu
5. Smt S. Kamalamma
6. Smt N. Leena
7. Shri K. V. Mathai
8. Shri R. D Goswamy

Stenographer Grade III

1. Smt Anitha K. John
2. Shri T. Viswanathan

Upper Division Clerk

1. Smt. P.C. Kamalakshy
2. Shri P.V. Venugopalan
3. Smt N.I. Mary
4. Smt M. S. Susanna
5. Shri P. P. Varghese
6. Shri P.K. Thomas
7. Smt 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. Shri V.S. Ambasadhan
14. Shri A.P. Gopalan
15. Smt T. D. Usheem
16. Smt V. S. Aleyamma
17. Smt G. N. Sarada
18. Shri K.B. Sabukuttan

19. Smt P.A. Sathy
20. Shri K.C. Baby
21. Shri C.K. Sukumaran
22. Smt Lillykutty George
23. Shri P.K. Somasekharan Nair

Lower Division Clerk

1. Shri P. Mani
2. Smt Jaya Das
3. Shri P. Bhaskaran
4. Smt K. Renuka
5. Smt P.R. Mini
6. Smt V.K. Raji
7. Shri M.N. Vinodh Kumar
8. Shri K. Das
9. Shri T. N. Shaji
10. Smt A.R. Raji
11. Smt E. Jyothilekshmy

Cook

1. Shri V. Ramachandran

Supporting Personnel**Supporting Staff Grade IV**

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

Supporting Staff Grade III

1. Shri T. V. Manoharan
2. Shri C. A. Krishnan
3. Shri K.K. Karthikeyan
4. Shri K.N. Mukundan
5. Shri P. Gopalakrishnan
6. Shri K.B. Bhaskaran
7. Shri K.A. Kunjan
8. Shri T.T. Thankappan
9. Shri P.R. Unnikrishna Panicker
10. Shri A.R. John
11. Shri K.N.Velayudhankutty

Supporting Staff Grade II

1. Shri P.A. Sivan
2. Smt C.G. Radhamoney
3. Shri C.D. Parameswaran
4. Shri P.P.George
5. Shri P.V. Raju
6. Shri A.V.Chandrasekharan
7. Shri E. Damodaran
8. Shri M.M. Radhakrishnan
9. Shri K.K.Karthikeyan

10. Smt C. Ammini
11. Smt P. Ammalu
12. Shri M.N. Sreedharan
13. Smt U.K. Bhanumathy
14. Shri T.K. Rajappan
15. Shri M.T. Udayakumar
16. Smt Mary Vinitha P.T
17. Shri O.P. Radhakrishnan

Supporting Staff Grade I

1. Shri P. Raghavan
2. Shri T.M. Balan

3. Shri Deepak Vin V.
4. Shri T.D. Bijoy
5. Shri K.R. Rajasaravanan

Auxiliary

1. Shri K.C. Mohanan : Tea Maker
2. Shri T. A. Gopalakrishnan : Bearer
3. Shri C.N. Chandrankutty : Bearer
4. Shri M. V. Rajan : Bearer

VERAVAL RESEARCH CENTRE

Scientific Personnel

1. Dr Arnab Sen : Scientist
2. Shri A.A. Zynudheen : Scientist
3. Shri Sreedhar Uttravalli : Scientist
4. Shri George Ninan : Scientist

Technical Personnel

1. Shri D. C. Besra : T-7 (Technical Officer)
2. Shri G. P. Vaghela : T-5 (Technical Officer)
3. Shri J.B. Paradwa : T-5 (Technical Officer)
4. Shri K.U. Dholia : T-5 (Technical Officer)
5. Shri K.U. Sheikh : T-4 (Jr. Lab. Assistant)
6. Shri V.N. Dileep Kumar : T-II-3 (Engine Driver)
7. Shri G.B. Tandel : T-3 (Deckhand)
8. Shri G.R.Bhogte : T-3 (Deckhand)
9. Shri D.R. Aparnathi : T-3 (Jr. Lab. Assistant)
10. Shri G.M. Vaghela : T-3 (Jr. Lab. Assistant)
11. Shri H.V. Pungera : T-2 (Jr. Lab. Assistant)
12. Shri Sida Hanif Ummer Bhai : T-1 (Driver)

Administrative Personnel

1. Shri P. Vasudevan : Asst. Administrative Officer
2. Shri Veersingh : Assistant
3. Shri S.B. Purohit : Upper Division Clerk
4. Shri M.M. Damodara : Upper Division Clerk
5. Shri D.P. Parmer : Lower Division Clerk

