



കേന്ദ്രീയ മത്സ്യകൃഷി പ്രാജിതിക സഞ്ചാലന
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Central Institute of Fisheries Technology
(Indian Council of Agricultural Research)
CIFT Junction, Matsyapuri P.O., Cochin - 682 029





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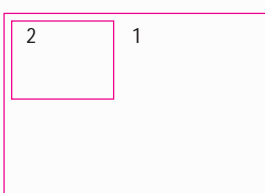
CIFT Annual Report 2010-2011

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- 1 Bumper catch of tunas from CIFT designed large mesh purse seine net
- 2 Power block - a handling device for hauling purse seine net

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Abbreviations used in the text

AAS	- Atomic Absorption Spectrometer	EFA	- Essential Fatty Acid
ABS	- Acrylonitrile Butadiene Styrene	EHEC	- Enterohemorrhagic <i>E. coli</i>
AP	- Andhra Pradesh	EIEC	- Enteroinvasive <i>E. coli</i>
APC	- Aerobic Plate Count	EIS	- Electrochemical Impedance Spectra
APHA	- American Public Health Association	ELISA	- Enzyme Linked Immunosorbent Assay
ASTM	- American Society for Testing and Materials	EPA	- Eicosapentaenoic Acid
ATCC	- American Type Culture Collection	EPEC	- Enteropathogenic <i>E. coli</i>
ATIC	- Agricultural Technology Information Centre	ERIC	- Enterobacterial Repetitive Intergenic Consenses
BHC	- Benzene Hexachloride	ETEC	- Enterotoxigenic <i>E. coli</i>
BIS	- Bureau of Indian Standards	ETP	- Effluent Treatment Plant
BOD	- Biological Oxygen Demand	EU	- European Union
BRD	- Bycatch Reduction Device	EUE	- Ecological Use Efficiency
BV	- Biological Value	EVC	- Ethylene Vinyl Chloride
CC	- Chilled Control	EVOH	- Ethyl Vinyl Alcohol
CCA	- Copper Chrome Arsenic	FFA	- Free Fatty Acid
CD	- Compact Disk	FCR	- Feed Conversion Ratio
CFU	- Colony Forming Unit	FPH	- Fish Protein Hydrolysate
CIFT	- Central Institute of Fisheries Technology	FRP	- Fibreglass Reinforced Plastic
CIPET	- Central Institute of Plastic Engineering Technology	GHG	- Green House Gases
CMFRI	- Central Marine Fisheries Research Institute	GHP	- Good Hygienic Practices
CMLRE	- Centre for Marine Living Resources & Ecology	GIS	- Geographical Information System
CNSL	- Cashew Nut Shell Liquid	GOI	- Government of India
COFISKI	- Community Fish Smoking Kiln	GMP	- Good Manufacturing Practices
CO ₂	- Carbon dioxide	GPS	- Global Positioning System
CPUE	- Catch Per Unit Effort	GSE	- Grape Seed Extract
CSH	- Cell Surface Hydrophobicity	HACCP	- Hazard Analysis and Critical Control Points
CT	- Chilled Treated	HCl	- Hydrochloric Acid
Cu	- Copper	HDPE	- High Density Polyethylene
DDT	- Dichloro Diphenyl Trichloro ethane	HF	- High Frequency
DHA	- Docosahexaenoic Acid	HIPP	- High Impact Polypropylene
DNA	- Deoxyribonucleic Acid	HIPS	- High Impact Polystyrene
DO	- Dissolved Oxygen	HL	- Headless
DPPH	- Di Phenyl Picryl Hydrazyl	HLSO	- Headless Shell-on
EAEC	- Enteraggregative <i>E. coli</i>	HOBT	- High Opening Bottom Trawl
EEZ	- Exclusive Economic Zone	Hp	- Horse Power





HPLC	- High Pressure Liquid Chromatography	OBM	- Outboard Motor
HPP	- High Pressure Processing	OD	- Optical Density
HPV	- Hepatopancreatic Parvo Virus	O ₂	- Oxygen
HSDT	- High Speed Demersal Trawl	PA	- Poly Amide
HTST	- High Temperature Short Time	PAH	- Poly Aromatic Hydrocarbon
H ₂ S	- Hydrogen sulphide	PCA	- Per Chloric Acid
ICAR	- Indian Council of Agricultural Research	PCR	- Polymerase Chain Reaction
ICMSF	- International Council for Microbiological Specification of Foods	PD	- Peeled and Deveined
IHHNV	- Infectious Hypodermal Haematopoietic Necro Virus	PE	- Poly Ethylene
ILC	- Inter Laboratory Comparison	PER	- Protein Efficiency Ratio
INCOIS	- Indian National Centre for Ocean Information Services	PEST	- Poly Ester
IQF	- Individually Quick Frozen	PFZ	- Potential Fishing Zone
ISO	- Indian Standards Organization	PLC	- Programmable Logical Control
IT	- Information Technology	PP	- Poly Propylene
JFE-SSD	- Juvenile Fish Excluder cum Shrimp Sorting Device	ppb	- parts per billion
KFDC	- Karnataka Fisheries Development Corporation	ppm	- parts per million
KOH	- Potassium hydroxide	ppt	- parts per trillion
LCMS	- Liquid Chromatography Mass Spectroscopy	PUD	- Peeled and Un-deveined
LDPE	- Low Density Poly Ethelene	PUFA	- Poly Unsaturated Fatty Acid
LF	- Low Frequency	PV	- Peroxide Value
LOA	- Length Overall	PVC	- Poly Vinyl Chloride
LOD	- Limit of Detection	RC	- Revealed Competitiveness
LPG	- Liquefied Petroleum Gas	RCA	- Revealed Comparative Advantage
MBV	- Monodon Baculo Virus	RED	- Radial Escapement Device
MFP	- Myo Fibrillar Protein	RPLA	- Reverse Passive Latex Agglutination
MPEDA	- Marine Products Export Development Authority	rpm	- revolutions per minute
MPa	- Mega Pascal	RS-PCR	- Ribosomal gene Spacer sequence PCR
MPN	- Most Probable Number	RTA	- Relative Trade Advantage
mpy	- mils per year	RT PCR	- Reverse Transcriptase Polymerase Chain Reaction
MUG	- Methyl Umbelliferyl beta D-Glucuronide	SAC	- Space Applications Centre
NaCl	- Sodium chloride	SDS-PAGE	- Sodium Dodecyl Sulphate-Poly Acrylamide Gel Electrophoresis
NAIP	- National Agriculture Innovation Project	SE	- Standard Error
NEH	- North East Hill	SEM	- Scanning Electron Microscopy
NIO	- National Institute of Oceanography	SGR	- Specific Growth Rate
nm	- nano meter	SIMPER	- Similarity Percentage
NPN	- Non Protein Nitrogen	SPTS	- Semi Pelagic Trawl System
NPU	- Net Protein Utilization	SRC	- Sulphite Reducing <i>Clostridium</i>
OAS	- Optically Active Substances	SS	- Stainless Steel



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SSOP	- Standard Sanitation Operation Procedures	TPC	- Total Plate Count
STPP	- Sodium Tri Poly Phosphate	TSS	- Total Soluble Sugar/Total Suspended Solids
TBA	- Thio Barbituric Acid	TVBN	- Total Volatile Base Nitrogen
TBC	- Total Bacterial Count	UK	- United Kingdom
TCA	- Tri Chloro Acetic Acid	UP	- Uttar Pradesh
TDS	- Total Dissolved Solids	US	- United States
TDH	- Thermostable Direct Hemolysin	USFDA	- United States Food and Drugs Administration
TED	- Turtle Excluder Device	VC	- Vacuum Control
TFA	- Tri Fluoro Acetic Acid	VHF	- Very High Frequency
TFS	- Tin Free Steel	VNTR	- Variable Number Tandem Repeats
TLC	- Thin Layer Chromatography	VT	- Vacuum Treated
TMA	- Tri Methyl Amine	WTO	- World Trade Organization
TMAN	- Tri Methyl Amine Nitrogen	WSSV	- White Spot Syndrome Virus
TOC	- Total Organic Carbon	YHV	- Yellow Head Virus





Preface

The Central Institute of Fisheries Technology has completed one more successful and fruitful year. The Institute continued its research work in accordance with the mandate of the Institute. The Institute continued to serve the fishing and fish processing industry and has provided consultancies for their changing needs. I am happy to present the achievements during the year, in the Annual Report 2010-11.

Continuing its tradition, the Institute bagged several prestigious awards this year also. The foundation stone for the ZTM-BPD Block at CIFT was laid by the DG, ICAR. CIFT had filed applications for 13 patents and two trademarks. The Institute is handling 25 projects and 17 externally funded projects funded by NAIP, DOD, INCOIS, SAC, DST, CMLRE, DBT and ICAR (Network Projects). CIFT held four Institute-Industry meets one each at New Delhi, Visakhapatnam, Karnal and Bangalore and a total of 148 training programmes were organized directly benefiting 1700 participants. Under the sponsorship of FAO, 10 officials from Sri Lanka were trained in Hygienic fish handling and quality assessment. The Institute conducted 36 outreach programmes and participated in 29 exhibitions in different parts of the country. This year, Dr. A.P.J. Abdul Kalam, former President of India visited the Institute in connection with World Environmental Day and International Year of Biodiversity Celebrations. The Institute has a new Biotechnology wing and non thermal processing facilities like high pressure processing unit, pulse light preservation unit, liquid smoke generation unit, etc. A new business incubation facility is also being set up under the NAIP-BPD. A Winter School on 'Current Trends in Microbial Biotechnology: Genomics, Diversity and Gene Mining' and a National Seminar on 'Aquatic Biodiversity and its Conservation' were organized at CIFT, Cochin during November and December respectively. An Energy efficient Effluent Treatment Plant was developed and commissioned at Poompuhar, Tamil Nadu. CIFT had offered various consultancies on design and construction of solar driers and design and construction of Tuna long liners. The Institute generated revenue by means of consultancy, training, etc. during the year.



The research programmes in the Fishing Technology Division, continued to focus on responsible fishing. The technology of eco friendly Semi-pelagic Trawl System for small-scale mechanized sector was released during the year and is expected to be of immense benefit to the ecosystem as well as the fishers. A project has been taken up for popularization of this technology. The introduction of large mesh purse seine to reduce catch of juveniles and also to target large pelagics is a success. The Institute is immensely proud to play a part in successfully revolutionizing the purse seine fishing operations in the region, with a participatory mode along with the fishermen. Studies on craft materials especially coconut wood for construction of fishing craft showed promising results. Short body in the shrimp trawls showed significant reduction of bycatches as compared to conventional trawls. CIFT continued to focus on inland fisheries sector and improved gill nets for operation in the North Eastern Hill regions and a FRP craft for inland waters were popularized.

The Institute emphasized on the development of safe and value added products with improved shelf life in the post harvest research work and also continued to focus on the post harvest work in the island sector. Institute organized Pangasius Festival at Elluru, Andhra Pradesh to popularize utilization of Striped Catfish. More than 1000 fish farmers and processors attended the meet. Battered and breaded products were prepared from nonconventional Myctophid fish *Diaphus watasei* which had acceptable organoleptic characteristics. CIFT also developed a high value pet food for dogs from Tuna waste. Studies were continued on new packaging materials for fish products like see-through pouches,



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laminated pouches and co-extruded pouches for enhancement of shelf life of value added products.

Research work on food safety, quality assurance and management was undertaken in the Institute and analysis of fish for pesticides and heavy metals were carried out to ensure safety of fish available to the consumers. Challenge studies with different food-borne pathogens were carried out to elucidate their survival pattern in different preservation methods like vacuum packaging, chilling, freezing and drying.

Research work in Microbiology, Fermentation and Biotechnology on seafood was carried out. Study on pathogens from retail fish markets in Kerala was carried out. Acid soluble collagen pepsin, digestible collagen and insoluble collagen were isolated from Tuna and Rohu skin.

Nutritional profiling studies of fishery products were carried out by the Biochemistry and Nutrition Division. A dietary supplement has been formulated using Tuna meat, Oyster meat and Clam meat. Fish oil rich PUFA was prepared from Tuna red meat waste.

The Engineering Division of the Institute designed and developed a pilot model renewable energy solar biomass hybrid dryer for eco-friendly and hygienic drying. An innovative model of fish drying system in marine container was also done.

The Institute continued to cater to the industry, fishers and students by organizing regular training programmes and tailor made training programmes in the Institute and in different parts of the country under the outreach programmes. The programmes covered the North Eastern Hill Regions and the Lakshadweep Islands also.

I compliment all my colleagues for the creditable work and thank the fishing industry, fish processing industry, state governments and the ICAR for all the help rendered in carrying out our activities. I am also grateful to the Institute Management Committee and Research Advisory Committee, for their cooperation and unstinted support. I look forward to your constructive criticism and suggestions to improve our research work.



(Dr. T.K. Srinivasa Gopal)

Director

Cochin

20th June, 2011





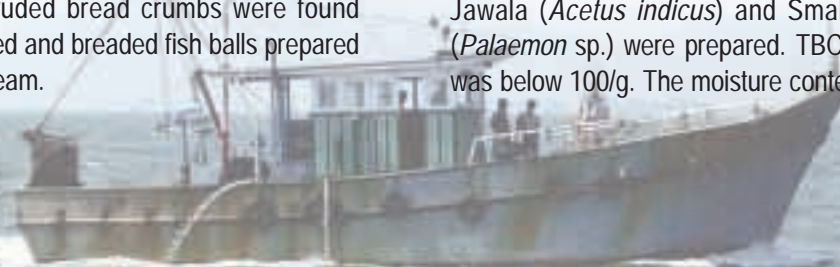
Executive Summary

- ◆ The two preservative treated rubber wood canoes and three FRP sheathed rubber wood canoes put on field trials started showing signs of mild bio-deterioration on completion of eight and seven years of service respectively.
- ◆ The coconut wood panels exposed to soil conditions after five years exposure showed that CCA and dual preservative treatment had better resistance to termite and fungal attack than chitosan, neem oil and CNSL treatment.
- ◆ Corrosion resistance tests on No. 7 round bend fishing hooks indicated that the rate of corrosion was higher in the first 50 hours of exposure which gradually reduced on prolonged exposure and there was a corresponding loss in break load by 3.07, 8.04, 18.17, and 25.14% respectively after 50, 100, 200 and 300 h of exposure to salt spray.
- ◆ Lack of infrastructure like OBM servicing, vessel dry docking and bunkering facility for the vessels at the jetty and lack of clear policy for sports fishing were some of the main problems identified with the recreational fishing in the marine sector.
- ◆ Experimental trials using short body shrimp trawls showed that there was a significant reduction in the mean bycatch generated by these trawls in comparison to the conventional shrimp trawl with no significant decrease in the shrimp catches.
- ◆ Introduction of large mesh purse seines and the high profit realized, has led to the revival of small mechanized purse seine fishery along the Cochin coast. All the 75 purse seiners based at the Cochin Fisheries Harbour have changed over to 45 mm mesh size purse seines and started operations in the deeper waters targeting Skipjack tuna, Little tunnies, Carangids, Black pomfret, Horse mackerel, Barracudas, Seerfishes and Mackerel.
- ◆ The deep sea shrimp landings by trawlers based at Kollam have been estimated as 7880 t, during the period September 2009 to August 2010. A deep sea trawler operating from the Sakthikulangara harbour of Kerala discards about 1000 – 2000 kg of bycatch in a fishing trip of 5-6 days.
- ◆ Total bycatch discards of deep sea shrimp trawlers at Kollam has been estimated as 11488 t. Myctophid contribution was about 3676 t, with a catch rate of 19.87 kg h⁻¹.
- ◆ The bio-optical properties of seawater along the coastal waters off Cochin was found to be very complex and hence region based remote sensing algorithms was found to be essential to explain the high spatial and temporal variability.
- ◆ Designed and developed multi seam bottom trawl for demersal fish exploitation.
- ◆ Developed semi circular fish eye and square mesh panels for juvenile fish exclusion.
- ◆ Developed foldable fish and prawn traps for reservoir fishery.
- ◆ Different species of bivalve molluscs and crustaceans such as *Anadara granosa* (Blood clam), *Perna viridis* (Brown mussel), *Perna indica* (Green mussel), crustaceans like *Oratosquilla nepa* (Matis shrimp), crabs like *Portunus pelagicus* (Reticulate crab), *Charybdis cruciata* (Cross crab), *Scylla serrata* (Green mud crab), *Portunus sanguinolentus* (Spotted crab), lobsters like *Panulirus homarus* (Green spiny lobster), *Panulirus polyphagus* (Banded spiny lobster) and almost all Penaeid and Non Penaeid prawns were reported from East Coast of India.
- ◆ Nine simultaneous fishing operations carried out in the PFZ and non-PFZ areas along the Gujarat coast using hired vessel indicated that the average CPUE from the vessels operating in the PFZ areas as 33.01 kg h⁻¹ and from the non-PFZ locations it was 30.15 kg h⁻¹.
- ◆ Yield of Stripped Catfish (*Pangasianodon hypophthalmus*) during different stages of processing was assessed. The average yield of fish after gutting

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was found to be 76.8% and fillet yield was 42%. Whole and gutted fish had a shelf life of 18 and 22 days respectively in iced condition. The steaks had a shelf life of 14 days in ice.

- ◆ Battered and breaded products prepared from Myctophid fish *Diaphus watasei* had acceptable organoleptic characteristics similar to coated products prepared from commonly used fishes.
- ◆ Developed a high value pet food for dogs from tuna canning waste. It is a rich source of protein and carbohydrate. The product also provides minerals and Vitamins like Vitamin-A, Vitamin-B and Vitamin-D. The nutritional factors in the pet food indicate that 100 g of the product provides more than 350 calories of energy.
- ◆ Canning studies of pelagic fish Mahi-mahi (*Coryphaena hippurus*) was carried out in oil and in tomato sauce medium. The fish has white meat with low fat and high protein content (Moisture content - 77.4%, Protein -19.8%, and Fat - 0.62%). Canned product in ground nut oil was more acceptable than the product in tomato sauce.
- ◆ Storage studies of coated and flash fried fish balls prepared from Lizard fish and frozen stored at -18°C has better organoleptic characteristics than balls prepared without flash frying. Both the products have good frozen shelf life of more than 12 months.
- ◆ Lizard fish canned in brine in TFS cans for an Fo value of 9.0 by heat processing for 27 min. at 121.1°C remained in acceptable condition for more than 12 months.
- ◆ Mussel curry processed in indigenous opaque retort pouches had good organoleptic qualities up to 12 months of storage.
- ◆ Ready to eat fish ball curry in retortable pouches had shelf life of 12 months at ambient temperature.
- ◆ Developed ready to serve bread spread from Blue swimmer crab (*Portunus pelagicus*) in TFS cans.
- ◆ Indigenously extruded bread crumbs were found suitable for battered and breaded fish balls prepared from Threadfin bream.
- ◆ Process parameters for ready to eat Yellowfin tuna steaks and White prawns in different forms in see-through pouches was optimized.
- ◆ Prepared packaging film based on chitosan from shell fish waste and optimized the process with respect to physical, mechanical and functional performance.
- ◆ Chitosan treatment and packing with O₂ scavenger and CO₂ emitter improved the keeping quality of Leather jacket (*Aluterus monoceros*) in chilled condition.
- ◆ Feeding trials conducted in Catla, Grass carp and Rohu fingerlings have shown that groups fed with the silage- incorporated feed had significant difference in PER (P<0.05) and FCR (P<0.05).
- ◆ Glucosamine hydrochloride was prepared under different conditions and the yield, colour, purity and polarity of the samples were assessed. The yield was found to vary from 16% to 69% and polarity between 54.9 to 66.1.
- ◆ Chitosan beads are being studied for drug delivery applications.
- ◆ Four batches of Striped Catfish (*Pangasianodon hypophthalmus*) fillets were prepared and packed with different conditions. The results indicate that Striped Catfish fillets can be stored for a period of nine days in chilled condition (4°C) and soaking the fillets in 1% NaCl and 2% STPP chilled water will improve texture.
- ◆ Chilled storage studies of whole cleaned Squid (*Loligo duvauceli*) indicated a shelf life of nine and 11 days in 12 µm polyester laminated, 75 µm low density polyethylene laminated flexible pouches and shrink packs respectively.
- ◆ Cuttle fish (*Sepia pharaonis*) in skinless gutted form packed in 12 µm polyester laminated and 75 µm low density polyethylene laminated flexible pouches showed a shelf life of less than a day, 5-6 and 18 days at room temperature, 7°C and under ice, respectively.
- ◆ Crispy golden brown ready to eat products from Jawala (*Acetis indicus*) and Small kardi shrimp (*Palaemon* sp.) were prepared. TBC in the product was below 100/g. The moisture content was 3-5%.





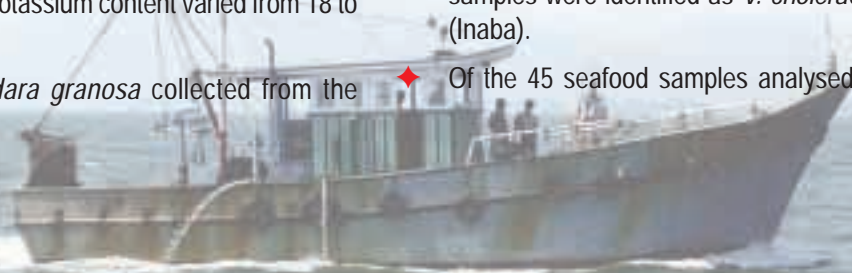
- ◆ The preparation of freeze dried prawn flavor extract was being standardized. The product was stored for 12 months in sealed brown glass bottles with slow loss of carotene level.
- ◆ Preliminary study was undertaken to develop bakery products like Rusk, Bread (*Pav*) and Khari (Puff like bakery product) incorporating freshwater fish (*Labeo rohita*) mince at 10, 20 and 30% levels.
- ◆ Withdrawal period of antibiotics such as Florfenicol and Sarafloxacin in *Macrobrachium rosenbergii* was estimated to be 22-25 and 21-24 days respectively.
- ◆ An assessment of antibiotic usage in hatcheries was undertaken. Antibiotics were detected above permissible limits in all the samples. 40% of samples had Oxytetracycline followed by Furazolidone (20%), Ciprofloxacin (20%), Erythromycin (10%) and Chloramphenicol (10%).
- ◆ No metabolites formation in *M. rosenbergii* was noticed after administration of Spectinomycin and Acriflavin.
- ◆ Heavy metal contents in Clam, Pearls spot, Tilapia and Sole in Kerala waters were found to be within prescribed limits.
- ◆ Analysis of EU notification alerts for export consignments of seafood from India showed a decreasing trend in alerts during 2010-11.
- ◆ Challenge studies with different food-borne pathogens were carried out to elucidate their survival pattern in different preservation methods like vacuum packaging, chilling, freezing and drying.
- ◆ Challenge studies with *Escherichia coli* O157:H7 in Yellowfin tuna indicated high resistance of the pathogen with respect to low temperature preservation.
- ◆ Inclusion of multiple barriers such as dip in organic acids in conjunction with chilling did not affect the survival pattern of *E. coli* O157:H7.
- ◆ Challenge studies with *Salmonella* in Anchovy (*Stolephorus commersonii*) revealed that 12 hours sun drying was adequate enough to eliminate the pathogen.
- ◆ Pandemic strains of *Vibrio parahaemolyticus* O3:K6 was found to be highly susceptible to low temperature. Inoculated pack studies revealed only four days survival of this pathogen during chill storage of Yellowfin tuna.
- ◆ Inclusion of Citric acid at 0.4% level and Potassium sorbate at 0.3% significantly increased the chill storage life of squid *Loligo duvauceli*.
- ◆ Phytochemicals extracted from *Orthosiphon glabratus*, *Lawsonia inermis* and *Cassia alata* exhibited broad spectrum antibacterial activity against pathogenic and spoilage flora encountered in seafood.
- ◆ Species-specific differential Cadmium bio-accumulation was observed in Squids. Tissue-wise variation and heterogeneous accumulation in edible parts were also noticed.
- ◆ Histamine forming bacteria during spoilage of Kawa Kawa (*Euthynnus affinis*) increased from 20 cfu/g to 8.8×10^3 cfu/g during storage for 18 h at ambient temperature (28°-30°C). The histamine forming bacteria belonged to Enterobacteriaceae. The histamine content in the meat reached 1457 ppm by the end of 18 h of storage.
- ◆ Different feeds used in the shrimp hatcheries viz., *Artemia* Cysts (n=2), *Zoea* feed (n=2), Post Larval feed (n=9), Probiotics (n=3), *Mysis* feed (n=2), and a chemical feed (n=1) were analyzed for various antibiotics and pesticides. Heptachlor epoxide, an organochlorine pesticide was detected in *Mysis* feed at 7.05 ppb level. No other pesticide was detected in the hatchery feed samples. Among antibiotics, only Chloramphenicol was observed in post larval feed 1-9 (453 ppb) and post larval feed 1-6 (112.5 ppb). Aquaculture farmers are procuring seeds from these hatcheries where some of the banned veterinary drugs were detected.
- ◆ Histamine level in the muscle in very fresh juveniles of Grey mullet (*Mugil cephalus*) from Vashi creek was 3.5 – 5 mg%. Histamine level in the muscle of fresh water fish was highest i.e., 4.33 mg% in freshwater Eel (*Macrogathus pancalus*). Histamine level in the muscle of one sample of Seer fish was 22.66 mg%.

Histamine forming bacteria was present in all species under study.

- ◆ Cadmium content in the muscle of all samples was below 0.03 ppm except in one Squid sample where its value was 0.093 ppm. Lead content in the muscle of freshwater fish samples was highest i.e., 1.023-1.029 ppm in freshwater Eel (*M. pancalus*) and fresh water shark (*Wallago attu*). Squid meat contained 0.919 ppm lead which was highest among marine fish samples.
- ◆ Insect infestation of *Necrobia rufipes* was observed in Bombay duck samples while *Dermestes* sp. beetles were observed in Ribbonfish samples.
- ◆ An increase in pH and reduction in the bacterial load was observed for different stages of individually quick (IQ) frozen Squid (*Loligo duvauceli*) under commercial operating conditions.
- ◆ A higher level of Cadmium was observed in commercially caught and commercially frozen cuttlefish and squids from the Veraval region.
- ◆ *Tenualosa ilisha*, an anadromous fish that migrates to the river Godavari during the monsoon season fetches a very premium price to the fishers. The protein content of the fish was relatively more when it is in marine environment (22% WWB) compared to riverine environment (18–19% WWB) but total lipid content of the fish was distinctly higher in the riverine environment (47.65% DWB) than in the marine environment (37% DWB).
- ◆ More than 40 shrimp hatcheries are located on the Kakinada coast, Andhra Pradesh which produces Black tiger (*Penaeus monodon*) and White prawn (*Litopenaeus vannamei*) post-larvae. The different stages of feed samples were collected and subjected for nutritional profiling. The moisture content of the farm feeds ranged between 7.8% and 8.9%, total fat varied from 7.46% to 7.95% and total ash from 15.7% to 16.9%. Wide variation was observed in the mineral content of farm feeds: Calcium content varied from 384 to 1252 mg%, Sodium content varied from 185 to 685 mg% and Potassium content varied from 18 to 935 mg%.
- ◆ Blood clam *Anadara granosa* collected from the

Kakinada coast of Andra Pradesh was subjected to analysis of proximate composition. The moisture and protein content were 77.54% and 17.63% respectively. Total Lipid was 1.96%. The minerals like Phosphorus, Iron, Sodium, Potassium and Calcium were 413 mg%, 61 mg%, 1761 mg%, 552.5 mg% and 200 mg% respectively. The total plate count was 1.02×10^6 cfu/g and total Enterobacteriaceae count was 7.15×10^3 cfu/g. Faecal indicators viz., faecal Coliforms (3.6 MPN/g), *E. coli* (3.6 MPN/g) and faecal Streptococci (110/g) were detected. Human pathogens namely *Staphylococcus aureus*, *V. cholerae* and *Salmonella* were not detected.

- ◆ Water soluble extract was prepared from the Blood clam contents. The Clam contents were further extracted with salt (5% NaCl) to get the salt soluble extract. These extracts were tested for antimicrobial activity against *E. coli*, *Staphylococcus aureus*, *V. cholerae*, *Salmonella*, *Bacillus cereus* and *Micrococcus luteus*. The water soluble extract showed antimicrobial activity against *Salmonella* whereas salt soluble extract showed antimicrobial activity against *S. aureus*.
- ◆ Pathogenic *V. parahaemolyticus* was found to be present in 21% of the 38 seafood samples collected from retail markets in Ernakulam, Kottayam and Alappuzha districts in Kerala, India.
- ◆ A total of 3.9% isolates of the 198 strains of *V. parahaemolyticus* isolated from seafood possessed ORF8 sequence indicating its pandemic potential while 11.6% isolates possessed TDH gene indicating its virulence potential.
- ◆ One Methicillin resistant *S. aureus* (MRSA) strain was isolated from seafood.
- ◆ *Yersinia enterocolitica* biotype 1A was detected in three out of 60 seafood samples collected from retail markets in Ernakulam, Kottayam and Alappuzha districts in Kerala, India. *ystb* gene was detected in the biotype 1A isolates.
- ◆ Three out of 50 *V. cholerae* isolates from seafood samples were identified as *V. cholerae* O1 serotype (Inaba).
- ◆ Of the 45 seafood samples analysed, 86.6% were





found to harbour *E. coli* but none of them were found to harbour *E. coli* O157:H7.

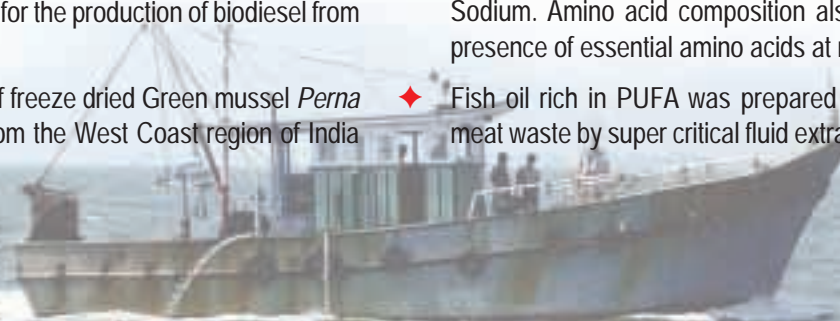
- ◆ *Shigella dysenteriae*, *S. boydii* and *S. flexneri* were detected in three out of 20 seafood samples from retail markets comprising of Shrimp, Clam and Mussel.
- ◆ *Listeria monocytogenes* was detected in 2.2% of the seafood samples and serogroups 1 and 4 were identified.
- ◆ *L. monocytogenes* isolate from freshwater fish and *L. monocytogenes* ATCC 19115 were found to be strong biofilm producer on polystyrene plate, stainless steel coupon, aluminum coupon and glass slide.
- ◆ Five strains of Lactic Acid Bacteria inhibitory to *L. monocytogenes* were identified as belonging to *Lactobacillus plantarum* and *L. fermentum*.
- ◆ *S. aureus* was present in 39% of the 87 samples of fish and shell fish tested.
- ◆ Staphylococcal enterotoxins; SEA, SEB, SEC, SEG and SEI were present in 12.5%, 20%, 27.5%, 22.5% and 20% of the 40 *S. aureus* isolates respectively.
- ◆ Enterotoxigenic *B. cereus* was detected in 16 of the 51 samples tested from fishery environment.
- ◆ Benzalkonium chloride at 0.1% concentrations were able to reduce the *Listeria* population in biofilm by 2.25 log₁₀ value, while 0.2% completely destroyed the *Listeria* population in biofilm.
- ◆ 20 ppm chlorine was sufficient to completely destroy the *Listeria* population in the biofilm.
- ◆ On chilling, the levels of aerobic mesophilic bacteria and H₂S producing bacteria on freshwater catfish, *Pangasius sutchi*, reached 10⁷ and 10⁵ cfu/g respectively on Day 8 limiting the shelf life to 6-7d whereas in ice stored fillets, the limit count was reached on Day 11 and shelf life was 8-11d.
- ◆ The activity of the purified alkaline protease enzyme from *B. subtilis* SQ12 was 545, 710, 918, 890, 645 U/ml respectively at pH 8, 9, 10, 11 and 12 and the activity was three times higher as compared to the crude enzymes.
- ◆ Sorbitol dehydrogenase, an enzyme that convert fructose to sorbitol which can act as an

osmoprotectant, from *Oceanobacillus iheyensis* was functionally characterised.

- ◆ The Mannitol 1 phosphate 5 dehydrogenase gene from *Bacillus licheniformis*, that catalyzes the conversion of fructose to mannitol was expressed in *E. coli* and a recombinant protein of 40KDa size was obtained after purification on His-tag column.
- ◆ Molecular and functional characterization of glutamate dehydrogenase gene from *Oceanobacillus iheyensis* was carried out.
- ◆ *O. iheyensis* whole Transcriptome Analysis was carried out using SOLiD 3 plus sequencer under 0.4 OD and 1.0 OD growth conditions at 7.5% growth conditions to understand the molecular mechanisms involved in halotolerance. There were 349 genes that were upregulated and 499 genes that were downregulated.
- ◆ Mapping of 499 downregulated genes of *O. iheyensis* onto KEGG pathways revealed three key pathways whereas 349 upregulated genes have been carried out onto eight key pathways.
- ◆ Green mussel (*Perna viridis*) collected from the sea at Kakinada, East Godavari district of Andhra Pradesh was analyzed for microbiological and chemical parameters. The moisture, protein, fat and ash content of big sized *P. viridis* were 78.5%, 17.1%, 3.06% and 7.93%, respectively. The Sodium, Potassium, and Phosphorus content were higher in small sized *P. viridis* (Na- 2824 mg%, K- 787 mg% and P- 1019 mg%) than in large sized *P. viridis* (Na-1594 mg%, K- 435 mg% and P- 910 mg%) whereas Calcium and Iron content were relatively higher in large sized *P. viridis* (Ca- 123 mg%, Fe- 232 mg%) than in small sized *P. viridis* (Ca- 79 mg% and Fe- 165 mg%).
- ◆ Microbiological quality parameters (total plate counts, H₂S producing bacteria, faecal Coliforms, *E. coli*, faecal Streptococci, *Salmonella*, *Listeria*, *V. cholerae* and Coagulase⁺ Staphylococci) were analyzed in water and ice collected from processing plants and also landing centers. One consignment (defective packaging and infested with insects) has been rejected for not meeting the EU2023/2006 standards.