Supporting Personnel

1. Shri P.A. Abdul Rehman : Supporting Staff Grade IV
2. Shri Harbajan : Supporting Staff Grade III
3. Shri B.M.A. Khoker : Supporting Staff Grade III
4. Shri Dhana Bhima Chudasama : Supporting Staff Grade II
5. Shri Kantilal Jivabhai Damor : Supporting Staff Grade II
6. Smt Chandrika C. Tank : Supporting Staff Grade II
7. Smt Gangaben Naren Chorwadi : Supporting Staff Grade II
8. Shri Dhodiya Khoda Viram : Supporting Staff Grade II
9. Shri Jitendra Bachubhai Malamdi : Supporting Staff Grade II

10. Shri Ramjilal Nathalal Gosai	:	Supporting Staff Grade II
11. Shri Aswinkumar Mohanlal Vala	:	Supporting Staff Grade II
12. Shri Makvana Karsan Kana	:	Supporting Staff Grade II
13. Smt Harshaban A. Joshi	:	Supporting Staff Grade I
14. Shri Narasinh K. Masani	:	Supporting Staff Grade I
15. Smt Pushpaben P. Chudasama	:	Supporting Staff Grade I
16. Smt Motiben K. Fofandi	:	Supporting Staff Grade I

Auxiliary

1. Shri Jethwa Kishan Khodidas	:	Wash Boy
2. Smt Veena Sreedhar Narkar	:	Coffee/Tea Maker

VISAKHAPATNAM RESEARCH CENTRE

Scientific Personnel

1. Dr Imam Khasim Saheb	:	Principal Scientist
2. Shri A.K. Chattopadhyay	:	Principal Scientist
3. Dr Rupshankar Chakraborty	:	Principal Scientist
4. Dr G. Rajeswari	:	Scientist (Sr. Scale)
5. Dr R.Raghu Prakash	:	Scientist
6. Dr B. Madhusudana Rao	:	Scientist
7. Shri J. Charles Jeeva	:	Scientist

Technical Personnel

1. Shri A. Veeranjanyulu	:	T-6(Technical Officer)
2. Shri V.V. Ramakrishna	:	T-5(Technical Officer)
3. Shri C. Srihari Babu	:	T-5(Technical Officer)
4. Shri KVSSS Kusuma Harnath	:	T-5(Technical Officer)
5. Shri K. Prakasa Rao	:	T-4(Engine Driver)
6. Shri Santhosh Alex	:	T-3(Jr. Hindi Translator)
7. Shri N. Ventaka Rao	:	T-3(Field Assistant)
8. Shri M. Venkateswara Rao	:	T-3(Driver)
9. Shri P. Radhakrishna	:	T-2(Junior Laboratory Assistant)

Administrative Personnel

1. Shri G.C. Adhikari	:	Assistant
2. Smt B. Hemalatha	:	Assistant
3. Smt D.A.L. Satyanarayanamma	:	Personal Assistant
4. Shri Y. Kanakaraju	:	Upper Division Clerk
5. Shri G. Chinna Rao	:	Upper Division Clerk

Supporting Personnel

1. Shri N. Gnanaranjana Rao	:	Supporting Staff Grade – IV
2. Shri Orilika Heman	:	Supporting Staff Grade – IV
3. Shri V. Kamaraju	:	Supporting Staff Grade – IV
4. Shri C. Kamaraju	:	Supporting Staff Grade – III
5. Shri K. Kameswara Rao	:	Supporting Staff Grade – III
6. Shri B. Sivanadam	:	Supporting Staff Grade – III
7. Shri K. Appa Rao	:	Supporting Staff Grade – III
8. Shri S. Appa Rao	:	Supporting Staff Grade – III
9. Shri Vasippilli Yelliah	:	Supporting Staff Grade – III
10. Shri S. Chakram	:	Supporting Staff Grade – III
11. Shri V. Venkata Ramana	:	Supporting Staff Grade – II

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|-----|-----------------------------------|---|-----------------------------|
| 12. | Shri G. Bhushanam | : | Supporting Staff Grade – II |
| 13. | Shri M. Sreevishnu Prabhakara Rao | : | Supporting Staff Grade – I |
| 14. | Smt Nalla Naveena | : | Supporting Staff Grade – I |

BURLA RESEARCH CENTRE

Scientific Personnel

- | | | | |
|----|-----------------|---|------------------|
| 1. | Dr M.M. Prasad | : | Senior Scientist |
| 2. | Shri Prem Kumar | : | Scientist |