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- ◆ During monitoring of pathogens in samples *E. coli* with counts more than 20/g was found to be present in 50% fresh fish samples. Fecal Streptococci and Sulphite reducing Clostridia and Coagulase⁺ Staphylococci were present in almost all samples. Pathogens *V. parahaemolyticus*, *V. cholera*, *Salmonella* and *Listeria* were absent in all samples.
- ◆ Nutritional evaluation of bivalve molluscs and crustaceans indicated the presence of bioinorganics of therapeutical significance.
- ◆ Blood clam (*Anadara granosa*) extracts exhibited significant antimicrobial activity against *Salmonella* and *Staphylococcus aureus*.
- ◆ Biochemical compositional analyses and microbial investigations of freshwater snail (*Pila gracilis*) collected from the paddy fields of East Godavari district, Andhra Pradesh indicated that it is safe and nutritive for human consumption.
- ◆ Studies on mineral status indicated that Sodium, Potassium and Phosphorus content were higher in small sized *Perna indica* (Na- 2824 mg%, K- 787 mg% and P- 1019 mg%) than in large sized *P. indica* (Na- 1594 mg%, K- 435 mg% and P- 910 mg%).
- ◆ Calcium and Iron content were relatively higher in large sized *P. indica* (Ca- 123 mg%, Fe- 232 mg%) than in small sized *P. indica* (Ca- 79 mg% and Fe – 165 mg%).
- ◆ Acid soluble collagen, pepsin-digestible collagen and insoluble collagen were isolated from Tuna and Rohu skin. Yield of acid soluble collagen from Tuna skin was 14%.
- ◆ Nutritional profiling was done for two IQ frozen products branded as Arabian Seamaster Squid Tubes and Arabian Seamaster Squid Stripes.
- ◆ Three different chemical processes developed for the production of biodiesel from Sardine oil by transesterification process indicated that the extraction methods with acidified alcohol and acetyl chloride are optimum methods for the production of biodiesel from fish oil.
- ◆ Chemical profile of freeze dried Green mussel *Perna viridis* collected from the West Coast region of India indicated that the incorporation of additives is required to make the product comparable to the commercially available New Zealand Green lipid mussel extract used for the treatment of arthritis.
- ◆ High Performance Liquid Chromatography analysis of the root extract of *Rhizophora apiculata* revealed the presence of three peaks corresponding to three standard compounds (Rutin, Quercitin) and Gallic acid.
- ◆ The antioxidant phenolic compounds and flavonoid content are higher in the root of *R. apiculata* than in *Acanthus ilicifolius*.
- ◆ Nutritional evaluation of oceanic squid *Sthenoteuthis ovalaniensis* indicated that it is devoid of ammonia content, which is often considered as a major cause for off-flavor.
- ◆ Biochemical profile of *Diaphus watasei*, a common Myctophid along the West Coast of India, collected off Kochi showed a fatty acid profile with high saturated fatty acid content (45%) followed by mono unsaturated and poly unsaturated fatty acids. The cholesterol content was very low compared to other pelagic fishes like Oil sardine and Indian mackerel. All essential amino acids were present in a balanced proportion.
- ◆ A dietary supplement for nutritional intervention of Endosulfan victims has been formulated using Tuna meat, Oyster meat and Clam meat mixed in 2:1:1 proportion, and added tyrosine, phenyl alanine, vitamins and minerals.
- ◆ Pollutant profiling of Oysters collected from West Coast of India indicated that they were devoid of any environmental pollutants in their meat. They are not only safe for consumption, but also nutritionally beneficial to humans.
- ◆ The nutrient profiling of Oysters revealed that it contained significant proportions of n-3 fatty acids (51.2%) especially EPA and DHA in their meat. Moreover, it is having higher content of Potassium than Sodium. Amino acid composition also depicted the presence of essential amino acids at required levels.
- ◆ Fish oil rich in PUFA was prepared from Tuna red meat waste by super critical fluid extraction, under 35





MPa at 60°C. The yield obtained was 5% of dry weight. Different trials were made to optimize the conditions of production.

- ◆ Designed and developed a pilot model renewable energy solar biomass hybrid dryer for eco-friendly and hygienic drying.
- ◆ Design optimization of solar fish dryer with alternate electrical back-up heating system was done.
- ◆ Design modification of CIFT Dryer SDL-250 was carried out.
- ◆ Design and development of solar fish drying system in marine containers was done.
- ◆ Installation and commissioning of solar dryer with LPG back-up for ICAR Research Complex for NEH at Imphal was carried out.
- ◆ Fabrication and supply of solar fish dryer for Cochin Corporation was done.
- ◆ COFISKIs were successfully installed at Aalong, West Siang district, Daporijo, Upper Sibinsiri district and Yinkiang, Upper Siang district of Arunachal Pradesh. It is observed that COFISKI installed at Tarin, Lower Sibinsiri district is being used successfully for various demonstration works during the training programmes for production of high quality smoke cured fish by scientific and hygienic methods. In the last phase three COFISKIs were installed at Seppa, East Kameng district, Bomidila, West Kameng district and Tawang, Tawang district. With these installations a total of 17 COFISKI were installed for the benefit of fishers in Arunachal Pradesh.
- ◆ The data collected under technology assessment in selected fishing villages revealed that among the fishermen operating 7.6 to 10.2 LOA FRP crafts in Kannur district, the average number of fishing days in a year was 277 days and the mean total investment on the fishing unit was ₹ 7.87 lakhs. The fishing units using mini-seine nets had mean annual income of ₹ 2.07 lakhs.
- ◆ Among the fishermen operating FRP crafts in Kozhikode district, the average number of fishing days was 184 days and the total investment on the fishing unit was ₹ 3.96 lakhs; the average income was ₹ 2.38

lakhs and gill nets were predominantly used.

- ◆ Among the respondents in Kollam district, the average number of fishing days was 280 days and the total investment on the fishing unit was ₹ 4.26 lakhs and mainly, gill nets were used; the average income was ₹ 1.20 lakhs.
- ◆ In Thiruvananthapuram district, the average number of fishing days was 280 days and the mean total investment on the fishing unit was ₹ 4.09 lakhs; the average investment on the fishing craft, fishing nets and engine were found to be ₹ 98,180/-, ₹ 1,48,150/- and ₹ 1,63,150/- respectively. Most of the fishermen had used gillnets. The mean annual income was estimated at ₹ 2.79 lakhs.
- ◆ While comparing the states on manpower, West Bengal contributed maximum manpower in fishing activity followed by Kerala. From the ANOVA analysis, it was inferred that the engagement of manpower in the fishing activity did not significantly contribute to fish landings.
- ◆ A group under 'Sri Dharma Sastha Paripalana Samithi' (SDSPS) was mobilized at Munambam and developed as a pilot level semi commercial unit (FRESH'N'FISH) for production of value added fish products.
- ◆ A perusal of the export value realised has shown that there is a decreasing trend in the actual unit value realisation. Though in rupee terms, the unit value realised has increased from ₹ 118.17 in 1995-96 to ₹ 147.86 in 2003-04, in USD (\$) terms it has actually fallen from 3.75 to 3.02 during the corresponding period.
- ◆ The average waste generation through cephalopod processing was found to be 25.49% in Cochin region.
- ◆ The Revealed Comparative Advantage (RCA) of shrimp exports to the US from India was 0.44 during 2006 indicating that India has no comparative advantage in exporting shrimp to US.
- ◆ Three resource specific maps were developed on Chellanam Panchayat on infrastructure and demographic characteristics.
- ◆ Under the NAIP sub-project, 'Mobilizing mass media

support for sharing agro information', a two-day Agricultural Exhibition and Farmer's Meet ('Krishi Darpan 2011') was organized at Cochin. As part of the project, media liaison has been strengthened by organizing three media visits at Kannur, Palakkad and

Munambam. Seventy six reports were published in print media and 14 reports in web media, technological information were disseminated through visual media by way of 13 reports in different TV channels and three success stories through 'Doordarshan'.

Introduction

The Central Institute of Fisheries Technology (named at the time of inception as Central Fisheries Technology Research Station) was set-up following the recommendation of a high power committee constituted by the Ministry of Food and Agriculture, Government of India. It 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. Other Divisions soon followed. The administrative control of the Institute was brought under the Indian Council of Agricultural Research on 1 October, 1967.

The Institute is the only national centre in the country where research in all disciplines relating to fishing and fish processing is undertaken. Research Centres at present function at Visakhapatnam (Andhra Pradesh), Veraval (Gujarat) and Mumbai (Maharashtra).

Mandate

- ◆ To conduct basic, strategic and applied research in fishing and fish processing.
- ◆ To develop designs for fuel efficient fishing vessels and fishing gear for responsible fishing.
- ◆ To develop technologies for commercial isolation of bioactive compounds and industrially important products from fish and fishery wastes.
- ◆ To design innovative implements and machineries for fishing and fish processing and pilot plants for facilitating commercialization of technologies developed.
- ◆ To do advanced research in food safety in fish and fishery products.
- ◆ To provide training and consultancy services in fishing and fish processing.

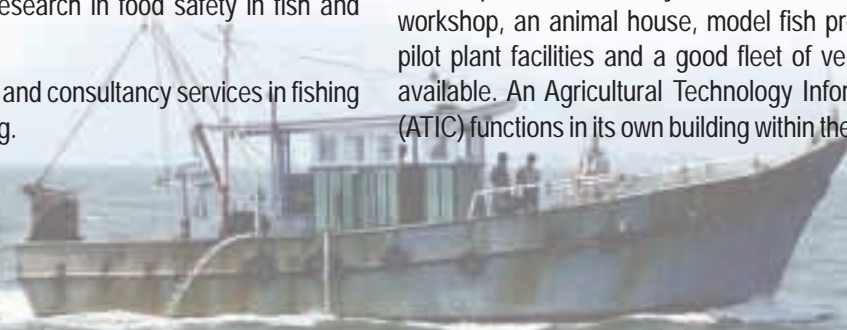
Organizational set-up

The Institute is headed by the Director with whom all administrative and financial powers are vested. He is assisted by a Senior Administrative Officer and Administrative Officer for dealing with matters relating to general administration and Finance and Accounts Officer for looking after the financial and accounting aspects, as also internal audit of the Institute. The Technical Section is headed by a Technical Officer who attends to the technical matters including those connected with research projects handled by the Institute, implementation of Right to Information Act-2005 and Intellectual Property Rights and Patents under Institute Technology Management Unit. Official Language Implementation Section is headed by the Deputy Director (Official Language).

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

1. Fishing Technology Division
2. Fish Processing Division
3. Quality Assurance and Management Division
4. Microbiology, Fermentation and Biotechnology Division
5. Biochemistry and Nutrition Division
6. Engineering Division
7. Extension, Information and Statistics Division

The Institute is housed in its own building in Willington Island, Cochin, and at all Research Centres. It has very good residential quarters for the staff at Cochin and Visakhapatnam, and library and IT facilities. A well equipped workshop, an animal house, model fish processing halls, pilot plant facilities and a good fleet of vehicles are also available. An Agricultural Technology Information Centre (ATIC) functions in its own building within the main campus.





Budget

(For the year 2010-2011 - ₹ in Lakhs)

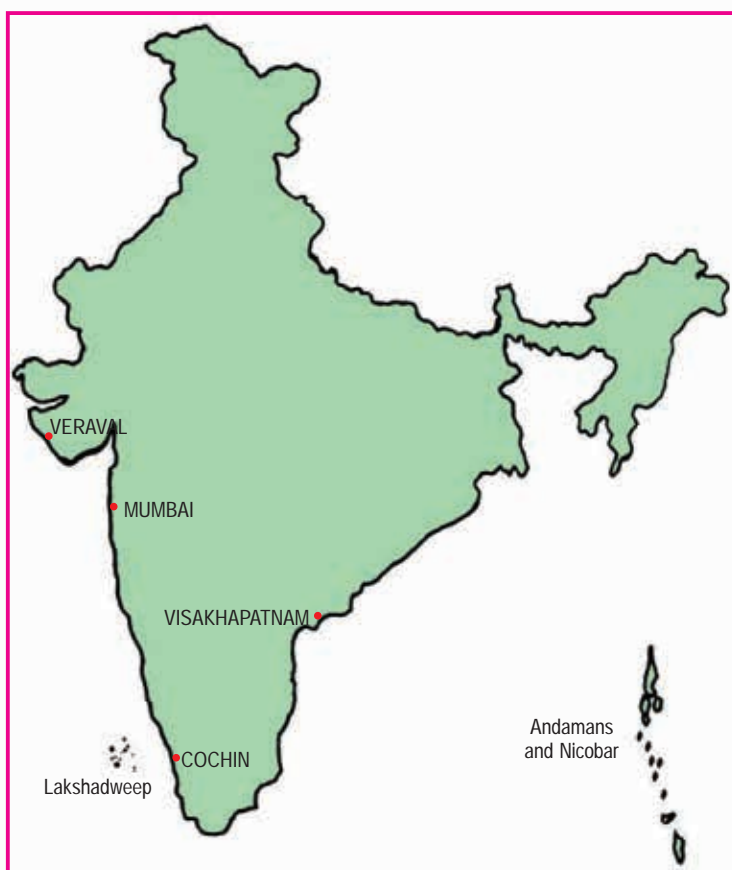
Particulars	Non-Plan		Plan	
Budget Head	Allocation	Expenditure	Allocation	Expenditure
Establishment charges	1470.00	1441.17	-	-
Overtime allowances	0.50	0.32	-	-
Travelling allowances	20.00	20.00	26.00	26.00
Works (Original)	-	-	120.00	120.00
Works (Maintenance)	90.00	89.99	-	-
Other charges (Equipments)	85.00	84.89	250.00	250.00
Other charges (Contingency)	44.50	44.48	299.00	299.00
Furniture and Fixtures	-	-	5.00	4.98
Library books	-	-	40.00	40.00
Other items	-	-	10.00	10.00
HRD	-	-	10.00	9.76
Information Technology	-	-	20.00	20.00
TOTAL	1710.00	1680.85	780.00	779.74

Staff position as on 31 March 2011

Category	Sanctioned	Filled
Scientific	95	61
Technical	132	115
Administrative	81	71
Supporting	72	53
Auxiliary	06	04
TOTAL	386	304



Addresses of Headquarters and Research Centres



COCHIN (Headquarters)

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E mail : enk_ciftaris@sancharnet.in
cift@ciftmail.org
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Website : www.cift.res.in

VISAKHAPATNAM

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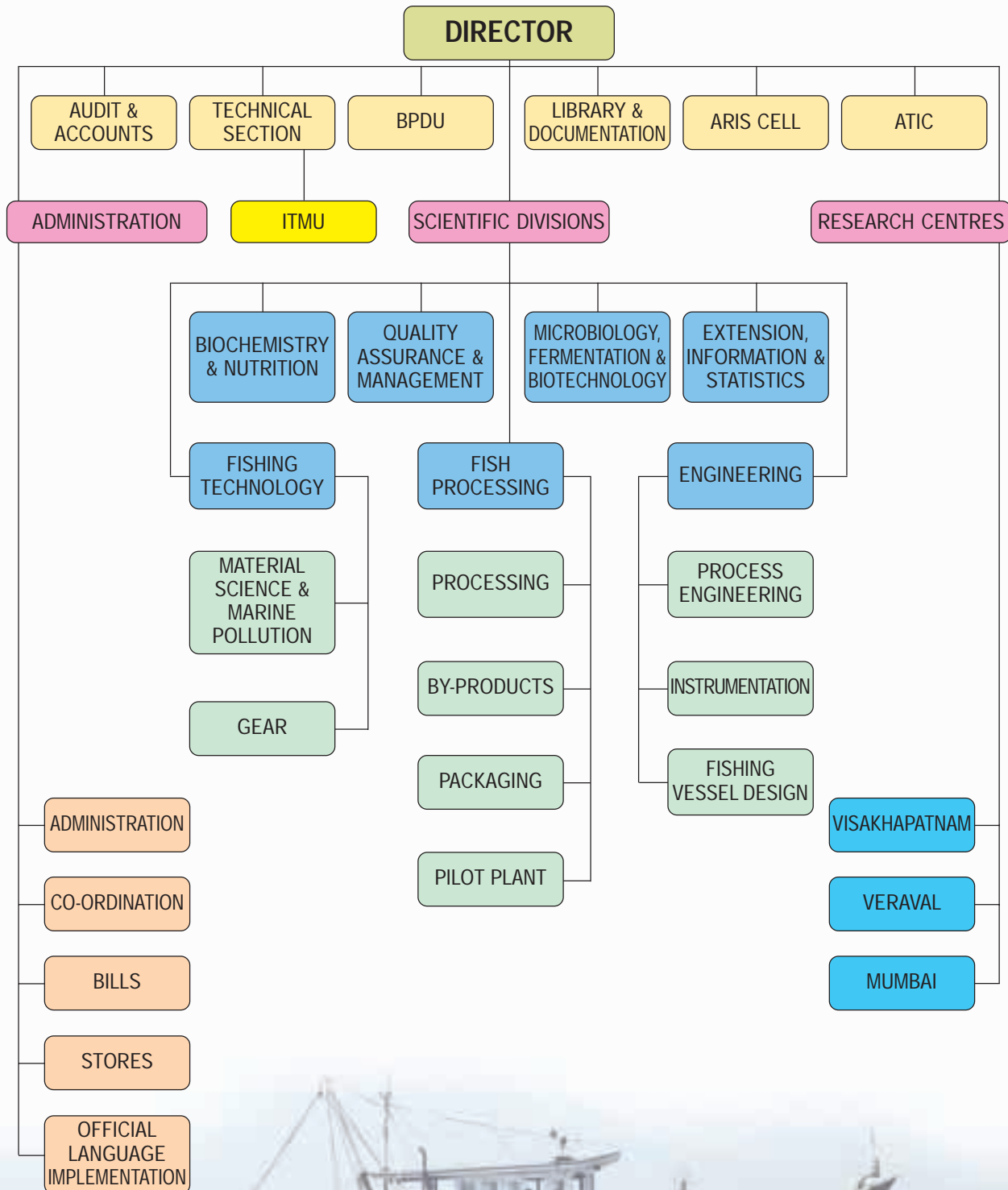
MUMBAI

Research Centre of CIFT
CIDCO Administrative Building
(Ground Floor), Sector - I
Vashi, Navi Mumbai - 400 703, Maharashtra
Ph : 022-27826017; Fax : 022-27827413
E mail : ciftmum@bom.nic.in
Telegram : FISHTECH/FISHPROCESS(FT)



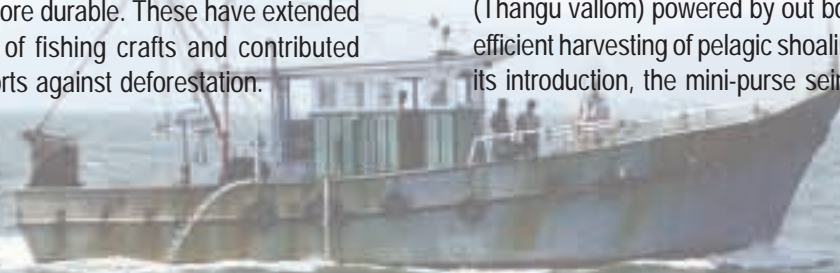


Organogram



A Quick Glance at Past Research Achievements

- ◆ CIFT has developed and introduced 12 standard designs of mechanized wooden fishing boats in the size range of 7.6 to 15.2 m LOA for coastal and intermediate range. It is estimated that over 80% of the nearly 54,000 mechanized wooden fishing crafts in the Indian fishing fleet confirm to the popular CIFT designs or its later adaptations.
- ◆ Hull maintenance of the fishing vessels is important for increasing its service life. CIFT has developed a package of technologies for protection from bio-deterioration, fouling and corrosion for increasing the life span, substantially reducing maintenance cost of fishing vessels.
- ◆ Aluminium-Magnesium alloy sheathing with cathodic protection and prescribed coating system was developed as a cost-effective substitute for Copper sheathing for wooden hulls as protection against marine borers. This technology is widely used in the small-scale mechanized vessels.
- ◆ Epoxy resin based coating developed has improved the life span of cast Iron propeller, making it a cost-effective substitute for Bronze propeller in fishing boats.
- ◆ Spheroidal graphite cast Iron with Nickel (21-24%) was recommended as substitute for conventional Manganese-Bronze for propellers of fishing boats, resulting in cost savings of 25-30%.
- ◆ Superior cost-effective antifouling paint formulations incorporating Cuprous oxide and modified indigenous resins were developed for protection against fouling in fishing boats.
- ◆ CIFT has developed technologies for the chemical preservation and upgradation of low cost timbers to make them more durable. These have extended the service life of fishing crafts and contributed towards the efforts against deforestation.
- ◆ Technology was evolved for upgradation of cheaper secondary species of wood as substitute for boat scantling, by impregnation with styrene-polyester monomers, fortification with Creosote/Tributyl tin oxide and polymerization with gamma irradiation.
- ◆ Fibreglass canoes and fibreglass sheathed canoes made of rubber wood introduced by CIFT have become very popular.
- ◆ Aluminium boats for reservoir fisheries is another innovation of CIFT.
- ◆ CIFT has made immense contribution towards the standardization of the netting, netting yarn and netting twine used for fishery purposes. These developments have led to an increase in the productivity of the fishing gear and increase in net profits due to low maintenance and long service life of the nets.
- ◆ CIFT has made significant contributions in the development of fishing gear and methods for the traditional sector, traditional motorized sector, small-scale mechanized sector and large-scale industrial sector in Indian fisheries, which is reflected in the increase in fish production.
- ◆ Improvements were made in the design and durability of lobster traps as substitute for traditional traps of short life span and low efficiency, for harvesting of spiny lobsters.
- ◆ A mini-trawl for operation from traditional crafts powered by outboard motors of 8-15 Hp, for shallow water shrimp trawling was introduced.
- ◆ The purse seine was introduced and popularized for operation from traditional plank built canoes (Thangu vallom) powered by out board motors, for efficient harvesting of pelagic shoaling fishes. Since its introduction, the mini-purse seine has become





very popular among the fishermen of motorized sector along the coast line of Kerala, significantly contributing to the landings of pelagic resources such as Sardines, Mackerels and anchovies.

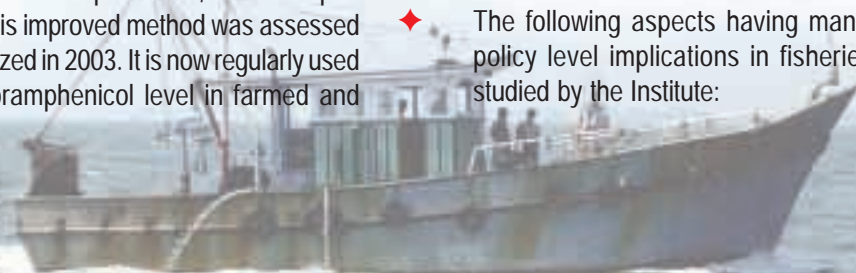
- ◆ Specially designed trawl for shrimp trawling with vertical opening and extra long wings on either side was found effective for sweeping of wider horizontal area along the sea bed resulting in increased shrimp catch.
- ◆ Bulged belly trawl with relatively high opening was designed to improve the catch of fin fishes without compromising on shrimp catch.
- ◆ In high opening trawls, vertical opening of the trawl is increased by innovative design improvements, facilitating capture of demersal as well as off-bottom resources.
- ◆ Large mesh trawl with relatively large meshes in the front portion resulted in significant reduction in trawl resistance, making use of the herding effect of large meshes on fin fishes. These designs have been well accepted by the trawler fishermen of Gujarat, Karnataka and Kerala.
- ◆ Otter boards are sheer devices used in trawls for keeping the trawl mouth horizontally open. Different sizes of flat rectangular boards and vertically cambered otter boards have been introduced by CIFT for the benefit of small-scale mechanized fleet, during the course of its developments. V-form otter boards with high stability, better hydrodynamic efficiency, low maintenance cost and longer service life is now replacing the flat rectangular boards in the small-scale mechanized sector. Overall savings by adoption of V-form otter boards in place of flat rectangular boards is about 15%.
- ◆ Purse seines for catching pelagic fishes such as Sardine and Mackerel from small mechanized vessels has been developed.
- ◆ Long lines for sharks using indigenous hooks has been developed as a low energy resource-specific alternative to energy intensive, less selective fishing methods such as trawling.
- ◆ Troll lines for predatory fishes such as Spanish

Mackerel and Barracuda using buffalo horn and stainless steel spoon and fish head jigs were developed.

- ◆ Marine gill net optimized for catching Sardine, Mackerel, Spanish Mackerel, Pomfret and Hilsa, in terms of material and mesh size were introduced for the benefit of non-motorized and mechanized segments of the industry.
- ◆ Gear systems have improved the capture fishery production from the inland open water resources significantly over the years. Trammel nets and monolines were also introduced in reservoir systems.
- ◆ Technology for the extraction of chitin from shrimp shell and conversion to chitosan has successfully addressed a very serious environmental threat due to the careless disposal of the waste. A number of parties have already taken this technology and started production and marketing. Nearly 20% of the available shell waste is being used by these industries for conversion to chitin and chitosan. In addition to creating employment, this has become a highly remunerative industry.
- ◆ Ready-to-serve fish curry products in retortable pouches can be stored at ambient temperature. This revolutionary technology has been given to more than a dozen parties who have already started production and marketing. This technology has long term impact in terms of value addition.
- ◆ Isinglass is a product that has got application as a clarifying agent in breweries, mainly in the beer industry. The technology was transferred to an industry for commercialization. This has resulted in the production of a value added product which has got demand in domestic and foreign market.
- ◆ The technology for extraction of Poly Unsaturated Fatty Acids (PUFA) from fish oil is a very important contribution towards nutritional security by providing a vital nutritional component. Many multinational companies are importing PUFA- enriched products and this technology will lead to import substitution. This value-added product will help in increasing the income of the fishermen.

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- ◆ Collagen-chitosan film has wide applications as a wound dressing material and in dental surgery. It replaces the imported Teflon membrane used in dental surgery and the cost will be only a small fraction of that of the imported material. The raw material is fish air bladder, which does not find any use now. This technology can utilize the industrial waste and thus can enhance the income of the fishermen.
- ◆ Database on biochemical composition of fish serves as the major source of data for product formulation and nutrition labeling.
- ◆ A single step microbiological assay was perfected for detecting residues of eight antibiotics in seafood, viz., Chloramphenicol, Oxolinic acid, Tetracycline, Oxytetracycline, Furazolidine, Nalidixic acid, Neomycin and Trimethoprim which are commonly found used in aquaculture farms in India. The method can detect the antibiotic residues to a level of 0.1 ppm. About 65 seafood factories in Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Maharashtra and Gujarat exporting seafood to EU and US are direct beneficiaries of this technology.
- ◆ A two step nested PCR method for the detection of White Spot Syndrome Virus in shrimps was developed, standardized, assessed and introduced for commercial use. This method can detect the presence of as small as 10 virions per host larvae. The technology is being used for regular testing of post larvae before introduction to the farms.
- ◆ A RT-PCR method to test the presence of the devastating Yellow Head Virus (YHV) in shrimp farms was developed, assessed and commercialized. This is the only test method for YHV now available in India. The method is being currently used for screening frozen shrimp for YHV, being exported to the US, to meet the phytosanitary regulations of the WTO.
- ◆ An improved ELISA method for detection of residues of Chloramphenicol, a 'zero tolerant' antibiotic, in processed seafood for export to EU, US and Japan was evolved. This improved method was assessed and commercialized in 2003. It is now regularly used to monitor Chloramphenicol level in farmed and processed shrimps. Hundreds of shrimp farmers and seafood exporters have gained by the technology.
- ◆ The 'Chloritest paper' developed for detection of ppm levels of Chlorine in process water, an essential requirement to implement sanitation and hygiene practice in food processing industry, was transferred to M/s Glaxo Laboratories Ltd. This has resulted in the non-rejection of seafood/food items on the basis of contamination with pathogens significantly, resulting in substantial savings of foreign exchange of the country.
- ◆ Suitable programmes were organized for implementation of HACCP in the seafood industry. A software and multimedia CD was also developed for HACCP.
- ◆ Throughout India the effluent treatment system attached to seafood processing units is a neglected area resulting in serious environmental problems. To alleviate this problem of pollution by the seafood industry, an efficient effluent treatment plant was designed to treat the effluents conforming to the Pollution Control Board standards.
- ◆ The following engineering equipment have been developed by CIFT for use in fishing and fish processing:
 - ❖ SS Tilting kettle
 - ❖ Oil fryer for battered and breaded products
 - ❖ Tunnel dryer
 - ❖ Fish meat bone separator
 - ❖ 15.5 M fuel efficient steel fishing vessel
 - ❖ Fiberglass canoes
 - ❖ Environmental data acquisition system
 - ❖ Temperature-Salinity meter
 - ❖ Ship borne data acquisition system
 - ❖ Speed and distance log
 - ❖ Trawl depth meter
- ◆ The following aspects having management and policy level implications in fisheries have been studied by the Institute:





- ❖ Idle capacity in fish processing plants in India
 - ❖ Price analysis of Indian seafood in the export market
 - ❖ Economics of artisanal fisheries
 - ❖ Economics of operation of fishing vessels of both West and East Coast of India
 - ❖ Price spread in domestic fish markets of Kerala and Gujarat
 - ❖ Fuel utilization pattern by the fishing industry in India
 - ❖ Assessment of harvest and post harvest losses in fisheries
 - ❖ Estimation of inland fish landings in reservoirs
 - ❖ Harvest and post harvest losses in fisheries
- ◆ The institute also undertakes research studies which provide feedback for technology development and transfer. The following are some of the works undertaken:
- ❖ Socio-economic profile of fisherfolk in different parts of the country and development of socio-economic status scale.
 - ❖ The areas and extent of participation of women in fisheries related activities.
 - ❖ The types and activities of Co-operatives and other organizations in fisheries and the role played by them in small scale fisheries.
 - ❖ Adoption behavior including extent of adoption, communication, decision making, response to technological gaps of fishermen in traditional, mechanized and motorized sectors and fish curers in relation to technology transfer by the Institute.
 - ❖ Evaluation of the training and extension programmes takenup by the Institute in terms of gain in knowledge, awareness, practices and constraints.
 - ❖ Studies on ban on monsoon trawling, coastal zone management and socio-legal issues.



RESEARCH ACHIEVEMENTS

HEADQUARTERS, COCHIN

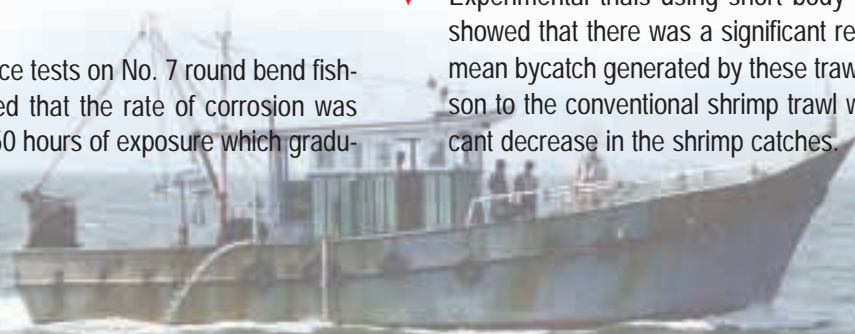
Fishing Technology Division

Research projects handled

- ☐ Studies on fortified natural biocides and corrosion resistant composite materials for protection of fishing craft and gear
- ☐ Responsible fishing using improved bottom and semi-pelagic trawls
- ☐ Resource specific large mesh purse seine for large pelagics in Indian EEZ
- ☐ Assessment of Myctophid resources in the Arabian sea and development of harvest and post harvest technologies
- ☐ Responsible harvesting and utilization of selected small pelagics and freshwater fishes
- ☐ Oceanic tuna fisheries off Lakshadweep seas - A value chain approach
- ☐ *In situ* time series measurements of bio-optical parameters off Kochi coast
- ☐ Euphotic zone production estimation using satellite data as an input to assess potential yield of pelagic herbivores in the Indian EEZ

Chief findings

- ♦ The two preservative treated rubber wood canoes and three FRP sheathed rubber wood canoes put on field trials started showing signs of mild bio-deterioration on completion of eight and seven years of service respectively.
- ♦ The coconut wood panels exposed to soil conditions after five years exposure showed that CCA and dual preservative treatment had better resistance to termite and fungal attack than chitosan, neem oil and CNSL treatment.
- ♦ Corrosion resistance tests on No. 7 round bend fishing hooks indicated that the rate of corrosion was higher in the first 50 hours of exposure which gradually reduced on prolonged exposure and there was a corresponding loss in break load by 3.07, 8.04, 18.17, and 25.14% respectively after 50, 100, 200 and 300 h of exposure to salt spray.
- ♦ Lack of infrastructure like OBM servicing, vessel dry docking and bunkering facility for the vessels at the jetty and lack of clear policy for sports fishing were some of the main problems identified with the recreational fishing in the marine sector.
- ♦ Experimental trials using short body shrimp trawls showed that there was a significant reduction in the mean bycatch generated by these trawls in comparison to the conventional shrimp trawl with no significant decrease in the shrimp catches.





- ◆ Introduction of large mesh purse seines and the high profit realized, has led to the revival of small mechanized purse seine fishery along the Cochin coast. All the 75 purse seiners based at the Cochin Fisheries Harbour have changed over to 45 mm mesh size purse seines and started operations in the deeper waters targeting Skipjack tuna, Little tunnies, Carangids, Black pomfret, Horse mackerel, Barracudas, Seerfishes and Mackerel.
- ◆ The deep sea shrimp landings by trawlers based at Kollam have been estimated as 7880 t, during the period September 2009 to August 2010. A deep sea trawler operating from the Sakthikulangara harbour of Kerala discards about 1000 - 2000 kg of bycatch in a fishing trip of 5-6 days.
- ◆ Total bycatch discards of deep sea shrimp trawlers at Kollam has been estimated as 11488 t. Myctophid contribution was about 3676 t, with a catch rate of 19.87 kg^h⁻¹.
- ◆ The bio-optical properties of seawater along the coastal waters off Cochin was found to be very complex and hence region based remote sensing algorithms was found to be essential to explain the high spatial and temporal variability.

Report of work done

Photodegradation of synthetic netting used for aquaculture purposes and for fixed fishing gears

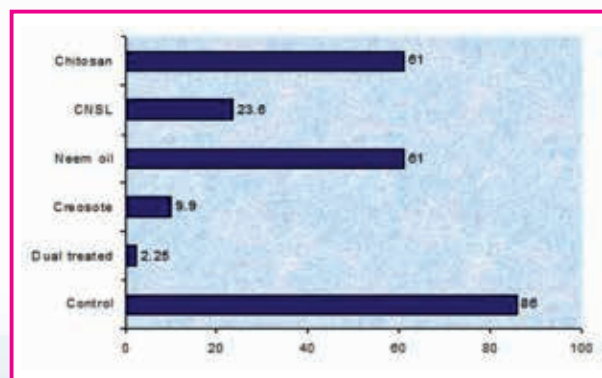
Samples of netting of sapphire (high quality High Density Polyethylene (HDPE), Polyamide (PA) Polyethylene (PE) and Dyneema (ultra high molecular weight high performance polyethylene) used for cage culture were selected for comparative study of fouling and weathering resistance. Experimental panels/racks made of PVC are being made ready to expose the samples at marine test sites. Samples of netting of PA monofilament, PA multifilament, and HDPE treated with Creosote, CCA, dual treatment, neem oil, cashew nut shell liquid and chitosan and exposed to weathering were tested for mesh break load and elongation to study the effect of treatment on the properties. In HDPE netting the dual treatment caused loosening of the knots.

Effect of corrosion on electrochemical, morphological and strength characteristics of fishing hooks

Corrosion resistance of fishing hooks was assessed for 90 hooks of No. 7 for 500 hours using salt spray chamber as per ASTM B-117 to test the corrosion rate and to assess change in mechanical strength after different periods of exposure to salt spray. The rates of corrosion after 50, 100, 200 and 300 h were 62.091 ± 0.212 , 33.415 ± 0.108 , 25.418 ± 0.094 and 25.104 ± 0.080 mpy respectively indicating that the rate was higher in the first 50 hours of exposure which gradually reduced on prolonged exposure. The loss in mechanical strength viz., the break load of the specimen due to corrosion was assessed by measuring the break load after exposure to salt spray. There was a loss of 3.07, 8.04, 18.17, and 25.14% in break load respectively after 50, 100, 200 and 300 h of exposure.

Assessment of the efficacy of eco-friendly preservatives in protecting timber

The condition of coconut wood panels was assessed after exposure to soil conditions for five years for the efficacy of the preservative. It was noticed that 62.5% of the control panels was completely decayed and rest of the control panels showed 42 to 47% weight loss. The dual and CCA treated panels lost their weights by a maximum of 5% only. Thirty eight percentage of chitosan treated panels was completely decayed. Neem oil treated panels showed 20-56% weight loss and in the case of CNSL treatment the panels lost their weights to a maximum of 75%. Among the different preservatives assessed for protection of coconut wood panels, CCA and dual treatment were most effective followed by CNSL, neem oil and



Bio deterioration of treated coconut wood samples exposed to soil for five years (%)

chitosan treatments.

Performance monitoring of rubber wood canoes

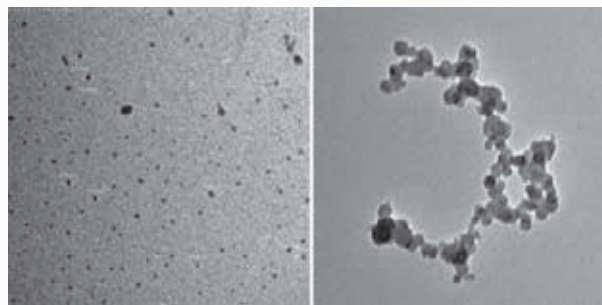
After eight years of operation, the two preservative treated rubber wood canoes given for experimental operations (backwater fishing) started showing problems such as appearance of micro-sized holes in the plank adjacent to the keel especially at the bottom by borer and fungal attack, at two or three areas. The planks were found slightly decayed through which water seems to have entered into the canoe and the ropes used for tying the planks were decayed at many portions. After seven years of service, the FRP sheathing of the FRP coated (untreated rubber wood) canoe operated by Aryad Lime Shell Co-operative Society, Alappuzha needed repair and was given new FRP sheathing for areas (25 x 30 cm, at two places, 25 x 10 cm and 10 x 10 cm). The sheathing on the cross planks was also found damaged by the abrasion and new sheathing given. In the case of the FRP sheathed canoe operating at Thalassery, an area of 5 x 3.75 m was found deteriorated due to continuous abrasion with oyster shells at the landing centre and this area was also repaired with FRP.

Procurement of coconut wood canoe

Three coconut wood canoes with the dimensions LOA 6.4 m, Breadth 0.83 m and Depth 4.2 m were fabricated for distributing to the fishermen for experimental trials. Three different treatments were given to the canoes viz., one with traditional treatment using Sardine oil, plant resins etc., the second canoe was coated with paint and the third one with fibreglass reinforced plastic sheathing. Experiments were initiated to study the effect of three treatment methods viz., dual treatment, chitosan copper complex and bio-pesticide extracted from cassava leaves on the wood panels of *Artocarpus hirsuta*, *Calophyllum inophyllum*, *Hevea brasiliensis* and *Terminalia paniculata*.

Studies on nano Samarium oxide incorporated aluminium for marine applications

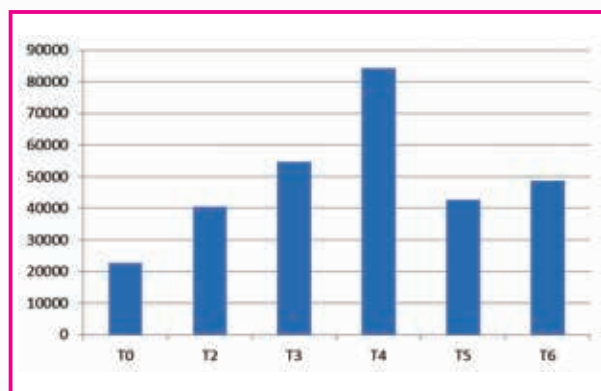
Nano Samarium oxide was prepared by top down precipitation and characterized by Transmission Electron Microscope and X ray diffraction. The results showed that the prepared nano Samarium oxide was of 10-14 nm in size.



Transmission Electron Micrographs of nano Samarium oxide

The nano Samarium oxide was incorporated into pure aluminium to prepare aluminium metal matrix composites. SmO_2 incorporated aluminium was subjected to different electrochemical tests. Linear sweep voltammetric analysis of nano SmO_2 -Al was carried out and the results showed that the corrosion potential (E_{corr}), corrosion current density (I_{corr}) and polarization resistance (R_p) varied from -0.70 to -0.799 V, 1.14×10^{-7} to 8.74×10^{-7} A/cm² and 63706 to 228600 Ω respectively. Increased amounts of nano SmO_2 decreased corrosion potential significantly compared to pure aluminium.

The electrochemical impedance spectra (EIS) of the nano Samarium oxide incorporated aluminium were carried out and the results showed that the polarization resistance in the high frequency (HF) and low frequency (LF) domain varied from 15.36 to 33.50 Ω and 22710 to 84250 Ω respectively. The result exhibited increased polarization resistance due to the incorporation of Samarium oxide indicating higher corrosion resistance in 3.5% NaCl



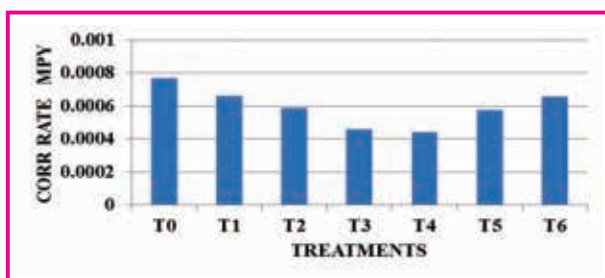
Variation of polarization resistance (R_p) with varied amounts of SmO_2 incorporation in aluminium by EIS method. (T0 is pure Al, T2, T3, T4, T5 and T6 are Al incorporated with nano SmO_2 @ 0.01, 0.02, 0.05, 0.1 and 0.2%)





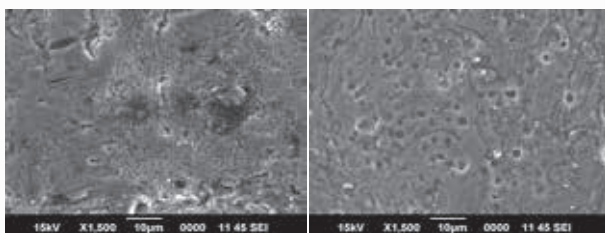
electrolyte. 0.05% SmO_2 incorporated aluminium metal matrix composite showed good corrosion resistance than other treatments.

Corrosion rates of different nano Samarium oxide incorporated aluminium were analysed by weight loss method and the result revealed that 0.05% nano SmO_2 reinforced aluminium metal matrix showed lowest corrosion rate when compared to pure aluminium and 0.1% micro sized SmO_2 incorporated aluminium. Open circuit potential of nano SmO_2 aluminium exposed in 3.5% NaCl was monitored for 40 days continuously and the results showed that the variation in OCP values were very minimal and stable.



Corrosion rates of nano SmO_2 incorporated aluminium. (T0 pure aluminium and T1 is micro sized SmO_2 incorporated aluminium and T2, T3, T4, T5 and T6 are nano SmO_2 incorporated Al @ 0.01, 0.02, 0.05, 0.1 and 0.2%)

The Scanning Electron Micrographs (SEM) of corroded nano SmO_2 aluminium revealed that there was uniform corrosion in the nano SmO_2 aluminium in comparison to micro sized SmO_2 aluminium.



Micro sized SmO_2 Al

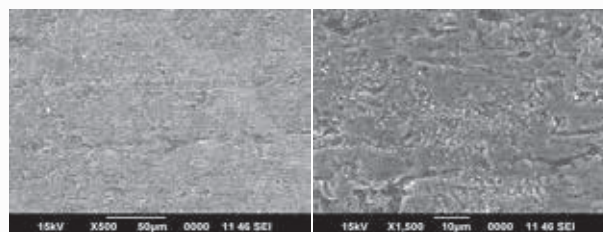
Nano SmO_2 Al

Scanning electron micrographs of corroded nano Samarium oxide incorporated aluminium and micro sized Samarium oxide incorporated aluminium

Studies on micro and nano sized mixture of Cerium oxide incorporated aluminium

Aluminium metal matrix composites of micro and nano

Cerium mixtures in five combinations (1:1) 0.01, 0.02, 0.05, 0.10 and 0.2% were prepared and tested for physio-chemical and electrochemical characteristics. The SEM analysis of coupons, revealed that the surface morphology has improved substantially in mixed nano and micro Cerium oxide incorporated aluminium. Higher magnification in the surface showed that there is a uniform distribution of micro and nano Cerium oxide particles.

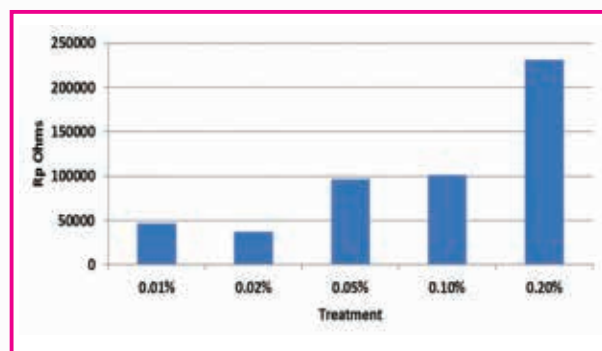


Nano CeO_2

Micro sized CeO_2

Surface morphology of nano and micro mixtures of Cerium oxide incorporated aluminium

The samples subjected to linear sweep voltammetry showed that 0.2% nano and micro CeO_2 incorporated aluminium exhibited highest polarisation resistance, lowest corrosion, current density and corrosion rate.



Polarisation resistance of micro and nano mixture of Cerium oxide incorporated aluminium in 3.5% NaCl

The SEM micrographs of corroded specimens showed that the corrosion was minimal near to the Cerium oxide and mainly confined to the β space of the matrix. Also the corrosion was found to be uniform.

Responsible fishing using improved bottom and semi-pelagic trawls

Analysis was carried out on the catch data generated during the comparative fishing trials onboard MFB Sagar

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Shakthi using the new 27 m short body shrimp trawl and 27 m conventional shrimp trawl. Twenty six alternative hauls were carried out in the 9-10 m depth zone along Cochin coast. Kruskal-Wallis one-way ANOVA was used to test significance of differences in the catch composition of the short body and traditional shrimp trawl. The mean CPUE (shrimp and fish together) was significantly higher in the conventional trawl. The mean values recorded were 12.54 ± 2.87 and 4.38 ± 0.72 kg h^{-1} respectively for the conventional and short-body trawls. The mean bycatch was significantly higher in the conventional shrimp trawls (9.75 ± 2.91 kg h^{-1}) compared to 2.75 ± 0.47 kg h^{-1} in the short-body trawl. No significant difference was noticed in the mean shrimp catches from the two trawl nets. The mean CPUE recorded for the conventional and short-body shrimp trawl was 2.79 ± 0.77 and 1.63 ± 0.48 kg h^{-1} respectively.

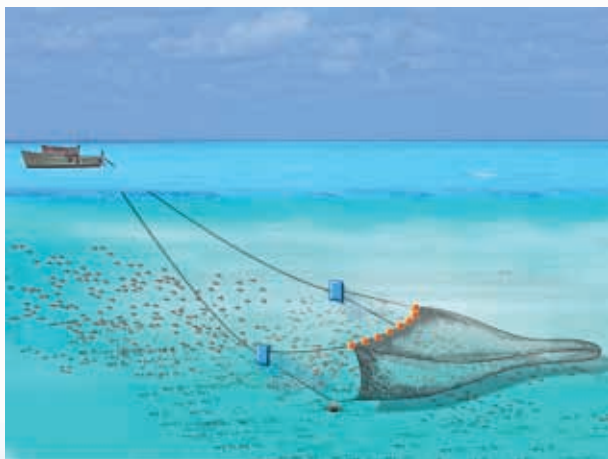
The study revealed that a reduction in the length of belly by 8% significantly reduced the quantity of fish bycatch. The lower Ecological Use Efficiency (EUE) index value (0.22) noticed in the short-body trawls indicate that they cause less ecological damage than the conventional shrimp trawls with a higher EUE value of 0.37. This preliminary findings show that modification in the trawl design has the potential to reduce fishes considered as bycatch in shrimp trawling.

Eight shrimp trawls viz., 27 m short body shrimp trawls, 44.8 m cut-away belly shrimp trawls, 27 m conventional shrimp trawls and 18 m CIFT-SPTS were fabricated for comparative fishing trials and demonstration at Cochin, Veraval and Vishakapatnam Centers of CIFT. Three

Vertically cambered otter boards for experimental trials are being fabricated.

Resource specific large mesh purse seine for large pelagics

The change-over of mesh sizes in the purse seine from the conventional 20 mm to 45 mm has shown good results and has facilitated to landing of larger size classes of high value species. Experimental fishing operations carried out from the purse seiner vessel Bharat Darshan during the period 2007-10 in the depth range of 50 to 220 m revealed that the catch mainly comprised of large sized Mackerels (62.08%), followed by Tunas (16.08%), Carangids (14.43%), Pomfrets (1.93%) and miscellaneous fishes (5.47%). The landing of quality fishes gave an impetus to the purse seine fishermen as it fetched better value for their catch, compared to the conventional purse seine landings. In addition, there was a demand for export for large sized pelagics which further added value to their catch. Adoption of the large mesh purse seine and shifting operations to deeper waters targeting Tunas and other large pelagic fishes would ease the fishing pressure in the intensively fished coastal waters. Further, the large meshes facilitated escapement of juveniles. Introduction of the large mesh purse seines has led to the revival of small mechanized purse seine fishery and all the purse seiners based at Cochin Fisheries Harbour have changed over to 45 mm mesh size purse seines and started operations in deeper waters targeting Skipjack tuna, Little tuna, Carangids, Black pomfret, Horse mackerel, Barracudas, Seer fishes and Mackerel.



Artist's perspective of CIFT SPTS



Bumper catch of tunas from CIFT designed large mesh purse seine net





A Power Block was also installed in the purse seiner, Bharat Darshan during February 2011 and fishing trials are being conducted using the Power Block.

Studies on Myctophid discards from deep sea shrimp trawlers operating off southwest coast of Kerala

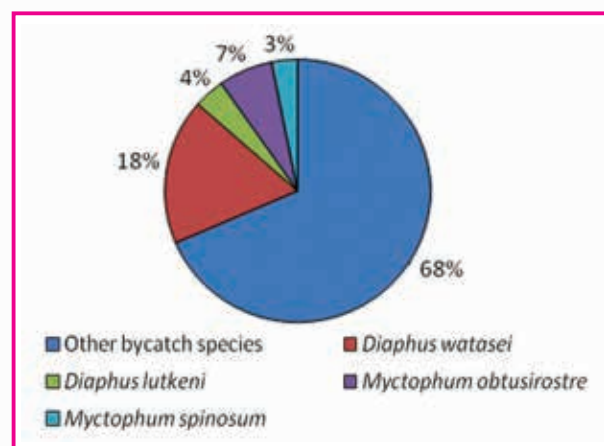
The deep sea shrimp trawlers operating off southwest coast of Kerala generate large quantities of Myctophids as bycatch discards. An analysis was carried out on the samples collected from the bycatch of commercial deep sea shrimp trawlers from September 2009 onwards. In the Kollam bank, mesh size of deep sea shrimp trawls ranged from 30 to 50 mm in the net body and 26 to 18 mm in the codend. Myctophid species and associated fishes obtained from deep sea trawlers, based at Sakthikulangara, Neendakara and Cochin were identified and length-weight data were collected. Six species of Myctophids belonging to the genus *Diaphus* (*Diaphus watasei*, *D. lutkeni* and *D. dumerili*), the genus *Myctophum* (*Myctophum spinosum* and *M. obtusirostre*) and the genus *Benthosema* (*Benthosema fibulatum*) were the predominant catch.



Sorting of Myctophids from deep sea trawl bycatch from Kollam, Kerala

The deep sea shrimp landings by trawlers based at Kollam have been estimated as 7880 t, during September 2009 to August 2010. The deep sea shrimp landings were mainly constituted by *Aristeus alcocki*, *Heterocarpus woodmasoni*, *H. gibbosus*, *Plesionika ensis* and *Solenocera* spp. Total bycatch discards of deep sea shrimp trawlers at fishing harbours based at Kollam has been estimated as 11488 t. Myctophid contribution was about 3676 t, with a catch rate of 19.87 kg.h⁻¹. Myctophid

contribution to the total discards was about 32%, consisting of four species belonging to the genus *Diaphus* (*Diaphus watasei* and *D. lutkeni*) and the genus *Myctophum* (*Myctophum spinosum* and *M. obtusirostre*). Length-weight relationship of some of the Myctophid species such as *Diaphus watasei*, *D. lutkeni*, *Benthosema fibulatum* and *Myctophum obtusirostre* were also studied.

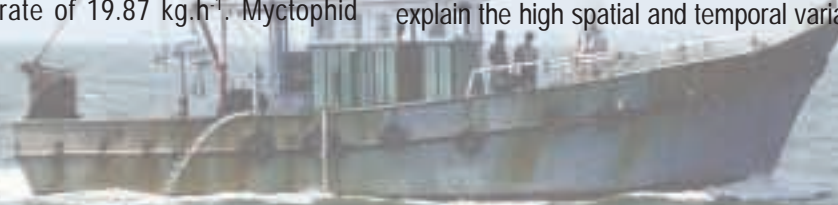


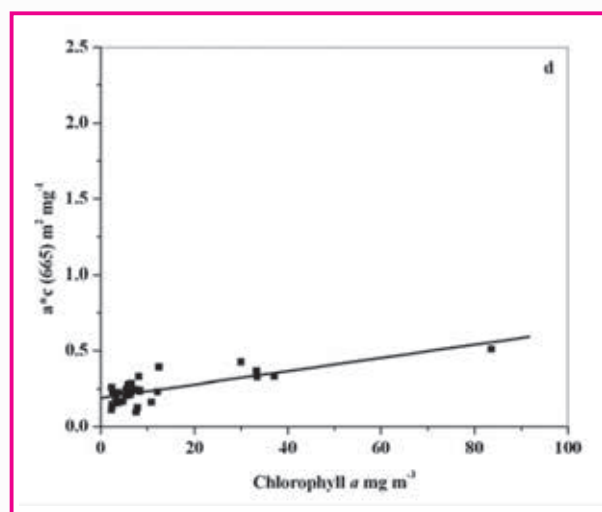
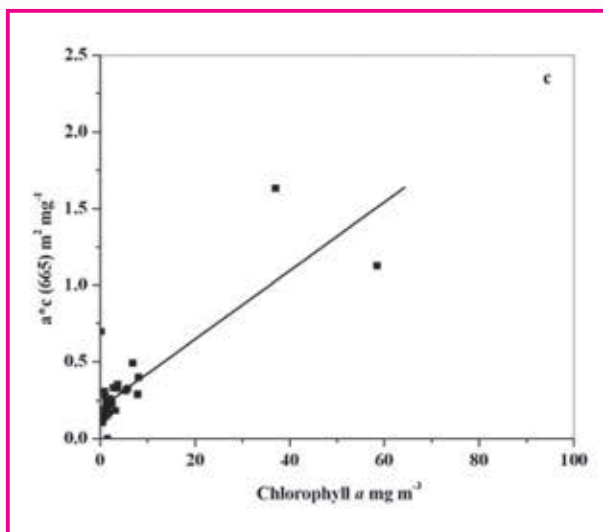
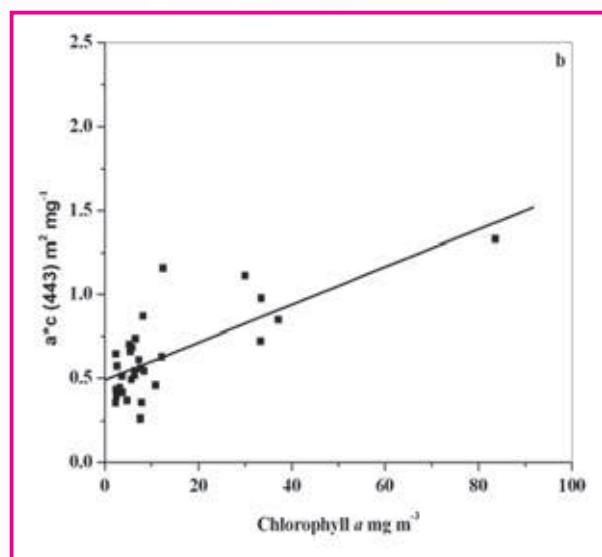
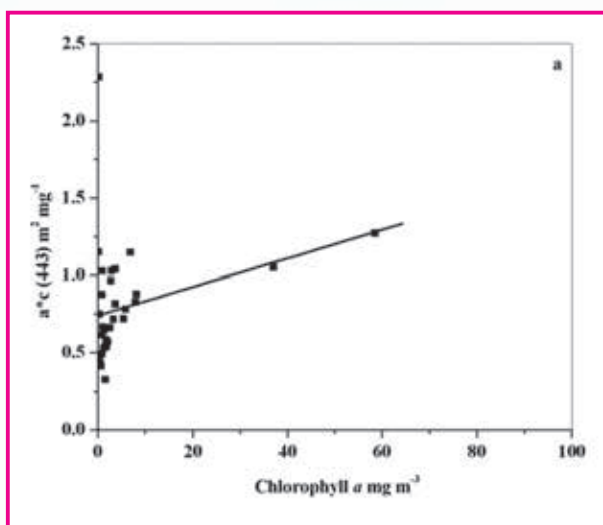
Percentage contribution of Myctophid species to the deep sea shrimp trawl bycatch

Design requirements for the prototype mesopelagic trawl were studied and a 45 m four equal panel Myctophid trawl was designed.

Seasonal variation of inherent bio-optical parameters along the coastal waters off Cochin

The spatial and temporal variation in the optically active substances (OAS) such as Chlorophyll-a, suspended sediments and other environmental parameters, from eight stations during February 2010 to October 2010 were studied along Cochin coast. The algal community composition was the main factor which influenced the Chlorophyll-a specific absorption coefficient at wavelength 443 and 665 nm. The results of the investigation showed definite fluctuations in the bio-optical, physico-chemical and biological features during the pre- and post-monsoon seasons. The size of the major phytoplankton species also influenced the Chlorophyll-a specific absorption coefficient and the spectral characteristics of the coastal waters. The results suggest that phytoplankton absorption properties along coastal waters off Cochin are complex and region based remote sensing algorithms need to be developed to explain the high spatial and temporal variability.

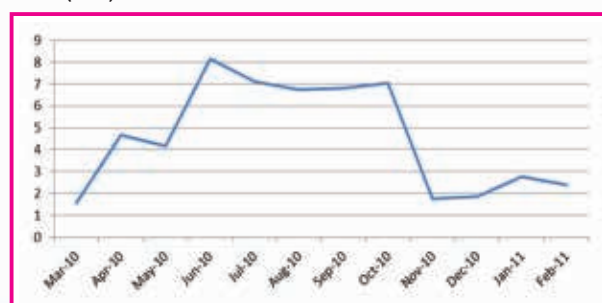




Relationship between Chlorophyll specific absorption, a^*c (443), a^*c (665) and Chlorophyll-a concentration during pre-monsoon (a&c) and monsoon (b&d)

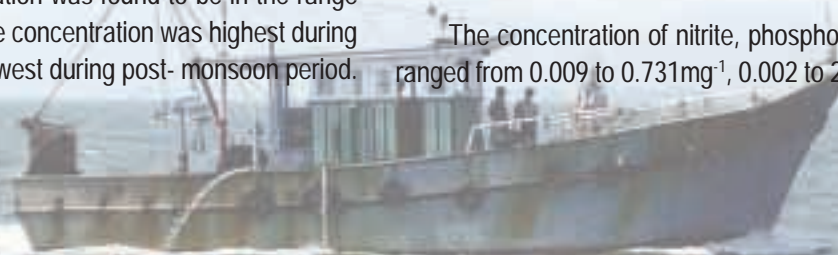
Studies on phytoplankton and its characteristics in waters of Sardine shoal sighted regions

The study was aimed to estimate total euphotic zone production from satellite data, its validation and assessment of potential yield of pelagic herbivores in the Indian EEZ based on productivity estimates. The water samples were collected periodically from the Sardine shoal sighted areas along Cochin coast and hydrographical, bio-optical and plankton diversity of the region was estimated. The Chlorophyll-a concentration was found to be in the range of 1.55 to $8.16 \mu\text{g}^{-1}$. The concentration was highest during monsoon period and lowest during post- monsoon period.



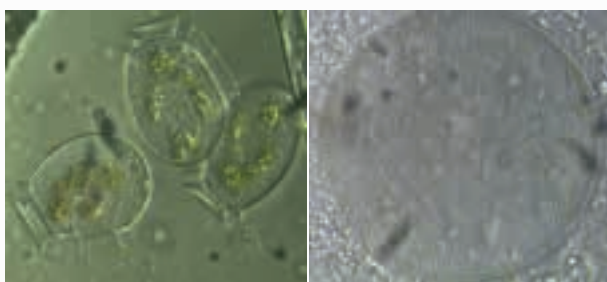
Variation of Chlorophyll-a concentration in water collected from Sardine shoal sighted regions during the year 2010-2011

The concentration of nitrite, phosphorus and silicate ranged from 0.009 to 0.731mg^{-1} , 0.002 to 2.7615mg^{-1} and



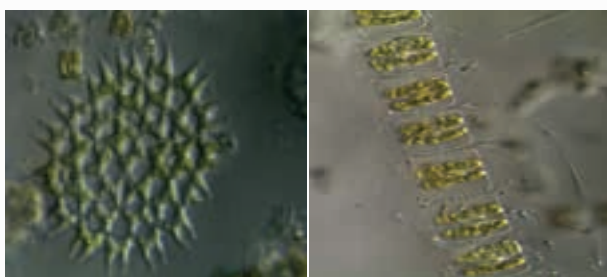


0.0375 mg⁻¹ to 0.773 mg⁻¹ respectively. Phytoplankton diversity in shoal sited areas was contributed by 18 major species. Plankton was dominated by Dinoflagellates. *Coscinodiscus* sp. and *Chaetoceros* sp. are the major species dominating the diversity among diatoms. Dinoflagellates bloom comprising of *Dinophysis* and *Prorocentrum* were observed during monsoon season.



Coscinodiscus

Dinophysis



Pediatrion

Chaetoceros

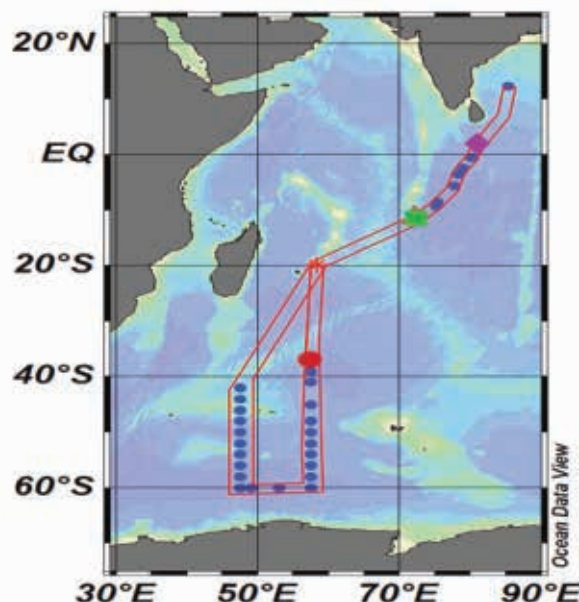
Some of the phytoplanktons observed in Sardine shoal sighted waters off Cochin

Sardine samples were collected for analyzing morphometric characters such as length, weight and class structure. Gut content analysis and relationship of gut composition with different classes to determine food selectivity was carried out. Though Sardine is considered as a planktivore, zooplankton and larvae were also observed in the gut in some quantity. *Biddulphia* sp. and *Coscinodiscus* sp. dominated the Sardine stomach contents.

In situ time series studies at Antarctica

Shri S.S. Shaju, Senior Research Fellow of the INCOIS project participated in India's 5th Southern Ocean Expedition onboard FORV Sagar Nidhi during 22 January - 12 March 2011. During the cruise, water samples were collected from different depths from 23 stations to measure

bio-optical characteristics and productivity of Antarctic waters. Apart from these, a time series at polar front with a sampling frequency of every three hours and another time series for three days at sub tropical front was also covered.



Stations covered during 5th Southern Ocean Expedition

Responsible harvesting and utilization of selected small pelagics and freshwater fishes

Two optimized ring seines of length 600 m, breadth 60 m and mesh size 22 mm were handed over to two fishermen groups under the Chellanam Kandakkadavu Fishermen Welfare Cooperative Society (CKFWCS). Both the gears were successfully operated from IBM fishing vessels of 18.28–21.34 m in length. The gears were operated for a minimum of 10 days per month for six months. Analysis of data in comparison to 35 other ring seiners being operated by the Society showed that the fishing system using CIFT gear has shown significantly better performance.

Three sets of experimental gill nets fabricated to optimize the gill net mesh sizes for Catla, Rohu and Mrigal in Malampuzha reservoir were put to comparative field trials through selected fishermen of seven SHGs. Initiated data collection on the total length, girth and weight of each species caught in each particular mesh size and the type of capture process was recorded.