Technical Personnel

- | | | | |
|-----|---------------------------|---|-------------------------|
| 1. | Shri Baikunta Pradhan | : | T-5(Technical Officer) |
| 2. | Shri Binod Kumar Pande | : | T-5 (Technical Officer) |
| 3. | Shri Asok Kumar Panigrahi | : | T-5 (Technical Officer) |
| 4. | Shri P.M. Pattanayak | : | T-4 (Lab. Technician) |
| 5. | Shri Kirtan Kisan | : | T-3 (Electrician) |
| 6. | Shri Sathrugan Kumara | : | T-3 (Tindal) |
| 7. | Shri Radhu Pandey | : | T-3 (Driver-Launch) |
| 8. | Shri Damodar Rout | : | T-3 (Jr. Lab. Asst.) |
| 9. | Shri A.K. Naik | : | T-3 (Mechanic) |
| 10. | Shri Rabinarayan Sahoo | : | T-2 (Driver-Launch) |
| 11. | Shri G. Jyothikumar | : | T-1 (Driver) |
| 12. | Shri Himansu Sekhar Bag | : | T-1 (Driver) |

Administrative Personnel

- | | | | |
|----|----------------------------|---|----------------------|
| 1. | Shri Jatindra Kumar Mishra | : | Assistant |
| 2. | Shri Udekar Pandey | : | Assistant |
| 3. | Shri Laxminarayan Badi | : | Upper Division Clerk |
| 4. | Shri Premlal Panda | : | Lower Division Clerk |

Supporting Personnel

- | | | | |
|-----|----------------------------|---|------------------------------|
| 1. | Shri Gajendra Karali | : | Supporting Staff Grade – IV |
| 2. | Shri K.C. Mehar | : | Supporting Staff Grade – IV |
| 3. | Shri Santhosh Banchor | : | Supporting Staff Grade – IV |
| 4. | Shri Satrugan Seth | : | Supporting Staff Grade – IV |
| 5. | Shri Sadhu Charan Mehar | : | Supporting Staff Grade – III |
| 6. | Shri Krishna Chandra Nayak | : | Supporting Staff Grade – III |
| 7. | Shri Badri Narain Guru | : | Supporting Staff Grade – III |
| 8. | Shri Jaisingh Oram | : | Supporting Staff Grade – II |
| 9. | Shri P.K. Bhangaraj | : | Supporting Staff Grade – II |
| 10. | Shri Satyanarayan Mirdha | : | Supporting Staff Grade – II |
| 11. | Shri Godabari Mahanandia | : | Supporting Staff Grade – II |
| 12. | Shri Dibyalochan Pattanaik | : | Supporting Staff Grade – II |
| 13. | Shri Surjananda Dishri | : | Supporting Staff Grade – II |
| 14. | Shri Triloknath Banchor | : | Supporting Staff Grade – II |
| 15. | Shri Sachida Nanda Dash | : | Supporting Staff Grade – II |
| 16. | Shri Basant Kumar Deo | : | Supporting Staff Grade – II |
| 17. | Shri Nande Oram | : | Supporting Staff Grade – II |
| 18. | Shri Sanyasi Ganik | : | Supporting Staff Grade – II |
| 19. | Smt Gyananetri Nag | : | Supporting Staff Grade – I |

HOSHANGABAD RESEARCH CENTRE

Administrative Personnel

Shri G. Somappan : Assistant

Supporting Personnel

Shri Rattan Chand : Supporting Staff Grade IV

MUMBAI RESEARCH CENTRE

Scientific Personnel

Shri S.P. Damle : Senior Scientist

Technical Personnel

1. Smt Sangeetha D. Gaikwad : T-5 (Technical Officer.)
2. Smt Triveni Gopal Adiga : T-5 (Technical Officer)
3. Shri B. B. Pinjari : T-1 (Driver)
4. Shri Prakash B. Bait : T-1 (Plant Attendant)

Administrative Personnel

1. Shri Milind S. Bhatkar : Assistant
2. Smt Smitha K. Shirishkar : Assistant
3. Shri Avinash N. Agawane : Lower Division Clerk

Supporting Personnel

1. Shri B.S. Tambe : Supporting Staff Grade – III
2. Shri Bandhu M. Ghare : Supporting Staff Grade – III
3. Shri Chandrakant B. Kolvalkar : Supporting Staff Grade – III
4. Shri Vinod S. Salvi : Supporting Staff Grade – II
5. Shri Tulsiram A. Waghmare : Supporting Staff Grade – II

CALICUT RESEARCH CENTRE

Scientific Personnel

Kum Bindu J. : Scientist

Technical Personnel

1. Shri K. Vasudevan Nair : T-7(Technical Officer)
2. Smt Tara Karupalli : T-4 (Jr. Lab. Asst.)
3. Smt M. K. Sreelekha : T-4 (Jr. Lab. Asst.)
4. Shri T. Gangadharan : T-3 (Sr. Lab. Asst.)
5. Smt M.V. Valsala : T-2 (Field Assistant)
6. Shri T.P. Balakrishnan : T-1 (Driver)

Administrative Personnel

1. Shri M. Ravindran : Assistant
2. Shri K.P. Velayudhan : Upper Division Clerk

Supporting Personnel

1. Shri P. Rajeev : Supporting Staff Grade – II
2. Smt Shiji John : Supporting Staff Grade – I