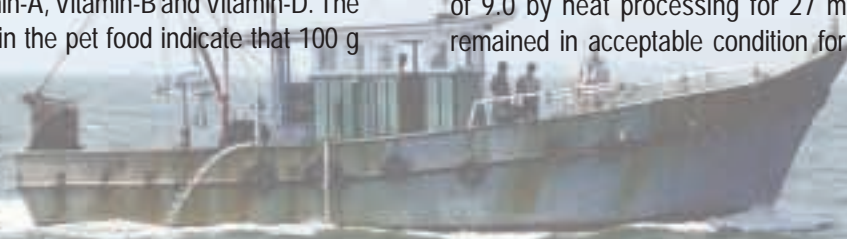
Fish Processing Division

Research projects handled

- ☐ Studies on handling, processing, preservation and product development of commercially important farmed and wild freshwater fish
- ☐ Post harvest processing of commercially important large pelagic, demersal and bycatch fishes for high value products for modern markets and NEH
- ☐ Innovative packaging techniques for processing and preservation of fish products
- ☐ Improved utilization of fish and shellfish waste
- ☐ Responsible harvesting and utilization of selected marine small pelagics and freshwater fishes
- ☐ Oceanic tuna fisheries off Lakshadweep sea - A value chain approach
- ☐ Studies on high pressure processing (HPP) of high value perishable commodities
- ☐ Capacity building of coastal fisher women through post harvest technologies in fisheries
- ☐ Assessment of Myctophid resources in the Arabian sea and development of harvest and post harvest technologies

Chief findings

- ◆ Yield of Striped Catfish (*Pangasianodon hypophthalmus*) during different stages of processing was assessed. The average yield of 2 kg fish after gutting was found to be 76.8% and fillet yield was 42%. Whole and gutted fish had a shelf life of 18 and 22 days respectively in iced condition. The steaks had a shelf life of 14 days in ice.
- ◆ Battered and breaded products prepared from Myctophid fish *Diaphus watasei* had acceptable organoleptic characteristics similar to coated products prepared from commonly used fishes.
- ◆ Developed a high value pet food for dogs from tuna canning waste. It is a rich source of protein and carbohydrate. The product also provides minerals and Vitamins like Vitamin-A, Vitamin-B and Vitamin-D. The nutritional factors in the pet food indicate that 100 g of the product provides more than 350 calories of energy.
- ◆ Canning studies of pelagic fish Mahi-mahi (*Coryphaena hippurus*) was carried out in oil and in tomato sauce medium. The fish has white meat with low fat and high protein content (Moisture content - 77.4%, Protein -19.8%, and Fat - 0.62%). Canned product in ground nut oil was more acceptable than the product in tomato sauce.
- ◆ Storage studies of coated and flash fried fish balls prepared from Lizard fish and frozen stored at -18°C has better organoleptic characteristics than balls prepared without flash frying. Both the products have good frozen shelf life of more than 12 months.
- ◆ Lizard fish canned in brine in TFS cans for an F_0 value of 9.0 by heat processing for 27 min. at 121.1°C remained in acceptable condition for more than 12





months.

- ◆ Mussel curry processed in indigenous opaque retort pouches had good organoleptic qualities up to 12 months of storage.
- ◆ Ready to eat fish ball curry in retortable pouches had shelf life of 12 months at ambient temperature.
- ◆ Developed ready to serve bread spread from Blue swimmer crab (*Portunus pelagicus*) in TFS cans.
- ◆ Indigenously extruded bread crumbs were found suitable for battered and breaded fish balls prepared from Threadfin bream.
- ◆ Process parameters for ready to eat Yellowfin tuna steaks and White prawns in different forms in see-through pouches was optimized.
- ◆ Prepared packaging film based on chitosan from shell fish waste and optimized the process with respect to physical, mechanical and functional performance.
- ◆ Chitosan treatment and packing with O₂ scavenger and CO₂ emitter improved the keeping quality of Leather jacket (*Aluterus monoceros*) in chilled condition.
- ◆ Feeding trials conducted in Catla, Grass carp and Rohu fingerlings have shown that groups fed with the silage incorporated feed had significant difference in PER (P<0.05) and FCR (P<0.05).
- ◆ Glucosamine hydrochloride was prepared under different conditions and the yield, colour, purity and polarity of the samples were assessed. The yield was found to vary from 16% to 69% and polarity between 54.9 and 66.1.
- ◆ Chitosan beads are being studied for drug delivery applications.

Report of work done

Shelf life evaluation of whole and gutted Striped Catfish stored in ice

Freshness of whole and gutted Striped Catfish (*Pangasianodon hypophthalmus*) stored in ice was assessed by biochemical and sensory methods. Increase in pH was observed for both whole and gutted samples towards the end of storage period. TVBN levels of both

the samples have shown fluctuations during the storage period, but did not cross the maximum acceptable limit of 35-40 mg%. Higher values of PV were observed for gutted samples compared to whole fish towards the end of storage period. However TBA values didn't show a definite trend. Sensory scores for appearance, flavour, texture and taste of both the samples decreased with the storage time. As per the sensory evaluation, whole fish and gutted fish were rejected on 18th day and 22nd day respectively.



Whole gutted *Pangasianodon hypophthalmus*

Chilled storage studies of treated fillets of Catfish

Pangasianodon hypophthalmus fillets were dip treated with 0.2% and 0.5% levels of chitosan and Ascorbic acid and stored in chilled conditions. Ascorbic acid treated fillets (both at 0.2% and 0.5%) showed significant extension of shelf life over chitosan treated and control fillets in chilled conditions. The shelf life observed for the fillets were 21 days (Ascorbic acid treated), 17 days (chitosan treated fillets) and 12 days (control fillets). Significant differences in fatty acid profile were not found between chitosan, Ascorbic acid treatments and control samples.

Shelf life studies of smoked Striped Catfish steaks

Shelf life of smoked Striped Catfish steaks treated with turmeric was studied. Two batches of fish portions (one treated with 2% turmeric and other without treatment) were light smoked and kept in chilled storage. Another two batches (one treated with 2% turmeric and other without treatment) were deep smoked and kept in chilled storage. Freshness of the steaks were assessed by biochemical and sensory methods. pH of treated samples were higher when compared to the control samples. TBA values of treated samples were low when compared to the control samples.

Deep smoked treated and control samples showed higher TBA value than the light smoked ones. In all the samples the TBA value increased during the storage period although the rate of increase was less in treated samples. There was a significant reduction in NPN content of both treated and control samples by the eight day of storage.

Biochemical and sensory attributes of Striped Catfish steaks during chilled and ice storage

Freshness of Striped Catfish steaks stored in ice and chill store were assessed by biochemical and sensory methods. TVBN levels of both the samples increased slowly during the storage period, but didn't reach the maximum acceptable limit of 35-40 mg%. Alpha-amino nitrogen level for iced and chilled steaks showed maximum values (35.7 mg% and 27.3 mg%) on Day 10 and 14 respectively and then decreased towards the end of the storage period. Sensory scores for appearance, flavour, texture and taste of cooked steaks decreased with the storage time. Quality of steaks stored in chill store and ice has crossed the acceptable limit of sensory score on 14th day and 17th day respectively and the steaks were rejected on Day 20.

Fatty acid composition of Striped Catfish fillets

Fatty acid profile of farmed freshwater Striped Catfish was determined by gas chromatography after preparation of fatty acid methyl esters from total lipid extract. Muscle tissue samples were taken from fresh fish, after seven days and 21 days of chilled storage. Fatty acid composition of fresh milt (eggs) was also determined. The ratio of saturated to unsaturated fatty acids in muscle tissue was in the range of 0.46 – 0.63 and in milt it was 0.63. The major fatty acids are Palmitic acid (C16:0) and Oleic acid (C18:1). No significant changes were observed in the composition during storage. Moreover, EPA (C20:5n3) and DHA (C22:6n3) were found in minimal quantities, unlike the previously analyzed wild caught *Wallago attu*. Interestingly, the concentration of Eicosatrienoic acid (C20:3) was significantly higher in milt tissue compared to that of muscle tissue. Similarly, EPA and DHA levels were also slightly higher in milt.

Development of products from *Wallago attu*

Wild caught freshwater fish *Wallago attu* of average size 2 Kg was used for the preparation of value added products. Steaks were prepared from whole fish with an yield of 65%. These steaks were used for the preparation

of fish curry and condiment-incorporated ready to cook steaks. Both the products were blast frozen and frozen storage studies are being carried out. Boneless steaks were used for the preparation of smoked and canned products. Two types of canned products were prepared by varying the smoking time.

Fatty acid composition of fresh and smoked fillets of *W. attu*

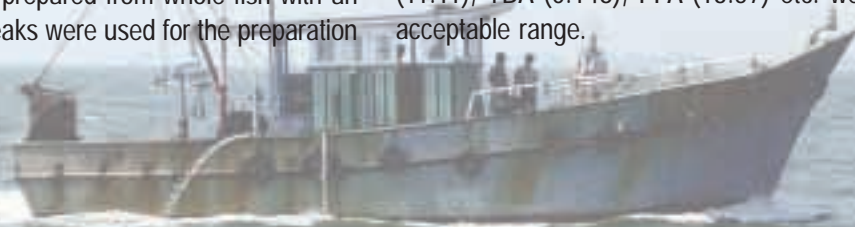
Fatty acid profile of *W. attu* was determined by gas chromatography after preparation of fatty acid methyl esters from total lipid extract. Similarly fatty acid profile of fillets smoked for one hour and two hours was also determined. The ratio of saturated to unsaturated fatty acids was 0.58–1.76. The major fatty acids were Palmitic acid (C16:0) and Oleic acid (C18:1). EPA (C20:5n3) and DHA (C22:6n3) were found in significantly high quantities.

Frozen storage studies of Lizard fish balls

Coated fish balls prepared from Lizard fish (*Saurida thombil*) with flash frying and without flash frying were subjected to storage studies at -18°C. At the end of 12 months storage, the biochemical quality parameters like TVBN, PV, TBA, FFA etc. were within the acceptable limits. Moisture, TBA, PV and FFA were lower in flash fried fish balls. The textural hardness was higher for flash fried fish balls compared to samples without flash frying. Microbial examination showed that TPC, Total Coliforms, faecal Coliforms, *Staphylococcus aureus*, Streptococci etc. were within the acceptable levels. There was a remarkable decrease in TPC in the case of flash fried fish balls (40/g) than in without flash fried samples (1.5×10^3). The samples were acceptable even after 12 months of storage.

Canning studies of Lizard fish

Canning studies of Lizard fish in brine in TFS cans were carried for an Fo value of 9.0 by heat processing for 27 min. at 121.1°C. Storage characteristics for 12 months have been evaluated. Initial evaluation showed that the Lizard fish canned in brine has good appearance, white colour, good odour and taste. The fish remained in acceptable condition even after 12 months storage. Biochemical quality parameters like TVBN (40.6), PV (11.11), TBA (0.148), FFA (13.57) etc. were within the acceptable range.





Canning studies on Leather jacket in curry medium

The fish, Leather jacket locally called Kottoori (*Aluterus monoceros*) is landed in large quantity during post-monsoon period. The species grows to a large size. The fish brought to the laboratory had an average length of 12" and 1.2 kg in weight. Local demand for this fish is poor. Fish curry was made and packed in TFS cans and heat processed. The product was given heat processing for 50 min. at 121.1°C and a total lethality of F_0 10.75 was obtained including lethality during cooling period of 10 min. The product had excellent organoleptic characteristics. The taste of the canned fish was judged excellent with an overall acceptance score of 8.5. Shelf life evaluation was carried out for nine months and the product remained in very good condition during this period.

Canning studies of pelagic fish Mahi-mahi

Canning studies of pelagic fish Mahi-mahi (*Coryphaena hippurus*) have been taken up during the period. The fish in canned form is a commercial product in the international markets. The fish was collected from Munambam fishing harbour. The fish has Moisture content - 77.4%, Protein - 19.8% and Fat - 0.62%. The fish has white meat with low fat and high protein content.

The fish was cooked in steam for 45 minutes, cooled to room temperature and kept in chill room overnight. On the next day the fish was split in to loins, skin, dark meat and bones were removed and cut into chunks of suitable size for packing in to TFS cans. 130 g of the cooked meat and 50 g hot refined ground nut oil were packed in the cans. Few cans were also packed in tomato sauce medium by diluting the commercial sauce to 75%. The cans were exhausted and sealed. Few cans were fitted with thermocouples for thermal process validation studies. Thermal processing was given to an F_0 value of 8.5 for sauce medium and 10.5 for oil medium.

Preliminary evaluation showed that the canned product had good organoleptic characteristics. Canned product in ground nut oil was more acceptable than the product in tomato sauce. Taste was very good and it was similar to that of canned seer fish. After six months storage at ambient temperature, the canned product showed overall acceptance of 8.0 for oil pack and 7.5 for sauce pack.

Development of products from the Myctophid species, *Diaphus watasei*

Myctophid fish, *Diaphus watasei* collected from deep sea trawlers operating from Cochin was used for development of value added products. Battered and breaded products were prepared and its organoleptic evaluation carried out. The odour, flavour and taste were acceptable. There were no characteristic changes in these factors from that of coated fish product prepared from commonly used fish.

Preparation of chitin derivatives

Yield, colour, purity and polarity of Glucosamine hydrochloride under different conditions (Acid ratio, treatment time and temperature) were assessed. The yield was found to vary from 16% - 69% and polarity showed a maximum of 66.15. The purity of the products was assessed and it ranged between 31.59 to 89.96%.

Chitosan beads for drug delivery applications

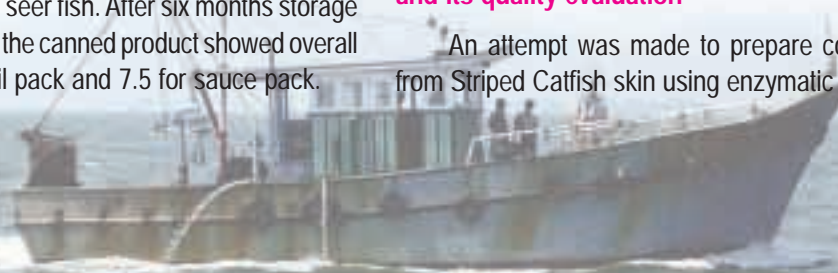
Chitosan beads were prepared using a solution of chitosan in 1% Acetic acid. The bead size can be varied depending on the requirement and can be cross-linked to enhance the mechanical properties. Further studies on slow drug release are in progress to use these as drug delivery vehicles.



Chitosan beads

Production of collagen peptides from fishery wastes and its quality evaluation

An attempt was made to prepare collagen peptide from Striped Catfish skin using enzymatic hydrolysis. The



degree of hydrolysis was determined for different enzyme concentrations. The functional and physico-chemical properties of collagen peptide were evaluated as a function of enzyme-substrate ratio. Chemical composition, solubility and fat binding capacity of collagen peptides varied moderately with different enzyme-substrate ratio. However, optical, surface active and bioactive properties varied significantly with different concentrations of enzyme.

Suitability of collagen peptide, gelatin and gelatin hydrolysate for preparing aspic products from fish meat was evaluated. Aspic products were developed with a combination of meat chunks of Catfish and vegetables. The eating quality of the products was assessed by sensory analysis. Incorporation of hydrolysate did not impart any additional flavour to the product as judged by the sensory panel.

Preparation of fish protein hydrolysate from Striped Catfish

Fish Protein Hydrolysate (FPH) was prepared from cooked frame meat of Striped Catfish using the neutral proteases Papain and Bromelain at an enzyme substrate concentration of 0.5 % (w/w) of the protein content in the fish meat. The yield of FPH prepared with Papain was 6.53% and that prepared with Bromelain was 5.61%. There was only marginal difference in yield, functional properties and antioxidative properties between FPH produced with both the enzymes. FPH was also produced from the frame meat of Catfish using alcalase enzyme. Concentrations of enzyme was used as variable with temperature and pH kept constant. FPH prepared from Catfish with alcalase enzyme showed excellent functional and antioxidative properties. Both functional and antioxidative properties were found in FPH prepared with lower enzyme concentrations.

Preparation of surimi from Striped Catfish

Surimi was prepared from Striped Catfish mince using single wash and double wash method. 0.2% Sodium bicarbonate was added for both the treatments to remove fat. Mince to water ratio was 1:1. Yield of surimi from whole fish using single wash method was 32% and that using double wash method was 31%. Functional properties of double washed surimi were better compared to single washed surimi. However, gel strength and textural

characteristics were found to be better for single wash surimi. Protein profiling of the surimi was carried out using SDS PAGE.

Feeding trials of ornamental fish larvae and carp fingerlings with silage-based feed

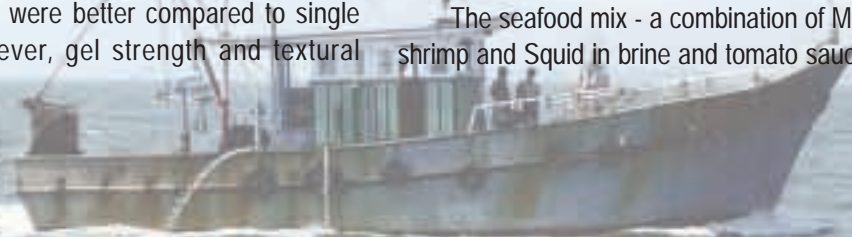
The efficacy of fish silage produced from fish wastes as a protein source in the diets of the larvae of two ornamental fishes, Koi Carp (*Cyprinus carpio*) and Rosy barb (*Puntius conconius*) was evaluated. For feeding studies, pelleted experimental diets were prepared. No significant difference in the weight gain, Specific Growth Rate (SGR), Feed Conversion Ratio (FCR), Protein Efficiency Ratio (PER) and survival rate (%) among dietary treatment with 35% silage was noticed in both experimental fishes. This revealed that the fish silage was equally utilized by both fishes comparable to a fish meal based commercial fish feed. Feeding trial was conducted in Catla (*Catla catla*), Grass carp (*Ctenopharyngodon idella*), and in Rohu (*Labeo rohita*) fingerlings to compare efficiency of the silage-incorporated feed with a commercial feed with varying quantity of fish silage. A significant deference could be observed in PER ($P<0.05$) and FCR ($P<0.05$). However, no significant difference was observed in the weight gain, SGR, weight increment and length increment.

Canned tuna with vegetables in TFS cans

Storage evaluation of the following products for 18 months has been completed: Tuna with broccoli, Tuna with green peas, Tuna with baby corn, Tuna with green peas and baby corn and Tuna with baby corn, green peas and broccoli. Tuna with green peas and baby corn was the best combination among the products. The natural green colour of the vegetables was decreased to a certain extent due the high temperature heat treatment. There was no off-odour or taste. There was no internal corrosion of the contents of both Tuna meat and the vegetables. However the canned product acquired metallic odour and taste. Eventhough there was no spoilage, the metallic odour and taste reduced the acceptance of Tuna with green peas and baby corn and it was 7.0 and 6.5 for Tuna with green peas and tuna with baby corn respectively.

Development of seafood mix in TFS cans

The seafood mix - a combination of Mackerel, White shrimp and Squid in brine and tomato sauce medium - in





TFS cans were heat processed for 45 min at 121.1°C for F_0 value 10 min. Initial organoleptic evaluation showed that the product in brine was more acceptable than in tomato sauce. Storage studies at ambient temperature for 13 months was done. After 10 months, the shrimp in brine medium developed black staining on the cut surface of the shrimp meat. Eventhough there was black staining, it had good organoleptic characteristics. The seafood mix in tomato sauce medium developed bitter taste and metallic odour during storage. The colour of tomato sauce changed to dark brown. The contents also became firm in texture and there was loss of characteristic taste and flavour. This product in tomato sauce medium was acceptable up to seven months. The product in brine was acceptable up to 10 months.

Ready to serve Mussel curry in retortable pouches

Studies on preparation of Mussel curry in indigenous opaque retort pouches were undertaken. Fresh shucked mussel meats were used for the curry preparation. Other ingredients used in the curry are green chillies, coconut paste, tomato, ginger, raw mango, curry leaves, turmeric powder, chilly powder, salt etc. Curry medium was prepared by cooking coconut paste and other ingredients, mussels were added to the curry medium and packed in indigenous retortable pouches. Pouches made of three layer laminates consisting of polyester, aluminum foil and cast PP were used. The curry processed to a F_0 value of 9 had good organoleptic qualities up to 12 months of storage. After 12 months of storage it was observed that the products retained the colour and no off-odor was observed. However, the Mussels did not have the original characteristic texture and hence was rejected. The total process time was 32 minutes.

Indigenous thermoform containers for packing Mussel biriyani

Ready to serve Mussel biriyani packed in indigenous thermoformed containers of high impact polypropylene were evaluated for their storage stability at ambient temperature. The product was packed in HIPP trays with a top seal using PEST/Cast Polypropylene and were processed to a F_0 value of 10. Storage studies indicated that the Mussel biriyani had a shelf life of seven months. Biochemical analysis indicated that the values for TBA,

PV and FFA were well within the limits but based on sensory analysis the products were rejected due to dark colour and slight off-taste.

Ready to eat fish ball curry in retortable pouches

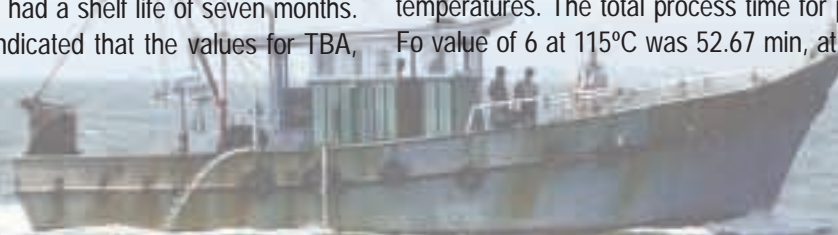
Fish balls and curry (from *Nemipterus japonicus*) prepared in Kerala style was packed in opaque retortable pouches in 60:40 ratio (ball:curry). Pack weight maintained was 100 g and it was thermal processed to an F_0 8.0 at 121.1°C. After processing, the fish balls were found intact and were organoleptically well accepted. Storage studies on ready to eat fish ball curry indicated that the curry is acceptable for a period of 12 months.

Thermal processing of ready to eat fish and tapioca

Development of ready to serve fish curry with tapioca as combination pack was undertaken. The initial trials indicated that the thermal processed fish curry and tapioca was not well appreciated due to loss of colour in tapioca. Thermal processing with added oleoresins, obtained from IISR, Calicut to tapioca resulted in the product with better colour retention. Hence trials were undertaken to process Sardine curry and tapioca in thermoformed HIPP trays. The final F_0 obtained for Sardine fish curry and tapioca was 8.33 and 3.34 respectively. Both fish curry and tapioca were commercially sterile. Although fish curry was still in very good condition sensorily, tapioca developed a very tough texture towards forth month indicating that the combination of fish curry and tapioca can be used up to three months only.

Thermal processing of bread spreads from Blue swimmer crab in TFS cans

Four different bread spread recipes were prepared from Blue swimmer crab (*Portunus pelagicus*) meat and packed in TFS cans for the standardization of recipe and thermal processed at 121.1°C for analyzing their thermal stability. From the four thermal processed spreads, one recipe was selected for conducting storage studies. The spread was processed at three different temperatures of 115, 121, and 130°C to an F_0 value of 6. The effect of temperature on physical (texture, colour and sensory) and bio-chemical parameters were studied. The sterility of the crab spread was determined and found to be sterile at all temperatures. The total process time for processing to a F_0 value of 6 at 115°C was 52.67 min, at 121.1°C it was



37.29 min. and at 130°C it was 32 min. The samples processed at 121.1°C got high overall acceptance, and the sample processed at 115°C also retained good colour and texture. The sample processed at 130°C lost the colour, texture and flavor in spite of its short time high temperature exposure. It was also found that a significant reduction in the amino acids content occurred in samples processed at 130°C. On the basis of above findings it was found that bread spread processed at 130°C lost all the product quality, and the most suitable temperature for thermal processing of bread spread is 121°C.

Suitability of extruded breadcrumbs for coated fish products

Studies were undertaken to compare conventional and extruded bread crumbs. Two different combinations of extruded bread crumbs were standardized using rice flour, maida and corn flour in different ratios. Fish balls were prepared from Threadfin bream mince and coated with the conventional and extruded bread crumbs. They were then packed in HIPP trays and blast frozen at -40°C. The fish balls were stored at -18°C and periodically analyzed for various chemical and microbiological parameters. Organoleptic analysis indicated that appearance of fish balls prepared with extruded breadcrumbs was not as good as with conventional coated ones but no difference was noticed with regard to other quality attributes.

Development of Prawn Manchurian using HTST technology

Prawn Manchurian was prepared using standard recipe. White prawns were used in the preparation. The product was then vacuum packed 100 g in indigenously developed opaque pouches having a three layer configuration of polyester, aluminum foil and cast polypropylene. The pouches were then heat processed to a F_0 value of 6 at three different temperatures, i.e. 115°C, 121.1°C and 126°C. The Prawn Manchurian processed at 126°C was found to be organoleptically superior.

Ready to eat Yellowfin tuna steaks in different forms in see-through pouches

Yellow fin tuna steaks were processed in indigenous see-through retort pouches made of three layer laminates consisting of polyester coated with Silicon dioxide and cast

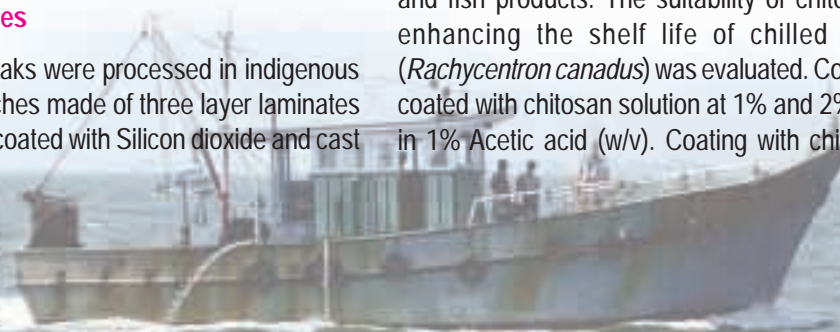
polypropylene to a F_0 value of 10. For the process fresh Yellow fin tuna was procured from the market and gutted and beheaded. The Tuna was then pre-cooked in a retort to reduce the moisture level. The pre-cooked Tuna was cooled and packed into 100 g retort pouches in three different forms namely, Tuna in brine, Tuna in oil and natural pack and processed to a F_0 value of 10. For natural packed Tuna 100 g was packed into the pouch and vacuum packed without any filling medium. In the case of Tuna in oil 70 gm Tuna and 30 ml hot sunflower oil was added as the filling medium. Tuna in brine contained 70 g Tuna and 30 ml of 1% brine solution. The three forms of vacuum packed Tuna were subjected to thermal processing in three different batches in an overpressure retort to F_0 value of 10. The pouches were found to be commercially sterile and are being subjected to shelf life studies.

Ready to eat White prawns in brine and natural pack

Indian white prawn (*Fenneropenaeus indicus*) were processed in indigenous see-through retort pouches made of three layer laminates consisting of polyester coated with silicon dioxide and cast polypropylene to a F_0 value of 8. Fresh prawns were purchased from Fort Kochi landing centre and brought in ice to the laboratory. The prawns were washed, peeled and deveined and hot blanched for 10 min. in brine solution. For natural pack 100 g prawn was packed into the pouch and vacuum packed without any filling medium. Prawn in brine contained 70 g prawn and 30 ml of 1% brine solution and vacuum sealed. Both the batches were subjected to thermal processing in an over pressure autoclave to a F_0 value of 8. The samples were kept for sterility tests and were found to be commercially sterile. The biochemical, sensory and textural parameters are being determined at regular intervals. The changes in amino acids and fatty acids at various stages of processing are also being determined to study the nutritional changes.

Development of antimicrobial packaging

Chitosan derived from the shellfish waste was identified as an effective antimicrobial agent for fresh fish and fish products. The suitability of chitosan coating in enhancing the shelf life of chilled stored Cobia (*Rachycentron canadus*) was evaluated. Cobia steaks were coated with chitosan solution at 1% and 2% concentration in 1% Acetic acid (w/v). Coating with chitosan solutions





showed desirable effect in enhancing the shelf life of the steaks in terms of biochemical, microbial and sensory attributes. Chitosan treated samples were acceptable till 19th day of chilled storage when compared to 10 days for control samples.

Attempt has been made to develop packaging film from chitosan. Chitosan films were prepared at different thickness. The films were characterized based on mechanical (tensile strength, elongation at break, elastic modulus etc.), physical (Oxygen Transmission Rate, CO₂ Transmission Rate, surface colour measurement, water solubility and swelling index with respect to air and water etc.) and optical properties (UV-VIS spectra). Based on the properties evaluated, it was evident that chitosan can be ideally used for making packaging films. Further analysis for the antimicrobial properties of chitosan powder and prepared film are underway. Extrusion of chitosan incorporated packaging films are being carried out at CIPET, Chennai.

Quality changes of chitosan treated unicorn Leatherjacket

Quality changes of unicorn Leather jacket fish (*Aluterus monoceros*) steaks packed in EVOH pouches as i) control, ii) chitosan treated (0.25%), iii) chitosan treatment and with O₂ scavenger, and iv) chitosan treatment and with CO₂ emitter, stored under iced conditions were studied. Sensory, biochemical, physical and microbiological quality during regular intervals were evaluated. The eating quality of the fish was maintained only up to 11 days for control packs when compared to 17, 22 and 29 days for chitosan treated, CO₂ emitter packs and for O₂ scavenger packs, respectively. The sensory odour and overall acceptability was correlated well with the TVBN, pH, total mesophilic counts and *Pseudomonas* spp. with the storage period.

Development of value added products from Myctophids: Quality evaluation and shelf life studies

Fish Protein Hydrolysate (FPH) was prepared from *Diaphus watasei* by enzymatic hydrolysis using three different enzymes, viz., Papain, Pepsin and Bromelain and its biochemical and functional properties were analyzed. The yield, in terms of percentage of weight of dry product to wet weight of fish, obtained using Papain, Bromelain

and Pepsin were 6.5%, 4.5% and 2%, respectively. Protein was higher in FPH using Papain and ash content was highest in FPH using Pepsin. Functional properties of FPHs such as Degree of hydrolysis, Nitrogen solubility Index, Peptide solubility, Fat absorption etc. were analysed.

Frozen storage studies on Myctophids

Battered and breaded products were prepared out of *Diaphus watasei* and were blast frozen at -40°C and is being stored at -20°C for shelf life study.

Preparation of silage

Diaphus watasei processing wastes were used for preparation of silage and the study is underway for analyzing its amino acids, fatty acid and other chemical changes during hydrolysis.

Capacity building for fisherwomen in post harvest technologies

A community fish drying unit was established at Chertala south village. Under the project a training manual was printed, training to fisherwomen imparted and production of dried fish marketing has begun.

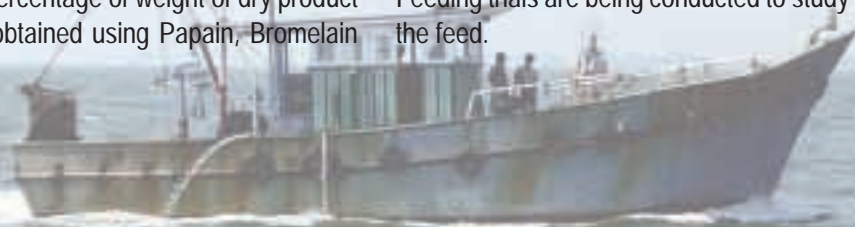
Value chain on oceanic tuna fisheries in Lakshadweep

Development of Fish Kure using red meat: Fish Kure (ready to eat snack) was developed using red meat. The product has high protein content due to the incorporation of the red meat which is usually discarded during processing.

Preparation of flakes and powder from masmin: A new method for the development of ready to use masmin flakes and powder from Tuna has been developed which gives an improved product with convenience to use.

Development of gelatin from tuna skin: This technology can be utilized to generate wealth from the waste. This will minimize problems associated with waste disposal and pollution at the processing factories and at the same time generate income to the entrepreneurs.

Feed: Fish feed and pet feed have been developed from tuna fish waste available from processing plants. Feed for pigs from Tuna red meat has also been developed. Feeding trials are being conducted to study the efficacy of the feed.



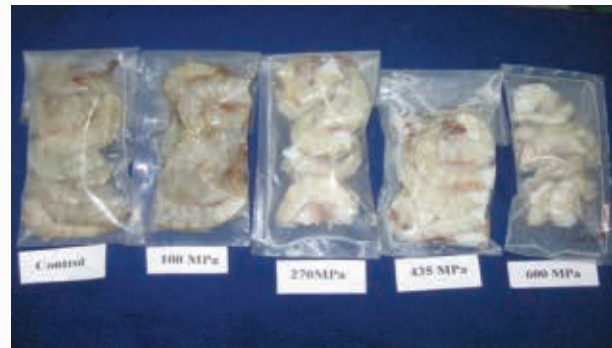
Studies on High Pressure Processing (HPP) of high value perishable commodities

Vacuum packing in EVOH multilayer and chill storage was found to delay the spoilage and extend the shelf life of fresh prawns to 21 days when compared to air pack (15

days). High pressure treatment of 200 MPa was found to be more suitable for retaining the shelf life and biochemical, microbiological and sensory characteristics of Yellowfin tuna chunks. White HL prawns pressure treated at 270 MPa had an extended shelf life with respect to biochemical, microbiological and sensory parameters.



High pressure processed Yellowfin tuna chunks (*Thunnus albacares*)



High pressure processed HL Prawns (*Fenneropenaeus indicus*)





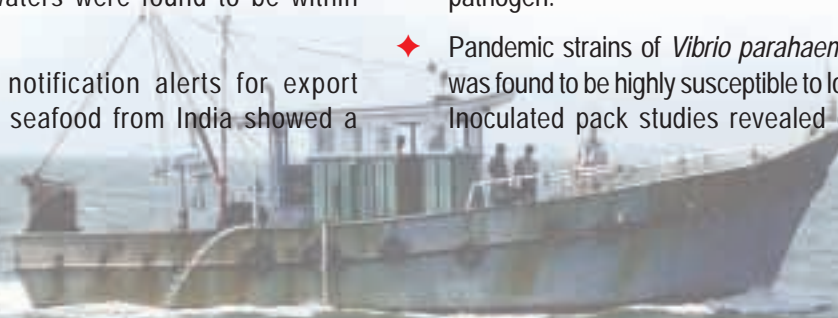
Quality Assurance and Management Division

Research projects handled

- ☐ Assessment of resident time of antibiotics in farmed aquatic animals by evaluating the metabolites
- ☐ Studies on effect of different processing methods, additives and natural preservatives on spoilage and pathogenic bacteria in fish and fishery products
- ☐ Location specific livelihood interventions in fisheries sector for the empowerment of fisherwomen in Kerala
- ☐ Studies on the detection, surveillance and implications of hazard in seafood meant for export market
- ☐ Responsible harvesting and utilization of selected small pelagics and freshwater fishes

Chief findings

- ◆ Withdrawal period of antibiotics such as Florfenicol and Sarafloxacin in *Macrobrachium rosenbergii* was estimated to be 22-25 and 21-24 days respectively.
- ◆ An assessment of antibiotic usage in hatcheries was undertaken. Antibiotics were detected above permissible limits in all the samples. 40% of samples had Oxytetracycline followed by Furazolidone (20%), Ciprofloxacin (20%), Erythromycin (10%) and Chloramphenicol (10%).
- ◆ No metabolites formation in *M. rosenbergii* was noticed after administration of Spectinomycin and Acriflavin.
- ◆ Heavy metal contents in Clam, Pearlsport, Tilapia and Sole in Kerala waters were found to be within prescribed limits.
- ◆ Analysis of EU notification alerts for export consignments of seafood from India showed a decreasing trend in alerts during 2010-11.
- ◆ Challenge studies with different food-borne pathogens were carried out to elucidate their survival pattern in different preservation methods like vacuum packaging, chilling, freezing and drying.
- ◆ Challenge studies with *E. coli* O157:H7 in Yellowfin tuna indicated high resistance of this pathogen with respect to low temperature preservation.
- ◆ Inclusion of multiple barriers such as dip in organic acids in conjunction with chilling did not affect the survival pattern of *E. coli* O157:H7.
- ◆ Challenge studies with *Salmonella* in Anchovy (*Stolephorus commersonii*) revealed that 12 hours sun drying was adequate enough to eliminate the pathogen.
- ◆ Pandemic strains of *Vibrio parahaemolyticus* O3:K6 was found to be highly susceptible to low temperature. Inoculated pack studies revealed only four days



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- survival of the pathogen during chill storage of Yellowfin tuna.
- ♦ Inclusion of Citric acid at 0.4% level and Potassium sorbate at 0.3% significantly increased the chill storage life of squid *Loligo duvauceli*.
- ♦ Phytochemicals extracted from *Orthosiphon glabratus*, *Lawsonia inermis* and *Cassia alata* exhibited broad spectrum antibacterial activity against pathogenic and spoilage flora encountered in seafood.
- ♦ Species-specific differential Cadmium bioaccumulation was observed in Squids. Tissue-wise variation and heterogeneous accumulation in edible parts were also noticed.

Report of work done

Assessment of resident time of antibiotics in crustaceans and identification of metabolites

Withdrawal period of two antibiotics Florfenicol and Sarafloxacin was established in *Macrobrachium rosenbergii* and *Fenneropenaeus indicus*. Administration of these antibiotics through feed was initiated after acclimatization with an initial concentration of 1.0% (0.50% of the total weight of the feed used). The feeding was continued till antibiotic level in the tissue reached 50-60 ppb. Afterwards the feeding of antibiotics was stopped and the tissue was regularly monitored to estimate the withdrawal period. The withdrawal period for Florfenicol and Sarafloxacin was found to be 22-25 days and 21-24 days respectively.

Antibiotics use pattern in shrimp hatcheries was monitored by taking periodic samples of feed, artemia cysts, prophylactic mixtures, egg, naupli and post larvae from different hatcheries in Kerala and Tamil Nadu. Antibiotics were detected above permissible limits in all the samples. 40% of samples had Oxytetracycline followed by Furazolidone (20%), Ciprofloxacin (20%), Erythromycin (10%) and Chloramphenicol (10%).

Metabolites formed from six antibiotics were enumerated using API 4000 QTRAP LCMSMS by employing light sight software. It was found that Sulphamethaxazole produced two major metabolites viz. nitroso sulphamethoxazole by oxidation and N acetyl sulphamethoxazole by acetylation. Trimethoprim produced two major metabolites viz., oxymethoprim and hydroxy

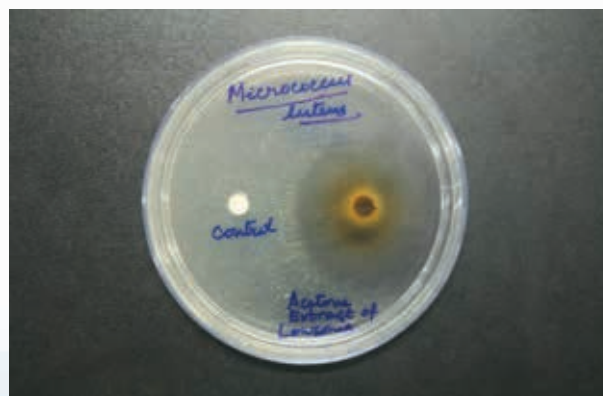
methoprim. Spectinomycin did not produce any significant metabolites after administration into *M. rosenbergii*. Chloramphenicol formed two major metabolites inside the shrimp viz. nitroso chloramphenicol and dichloro acetamide. Oxolonic acid produced only one major metabolite in *M. rosenbergii* viz. Oxolonic acid glucuronide. Acriflavin did not produce any metabolites in *M. rosenbergii*.

Screening of plant-based extracts for antimicrobial compounds

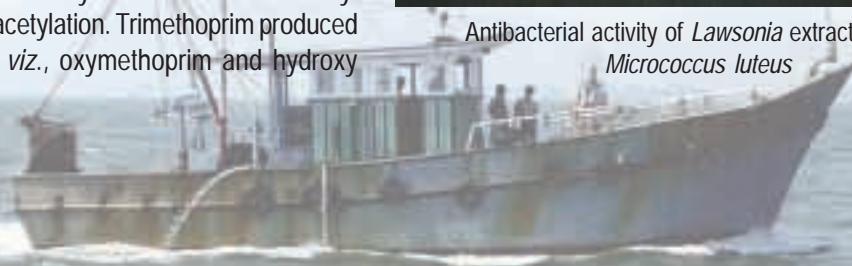
Eight plant varieties (*Centella asiatica*, *Orthosiphon glabratus*, *Scoparia dulcis*, *Lawsonia inermis*, *Achyranthes aspera*, *Cyclea peltata*, *Cassia alata* and *Biophytum sensitivum*) were screened for antibacterial activity. Leaves of these plant varieties were dried, ground and serially extracted to obtain polar, moderately polar, neutral and basic fractions. All these fractions were tested for antibacterial activity against sensitive ATCC bacterial cultures by disc or well diffusion assay. The polar extracts obtained from *O. glabratus* and *C. alata* exhibited highest



Plant extracts for antimicrobial activity



Antibacterial activity of *Lawsonia* extract against *Micrococcus luteus*





antibacterial activity, whereas minimal to moderate activity was obtained for *S. dulcis*, *L. inermis* and *A. aspera*.

Survival of pathogenic bacteria in seafood and evaluation of biological hazard reduction profile in different processing methods

Challenge studies with various food-borne pathogens was carried out by inoculating fish/fishery products at a constant inoculum level followed by subjecting them to normal processing step. Inclusion of multiple barriers was evaluated with respect to various processing steps. Survival of pathogens during the processing steps as well as during storage is assessed for developing predictive microbiological models.

Effect of organic acid treatment (0.2-0.4% Citric acid; 0.1-0.3% Potassium sorbate) on the survival of spoilage bacterial flora in squid during chilled storage was studied. Untreated squids had seven days storage life, whereas those treated with 0.3% Potassium sorbate and 0.4% Citric acid had extended shelf life of 10 days. The microbiological quality parameters (APC and H_2S former count) did not correlate well with sensory values, but agmatine content was found to have good correlation with organoleptic characteristics within the sensory life of the product in both treated and un-treated samples.

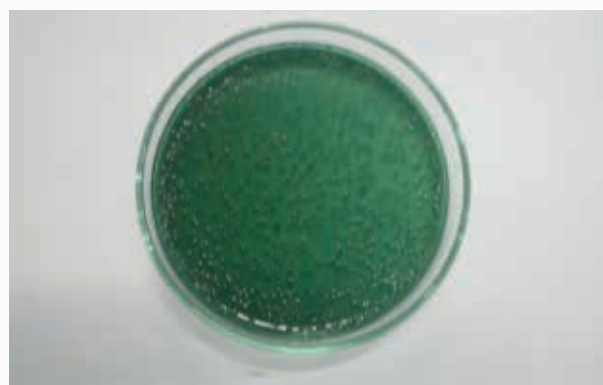
The influence of bacterial load in spoilage of Indian Squid (*Loligo duvauceli*) during chilled storage condition indicated predominance of autolytic process rather than microbial load in influencing the spoilage in squids. Efficacy of Citric acid treatment in the extension of shelf life of Indian Mackerel *Rastrelliger kanagurta* in chilled storage conditions demonstrated that Citric acid was ineffective in extension of shelf life for whole fish preservation as well as when fishes are stowed in direct contact with ice without using any packaging material.

Survival of Enterohemorrhagic *E. coli* i.e. *E. coli* O157:H7 in Squid during chilled storage for 30 days was studied. Survival of this pathogenic bacteria during chilled storage with separate inclusion of 0.3% Citric acid and 0.2% Potassium sorbate indicated that *E. coli* O157:H7 is quite resistant to chilling stress and organic acid treatment. The present study indicated that treatment with organic acid can be carried out in conjunction with chilling preservation, when the expected population density of *E. coli* O157:H7 is below 3 log counts.

Studies have shown that *E. coli* O157:H7 could survive more than 50 days on fish substratum in chilled condition, but its load reduced from 1.7×10^6 to 1.9×10^5 cfu/g in air pack and 6.6×10^4 cfu/g in vacuum pack. Not much reduction was observed in the load of *E. coli* O157:H7 after freezing at -40°C and subsequent storage at -20°C .

Studies on effects of chilling, freezing and cold storage on *Vibrio parahaemolyticus* O3:K6 indicated that the pathogen is highly susceptible to cold shock and could survive only four days during chill storage at 4°C in pre-inoculated Tuna chunks.

Survival of *Salmonella enterica* in sun-dried Anchovy (*Stolephorus commersonii*) indicated that the pathogen can survive for 12 hours of cumulative exposure to sun-drying. Five log reduction of the inoculated pathogen was observed.



Vibrio parahaemolyticus O3:K6 on TCBS Agar

Role of psychrotolerant bacteria in histamine formation in Tuna

Level of psychrotrophic histamine formers varied between 5-14% in muscles of Yellowfin tuna (*Euthynnus affinis*). Use of Niven's medium was found to give false positive result as only 12.5% of the isolates were confirmed to possess histidine decarboxylase activity.

Validation of consumer preference and hygiene standards in domestic fish markets of Kerala

Different market segments across Ernakulam were selected for consumer preference studies. The consumer preferred fish samples were subjected to an array of biochemical, microbiological and organoleptic analysis to determine presence of hazards. The ice and water used in



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fish markets were also analysed for the presence of hazards. Consumers were found to ignore safety attributes for high priced commodities. High load of indicator organisms like Sulphite reducing Clostridia, Coliforms and faecal Streptococci were observed in fish samples as well as in ice used in markets. *Salmonella* and non-O1 *Vibrio cholerae* was encountered in market samples.



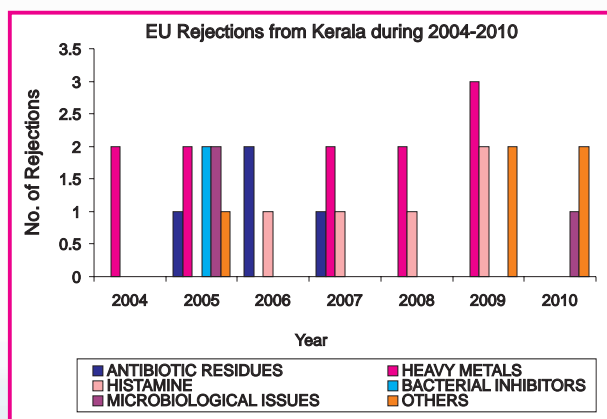
Hygiene assessment of fish markets

Monitoring presence of antibacterial substances in food

Seventy five samples comprising of imported fish, fish products, food additives and milk were tested for the presence of antibacterial substances by using sensitive bacterial culture viz. *Bacillus subtilis* (ATCC-6633) and *Micrococcus luteus* (ATCC-9341). Seven samples (9.3%) including two fish feed, imported fish products and ready to cook fish products were found to be positive.

Export rejections on seafood

The export rejections for fish and fishery products during 2004-2010 were mostly from EU countries. Antibiotic



residues were the major cause of rejection. Analysis of EU notification alerts for export consignments of seafoods from India showed a decreasing trend in 2010-11. In case of Kerala, heavy metals, especially Cd in cephalopods was found to be the major concern.

Studies on the detection and surveillance of hazards in landing centres

Sanitary conditions prevailing at the fish landing centres were assessed. The data indicated that water used for cleaning as well as food contact surfaces had high bacterial load indicating lack of hygienic practices at the primary production centres.



Unhygienic practices prevailing in a fish landing centre

Livelihood interventions in fisheries sector for the empowerment of fisherwomen in Kerala

Needs of fisherwomen in selected stretches of Kerala coast are prioritized and groups in the area are provided with developmental inputs for giving expertise in each location. Interventions have been initiated on culture of Edible oysters (*Crassostrea madrasensis*), preparation of specialty seafood products and training on net mending.

Effect of thawing method and duration on recovery of bacteria

Thawing duration and method adopted was found to affect significantly the recovery of bacteria from frozen seafood and hence a differential aerobic plate count was obtained. The variables chosen were no thawing, room temperature thawing (1h, 2h, 3h), running water thawing (15 min.), water bath thawing (45°C for 30 min. and 1h), chilled room thawing (2°C for 2h and 4h), thawing in refrigerator (2h, 4h, 6h, 18h, 20h, 22h) and microwave



thawing (15 sec and 30 sec). Thawing at room temperature for 3h and refrigerated thawing for 6h resulted in highest APC. Based on this result, appropriate thawing regime for frozen seafood is being established.

Post harvest quality of dried Bombay Duck

Dried Bombay Duck samples collected from Jaffrabad, Gujarat were analyzed for microbiological quality parameters. Bacteria of public health significance were not detected, but yeast and mould were present in most of the samples. The water activity values ranged from 0.68-0.71.



Fungus infested dried Bombay Duck

Comparative analysis of different standard methods for estimation of bacterial load from seafood

Different standard methods given by USFDA, APHA, BIS, ISO and ICMSF were used for determination of aerobic plate count from seafood. Different methods were tested in shrimp, Sardine and Tuna samples. Statistical analysis revealed significant difference in APC count obtained through different methods. Incubation temperature, type of diluents used and dilution volume affected the estimation of viable bacterial population from seafood.

Studies on bio-accumulation of Cadmium in Squid

Species-wise and organ-wise differentiation in bio-accumulation of Cadmium was observed in squid species landed along Kerala coast. The Cd level in skin, mantle, ink gland, digestive gland, gonads, muscle and tentacles were analysed in three different species of squid (*Loligo duvauceli*, *L. singhalensis* and *L. edulis*). Muscle of *L. singhalensis* contained Cd level above the prescribed limit of 1 ppm and ink gland contained 2-7 ppm of Cd in most of the samples. Tentacle contained more Cd than other edible parts.



Squid species used for bioaccumulation studies

Energy efficient low cost effluent treatment plant

Waste waters from fish processing plants are usually high in proteinaceous compounds and oils and hence have high Biological Oxygen Demand (BOD). This sizable effluent is discharged to the surrounding receiving waters generally. The primary waste load in operating a frozen fish factory is directly related to the handling considerations in pre-processing activities and other process practices followed in the factory. CIFT has developed designs for an Effluent Treatment System for handling processing effluents.

Advantages: The treated effluent conforms to the norms of Central and State Pollution Control Boards. Treated water is suitable for reuse in the plant; Small land requirement for installation; Zero pollution atmosphere; Eco friendly; Less power consumption (only 1-2HP motor is required); Ease of operation; Low cost of construction; Low maintenance and small footprint.



Effluent treatment plant



Microbiology, Fermentation and Biotechnology Division

Research projects handled

- ☐ Assessment of microbial seafood safety hazards and bioprospecting of aquatic microbial resources for enzymes
- ☐ Studies on handling, processing, preservation and product development of commercially important farmed and wild freshwater fish
- ☐ Development of convenience products from fish and shellfish
- ☐ Assessment of resident time of antibiotics in cultured shrimp by evaluating the metabolites in farmed aquatic animals
- ☐ Responsible harvesting and utilization of small pelagics and freshwater fishes
- ☐ Bioprospecting of genes and allele mining for abiotic stress tolerance
- ☐ Studies on high pressure processing (HPP) on high value perishable commodities
- ☐ Assessment of Myctophid resources in the Arabian sea and development of harvest and post-harvest technologies

Chief findings

- ◆ Pathogenic *V. parahaemolyticus* was found to be present in 21% of the 38 seafood samples collected from retail markets in Ernakulam, Kottayam and Alappuzha districts in Kerala, India.
- ◆ A total of 3.9% isolates of the 198 strains of *V. parahaemolyticus* isolated from seafood possessed ORF8 sequence indicating its pandemic potential while 11.6% isolates possessed TDH gene indicating its virulence potential.
- ◆ One Methicillin resistant *S. aureus* (MRSA) strain was isolated from seafood.
- ◆ *Yersinia enterocolitica* biotype 1A was detected in three out of 60 seafood samples collected from retail markets in Ernakulam, Kottayam and Alappuzha districts in Kerala, India. *ystb* gene was detected in the biotype 1A isolates.
- ◆ Three out of 50 *V. cholerae* isolates from seafood samples were identified as *V. cholerae* O1 serotype (Inaba).
- ◆ Of the 45 seafood samples analysed, 86.6% were found to harbour *E. coli* but none of them were found to harbour *E. coli* O157:H7.
- ◆ *Shigella dysenteriae*, *S. boydii* and *S. flexneri* were detected in three out of 20 seafood samples from retail markets comprising of Shrimp, Clam and Mussel.
- ◆ *Listeria monocytogenes* was detected in 2.2% of the seafood samples and serogroups 1 and 4 were





identified.

- ◆ *L. monocytogenes* isolate from freshwater fish and *L. monocytogenes* ATCC 19115 were found to be strong biofilm producer on polystyrene plate, stainless steel coupon, aluminum coupon and glass slide.
- ◆ Five strains of Lactic acid Bacteria inhibitory to *L. monocytogenes* were identified as belonging to *Lactobacillus plantarum* and *L. fermentum*.
- ◆ *S. aureus* was present in 39% of the 87 samples of fish and shell fish tested.
- ◆ Staphylococcal enterotoxins; SEA, SEB, SEC, SEG and SEI were present in 12.5%, 20%, 27.5%, 22.5% and 20% of the 40 *S. aureus* isolates respectively.
- ◆ Enterotoxigenic *B. cereus* was detected in 16 of the 51 samples tested from fishery environment.
- ◆ Benzalkonium chloride at 0.1% concentrations were able to reduce the *Listeria* population in biofilm by 2.25 log₁₀ value, while 0.2% completely destroyed the *Listeria* population in biofilm.
- ◆ 20 ppm chlorine was sufficient to completely destroy the *Listeria* population in the biofilm.
- ◆ On chilling, the levels of aerobic mesophilic bacteria and H₂S producing bacteria on freshwater Catfish, *Pangasius sutchi*, reached 10⁷ and 10⁵cfu/g respectively on Day 8 limiting the shelf life to 6-7d whereas in ice stored fillets, the limit count was reached on Day 11 and shelf life was 8-11d.
- ◆ The activity of the purified alkaline protease enzyme from *B. subtilis* SQ12 was 545, 710, 918, 890, 645 U/ml respectively at pH 8, 9, 10, 11 and 12 and the activity was three times higher as compared to the crude enzymes.
- ◆ Sorbitol dehydrogenase, an enzyme that convert fructose to sorbitol which can act as an osmoprotectant, from *Oceanobacillus iheyensis* was functionally characterised.
- ◆ The Mannitol 1 phosphate 5 dehydrogenase gene from *Bacillus licheniformis*, that catalyzes the conversion of fructose to mannitol was expressed in *E. coli* and a recombinant protein of 40KDa size was obtained after purification on His-tag column.

- ◆ Molecular and functional characterization of glutamate dehydrogenase gene from *Oceanobacillus iheyensis* was carried out.
- ◆ *O. iheyensis* whole Transcriptome Analysis was carried out using SOLiD 3 plus sequencer under 0.4 OD and 1.0 OD growth conditions at 7.5% growth conditions to understand the molecular mechanisms involved in halotolerance. There were 349 genes that were upregulated and 499 genes that were downregulated.
- ◆ Mapping of 499 downregulated genes of *Oceanobacillus iheyensis* onto KEGG pathways revealed three key pathways whereas 349 upregulated genes have been carried out onto eight key pathways.

Report of work done

Pathogenic *Vibrio parahaemolyticus* in seafoods

Thirty eight seafood samples collected from 11 markets of Ernakulam, Alapuzha and Kottayam districts of Kerala revealed the presence of *Vibrio parahaemolyticus* in 15 samples. Among 143 *V. parahaemolyticus* isolates, 30 (21%) were found to exhibit beta-hemolysis on Wagatsuma agar (Kanagawa phenomenon) which is an important virulence determinant in *V. parahaemolyticus*.

Vibrio cholerae O1 in seafood

Seventy six seafood (fish, shrimp, crab, clams, and mussel), pond water (n=2) and pond mud (n=2) samples were analyzed for the presence of *V. cholerae*. Thirty nine samples were positive for *V. cholerae*. Seventy nine *V. cholerae* isolates were identified from the positive samples. Biochemically identified *V. cholerae* isolates (n=50) were further serotyped to confirm the presence of *V. cholerae* O1 using antisera (BD, USA). Three out of 50 *V. cholerae* isolates were identified as *V. cholerae* O1 serotype (Inaba).

Molecular characterization of virulence determinants in *V. parahaemolyticus* isolated from seafood

Among 150 isolates of *Vibrio parahaemolyticus* from seafood, 16.6% were found to possess the gene encoding the thermostable direct hemolysin (TDH), an important virulence determinant. None of the strains had the gene *trh*, encoding the TDH-related hemolysin (TRH). All the



PCR for detection of *tdh* and *orf8* from *Vibrio parahaemolyticus*. Lane M; Molecular marker; Lanes 1&2 *V. parahaemolyticus* strains with *tdh* gene (251 bp), the virulence marker; Lanes 4&5 *V. parahaemolyticus* strains with *orf8* gene (700bp), the pandemic marker

strains were found to carry the *V. parahaemolyticus toxR* specific sequence, which was confirmed by PCR. A unique open reading frame, ORF 8, which is present in a filamentous phage Φ 237 and specifically associated with the pandemic O3:K6 serovar strain of *V. parahaemolyticus*, was detected in 3.9% of the isolates.

***Yersinia enterocolitica* in fish and shellfish**

Sixty seafood samples comprising of marine fish, freshwater fish and shellfish collected from retail outlets in and around Cochin were screened for *Y. enterocolitica*. *Y. enterocolitica* biotype 1A was detected in three samples *ystb* gene was detected in the isolates by PCR. *Y. intermedia* was dominant in the fish samples analysed.

Non-proteolytic *Clostridium botulinum* in fish and shellfish

Sixteen fish and shellfish samples were tested for the presence of non-proteolytic *C. botulinum*. Three samples were found to be positive. Type B toxin was detected in the positive samples.

***Staphylococcus aureus* in seafoods**

Eight four samples from ten markets were screened for presence of *S. aureus*. Forty percent samples harbored the organism and 119 isolates obtained. One Methicillin

resistant (MRSA) strain was isolated. All strains were sensitive to Cephalothin, Clindamycin, Clotrimazole, Vancomycin, Ampicillin, Chloramphenicol, Tricopenic acid, Novobiocin and Tetracycline. Thirty percent of the strains were resistant to Erythromycin, 23% resistant to Azithromycin, 20% resistant to Clarithromycin and 3% each resistant to Gentamycin and Orfloxacin.

Enterotoxigenic *Staphylococcus aureus* in seafood

Fourty strains of *S. aureus* isolated from fish from retail outlets at Ernakulam, Alapuzha and Kottayam districts were tested for the enterotoxigenic potential by PCR. The enterotoxigenic genes SEA, SEB, SEC, SEG and SEI were present in 12.5%, 20%, 27.5%, 22.5% and 20% of the isolates respectively.

Enteropathogenic *Escherichia coli* in fish and shellfish

A total of 45 fish and shellfish samples collected from different fish markets and estuarine environments covering three districts of Kerala (Ernakulam, Alapuzha and Kottayam) were screened for the presence of enteropathogenic *E. coli* with special reference to *E. coli* O157:H7 by standard isolation protocols. 86.6% samples were found to harbour *E. coli* but none of them were found to harbour *E. coli* O157:H7.

Incidence of *Shigella* spp. in seafood

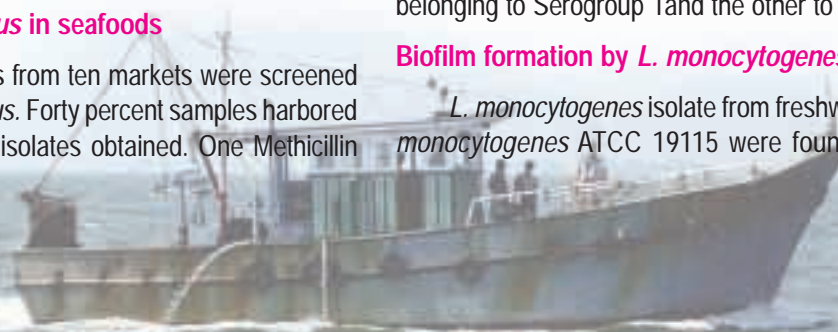
Fish, shrimp, clam and mussel samples (n = 20) collected from retail markets were analyzed for the presence of *Shigella* spp. Three seafood samples were found to be positive for *Shigella*. *Shigella* isolates (n=48) identified were serotyped using commercial antisera (Remel, USA). *S. dysenteriae*, *S. boydii* and *S. flexneri* were identified.

***Listeria monocytogenes* in fish and fishery environment**

A total of 89 samples comprising of 70 fish samples and 19 fishery environmental samples (9 ice and 10 and sands) were screened. Thirty four (26 fish and 8 environmental samples) were found to harbour *Listeria* spp. *L. monocytogenes* was detected in two samples, one belonging to Serogroup 1 and the other to Serogroup 4.

Biofilm formation by *L. monocytogenes*

L. monocytogenes isolate from freshwater fish and *L. monocytogenes* ATCC 19115 were found to be strong





biofilm producer on polystyrene plate. Studies on the biofilm formation on stainless steel coupon, aluminum coupon and glass slide revealed that *L. monocytogenes* ATCC 19115 was a biofilm former in all matrices tested with 7.965×10^5 , 1.128×10^5 , 5.6×10^5 cfu/cm² on stainless steel, aluminum and glass slide, respectively.

Effect of disinfectants on *L. monocytogenes* in biofilm

Different concentrations of Benzalkonium chloride (0.05, 0.1 and 0.2%) and chlorine (10, 20, 30, 40, 50, 150 and 200 ppm) were tested for inactivation efficacy on biofilm of *L. monocytogenes* ATCC 19115 formed on glass slide. Benzalkonium chloride at 0.05 and 0.1% concentrations reduced the *Listeria* population in biofilm by 1.2 and 2.25 log₁₀ value, while 0.2% completely destroyed the *Listeria* population in biofilm. 20 ppm chlorine was sufficient to completely destroy the *Listeria* population in the biofilm. 10 ppm of chlorine reduced the *Listeria* population by around 4 log₁₀.

Anti-*Listeria* activity of Lactic Acid Bacteria (LAB)

Five LAB isolates out of the 28 isolates from fish samples exhibiting most potent anti-*Listeria* activity were identified upto species level by sequencing of 16S rRNA gene. Four isolates have been identified as *Lactobacillus plantarum* and one isolate has been identified *Lactobacillus fermentum*. They were further confirmed by PCR using *L. plantarum* and *L. fermentum* species specific primers.

Enterotoxigenic *Bacillus cereus* in fishery environmental samples

Out of 51 samples of fishery environment (30 ice, 18 mud and sand and 3 sea water) tested, presence of enterotoxigenic *B. cereus* was detected in 16 samples (4 ice and 12 mud and sand samples). The isolates were confirmed by *B. cereus* group specific PCR as evidenced by the presence of 533 bp PCR amplified product.

Enteric viruses in seafood and aquatic environment

A method for detection of Hepatitis A virus and Rotavirus was standardized using Reverse Transcriptase PCR with standard viruses. For identification of enteric viruses by combined cell culture and RT-PCR method, Cell lines Vero and MDBK cell lines are being maintained.

Microbial profile of farmed Catfish *Pangasius sutchi*

The bacterial profile on the surface of farmed Catfish

(*P. sutchi*) collected from a farm located at Kodungallore, Trichur district, Kerala was studied. The aerobic mesophilic count was in the range of 10³ to 10⁴ cfu/g. Total Coliform and faecal Streptococci were present. The mesophilic count of Catfish fillet was greater than the surface count. Total Coliform and *E. coli* were present. H₂S producing bacterial flora was dominated by *Aeromonas* and Enterobacteriaceae. The mesophilic microflora was dominated by *Pseudomonas*, *Aeromonas*, *Flavobacterium*, *Acinetobacter*, *Cytophaga*, *Bacillus* and *Micrococcus*.

Microbial ecology of Striped catfish fillets during chilled and iced storage

The mesophilic microflora was $\geq 10^5$ cfu/g and total Coliform level was $\geq 10^3$ cfu/g initially. The levels of H₂S producing bacteria was low initially. *E. coli* and faecal Streptococci were present. *S. aureus* could not be detected. On chilling, the levels of aerobic mesophilic bacteria and H₂S producing bacteria reached 10⁷ and 10⁵ cfu/g respectively on Day 8 limiting the shelf life to 6-7d whereas in ice stored fillets, the limit count was reached on Day 11 and shelf life was 8-11d.

Microbiological quality of Striped Catfish packed under air and vacuum

Microflora associated with Striped Catfish packed under air and vacuum were investigated. Significant increase was noticed in the counts of aerobic bacteria and total Coliforms in samples packed under air limiting the shelf life to 7d. The aerobic mesophilic counts increased gradually in vacuum packed samples and exceeded the limit count on Day 13.

Effect of chitosan and Ascorbic acid treatment on the microbiological quality of Striped Catfish steaks

Effect of Ascorbic acid and chitosan treatments on the quality of Striped Catfish steaks was studied. The aerobic mesophilic count, *Pseudomonas* and Coliform levels increased in both treated and control samples. Significant increase was observed in control and Ascorbic acid treated samples.

Microbiological quality of Cobia during chilled storage

Effect of chitosan treatment on the microbiological quality of Cobia (*Rachycentron canadum*) during chilled storage was investigated. The initial quality of the fish used



for treatments was determined and quality was good. Samples treated with 1% chitosan had lower bacterial count and shelf life was 11d where as control samples had a shelf life of 5d.

Chitosan treatment enhanced shelf life of Cobia during chilled storage.

Bioprospecting of aquatic bacteria for enzymes

Alkaline protease from aquatic bacteria: Protease enzyme obtained from *Bacillus subtilis* SQ12 was partially purified by Ammonium sulphate precipitation followed by dialysis and acetone precipitation methods. The enzyme activity was determined at different temperature and pH. The activity of the purified enzyme was 545, 710, 918, 890, 645 U/ml respectively at pH 8, 9, 10, 11 and 12. The activity was three times higher as compared to the crude enzymes. Studies on the stability of the purified enzyme at different temperatures showed maximum activity of 905 U/ml at 50°C and 90% relative activity at 50°C for 120 min.

Chitinase enzyme from aquatic bacteria: *Oceanobacillus* and *Bacillus chitinolyticus* strains exhibiting potent chitinase activity was isolated and characterized.

Psychrotrophic deep sea bacteria associated with seafood : Deep sea prawn and fish samples were analysed for psychrotrophic deep sea bacteria. The DNA sequence of the bacterial isolates revealed that the isolated bacteria belong to genera *Vibrio*, *Photobacterium* sp., *Pseudoalteromonas* sp. and *Salinivibrio* sp.

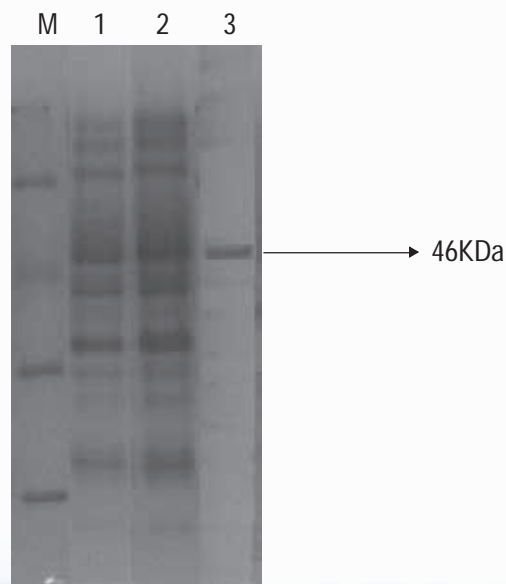
Molecular and functional characterization of mannitol 1 phosphate dehydrogenase gene from *Bacillus licheniformis*: The mannitol 1 phosphate 5 dehydrogenase gene from *B. licheniformis*, that catalyzes the conversion of fructose to mannitol, was expressed in *E. coli* host after ligation into pQE30 expression vector. Sequence analysis revealed similarity of the protein with mannitol 1 phosphate 5 dehydrogenase gene from *B. licheniformis* with 97% identity. A recombinant protein of 40KDa size was obtained after purification on His-tag column. The molecular weight of the purified protein was similar to that of the predicted mass. The fusion protein was able to catalyse the reduction of fructose to mannitol as revealed by enzymatic assay. In induced expression plasmids, the specific activity of the mannitol dehydrogenase synthesized in *E. coli* was increased from

0.02 U (mg protein)⁻¹ to 10 U (mg protein)⁻¹.

Molecular and functional characterization of sorbitol dehydrogenase gene from *Oceanobacillus iheyensis*: Sorbitol dehydrogenase, an enzyme which convert fructose to sorbitol which can act as an osmoprotectant was PCR amplified from *O. iheyensis* and heterologously expressed in *E. coli*. An expected protein of approximately 40 KDa was obtained on purification using His-tag column. The activity of the enzyme coded by the recombinant gene was found to be five times higher than the uninduced control cells.

Molecular and functional characterization of glutamate dehydrogenase gene from *O. iheyensis*: Glutamate is one of the main compatible solute in moderately halophilic bacteria, *O. iheyensis*. The gene encoding glutamate dehydrogenase in *O. iheyensis* was PCR amplified using primers designed and an expected product of 1280 bp was obtained.

The glutamate dehydrogenase gene from *O. iheyensis* was cloned and expressed in *E. coli* host. His tagged purified recombinant protein of 46 KDa of expected size was obtained. On enzymatic assay, a four fold increase in the activity of glutamate dehydrogenase was observed in the recombinant strain (130U/mg) after induction compared to



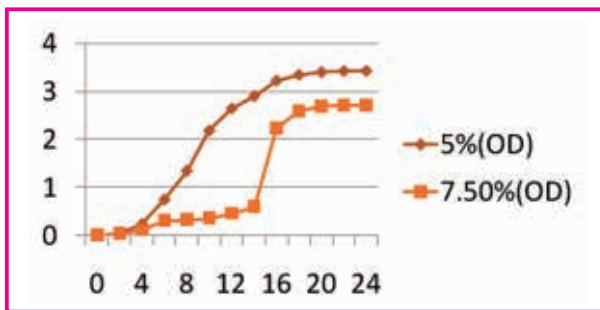
SDS PAGE analysis of expressed glutamate dehydrogenase in *E. coli*. Lane M- Marker Lane 1- Uninduced control Lane 2- Induced Lane 3- Purified protein (His tagged)



that of the strain without induction (20U/mg).

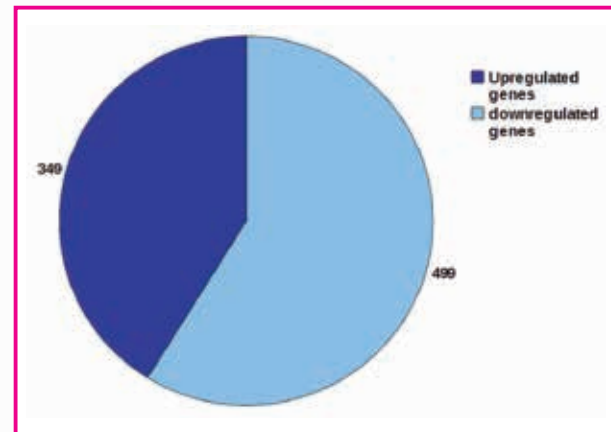
Differential gene expression of *O. iheyensis*:

Growth curve analysis of *O. iheyensis* at different concentrations of salt revealed an extended lag phase at 7.5% salt till 14 hours after which the log phase was initiated. However the extended lag phase was not present at 5% salt concentration. To understand the molecular mechanisms involved in salt tolerance of *O. iheyensis*, a differential expression study using RNAseq technology of *O. iheyensis* cells at lag phase (0.4 OD) and log phase (1.0 OD) at 5% salt concentration was done.



Growth curve analysis of *O. iheyensis* cultures at high salt conditions (7.5%) and standard conditions (5%)

Eleven genes were detected in *O. iheyensis* exclusively at an OD of 0.4. Out of these 11 genes, seven are "hypothetical proteins" and four genes are completely annotated. At 1.0 OD, 18 genes were detected in *O. iheyensis*. Out of these 18 genes, 14 are "hypothetical proteins" and four genes are completely annotated. There were 848 genes in total that have significant difference in their FPKM values in *O. iheyensis* 1.0 OD and 0.4 OD samples. These 848 genes from *O. iheyensis* 1.0 OD to 0.4 OD. have been further divided into two categories, i.e. upregulated genes and downregulated genes. There are 349 upregulated genes and 499 downregulated genes. There are 16 highly downregulated genes (fold change ≤ -1.0) from *O. iheyensis* 1.0 OD to 0.4 OD. In addition to that, 13 highly upregulated genes (fold change ≥ 1.0) from



Differential gene expression of *O. iheyensis*

O. iheyensis 1.0 OD to 0.4 OD. Mapping of 499 downregulated genes of *O. iheyensis* on to KEGG pathways revealed three key pathways whereas 349 upregulated genes have been carried out onto eight key pathways.

Pathway analysis of upregulated genes in *O. iheyensis* using KEGG database

Sl. No.	Name of the pathway	No. of genes involved
1	Ribosome	76
2	Oxidative phosphorylation	34
3	RNA polymerase	5
4	Biosynthesis of siderophore group non ribosomal peptides	8
5	Pyrimidine metabolism	44
6	Glutathione metabolism	9
7	Glycerophospholipid metabolism	11
8	Glycerolipid metabolism	17

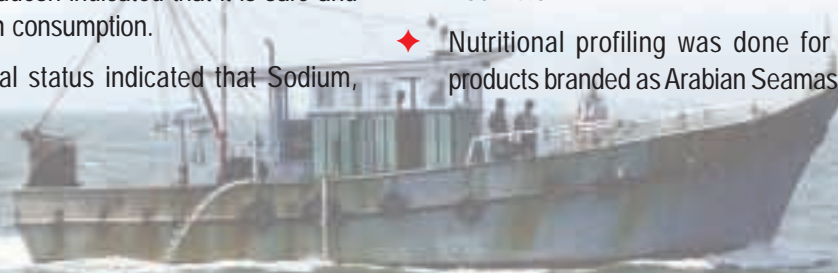
Biochemistry and Nutrition Division

Research projects handled

- ☐ Bio-monitoring of bivalve molluscs and crustaceans from Indian waters as health promoters and indicators of environmental contaminants
- ☐ Bioevaluation and purification of natural bioactive compounds of therapeutical and nutraceutical significance from aquatic resources
- ☐ Nutritional and pharmacological evaluation of marine molecules in alleviating diseases and disorders
- ☐ Nutrient profiling and evaluation of fish as a dietary component
- ☐ Isolation and characterization of collagen and gelatin from aquatic sources and development to pharmaceutical and food grade products of commercial importance
- ☐ Responsible harvesting and utilization of selected small pelagics and freshwater fishes
- ☐ Oceanic tuna fisheries off Lakshadweep seas - A value chain approach
- ☐ Utilization strategy for oceanic squids of Arabian sea - A value chain approach
- ☐ Resource assessment of deep-sea fishes along the continental slope of Indian EEZ
- ☐ Assessment of Myctophid resources in the Arabian sea and the development of harvest and post harvest technologies

Chief findings

- ◆ Nutritional evaluation of bivalve molluscs and crustaceans indicates the presence of bioinorganics of therapeutical significance.
- ◆ Blood clam (*Anadara granosa*) extracts exhibited significant antimicrobial activity against *Salmonella* and *Staphylococcus aureus*.
- ◆ Biochemical compositional analyses and microbial investigations of freshwater snail (*Pila gracilis*) collected from the paddy fields of East Godavari district, Andhra Pradesh indicated that it is safe and nutritive for human consumption.
- ◆ Studies on mineral status indicated that Sodium, Potassium and Phosphorus content were higher in small sized *Perna indica* (Na- 2824 mg%, K- 787 mg% and P- 1019 mg%) than in large sized *P. indica* (Na- 1594 mg%, K- 435 mg% and P- 910 mg%).
- ◆ Calcium and iron content were relatively higher in large sized *P. indica* (Ca- 123 mg%, Fe- 232 mg%) than in small sized *P. indica* (Ca- 79 mg% and Fe- 165 mg%).
- ◆ Acid soluble collagen, pepsin-digestible collagen and insoluble collagen were isolated from Tuna and Rohu skin. Yield of acid soluble collagen from Tuna skin was 14%.
- ◆ Nutritional profiling was done for two IQ frozen products branded as Arabian Seamaster Squid Tubes





and Arabian Seamaster Squid Stripes.

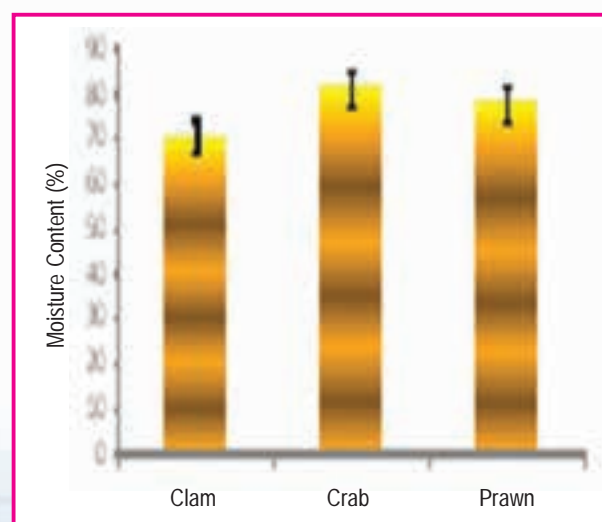
- ◆ Three different chemical processes developed for the production of biodiesel from Sardine oil by transesterification process indicated that the extraction methods with acidified alcohol and acetyl chloride are optimum methods for the production of biodiesel from fish oil.
- ◆ Chemical profile of freeze dried Green mussel *Perna viridis* collected from the West Coast region of India indicated that the incorporation of additives is required to make the product comparable to the commercially available New Zealand green lipid mussel extract used for the treatment of arthritis.
- ◆ High Performance Liquid Chromatography analysis of the root extract of *Rhizophora apiculata* revealed the presence of three peaks corresponding to three standard compounds (Rutin, Quercetin) and Gallic acid .
- ◆ The antioxidant phenolic compounds and flavonoid content are higher in the root of *R. apiculata* than in *Acanthus ilicifolius*.
- ◆ Nutritional evaluation of oceanic squids *Sthenoteuthis oualaniensis* indicated that it is devoid of ammonia content, which is often considered as a major cause for off-flavor.
- ◆ Biochemical profile of *Diaphus watasei*, a common Myctophid along the West Coast of India, collected off Kochi showed a fatty acid profile with high saturated fatty acid content (45%) followed by mono unsaturated and poly unsaturated fatty acids. The cholesterol content was very low compared to other pelagic fishes like oil sardine and Indian mackerel. All essential amino acids were present in a balanced proportion.
- ◆ A dietary supplement for nutritional intervention of Endosulfan victims has been formulated using Tuna meat, Oyster meat and Clam meat mixed in 2:1:1 proportion, also tyrosine, phenyl alanine, vitamins and minerals added.
- ◆ Pollutant profiling of Oysters collected from West Coast of India indicated that they were devoid of any environmental pollutants in their meat. They are not only safe for consumption, but also nutritionally beneficial to humans.

- ◆ The nutrient profiling of Oysters revealed that it contained significant proportions of n-3 fatty acids (51.2%) especially EPA and DHA in their meat. Moreover, it is having higher content of Potassium than Sodium. Amino acid composition also depicted the presence of essential amino acids at required levels.
- ◆ Fish oil rich in PUFA was prepared from Tuna red meat waste by super critical fluid extraction; under 35 MPa at 60°C. The yield obtained was 5% of dry weight. Different trials were made to optimize the conditions of production.

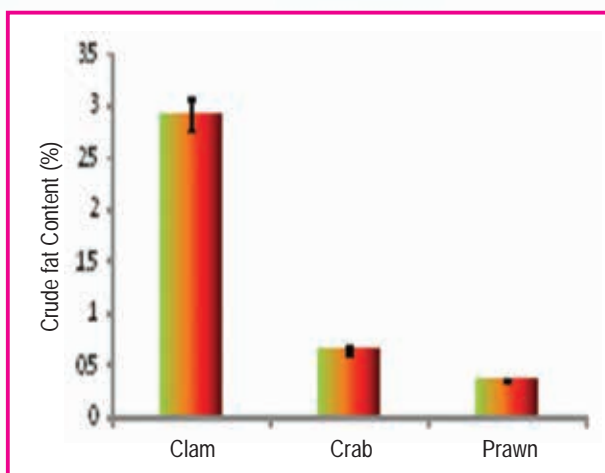
Report of work done

Nutrient profiling of Clam, Crab and Prawn

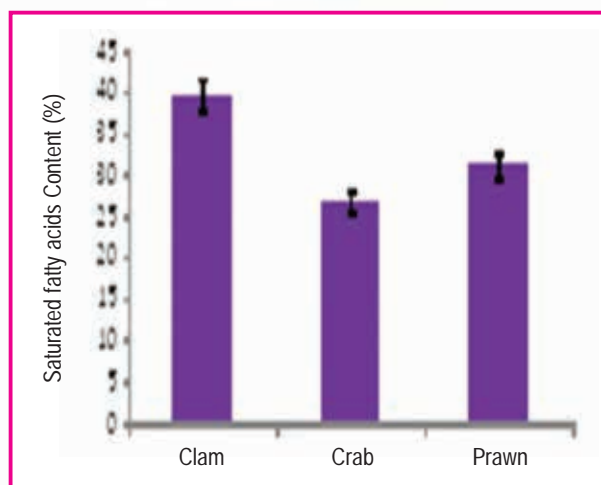
Nutrient profiling of Clam (*Villorita cyprinoides*), Crab (*Portunus pelagicus*) and Prawn (*Penaeus indicus*) were analyzed. There was no significant change observed in the total protein content of the species (Clam - 18.2%, Crab - 16.2% and Prawn - 19.6%). Similarly, the mineral composition was comparable among the organisms (Clam - 1.98%, Crab - 1.59% and Prawn -1.43%) examined. The saturated fatty acid content was significantly high in Clam (39.6%) as compared to Crab (26.7%) and Prawn (31.1%). The mono unsaturated fat content was significantly high in Clam (13.7%) as compared to Crab (12.0%) and Prawn (11.1%). The poly unsaturated fat content was significantly high in Crab (60.3%) and Prawn (57.0%) as compared to



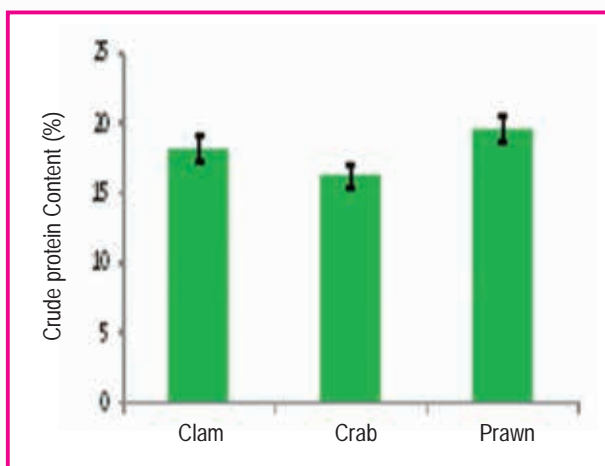
Level of moisture content



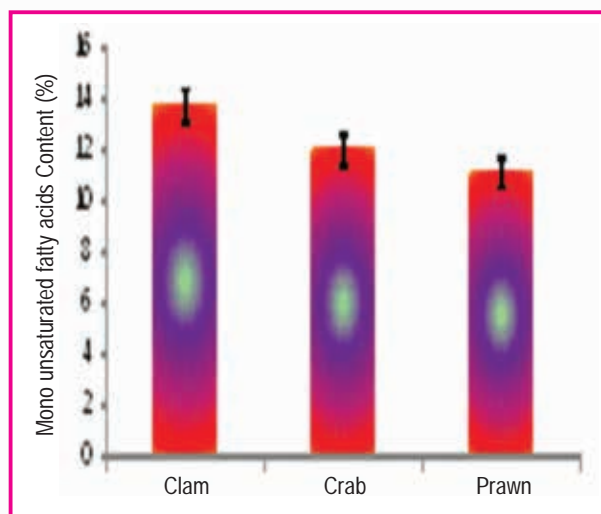
Level of crude fat content



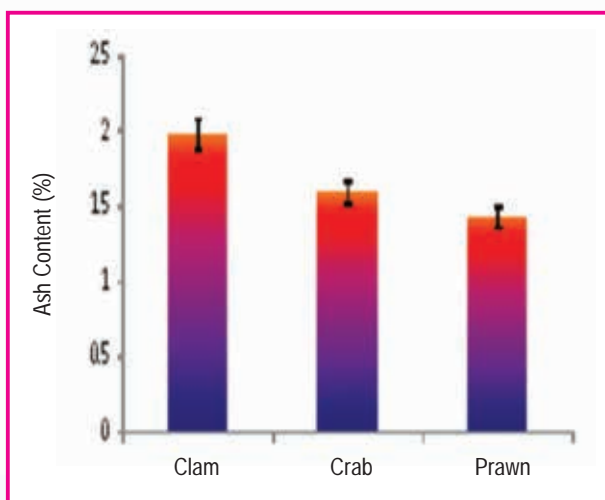
Level of saturated fatty acids content



Level of crude protein content



Level of mono unsaturated fatty acids content



Level of ash content

Clam (45.1%). The fatty acid composition of these species indicated that Crab possesses superior nutritive fat profile.

A nutritive dietary supplement for Endosulfan victims

A dietary supplement has been formulated using Tuna meat, Oyster meat and Clam meat mixed in 2:1:1 proportion and added tyrosine, phenyl alanine, vitamins and minerals. Dietary supplement along with minerals (particularly Se) was formulated and the composition of the diet was analyzed in detail. The diet also contains antioxidants and nutrients like Vitamin E, squalene, PUFA, etc. The amino acid composition and fatty acid profile of the diet has also been evaluated. Since, the dietary supplementation is providing many anticancer elements like Se, tyrosine/phenylalanine and also





antioxidants like squalene, Vitamin E, the diet (in the form of soup), may prevent further degeneration and fresh occurrence of diseases like tumors, cancers and epilepsy. After formulation of the diet, it is now being subjected to animal experiments. Based on the results of the animal experiments, further modification shall be considered and finalized.

Biochemical and pollution profile of edible oysters of West Coast of India

Chemical contaminants like heavy metals, pesticides, PAH etc. were monitored in various finfish and molluscs from the West Coast of India. Oysters analyzed for chemical contaminants indicated that they were devoid of any environmental pollutants in their meat. The nutrient profiling of Oysters reveals significant proportions of n-3 fatty acids (51.2%) especially EPA and DHA in their meat. It is having higher content of Potassium than Sodium. Amino acid composition also depicted the presence of essential amino acids at required levels. The Oysters of West Coast of India are therefore safe and nutritionally beneficial for human health.

Biochemical screening of bivalve molluscs for nutritionally important bio-inorganics

With an objective to prepare nutritional supplements rich in bio-inorganics and antioxidants, bivalve molluscs were screened to identify the best source of important bio-inorganics. Copper and Manganese were significantly present in Clams and Sole. Lithium is also uniformly present in all the samples. Meat of Green mussel *Perna viridis* was freeze-dried and was compared to the commercial drug used for the treatment of arthritis. The parameters compared included moisture, fat, protein, ash content, amino acid, fatty acids and minerals. The main differences observed were in ash and fat contents. In both cases the freeze-dried mussel contained half that of commercial preparation. The main minerals and heavy metals which were differing were Zn, Mn, Mg, and Ca, the quantity being more in the commercial preparation.

Chemical contaminant profiling of Clam, Crab and Prawn

The meat samples of Clam, Crab and Prawn were analyzed for the presence of chemical contaminants such

as organochlorines, polychlorobiphenyls and polyaromatic hydrocarbons. It is observed that Crab is devoid of organochlorine pesticide contamination as compared to the other two species. β -BHC was found to be present in prawn at 0.54 ppm level. The Clam meat is found to contain low levels of α -BHC (0.105 ppm), heptachlor (0.174 ppm) and ppDDD (0.048 ppm). However, no polychlorobiphenyls were detected in any of the species analyzed. The meat samples of Clam, Crab and Prawn were analyzed for the presence of chemical contaminants such as organochlorines, polychlorobiphenyls and polyaromatic hydrocarbons.

Off-flavour compounds: The meat samples were also subjected to analysis of geosmin content using Gas Chromatograph-MS. It is observed that these species are devoid of geosmin content.

Antioxidant and neuroprotective activities of mangrove extracts

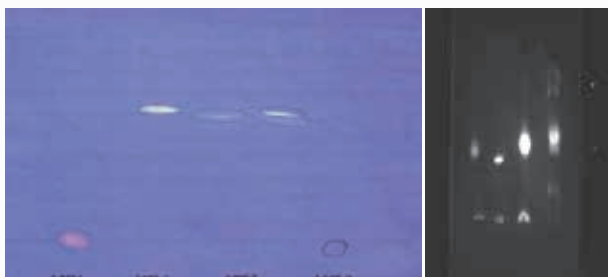
The mangroves represent an incompletely utilized reservoir of novel chemicals awaiting detection. *Rhizophora apiculata* and *Acanthus ilicifolius* root extracts were found to be rich sources of phenolic compounds and flavonoids. *In vitro* studies (DPPH free radical scavenging assay) confirmed that *R. apiculata* has a better antioxidant activity than *A. ilicifolius*. It is observed that oral intake of *R. apiculata* root extract ameliorates the sodium nitrite-induced oxidative deterioration in the brain by its free radical scavenging ability. It also maintained the level of enzymatic and non-enzymatic antioxidant status at a higher level to counteract the lipid peroxidation in the neuronal tissue.

Phytochemical screening of mangrove extracts

TLC of the root extracts showed intense yellow orange and blue bands under UV light. The standard R_fs correspond to Rutin (R_f: 8.0), Gallic acid (R_f: 12.0) and Quercetin (R_f: 12.5). Flavonoids (Rutin and Quercetin) are known to give yellow-orange fluorescence and Phenols (Gallic acid) appear blue. The phenolic compounds and flavonoid content are higher in the root of *R. apiculata* than in *A. ilicifolius*. As a correlation the DPPH free radical scavenging activity was found to be higher in *R. apiculata*. DPPH IC₅₀ values for *R. apiculata*, *A. ilicifolius* and standard Gallic acid were 11.4, 27.6 and 2.75 μ g/ml respectively.

Presence and purification of flavonoid and phenolic compounds in mangrove root extract

High Performance Liquid Chromatography analysis of the root extract of *R. apiculata* revealed the presence of three peaks corresponding to three standard compounds (Rutin, Quercitin (flavonoids) and Gallic acid (phenolic compound)). The eluate was monitored simultaneously at two wavelengths, viz., 254 nm and 370 nm. At 254 nm all three constituents have an absorption maxima, whereas at 370 nm only flavonoids ie. Rutin and Quercitin show peaks since flavonoids alone exhibit fluorescence. Gallic acid being a phenolic compound showed absorbance maxima only at 254 nm but not at 370 nm.



HPLC of root extract of *R. apiculata*

Preparation of biodiesel from fish oil

Three different chemical processes have been tried for the production of biodiesel by transesterification process from Sardine oil.

Method 1: Alcoholic KOH and extraction with hexane

Method 2: Acidified alcohol and extraction with hexane

Method 3: Acetyl chloride, methanol and extraction with hexane

It is observed that the second and third methods are optimum methods for the production of biodiesel from fish oil. Though the total yield (89.4%) in Method-3 is less than that in Method-2 (96.2%), the purification process time is comparatively lesser in Method-3. It is found possible to reutilize the hexane used for the extraction purpose.

Fatty acid composition of *Sargassum wightii* and *Amphiroa anceps*

The fatty acid composition of two sea weeds viz., *Sargassum wightii* (Phaeophytae) and *Amphiroa anceps* (Rhodophytae) collected from the Mandapam coast, Tamil

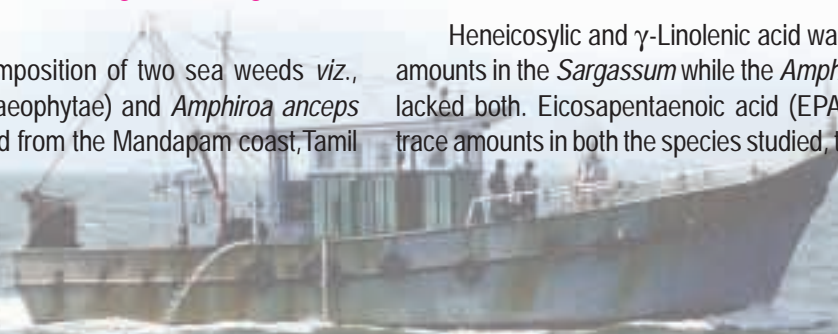
Nadu were evaluated using Gas Chromatograph Mass Spectrometry. Upon analysis it was found that *S. wightii* had the highest amount of poly unsaturated fatty acid (PUFA) while *A. anceps* showed comparatively greater amount of saturated fatty acid. Among the various other fatty acids, both the algal species showed significantly higher proportions of Myristic acid, Stearic acid, α -linoleic acid, Palmitoleic acid, Arachidonic acid and Oleic acids. *S. wightii* showed comparatively larger amount of omega 3, 6 and 9 classes of fatty acids than *A. anceps*. Both the species showed comparatively moderate amount of mono unsaturated fatty acids.

From the fatty acid composition of the two algal species it was found that Myristic acid, Palmitoleic acid, Oleic acid, Linoleic acid, α -linolenic acid and Arachidonic acids are the predominant acids in the *Sargassum* sp. Of these, Oleic acid (27%) was found to be the highest followed by Arachidonic acid (17%), Linoleic acid (11%) and Myristic acid (9%). In *A. anceps* the predominant acids where Oleic acid (24%), Stearic acid (17%), Myristic acid (17%) and Palmitoleic acid. *Sargassum* species had comparatively much greater content of poly unsaturated fatty acids (70%) than *A. anceps* (35%). While *A. anceps* exhibited 16% content of mono unsaturated fatty acids, the *Sargassum* showed 11%. The content of saturated fatty acids was also found to be high in *Amphiroa* (49%) than *Sargassum* (20%). While *Sargassum* showed trace amounts of Caproic acid, it was absent in the *Amphiroa* sp. The red algae showed trace amounts of Caprylic acid while it was completely absent in *Sargassum*.

Fatty Acid	<i>S. wightii</i>	<i>A. anceps</i>
Saturated Fatty Acid	19.14	48.53
Mono unsaturated Fatty acid	10.75	16.63
Poly unsaturated Fatty Acid	70.05	34.81

Percentage composition of Saturated, Mono unsaturated and Poly unsaturated fatty acid distribution in the two sea weeds

Heneicosylic and γ -Linolenic acid was noted in trace amounts in the *Sargassum* while the *Amphiroa* completely lacked both. Eicosapentaenoic acid (EPA) was found in trace amounts in both the species studied, the higher being





in the *Sargassum*. Both the species of the sea weeds show significantly high levels of both the classes of the essential fatty acids (EFA), viz. the n-6 or omega 6 and the n-3 or the omega 3 fatty acids. *S. wightii* was found to be rich in omega-3 or the n-3 class of fatty acids (11%) while the red algae contained only 2% of omega-3 acids. Omega-6 as well as omega-9 family of fatty acids also showed significantly higher levels in *S. wightii* (13 and 27% respectively) than *A. anceps*.

Assessment of Myctophid resources in the Arabian sea and the development of harvest and post harvest technologies

Myctophid fish samples were collected from Cochin and Kollam. The samples were analyzed for biochemical studies and protein functionality studies. Six Myctophid samples viz., *Diaphus watasei*, *Benthosema fibulatum*, *Myctophum obtusirostre*, *Diaphus lutkeni*, one *Myctophum* species and one unidentified sample were analysed. It was found that the proximate composition of Myctophid fishes are comparable with other mesopelagic and pelagic fishes. The moisture ranged from 63% to 78% and in some species, protein content was up to 22%. *Diaphus watasei* samples contained more than 13% fat. Ash also showed significantly high values. Amino acid and fatty acid analysis were conducted and found that most of the Myctophids contain essential amino acids and fatty acids. Myctophids are also rich in bio-inorganics required for the normal maintenance of human health. The myofibrillar sarcoplasmic and stroma proteins were extracted and various functionality studies were done. It was found that Myctophid fishes contain good quantity of myofibrillar proteins. Oil has been extracted from Myctophid fish *Diaphus watasei* and its analgesic and anti-inflammatory properties were studied in experimental animals. It is noticed that the oil possesses significant analgesic and anti-inflammatory properties.

Also an attempt has been made to investigate the fatty acid profile of *Myctophid* sp. caught from Arabian waters of Indian West Coast. Fatty acid methyl esters prepared from the lipid extracted from the Myctophid fish, *Myctophum obtusirostre*, was injected to a Gas Chromatograph equipped with Mass Spectrophotometer and identified. It is noticed that considerable quantities of

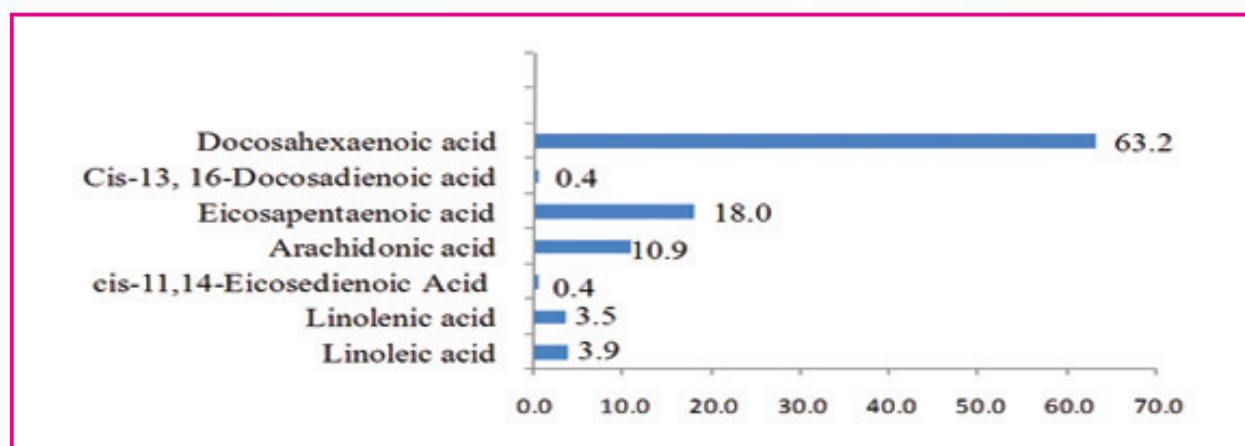
poly unsaturated fatty acids (51.63%), which is beneficial to human health is present in the Myctophid. Among total fatty acids, DHA alone recorded 32.58%, while the saturated fatty acid, Palmitic acid comprised 21.75%. Interestingly, this Myctophid also possess significant proportion of EPA (9.26) in its total fatty acid content. It is also important to note that the contents of saturated fatty acids and mono unsaturated fatty acids content were comparatively low in this Myctophid species as compared to that of poly unsaturated fatty acids. The results of the present study indicate that *M. obtusirostre* is rich in poly unsaturated fatty acid, which is essential to maintain the health integrity of human beings.

Fatty acid	Percentage of Fatty acid
Saturated Fatty acid	35.7
Mono unsaturated Fatty acid	12.7
Poly unsaturated Fatty acid	51.6

Percentage composition of Saturated, Mono unsaturated and Poly unsaturated fatty acid distribution in *M. obtusirostre*

Poly unsaturated Fatty acids	Percentage of total Poly unsaturated Fatty acid
Linoleic acid C18:2	3.9
Linolenic acid C18:3	3.5
cis-11,14-Eicosadienoic acid C20:2	0.4
Arachidonic acid C20:4	10.9
Eicosapentaenoic acid C20:5n3	18.0
Cis-13, 16-Docosadienoic acid C22:2	0.4
Docosahexaenoic acid C22:6n3	63.2

Percentage composition of total poly unsaturated fatty acid distribution in *M. obtusirostre*



Percentage of total poly unsaturated fatty acid content in *M. obtusirostre*

Fatty acid profile of <i>M. obtusirostre</i>		
C14	Myristic acid	4.3
C15	Pentadecyclic acid	1.6
C16	Palmitic acid	21.8
C16:1	Palmitoleic acid	5.1
C17	Margaric acid	1.2
C17:1	cis-10Heptadecenoic acid	0.5
C18	Stearic acid	6.1
C18:1	Oleic acid	6.0
C18:2	Linoleic acid	2.0
C18:3	Linolenic acid	1.8
C20	Arachidic acid	0.4
C20:1	Gadoleic acid	0.8
C20:2	cis-11,14-Eicosedienoic acid	0.2
C20:4	Arachidonic acid	5.6
C20:5	Eicosapentaenoic acid	9.3
C22	Behenic acid	0.3
C22:1	Erucic acid	0.1
C22:2	Cis-13, 16-Docosadienoic acid	0.2
C22:6	Docosahexaenoic acid	32.6
C24	Lignoceric acid	0.2
C24:1	Nervonic acid	0.1

Responsible harvesting and utilization of selected small pelagics and freshwater fishes

PUFA concentrate prepared from fish oil is easily susceptible to autoxidation. Hence, it is encapsulated in inert atmosphere and storage studies conducted. Since the experimental studies incorporating PUFA concentrate in the diet indicate the presence of PUFA rich quantities in the meat, a separate trial is underway in chickens for PUFA enrichment in meat and meat products.

Oceanic tuna fisheries off Lakshadweep seas

Fish oil rich in PUFA was prepared from Tuna red meat waste by super critical fluid extraction procedure; under 35 Mpa at 60°C. The yield obtained was 5% of dry weight.

Nutrient profiling and evaluation of fish as a dietary component

Biochemical profiling of seven Species of fishes such as Yellowfin tuna (*Thunnus albacares*), Kawa kawa (*Euthynnus affinis*), Japanese Threadfin Bream (*Nemipterus japonicus*), Indian Mackerel (*Rastrelliger kanagurta*), Commerson's anchovy (*Stolephorus commersonii*), White bait (*Stolephorus waitei*) and Striped Snakehead (*Channa striatus*) were collected from Cochin, Chennai, Visakhapatnam and Veraval and examined to determine their nutritive efficacy, which may be useful in ameliorating or treating the diseases and disorders associated with malnutrition and aging. It is interesting to note that protein and amino acid profiling (especially essential amino acids) of red and white meat of Yellowfin



Rastrelliger kanagurta (Indian Mackerel)



Nemipterus japonicus (Japanese Threadfin Bream)



Stolephorus commerson (Commerson's anchovy)



Channa striatus (Stripped Snakehead)



Stolephorus waitei (Batavian anchovy)

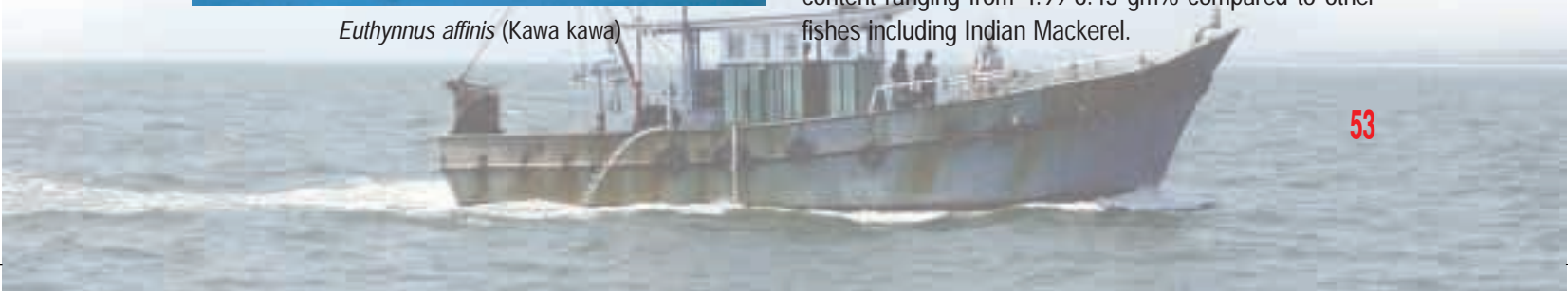


Thunnus albacares (Yellowfin tuna)



Euthynnus affinis (Kawa kawa)

tuna (*T. albacares*) and Kawa kawa (*E. affinis*) demonstrate good quantity of edible protein ranging from 23-25 gm% in comparison with other fish species investigated. This finding indicates that it is very much viable to formulate nutritionally enriched protein supplement from Yellowfin tuna and Kawa kawa. Though white muscle Japanese Threadfin Bream is the preferable option for surimi preparation, the present research finding illustrates that it is possessing a high fat content ranging from 4.99-6.43 gm% compared to other fishes including Indian Mackerel.



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Mineral and trace element profiling of fishes were also carried out to determine the presence of electrolytes and bio-inorganics involved in the regulation of human health. Indian Mackerel registered both highest in Chennai (0.75 ± 0.09) and lowest in Cochin (0.11 ± 0.06) gm% of Na. Red meat of Yellowfin tuna obtained from Cochin had higher level (2.51 ± 0.04 gm%) of K and Zn content (9.08 ± 0.023 gm%) from Veraval compared to other species from all other centres; Ca and Mn were higher in Commerson's

anchovy from Cochin and Vishakapatnam (1.40 ± 0.01 gm% and 0.002 ± 0.08 gm%) respectively. Fe (0.03 ± 0.05 gm%) content was significantly higher in red meat of Tuna compared to other fishes. It is interesting to note that Cu content was very much higher in samples from Veraval ranging from 30-153 gm%, especially Red meat of Yellowfin tuna had 152.94 ± 0.01 gm%, indicating that this may be due to bio-accumulation of Cu in the fish muscle because of environmental pollutions/hazards.

Proximate composition analysis

Place of collection: Cochin, Kerala

Month and Year: April, 2010

Sl. No.	Scientific Name	Common Name	Moisture (%)	Crude Protein (%)	Crude Fat (%) (w/w)	Ash (%) (w/w)
1.	<i>Thunnus albacares</i>	Yellowfin Tuna (White meat) Big size	73.49 \pm 0.18	23.4 \pm 0.13	0.40 \pm 0.05	1.26 \pm 0.04
2.	<i>Thunnus albacares</i>	Yellowfin Tuna (Red meat) Big size	73.94 \pm 0.15	24.11 \pm .18	1.34 \pm .06	1.44 \pm 0.03
3.	<i>Thunnus albacares</i>	Yellowfin Tuna (White meat) Small size	72.39 \pm .17	25.4 \pm 0.14	1.12 \pm .04	0.99 \pm .05
4.	<i>Thunnus albacares</i>	Yellowfin Tuna (Red meat) Small size	72.12 \pm 0.19	25.37 \pm .19	1.13 \pm .09	1.5 \pm 0.07
5.	<i>Rastrelliger kanagurta</i>	Mackerel Big size	76.17 \pm .26	19.2 \pm 0.18	2.64 \pm .05	1.99 \pm .04
6.	<i>Rastrelliger kanagurta</i>	Mackerel Small size	75.16 \pm 0.19	18.34 \pm .15	4.1 \pm 0.08	2.4 \pm 0.06
7.	<i>Nemipterus japonicus</i>	Japanese Threadfin bream	78.51 \pm .21	15.37 \pm .19	5.14 \pm .04	1.05 \pm .09
8.	<i>Stolephorus commersonnii</i>	Commerson's anchovy	77.37 \pm .27	17.68 \pm .14	1.81 \pm .07	3.14 \pm .05

Place of collection: Visakhapatnam, Andhra Pradesh

Month and Year: June, 2010

Sl. No.	Scientific Name	Common Name	Moisture (%)	Crude Fat (%) (w/w)	Ash (%) (w/w)
1.	<i>Thunnus albacares</i>	Yellowfin Tuna (White meat)	73.48 \pm 0.22	0.69 \pm 0.11	3.75 \pm 0.49
2.	<i>Thunnus albacares</i>	Yellowfin Tuna (Red meat)	74.2 \pm 0.23	0.55 \pm 0.13	3.83 \pm 0.48
3.	<i>Euthynnus affinis</i>	Little Tuna (White meat)	69.84 \pm 0.11	2.28 \pm 0.10	4.37 \pm 0.4

Contd...





Sl. No.	Scientific Name	Common Name	Moisture (%)	Crude Fat (%) (w/w)	Ash (%) (w/w)
4.	<i>Euthynnus affinis</i>	Little Tuna (Red meat)	71.34 ± 0.14	2.00 ± 0.19	4.41±0.21
5.	<i>Rastrelliger kanagurta</i>	Mackerel (Small)	75.01 ± 0.09	2.63 ± 0.10	4.01±0.25
6.	<i>Rastrelliger kanagurta</i>	Mackerel (Big)	71.28 ± 0.13	4.46 ± 0.19	3.55±0.77
7.	<i>Nemipterus japonicus</i>	Japanese Threadfin bream	75.03 ± 0.14	6.43 ± 0.17	4.82±0.64
8.	<i>Stolephorus commersonnii</i>	Commerson's anchovy	75.91 ± 0.46	2.45 ± 0.13	6.6±0.46

Place of collection: Chennai, Tamil Nadu Month and Year: June, 2010

Sl. No.	Scientific Name	Common Name	Moisture (%)	Crude Fat (%) (w/w)	Ash (%) (w/w)
1.	<i>Rastrelliger kanagurta</i>	Mackerel	75.26 ± 0.19	3.81 ± 0.29	3.31±0.46
2.	<i>Nemipterus japonicus</i>	Japanese Threadfin bream (Big)	77.13 ± 0.41	1.51 ± 0.21	4.26±0.25
3.	<i>Nemipterus japonicus</i>	Japanese Threadfin bream (Small)	77.81 ± 0.14	4.99 ± 0.16	5.44±0.32
4.	<i>Stolephorus commersonnii</i>	Commerson's anchovy	77.16 ± 0.39	2.76 ± 0.22	6.82±0.44
5.	<i>Channa marulius</i>	Giant Snakehead	78.89 ± 0.13	1.70 ± 0.20	2.88±0.22

Place of collection: Veraval, Gujarat Month and Year: October, 2010

Sl. No.	Scientific Name	Common Name	Moisture (%)	Crude Protein (%)	Crude Fat (%) (w/w)	Ash (%) (w/w)
1.	<i>Rastrelliger kanagurta</i>	Mackerel	76.09 ± 0.23	22.11± 0.3	0.21 ± 0.02	1.44±0.1
2.	<i>Nemipterus japonicus</i>	Japanese Threadfin bream	77.08± 0.45	20.64 ± 0.21	0.81 ± 0.1	1.47±0.19
3.	<i>Thunnus albacares</i>	Yellowfin tuna (White meat)	72.45 ± 0.14	24.82 ± 0.44	1.28 ± 0.28	1.29± 0.16
4.	<i>Thunnus albacares</i>	Yellowfin tuna (Red meat)	72.69 ± .22	23.7 ± 0.26	2.32± 0.53	1.27± 0.18
5.	<i>Euthynnus affinis</i>	Little tuna (Red meat)	72.72 ± .19	24.96 ± 0.14	0.94± 0.11	1.39± 0.03
6.	<i>Euthynnus affinis</i>	Little tuna (White meat)	73.19 ± 0.34	24.8 ± 0.22	0.17± 0.06	1.38± 0.06

Survey on fish consumption patterns

A socio-economic survey on fish consumption patterns for identifying Low Birth Weight (LBW) among the human population and to study the correlation between LBW and fish consumption is being carried out. The survey is being carried out in the states of Kerala and Gujarat. In Kerala, a total of 2700 households (900 from each district) will be surveyed from Kollam, Thrissur and Calicut districts

representing Southern, Central and Northern Kerala respectively. From Kollam district, 900 households were surveyed, 300 each from Thangassery panchayath (coastal area), Kadavoor panchayath (adjacent to brackishwater lake) and Kottarakkara panchayath (interior area). In Thrissur district (Central Kerala) survey was finished in two panchayaths of Peechi and Adat. Survey is presently being conducted in Nattika panchayath. Survey is also being envisaged in Kozhikode district (Northern Kerala).





Engineering Division

Research project handled

- Design and development of renewable energy, solar biomass hybrid dryers

Chief findings

- ◆ Designed and developed a pilot model renewable energy solar biomass hybrid dryer for eco-friendly and hygienic drying.
- ◆ Design optimization of solar fish dryer with alternate electrical back-up heating system was done.
- ◆ Design modification of CIFT Dryer SDL-250 was carried out.
- ◆ Design and development of solar fish drying system in marine containers was done.
- ◆ Installation and commissioning of solar dryer with LPG back-up for ICAR Research Complex for NEH at Imphal was carried out.
- ◆ Installation and commissioning of solar dryer with alternate electrical heating system for Directorate of Fisheries, Manipur was carried out.
- ◆ Fabrication and supply of solar fish dryers for Cochin Corporation was done.

Report of work done

Solar biomass hybrid dryer

Designed and developed a pilot model renewable energy solar biomass hybrid dryer for eco-friendly and hygienic drying and preservation of fish and agricultural produce by harnessing solar energy during favourable weather conditions and biomass back-up to achieve elevated temperatures during unfavourable weather conditions like rain, cloud and night times. The system consists of well insulated, efficient solar air heating panels for

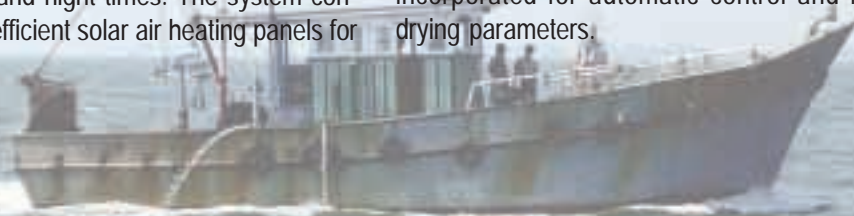
harnessing solar energy and the hot air generated inside the panel is allowed to flow through a fish drying chamber loaded with fish/vegetables in stainless steel mesh trays. Continuous flow of hot air is maintained with the help of Photo Voltaic cells and fans to enable drying process. The hybrid dryer is equipped with an alternate biomass, fire-wood water heating system for generating necessary heat energy required during the drying process even under unfavourable weather conditions and non-sunny days. Standardization of the system was made by varying the inflow and outflow of hot air circulation system in the drying chamber. Extensive trials were conducted in the solar biomass hybrid dryer for standardization of different drying parameters and the optimization of the drying process.

Design optimization of solar fish dryer with alternate electrical back-up heating system

Thermal insulations are provided in the duct system to reduce heat losses. Double glass solar heat collecting panels are also incorporated to increase the heat carrying capacity of air inside the drying chamber. Extensive trials were carried out for studying the temperature distribution as well as air flow inside the drying chamber.

Design modification of CIFT Dryer SDL-250

The design of the solar dryer with LPG back-up was modified by incorporating a desiccant type dehumidifier, which enhances the drying rate and improves the quality of the dried fish product. A set of reversible flow fans are provided to enable uniform drying throughout the chamber. A Programmable Logical Control system (PLC) is incorporated for automatic control and monitoring of drying parameters.



Design and development of solar fish drying system in marine containers

A new concept of design of solar fish drying unit in a marine container which can be easily transported and installed in the coastal area is designed. This new conceptual design with LPG back-up and a dehumidifier is having a capacity of 100 sq.m tray loading area for drying fish. All fish contact parts are made of food grade stainless steel (SS 304). The drying chamber is set up in a SS lined marine container with insulation. This unit can be transported and installed as such in the coastal area near any existing building, where fish can be processed. The capacity of the fish dryer can be increased to about 1000 kg/batch. In the indirect type solar drying system, Solar Vacuum Tube Collector water heating system and Calorifier tank are incorporated to increase the energy storage. LPG back-up heating system is used as alternate energy source. Incandescent type dehumidifier and axial flow fans for hot air circulation and Programmable Logic Control for automatic control of humidity and temperature were incorporated for accelerating drying process and to improve the quality of drying fish.

Solar dryer with LPG back-up for ICAR Research Complex for NEH at Imphal

A 250 kg capacity solar fish dryer with LPG alternate back-up heating system was installed and commissioned at ICAR Research Complex for NEH Region at Imphal for preservation of inland fish. The dryer has given excellent results in drying fish much faster than normal sun drying, hygienically and efficiently without losing the nutritional



Fish drying trials at Manipur

qualities. Fish can be dried efficiently in the rainy period also using the LPG back-up heating system. This solar dryer is ideal for drying other agricultural and horticultural products too by maintaining their colour and flavour. Trial runs were conducted with fresh inland fish and turmeric and very good results were obtained. Training was imparted to the Scientists, technical officers and other staffs for using this dryer.

Solar dryer with alternate back-up for Directorate of Fisheries, Manipur

A solar dryer with electrical back-up having 50 kg capacity was installed and commissioned at Directorate of Fisheries, Manipur for preservation of inland fish. Specially designed solar air heating panels are used for harnessing solar energy and to supply hot air for the drying process. Alternate back-up heating system enables drying during unfavourable weather conditions. Trial runs were conducted successfully. Training was imparted to the State Fisheries Department Officials in fish drying using the dryer during the month of June 2010 at Manipur.



Training to State Fisheries officials at Manipur

Solar fish dryers for Cochin Corporation

Corporation of Cochin under People's Planning Project for Economic Development has formulated a project for starting a women group micro enterprise for hygienic production of dry fish and entrusted the work to CIFT to implement the scheme. Three solar fish dryers with alternate electrical back-up heating system having 20 kg capacity (SDE-20) were fabricated and supplied at three locations in Cochin Corporation area under the technical consultancy of CIFT, Cochin.





Extension, Information and Statistics Division

Research projects handled

- ☐ Studies on technology assessment and transfer among the client system
- ☐ Studies on sustainability parameters for the Indian fish processing industry and the forward and backward linkages
- ☐ Consumer preferences and its impact on domestic fish marketing
- ☐ An alternate sustainable livelihood model for coastal fisherfolk through market-led extension of value added fish products
- ☐ Mobilizing mass media support for sharing agro information
- ☐ Responsible harvesting and utilization of small pelagics and freshwater fishes

Chief findings

- ◆ The data collected under technology assessment in selected fishing villages revealed that among the fishermen operating 7.6 to 10.2 LOA FRP crafts in Kannur district, the average number of fishing days in a year was 277 days and the mean total investment on the fishing unit was ₹ 7.87 lakhs. The fishing units using mini-seine nets had a mean annual income of ₹ 2.07 lakhs.
- ◆ Among the fishermen operating FRP crafts in Kozhikode district, the average number of fishing days was 184 days and the total investment on the fishing unit was ₹ 3.96 lakhs; the average income was ₹ 2.38 lakhs and gill nets were predominantly used.
- ◆ Among the respondents in Kollam district, the average number of fishing days was 280 days and the total investment on the fishing unit was ₹ 4.26 lakhs and mainly, gill nets were used; the average income was ₹ 1.20 lakhs.
- ◆ In Thiruvananthapuram district, the average number of fishing days was 280 days and the mean total investment on the fishing unit was ₹ 4.09 lakhs; the average investment on the fishing craft, fishing nets and engine were found to be ₹ 98,180/-, ₹ 1,48,150/- and ₹ 1,63,150/- respectively. Most of the fishermen had used gillnets. The mean annual income was estimated at ₹ 2.79 lakhs.
- ◆ While comparing the states on manpower, West Bengal contributed maximum manpower in fishing activity followed by Kerala. From the ANOVA analysis, it was inferred that the engagement of manpower in the fishing activity did not significantly contribute to fish landings.
- ◆ A group under 'Sri Dharma Sastha Paripalana Samithi' (SDSPS) was mobilized at Munambam and developed as a pilot level semi commercial unit (FRESH'N'FISH) for production of value added fish products.



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- ◆ A perusal of the export value realised has shown that there is a decreasing trend in the actual unit value realisation. Though in rupee terms, the unit value realised has increased from ₹ 118.17 in 1995-96 to ₹ 147.86 in 2003-04, in USD (\$) terms it has actually fallen from 3.75 to 3.02 during the corresponding period.
- ◆ The average waste generation through cephalopod processing was found to be 25.49% in Cochin region.
- ◆ The Revealed Comparative Advantage (RCA) of shrimp exports to the US from India was 0.44 during 2006 indicating that India has no comparative advantage in exporting shrimp to US.
- ◆ Three resource specific maps were developed on Chellanam Panchayat on infrastructure and demographic characteristics.
- ◆ Under the NAIP sub-project, 'Mobilizing mass media support for sharing agro information', a two-day Agricultural Exhibition and Farmer's Meet ('Krishi Darpan 2011') was organized at Cochin. As part of the project, media liaison has been strengthened by organizing three media visits at Kannur, Palakkad and Munambam; Seventy six reports were published in print media and 14 reports in web media, technological information were disseminated through visual media by way of 13 reports in different TV channels and three success stories through 'Doordarshan'.

Report of work done

Analysis of technology assessment in fishing villages in harvest and post harvest sectors

Data were collected from 75 fishermen operating 7.6 to 10.2 m (24'-32' LOA) FRP crafts in the selected fishing centres. Through structured schedules, data were collected on the socio-personal variables, technology adoption with reference to craft, gear and engine used, number of fishing days, investment on craft, gear and engine, annual income, sources of information, etc. The data revealed that for the respondents in Kannur district, the average number of fishing days in a year was 277 days and the mean total investment on the fishing unit was ₹ 7.87 lakhs due to the use of mini-seine nets; the mean annual income was about ₹ 2.07 lakhs.



Fisherfolk selling fish catch, icing and packing of fish on shore

Among the respondents in Kozhikode district, the average number of fishing days was 184 days and the total investment on the fishing unit was ₹ 3.96 lakhs. The average income was ₹ 2.38 lakhs and gill nets were predominantly used.



FRP boats with engines used by fishermen respondents

Among the respondents in Kollam district, the average number of fishing days was 280 days and the total investment on the fishing unit was ₹ 4.26 lakhs and mainly gill nets were used. The average income was ₹ 1.20 lakhs. Inadequate fuel subsidy, diminishing fish catches, price fluctuations and increasing operational expenses were reported as major constraints.

In Thiruvananthapuram district, data were collected from 33 respondents and computerized: the results revealed that the average number of fishing days was 280 days and the mean total investment on the fishing unit was ₹ 4.09 lakhs; the average investment on the fishing craft, fishing nets and engine were found to be ₹ 98,182/-,





₹ 1,48,150/- and ₹ 1,63,150/- respectively. Most of the fishermen had used gillnets. The mean annual income was estimated at ₹ 2.79 lakhs.



Different types of gillnets used by fisherfolk

Evaluation of the role performance of extension functionaries

During the period, 20 questionnaires each were sent to the various State Fisheries Departments and the filled-up questionnaires are being collected. Data were also collected from 20 fisheries officials from the Department of Fisheries, Kerala and Andhra Pradesh; the results revealed that they had an average age of 47 years with an annual income of ₹ 3.786 lakhs. It is seen that the officials had attended only one training during the last five years.

Data on the job activities attended and time spent on each activity were collected; the results revealed that the fisheries officials had spent about 14.5% of their time on conducting training/demonstration programmes, 28% on implementation of Departmental schemes, 22% on administrative work and 35.5% on other applicable activities viz., supply of inputs, infrastructure facilities, research, etc.

Data were also collected regarding other socio-personal variables of officials, training needs, organizational climate, job satisfaction, etc. For implementation of technology transfer programmes, their perceptions on role expectations and role performance were recorded on ten roles/activities. The preliminary analysis with the available data revealed that the Role Expectation Index (in terms of importance) was 88.5% and Role Performance Index was 83.3%.

As constraints for technology transfer activities, the

following organizational factors were reported: (1) Inadequate financial allocations (100%), (2) Lack of adequate field staff (70%), (3) Administrative constraints (70%), (4) Lack of transport facilities (60%), (5) Lack of infrastructural facilities (50%), (6) Lack of promotional opportunities (50%), (7) Lack of autonomy (30%), and (8) Lack of rewards and recognition (30%), etc.

Manpower assessment in the fishing sector and determination of socio-economic variables of fishermen

From various secondary sources, data collected were analysed, and while comparing the states on manpower, West Bengal contributed maximum manpower in fishing activity followed by Kerala. From the ANOVA analysis, it was inferred that the engagement of manpower in the fishing activity did not significantly contribute to fish landings. The manpower engaged in fishing and allied occupations showed that there was maximum concentration of manpower in marketing followed by boat and net repairing, and processing.

Data on manpower in fish processing activities viz., curing/processing, peeling, ice making, marketing, labourers, etc. were collected among eight coastal states. Cross-sectional data were also collected from 120 fishermen from eight villages of Alappuzha and Ernakulam districts of Kerala. Of these fishermen respondents, 60 were fishing labourers, and 30 had operated motorized fishing crafts and 30 had operated traditional crafts. Socio-economic variables were analyzed for these fishermen respondents.

Socio-economic studies were conducted in two fishing villages near Visakhapatnam, two fishing villages near Puri, Odisha and four fishing villages in Balasore district, Odisha. Of the six villages surveyed in Odisha, Balinoulisahi has more of traditional fishermen and in other villages, both motorized and traditional fishermen were engaged in fishing.

Popularization of appropriate technologies in the selected fishing centres

A workshop on Greener technologies was organised in association with Gandhi Smaraka Grama Seva Kendram, S.L. Puram on 8 June, 2010. Training programmes on 'Hygienic handling of fish' to 31 women fish vendors and 'Production of value added fishery products' to 20 fisherwomen group members were organised.



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Training programmes on 'Production of value added fishery products and entrepreneur development' were conducted in several centres such as Kozhikode, Kannur, Kollam, and Kayamkulam in association with Krishi Vigyan Kendras, MATSYAFED and other NGOs.



Human resource development in post harvest fisheries sector

An alternate sustainable livelihood model for coastal fisherfolk through market-led extension of value added fish products

The modes of transfer of technology with respect to value added products were documented and the points of intervention where gaps exist were identified. Two case studies were completed on failed attempts of similar enterprises.

A group was mobilized and developed as a model for semi-commercial unit on value added fishery products. The unit was inaugurated by the Minister for Fisheries Shri S. Sharma. Product logo was launched and regular follow up activities are being done. Assessment studies of the entrepreneurial capacity of the group member's marketability/profitability of different fish based value added products were done. Different training programmes on group capacity building, marketing, product development and on packaging of fishery products were also done. Based on market response, products were selected, training imparted and linkages established with development agencies for expansion of the unit. Entrepreneurship assessment and refinements in the enterprise were done based on market needs.

Two groups of 18 coastal women are employed for the last one year in the unit. Efforts for scaling-up the unit

through market expansion are on the way and also new products are being tried. The lacunae identified in the present mode of technology transfer on value added fishery products are properly recorded and remedies are attempted to.



Launching of the unit at Munambam

Studies on sustainability parameters for the Indian fish processing industry and the linkages

The crucial factors for the sustainability of the seafood industry were identified as raw material supply for processing, labour, cost of production and installed capacity utilization.

Due to raw material shortage, the processing plants had reported very low utilization of installed capacity. Cost of raw material was the major component of the cost of operation with approximately 85% contribution. A perusal of the export value realised showed that there is a decreasing trend in the actual unit value realisation. Though in rupee terms, the unit value realised has increased from ₹ 118.17/- in 1995-96 to ₹ 147.86/- in 2003-04, in \$ terms



Procuring raw material for processing



it has actually fallen from 3.75 to 3.02 during 2006-07.

The average waste generation through cephalopod processing was found to be 25.49% in Cochin region. The competitiveness with respect to shrimp exports from India to USA as compared to other major shrimp exporters to USA namely, Bangladesh, Ecuador, Thailand, Vietnam, Mexico and Indonesia was studied. The Revealed Comparative Advantage (RCA) of shrimp exports to the USA from India was 0.44 during 2006 indicating that India had no comparative advantage in exporting shrimp to USA. The competitiveness of finfish products in the global market was studied and the RCA was less than one indicating that India had no comparative advantage as far as finfish is concerned, even though the quantity exported had risen significantly.

To assess the correlation between the present wage of women workers in the seafood industry and the variables such as age, education, work experience and marital status, Pearson Correlation coefficients were calculated. The results showed that the present wage had positively correlated with the marital status.

Thematic layers of non-mechanized fish landing centres were created in a GIS platform. The spatial and attribute data collected from non-mechanized fish landing centres through field survey, use of GPS and other data collection tools were scrutinized and stored in a data base format. Then, the GIS map of non-mechanized fish landing centres of Ernakulam district of Kerala was developed as a fisheries resource map. Similarly, spatial and attribute data were collected from different fish processing centres of Ernakulam district. The data pertaining to the fish processing centres were populated into the geo data base and a GIS map of fish processing centres of Ernakulam district was developed.

Studies on energy utilization in fish processing sector

The main sources of energy utilization in fish processing sector are found to be electricity and diesel, and they are used for processing, ice making, transportation and storage. Major sources of indirect emission of Green House Gases (GHG) occur through the use of purchased electricity when fossil fuels such as coal are burned to produce heat and power. A standard protocol recommended by

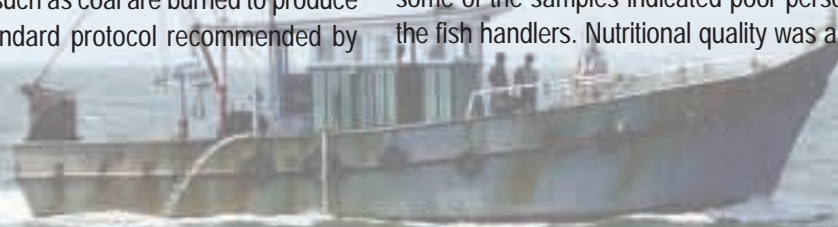
Environmental Protection Agency, USA was reviewed. They recommend the calculation of emission for each GHG as the product of electricity usage and emission rate which is specific to the region where electricity is used. The emission rate depends on the way of electricity generation, the method/type of fuel used and efficiency of converting input energy for electricity. For this study, the Asian Electricity LCI database was used for calculation.

Data were collected from 20 randomly selected fish processing factories in Cochin and Alappuzha districts. On the basis of installed capacity, the factories were categorized into three strata viz., < 20 tonnes, 20-40 tonnes and > 40 tonnes. Electricity was the main energy source used for fish processing. Data collected on the consumption for the year 2009-10 were analyzed. The average emission (in million tonnes per year) of GHG (CO₂) by industries, considering that the electricity is imported from source as thermal power generation will be 99.24, 984.17 and 1814.93 instead of 44.06, 436.96 and 805.82 when the energy source is from hydro power, and when the energy source is from diesel, it will be 381.93, 296.63 and 101.91 respectively for the low, medium and high capacity categories of processing factories.

Consumer preferences and its impact on domestic fish marketing

Collection of consumer preferred fish samples was carried out in sampled markets and samples were analyzed. Simultaneously, a consumer survey was carried out among 51 consumers to assess the consumer perception regarding their preferences and attitude towards nutrition, food safety and quality aspects. Cluster analysis has been attempted for studying the variables that have an impact on consumer preference. Five markets were surveyed for studying the market structure, and performance. Detailed information on market infrastructure, ownership and functioning were collected. Price data from these markets are also being collected.

Consumer selected fish samples were collected from the selected markets for quality analysis on food safety. Sixteen fish varieties were analyzed for microbiological parameters in Cochin and Visakhapatnam; presence of Coagulase⁺ve *Staphylococcus aureus* in high numbers in some of the samples indicated poor personal hygiene by the fish handlers. Nutritional quality was also assessed in



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Visakhapatnam. Visits were undertaken to four markets in Alappuzha district, Kerala to assess the quality aspects. An awareness programme on 'Hygiene and sanitation in fish markets' was held at Panavally, Alappuzha on 15 September 2010. Three such awareness programmes were organized at Visakhapatnam. Two brochures were brought out on 'Hygiene and sanitation in markets' one in Malayalam and one in Telugu.

For development of digital map and spatial database of domestic fish markets of Ernakulam district in a GIS platform, the spatial data were collected using GPS (Global Positioning System) handset from each of seven sampled markets. A district map of wholesale fish markets of Ernakulam district of Kerala was developed in a GIS platform.

Mobilizing mass media support for sharing agro information

Strengthened media liaison by organizing three media visits at Kannur, Palakkad and Munambam. Seventy six reports were published in print media and 14 reports in web media. Technological information were disseminated through visual media by way of 13 reports in different TV channels and three success stories in 'Door-darshan'. Two video films were made on 'Solar fish driers' and 'Preparation of chitin and chitosan'. Fourteen video documents were uploaded in internet. Interviews and other programmes were prepared in audio and video modules for dissemination through AIR and different TV channels. Media support for the programmes of the Institute were



Krishi Darpan 2011- Farmers meet

offered by way of AIR broadcasts, video telecasts, printing of brochures, etc.

A two-day Agricultural Exhibition and Farmer's Meet (Krishi Darpan, 2011) was organized at Ernakulam on 28 and 29, March, 2011. Detailed report appears elsewhere in the Chapter on 'Special days and events'.

Responsible harvesting and utilization of small pelagic and freshwater fishes (Marketing component)

A workshop on 'Value chain oriented fishery micro enterprises through women' was organized during 11 - 12, November 2010, at Quilon Social Service Society (QSSS), Kollam (Detailed report appears elsewhere).

Setting up of Community Processing Centre at Chulliyar, Palakkad

The landings from reservoirs in the state of Kerala are mainly sold as fresh fish resulting in low returns to the fishermen. Absolutely no value addition is taken up and the muddy flavour of the carps restricts trade in the premium consumption market. Chulliyar reservoir is a highly productive reservoir with average monthly production of Rohu upto 90 tonnes. The entire production is sold as fresh fish at the rates fixed by the State Fisheries Department through the Fish Sales Counter at Chulliyar. Consumer preference studies conducted in Palakkad region indicated good demand for healthy fish based snack items among the consumers. A willingness to pay survey conducted among the middle class group also indicated that the consumer is ready to pay more for a healthy and safe snack. A workshop on Value chain oriented fishery micro-enterprises was organized during 18 and 19 January, 2011 at Chulliyar. Eleven trainees attended an intensive training on 4 February, 2011. Under the technical guidance from the project team, the fish retail outlet "Meenoos" owned by the Society in Palakkad town was suitably modified as a modern fish vending point. The formal inauguration of the outlet was held on 5 February, 2011 at Palakkad.

Other Workshkops/organized on "Value Chain oriented Fishery Micro Enterprises"

- ◆ A training on value added products was organized at Kannur in collaboration with Matsyafed, Kannur during 1st and 2nd December, 2010. Fourteen participants sponsored by Matsyafed attended the programme. A unit called Seafood Court was inaugurated at St.





Angelo Fort, Kannur on 7th December, 2010.

- ◆ Associated with the setting up of an industrial unit at Munambam named as "Fresh-n-Fish" and the unit was inaugurated by Shri S. Sharma, Hon'ble Minister for Fisheries, Government of Kerala on 1st November, 2010.
- ◆ A workshop on Development of value added fish products was conducted at KVK, Vriddhachalam, Cuddalore in collaboration with the Krishi Vigyan Kendra (KVK), Tamil Nadu Agricultural University during 22nd and 23rd December, 2010. Thirty participants attended the training-cum-workshop.
- ◆ A training course on Value added fish products was organized at KVK, CPCRI Regional Station, Kayamkulam during 24th and 25th January, 2011 and 30 trainees attended the programme.
- ◆ A training course on Value added fish products was organized at District Industries Centre (DIC), Kollam during 9th and 10th February, 2011 and 25 trainees attended the programme.
- ◆ A workshop on Value chain oriented Fishery Micro-

enterprises was conducted at Krishi Vigyan Kendra (KVK), Sikkal, Nagapattinam District in collaboration with the KVK during 22nd and 23rd February, 2011. Thirty three participants attended the workshop.

- ◆ A workshop on Value chain oriented fishery micro-enterprises was conducted at Krishi Vigyan Kendra (KVK), Madur, Karaikal in collaboration with the KVK during 24nd and 25th February, 2011. Thirty participants attended the workshop.
- ◆ A workshop/training on Value added fishery products and entrepreneurship development was conducted at Mopila Bay Fisheries Complex, Kannur during 18th and 19th March, 2011 in collaboration with Deputy Director of Fisheries, Kannur. Twenty Five candidates attended the training.

Capacity building of coastal fisherwomen through post harvest technologies in fisheries

A two day training programme was organized in association with Gandhi Smaraka Grama Seva Kendram, Alappuzha at Thiruvizha, South Cherthala, Alappuzha during February 22-23, 2011 (Detailed report appears elsewhere).



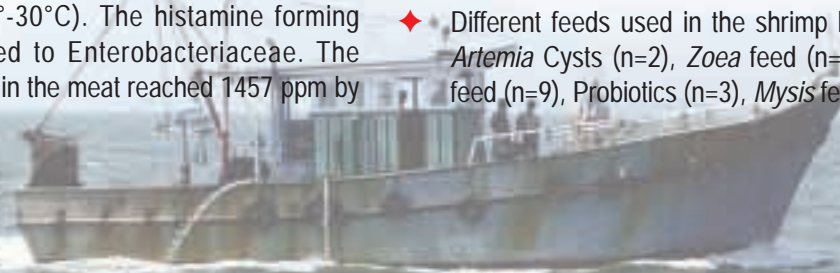
Visakhapatnam Research Centre

Research projects handled

- ☐ Development of sustainable fishing technologies for exploitation of fishery resources in the East Coast of India
- ☐ Development and evaluation of Juvenile Excluder Device for trawl fisheries along East Coast of India
- ☐ Assessment of demersal fishery resources along the Indian continental slope and central Indian ocean
- ☐ Nutritional profiling and hazard assessment of fish and fishery products of marine and lacustrine environs of East Coast of India

Chief findings

- ◆ Designed and developed multi seam bottom trawl for demersal fish exploitation.
- ◆ Developed semi circular fish eye and square mesh panels for juvenile fish exclusion.
- ◆ Developed foldable fish and prawn traps for reservoir fishery.
- ◆ *Tenualosa ilisha*, an anadromous fish that migrates to the river Godavari during the monsoon season fetches a very premium price to the fishers. The protein content of the fish was relatively more when it is in marine environment (22% WWB) compared to riverine environment (18–19% WWB) but total lipid content of the fish was distinctly higher in the riverine environment (47.65% DWB) than in the marine environment (37% DWB).
- ◆ Histamine forming bacteria during spoilage of Kawa Kawa (*Euthynnus affinis*) was increased from 20 cfu/g to 8.8×10^3 cfu/g during storage for 18h at ambient temperature (28°–30°C). The histamine forming bacteria belonged to Enterobacteriaceae. The histamine content in the meat reached 1457 ppm by the end of 18 h of storage.
- ◆ Four batches of Striped Catfish (*Pangasionodon hypophthalmus*) fillets were prepared and packed with different conditions. The results indicate that Striped Catfish fillets can be stored for a period of nine days in chilled condition (4°C) and soaking the fillets in 1% NaCl and 2% STPP chilled water will improve texture.
- ◆ More than 40 shrimp hatcheries are located on the Kakinada coast, Andhra Pradesh which produces Black tiger (*Penaeus monodon*) and White prawn (*Litopenaeus vannamei*) post-larvae. The different stages of feed samples were collected and subjected for nutritional profiling. The moisture content of the farm feeds ranged between 7.8% and 8.9%, total fat varied from 7.46% to 7.95% and total ash from 15.7% to 16.9%. Wide variation was observed in the mineral content of farm feeds: Calcium content varied from 384 to 1252 mg%, Sodium content varied from 185 to 685 mg% and Potassium content varied from 18 to 935 mg%.
- ◆ Different feeds used in the shrimp hatcheries viz., *Artemia* Cysts (n=2), *Zoea* feed (n=2), Post Larval feed (n=9), Probiotics (n=3), *Mysis* feed (n=2), and a





chemical feed (n=1) were analyzed for various antibiotics and pesticides. Heptachlor epoxide, an organochlorine pesticide was detected in *Mysis* feed at 7.05 ppb level. No other pesticide was detected in the hatchery feed samples. Among antibiotics, only Chloramphenicol was observed in post larval feed 1-9 (453 ppb) and post larval feed 1-6 (112.5 ppb). Aquaculture farmers are procuring seeds from these hatcheries where some of the banned veterinary drugs were detected.

- ◆ Different species of bivalve molluscs and crustaceans such as *Anadara granosa* (Blood clam), *Perna viridis* (Brown mussel), *Perna indica* (Green mussel), crustaceans like *Oratosquilla nepa* (Matis shrimp), crabs like *Portunus pelagicus* (Reticulate crab), *Charybdis cruciata* (Cross crab), *Scylla serrata* (Green mud crab), *Portunus sanguinolentus* (Spotted crab), lobsters like *Panulirus homarus* (Green spiny lobster) *Panulirus polyphagus* (Banded spiny lobster) and almost all Penaeid and Non Penaeid prawns were reported from East Coast of India.
- ◆ Blood clam *Anadara granosa* collected from the Kakinada coast of Andhra Pradesh was subjected to analysis of proximate composition. The moisture and protein content were 77.54% and 17.63% respectively. Total Lipid was 1.96%. The minerals like Phosphorus, Iron, Sodium, Potassium and Calcium were 413 mg%, 61 mg%, 1761 mg%, 552.5 mg% and 200 mg% respectively. The total plate count was 1.02×10^6 cfu/g and total Enterobacteriaceae count was 7.15×10^3 cfu/g. Faecal indicators viz., faecal Coliforms (3.6 MPN/g), *E. coli* (3.6 MPN/g) and faecal Streptococci (110/g) were detected. Human pathogens namely *S. aureus*, *V. cholerae* and *Salmonella* were not detected.
- ◆ Water soluble extract was prepared from the Blood clam contents. The Clam contents were further extracted with salt (5% NaCl) to get the salt soluble extract. These extracts were tested for antimicrobial activity against *E. coli*, *Staphylococcus aureus*, *V. cholerae*, *Salmonella*, *Bacillus cereus* and *Micrococcus luteus*. The water soluble extract showed antimicrobial activity against *Salmonella* whereas salt soluble extract showed antimicrobial activity against *S. aureus*.

- ◆ Green mussel (*Perna viridis*) collected from the sea at Kakinada, East Godavari district of Andhra Pradesh was analyzed for microbiological and chemical parameters. The moisture, protein, fat and ash content of big sized *P. viridis* were 78.5%, 17.1%, 3.06% and 7.93%, respectively. The Sodium, Potassium, and Phosphorus content were higher in small sized *P. viridis* (Na- 2824 mg%, K- 787 mg% and P- 1019 mg%) than in large sized *P. viridis* (Na- 159 mg%, K- 435 mg% and P- 910 mg%) where as calcium and iron content were relatively higher in large sized *P. viridis* (Ca- 123 mg%, Fe- 232 mg%) than in small sized *P. viridis* (Ca- 79 mg% and Fe- 165 mg%).
- ◆ Microbiological quality parameters (total plate counts, H_2S producing bacteria, faecal Coliforms, *E. coli*, faecal Streptococci, *Salmonella*, *Listeria*, *V. cholerae* and Coagulase +^{ve} Staphylococci) were analyzed in water and ice collected from processing plants and also landing centers. One consignment (defective packaging and infested with insects) has been rejected for not meeting the EU2023/2006 standards.
- ◆ COFISKIs were successfully installed at Aalong, West Siang district; Daporijo, Upper Sibinsiri district and Yinkiang, Upper Siang district of Arunachal Pradesh. It is observed that COFISKI installed at Tarin, Lower Sibinsiri district is being used successfully for various demonstration works during the training programmes for production of high quality smoke cured fish by scientific and hygienic methods. In the last phase three COFISKIs were installed at Seppa, East Kameng district, Bomidila, West Kameng district and Tawang, Tawang district. With these installations a total of 17 COFISKI were installed for the benefit of fishers in Arunachal Pradesh.

Report of work done

Development of sustainable fishing technologies for exploitation of fishery resources in the East Coast of India

Experimental fishing operations were made with 26 m multi seam finfish trawl developed for demersal fish resource exploitation on CIFTECH-1 vessel with V form otter boards at 17°40'-17°42' lat., 83°21'-83°30' longitude between 25-45 m depth. The trawl yielded a total catch of



4930 kg in 97 hours with a CPUE of 50 kg/hr.

Field trials were undertaken to study the relative utility of a newly designed 26 m multi seam fish trawl on a conventional two seam fish trawl at 25-45 m depth range along the Visakhapatnam coast. Data for each haul, the catch composition and total catch were recorded. The catch per unit effort of multi seam trawl was 50 kg/hr and two seam was 32 kg/hr. The major catch comprised of Silver bellies (35%), *Upeneus* spp. (25%), *Trichiurus lepturus* (15%), *Nemipterus* spp. (5%), Sciaenids (5%), *Saurida* spp. (5%), Squids and Cuttle fish (5%), and Crabs (5%).

A 28 m eight seam demersal fish trawl was field tested with V form otter boards to yield CPUE of 34kg/hr.

Data was collected from the commercial fishing trawlers operating along the East Coast. The quantity of fish landed by the single day fishing vessels on an average was 215 kg/vessel and multi-day vessels was around 230 kg/vessel/day.

Data of the bycatch landed by the experimental trawl and commercial trawls were collected for study. The juvenile catch landed by experimental and commercial trawls are *Upeneus* and *Nemipterus* spp. in the first quarter, *Upeneus* spp. and *Parastromateus niger* in the second quarter and the juveniles of *Upeneus* spp., Cuttle fish and *Trichiurus lepturus* in the third quarter. Large quantities of Silver bellies, *Loligo duvacelli*, *Trichiurus lepturus* and *Magalaspis cordyla* juvenile catch were recorded in the last quarter.

Survey was conducted at Kakinada, Machilipatnam and Visakhapatnam coast to study the fishing crafts and gears. Data base for craft and gears operated in the East Coast and trawl fishery resources were documented.

Development and evaluation of Juvenile Excluder Devices for trawl fisheries along East Coast of India

Designed and developed a 300 x 200 mm fish eye BRD with vertical opening and an oval grid (900 x 600 mm) having 60 mm bar space. Field trials were conducted with 300 x 200 mm semi-circular fish eye with vertical opening and rigged on a 28 m trawl. The shrimp loss from 300 x 200 mm fish eye with vertical opening was less than 0.01% and overall bycatch reduction was about 21.7%.

Escapement of finfishes were found to be less than 2.9% and Nil for shell fishes with 100% exclusion of turtles

in trawl operations with CIFT-TED installed operations at Dhamra, Odisha.

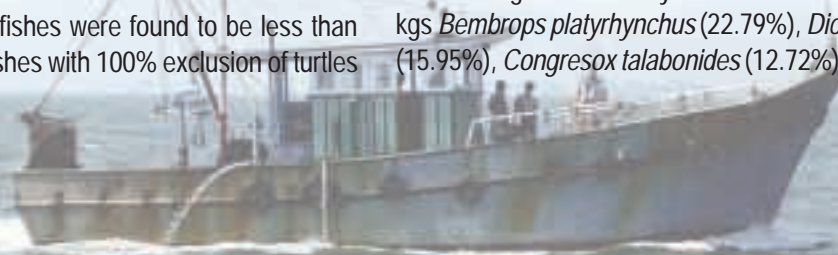
Diversity parameters of retained catch from 28 m trawl fitted with fish eye were as follows: Species Richness (26), Shannon-Wiener Diversity Index (1.13), Shannon's Evenness (0.25), Effective Richness (3.11), Simpson's D (0.36), Simpson's (N2) 1.66 and Simpson's Evenness using N2 (0.064). The trawl biodiversity was consolidated from four trawling grounds.

Selectivity data was collected for 40 mm diamond mesh codend fitted to a 28 m trawl for commercially important fishes. Length frequencies of escaped and retained catch were recorded for selectivity studies. Selectivity curves for 30 mm, 40 mm and 50 mm square mesh codends for 10 commercially important fish species from Visakhapatnam were generated using CONSTANT 2000.

Assessment of demersal fishery resources along the Indian continental slope and central Indian ocean

Studies were undertaken in two cruises of FORV Sagar Sampada (No.279 and 281). Data collected during the cruises was analyzed. Sampling was carried out using EXPO modal fish trawl and HSDT (CV). Stocks were estimated latitude-wise and depth-wise along the continental slope of East and West Coast of Indian EEZ. Stock sizes are expressed as CPUE (kg/h). The collected samples were identified to least taxon.

In cruise No 279, A total of 33 stations were covered during the cruise of which 23 were for ENP studies and 10 stations for deep sea trawling. Four fishing operations were conducted with EXPO model net and two operations with HSDT (CV) and four operations with HSDT (FV). Fishing operations were conducted at depths ranging from 55 m to 650 m covering the geographical area from Longitude 10° to 19° N and Latitude 80° to 85° E. Ten stations were covered during the cruise with a total fishing effort of 8.33 hrs, yielding a total catch of 1970 kgs with a CPUE of 236 kgs/hr. The catch comprised of finfishes, shell fishes, elasmobranchs, crustaceans, cephalopods and gastropods. About 45 deep sea fishes were identified on board using standard keys. Of the total catch of 1970.4 kgs *Bembrops platyrhynchus* (22.79%), *Dicrolene multifilis* (15.95%), *Congresox talabonides* (12.72%) and *Physiculus*





sp. (12.09%) dominated the catch. The gear parameters studies were also conducted during the cruise.

In cruise No 281, a total of 37 fishing grounds were scanned covering nine transects and a time of 20.8 hours. The results indicate that much of the region beyond 200 m in the region between 11°N and 18°N is predominantly rocky and uneven, making trawling operations risky to net damage. A total of six fishing operations using High-Speed Demersal Trawl (HSDT- CV) and EXPO model fishing nets were done at 200 – 1000 m depths at identified stations in the nine transects. The total catch was 312.9 kg with a CPUE of 89.4 kg. The catch composition for the four successful fishing hauls in the various transects is as follows: Station 1 (0818.60' N, 7613.72') located at a depth of 995 m yielded a total catch of 168.4 kg with a 0.5 hour effort. Finfishes (61%) followed by elasmobranchs (20%) and crustaceans (3%) dominated the catch. Among elasmobranchs, *Benthobatis moyesbi* and *Centrophorus* spp. contributed most followed by the chimaera *Hydrolagus africanus*. Finfish catch was dominated by *Coryphaenoides* sp., *Narcitus* sp. and *Bathyrcongus* sp. while among crustaceans, *Plesiopenaeus edwardsensis* and *Acanthephyra armata* dominated.

Nutritional profiling and risk assessment of ready-to-eat fish products and ready-to-cook frozen products

The composition (total protein, total lipid, ash, Fe, Ca Na and P) chemical quality parameters (TVBN, AAN, NPN, PV and FFA) and microbiological quality parameters (total plate counts, H₂S producing bacteria, faecal Coliforms, *E. coli*, faecal Streptococci, *Salmonella*, *Listeria*, *V. cholerae* and Coagulase +^{ve} Staphylococci of ready-to-cook frozen fish and shrimp products purchased from local super market was assessed.

Studies on the characteristics of Polasa (*Tenualosa ilisha*) in riverine and marine environments

Tenualosa ilisha, an anadromous fish that migrates to the river Godavari during the monsoon season fetches a very premium price to the fishers. Studies on the nutritional composition and fatty acid profile of this fish caught from the Bay of Bengal prior to migration were conducted. Samples were screened at regular intervals. Polasa was collected from marine (Bay of Bengal) and freshwater (river Godavari) environments during the course of its migration. The fish were analyzed for nutritional

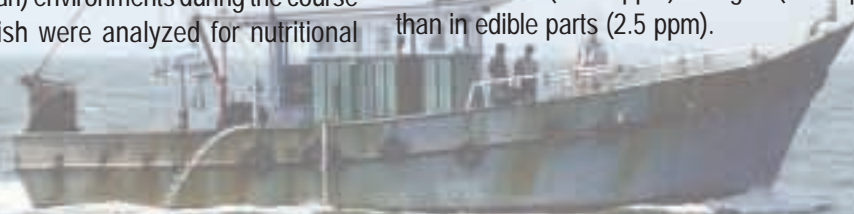
composition. The protein content of the fish was relatively more when it is in marine environment (22% WWB) compared to riverine environment (18–19% WWB) but total lipid content of the fish was distinctly higher in the riverine environment (47.65% DWB) than in the marine environment (37% DWB). Minerals like Sodium was more in marine environment fish (232 mg%), when compared to that in riverine environment (66 mg%) but Potassium was more in riverine system (1221 mg%) in comparison to marine environment (754 mg%).

Nutritional profiling of Polasa: Polasa was collected from freshwater (river Godavari) environments during the course of its migration. The male and female fish were analyzed for nutritional composition. The protein, ash, phosphorus and iron content of the female fish (22.38%, 1.66%, 439.8 mg%, 15.12 ppm) were higher than the male fish (21.53%, 1.38%, 380.7 mg%, 12.96 ppm). All values were given on WWB. However, the fat content of the male fish (15.36%) was higher than the female fish (8.73%). No significant difference was observed in the total plate count (10⁴ cfu/g) and total Enterobacteriaceae counts (10² cfu/g) of both the male and female fish. Faecal Coliforms were higher in female fish (15 MPN/g) than in male (9.5 MPN/g). Faecal Streptococci were detected in both the fish. Coagulase +^{ve} Staphylococci were not detected.

Hazards associated with fish, fishery products and fishery environs

Histamine forming bacteria during spoilage of Kawa Kawa (*Euthynnus affinis*) was studied. The counts of Histamine forming bacteria increased from 20 cfu/g to 8.8 x 10³ cfu/g during storage for 18 h at ambient temperature (28°C-30°C). The histamine forming bacteria were all found to be members of Enterobacteriaceae. The histamine content in the meat reached 1457 ppm by the end of 18 h of storage. The histamine production potential of the isolated histamine forming bacteria is being studied.

Studies on occurrence of trace metals: Trace metals like Lead, Zinc and Chromium were analyzed from the edible parts, skin, liver and gills of marine fish (Mullet). Lead was highest in liver (18.44 ppm) followed by gills (5.36 ppm), skin (5 ppm) and edible part (2.98 ppm), which are above the tolerance limit. Interestingly the accumulation of Zinc in skin (54.99 ppm) and gills (64.11 ppm) is higher than in edible parts (2.5 ppm).



Trace metal concentrations in some of aquatic animals: A total of 50 samples comprising of fishes (Hilsa, Seabass), freshwater Prawns, Jelly fish and Blood clam were analyzed for Cadmium, Copper and Zinc. Cadmium levels were less than 1 ppm in all the samples but liver of Seabass showed more than 1 ppm. Copper levels ranged between 0.87 ppm (Hilsa meat) to 7.13 ppm (Seabass intestine). Zinc levels ranged between 2.65 ppm (Jelly fish meat) to 22.2 ppm (Hilsa meat).

Installation of Community Fish Smoking Kilns (COFISKI) in Arunachal Pradesh

A team of scientists and officers visited Arunachal Pradesh from 12th to 23rd April 2010. During this period the COFISKIs were successfully installed at Aalong, West Siang district, Daporijo, Upper Sibinsiri district and Yinkiang, Upper Siang district of Siang Arunachal Pradesh. A letter of appreciation was given by Shri Tagemoda, Director of Fisheries, Itanagar, Government of Arunachal Pradesh, praising the team for successful installation of COFISKI despite extreme unfavorable conditions. The team also demonstrated different methods of packaging of smoke cured fish and fishery products using high quality polythene bags employing heat sealing machines given by CIFT as part of the outreach programme. The demonstrations were held both at Aalong and Daporajo. Further, the team visited Ziro, Lower Sibinsiri district and inspected the functioning of COFISKI installed at high altitude fish farm at Tarin. It is observed that COFISKI installed at this place is being used successfully for various demonstration works during the training programmes for production of high quality smoke cured fish by scientific and hygienic methods.

In the last phase in three high altitude areas COFISKI were installed at Seppa (5000 MSL), East Kameng district, Bomidila (9000 MSL), West Kameng district and Tawang (11000 MSL), Tawang district. With these installations a total of 17 COFISKI were installed for the benefit of fishers in Arunachal Pradesh.

Studies on the effect of salt on icing in transport of fresh fishes to different fish markets of the country

Andhra Pradesh is bestowed with a rich array of natural resources of marine pelagic and mid-water aquatic resources. Marine catch and also freshwater fishes are transported mainly to West Bengal, Madhya Pradesh,

Chattisgarh and Uttar Pradesh. Generally salt is mixed with ice while packing the fish in corrugated carton boxes. Three varieties of fishes namely Indian Mackerel (*Rastrelliger kanagurta*), Goat fish (*Upeneus* spp.) and Sardine (*Sardinella longiceps*) were selected for the present study. Initially, fresh fish characteristics viz., proximate composition, biochemical and microbiological quality were studied. The fish were packed in thermocole boxes with ice (control) and in thermocole boxes with salt and ice (treated). The biochemical and microbiological quality of the control and treated samples were studied. Salt treated and control samples has shown interesting results, volatile bases are liberated more in control samples compared to treated samples but salt soluble nitrogen has shown decreasing trend in treated samples compared to control samples. Protein hydrolysis which was indicated by estimating Alpha Amino Acid was more in treated samples compared to control and fresh fish. But interestingly Non-Protein Nitrogenous matter has not altered much in treated as well as in control samples. Lipid quality parameters like Peroxide Value has shown higher values in control samples when compared to treated samples, even though salt is a pro-oxidant. It appears that in the presence of ice, salt has not played any role in oxidation process and it is confirmed by higher lipid hydrolysis in control samples (higher FFA value: 5.5% Oleic acid) when compared to treated samples (lower FFA value: 1.1% Oleic acid).

Studies on chemical contaminants in hatchery and farm samples

Hatchery feed, Probiotics, Cysts and farm feed samples were collected along Kakinada coast for the analysis of antibiotics, pesticides, trace metals, amino acid composition and proximate composition. The Zoea Feed, Mysis feed, post larvae feed in different stages, Probiotics, farm feeds of different brands and cysts used in shrimp hatchery including production of *Litopenaeus vannamei* samples were investigated.

Histamine production potential of bacteria isolated from Kawa Kawa

Three histamine forming bacteria were isolated from Kawa Kawa (*Euthynnus affinis*) and all the three isolates were identified as members of Enterobacteriaceae. The histamine production potential of the three isolates was carried out at three different temperatures viz., 37°C, 22°C





and refrigerated temperature (5-8°C). The production of histamine by all the three isolates was minimum at 5-8°C (ranging between 26 ppm to 106 ppm) and maximum at 37°C (ranging between 167 ppm to 213 ppm). At 22°C, the histamine production was similar to that at 37°C (ranging between 113 to 210 ppm).

Nutritional profiling of bio-processed products

Bio-processed fish ('Seedhal') procured from the North Eastern states (Assam and Arunachal Pradesh) were analyzed for nutritional and quality parameters. Dried samples of the same fish species were also analyzed for comparison. The total plate counts of the fermented fish ranged between 4.2×10^3 cfu/g to 6.76×10^4 cfu/g. Faecal Coliforms, *E. coli*, Hydrogen sulphide producing bacteria and *Lactobacillus* were not detected in 'Seedhal' samples. Faecal Streptococci (470 cfu/g) and Yeast (40/g) were detected in one 'Seedhal' sample. Total Enterobacteriaceae counts in 'Seedhal' samples ranged from 50 cfu/g to 920 cfu/g. The anaerobic bacterial counts of fermented fish ranged from 5×10^3 cfu/g to 4.14×10^5 cfu/g and were relatively higher than the corresponding aerobic count. The nutritional composition and biochemical quality parameters are being carried out.

Studies on chilled storage of Striped Catfish fillets

Four batches of Striped Catfish (*Pangasianodon hypophthalmus*) fish fillets were prepared. First batch (CC, chilled control) of Striped Catfish fillets were packed individually in polythene pouches and stored in chilled condition (4°C) in ice. Second batch (VC, vacuum control) of Striped Catfish fillets were vacuum packed in polythene pouches and stored under chilled condition (4°C) in ice. Third batch (CT, chilled treated) of Striped Catfish fillets were soaked in chill water solution (1% salt, 2% STPP) for 30 minutes and were packed in polythene pouches and stored under chilled condition (4°C) in ice. Fourth batch (VT, vacuum treated) of Striped Catfish fillets were soaked in chill water solution containing 1% NaCl, 2% STPP for 30 minutes and vacuum packed in polythene pouches and stored under chilled condition (4°C) in ice. The fillets were analyzed for chemical and microbiological parameters at regular intervals viz., 1, 3, 6, 9 and 12 days of storage.

The uptake of phosphate (P_2O_5) by the Striped Catfish fillets ranged from 760 ppm to 1330 ppm. The phosphate content of CT (4410 ppm) and VT (4120 ppm) fillets at the



Pangasianodon hypophthalmus

Striped Catfish

end of 12 days of chilled storage was lower than the permissible limit of 5000 ppm. At the end of 12 days of chilled storage, the Peroxide Value (PV) was relatively higher in CC (4.8 meq/kg fat) than in CT (2.1 meq/kg fat), VC (1.5 meq/kg fat) and VT (1.5 meq/kg fat) fillets. However, all the PV was below the acceptable limit (10 meq/Kg fat). TVBN values were lower than 30 mg% in CC, CT, VC and VT fillets till nine days of chilled storage and thereafter showed relatively rapid increase. The texture of treated fillets (CT and VT) was firm. The colour of vacuum packed fillets (VC and VT) was relatively darker. The total plate count of treated fillets (CT and VT) was lower than the corresponding control fillets (CC and VC) but the difference was always lower than 1 log value. Total Enterobacteriaceae counts showed increasing trend after seven days of storage. Hydrogen sulphide producing bacterial counts were low in all the samples even after 12 days of chilled storage. The results indicate that Striped Catfish fillets can be stored in chilled condition (4°C) for a period of nine days and soaking the fillets in 1% NaCl and 2% STPP chilled water will improve texture.

As the time period increases from 0 day to 12 days, there was a gradual increase in Aerobic Plate Counts (APC) of chilled (CC) and STPP treated (CT) fish fillets but even at the end of 12 days of storage the counts were less than 5, 00,000 cfu/g whereas the APC of both the VC and VT fillets were beyond the acceptable level at the end of nine days of chilled storage. TVN contents were within acceptable limit for nine days and were not acceptable at the end of 12 days of storage. The PV of vacuum packed fillets was lower (VC: 1.48 to 2.3 meq/kg of fat), fillets was relatively lower than chilled fillets (CC: 3.15 to 5.76 meq/kg of fat). Treatment with STPP and salt had a beneficial

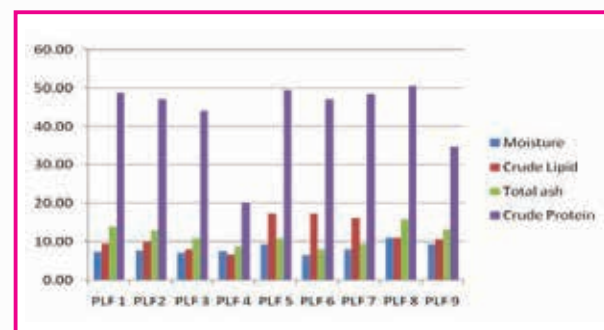
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effect on fat quality (PV of VT: 1.1 to 2.2 meq/kg of fat and PV of CT 1.14 to 2.2 meq/kg of fat). It is observed that the moisture content of STPP treated fillets was always higher. The difference in moisture percentage between VT and VC ranged from 2.19% to 5.88%. The difference in moisture percentage between CT and CC ranged from 0.6% to 2.76%. WSN and SSN values of the vacuum packed and chill stored *P. hypophthalmus* fish fillets decreased with increase in storage period.

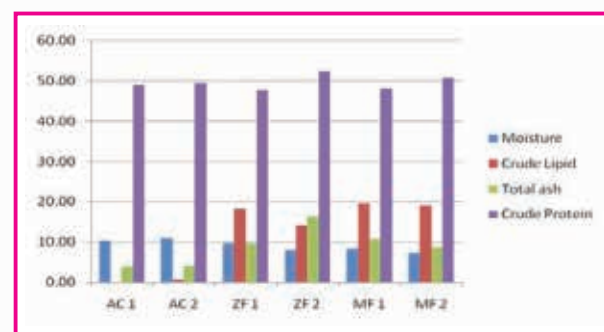
Studies on the composition and quality of feeds and probiotics from shrimp hatcheries and aquaculture farms

More than 40 shrimp hatcheries are located on the Kakinada coast, Andhra Pradesh which produces Black tiger (*Penaeus monodon*) and White prawn (*Litopenaeus vannamei*) post-larvae. Shrimp consignments are rejected by EU on the grounds of presence of antibiotics. For a study, feeds used in shrimp hatcheries, aquaculture farm feeds, probiotics and Artemia cysts were collected along Kakinada coast and were analyzed for proximate composition, fatty acid composition, amino acids composition, heavy metals, microbiological parameters, antibiotics and pesticides. The moisture content of the farm feeds ranged between 7.79% and 8.9%, total fat varied from 7.46% to 7.95% and total ash from 15.69% to 16.9%. Wide variation was observed in the mineral content of farm feeds. Calcium content varied from 384 to 1252 mg%, Sodium content varied from 185 to 685 mg% and Potassium content varied from 18 to 935 mg%. In Probiotic samples, moisture content varied from 4.66% to 8.86% but fat content was Nil in all Probiotic samples (All compositional results are expressed as dry weight basis). Out of 21 samples, highest TPC value of 97 cfu/g was

observed in Zoea feed. Highest Enterobacteriaceae count of 50 cfu/g was noticed in Probiotic sample. Yeasts and moulds (40/g) were maximum in Artemia Cyst. *Lactobacillus* were detected only in Probiotics (4.28×10^3 cfu/g).



Proximate Composition of Post Larval Feed



Proximate Composition of Artemia Cyst, Zoea and Mysis Feed

Studies on the composition and quality of feeds

Shrimp farm feeds (n=8) of different brands that are commonly used by the farmers were collected from the East and West Godavari districts of Andhra Pradesh area and subjected for the analysis of nutritional value, microbiological parameters and trace metals.





Veraval Research Centre

Research projects handled

- ☐ Technological innovations on improved utilization and value addition of marine and cultured fishery resources in Gujarat
- ☐ Project validation of PFZ along Gujarat coast
- ☐ Zooplankton production modeling investigations
- ☐ Coastal *in situ* data collection for Case 2 algorithms
- ☐ Measurement of inherent optical properties of seawater and development of inversion algorithms

Chief findings

- ◆ Chilled storage studies of whole cleaned Squid (*Loligo duvauceli*) indicated a shelf life of nine and 11 days in 12 μm polyester laminated, 75 μm low density polyethylene laminated flexible pouches and shrink packs respectively.
- ◆ Cuttle fish (*Sepia pharaonis*) in skinless gutted form packed in 12 μm polyester laminated and 75 μm low density polyethylene laminated flexible pouches showed a shelf life of less than a day, 5-6 and 18 days at room temperature, 7°C and under ice, respectively.
- ◆ An increase in pH and reduction in the bacterial load was observed for different stages of individually quick (IQ) frozen Squid (*Loligo duvauceli*) under commercial operating conditions.
- ◆ Preliminary study was undertaken to develop bakery products like Rusk, Bread (*Pav*) and Khari (Puff like bakery product) incorporating freshwater fish (*Labeo rohita*) mince at 10, 20 and 30% levels.
- ◆ A higher level of Cadmium was observed in commercially caught and commercially frozen cuttlefish and squids from the Veraval region.

- ◆ Nine simultaneous fishing operations carried out in the PFZ and non-PFZ areas along the Gujarat coast using hired vessel indicated that the average CPUE from the vessels operating in the PFZ areas was noticed as 33.01 kg h⁻¹ and from the non-PFZ locations it was 30.15 kg h⁻¹.

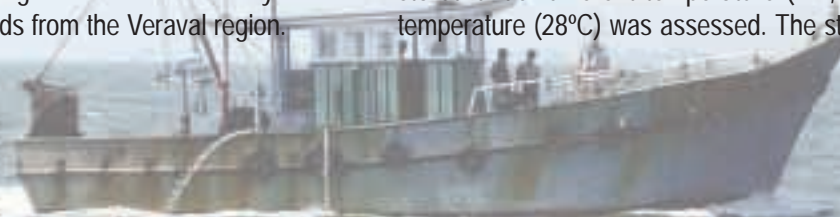
Report of work done

Chilled storage studies on Squid

Chilled storage studies of whole cleaned Squid (*Loligo duvauceli*) packed in 12 μm polyester laminated, 75 μm low density polyethylene laminated flexible pouches and shrink packs was undertaken to assess the shelf life. Various biochemical, microbiological and sensory quality parameters were monitored during the study. The study indicated a shelf life of nine and 11 days in 12 μm polyester laminated with 75 μm low density polyethylene laminated flexible pouches and shrink packs respectively.

Shelf life studies on Cuttle fish

Shelf life of Cuttle fish (*Sepia pharaonis*) in skinless gutted form packed in 12 μm polyester laminated and 75 μm low density polyethylene laminated flexible pouches stored under different temperature (1-2, 7°C and room temperature (28°C)) was assessed. The studies indicated



that the shelf life of Cuttle fish at room temperature was less than a day whereas it was 18 days under ice and only 5-6 days for the samples stored at 7°C.

Quality studies on Squid

Quality changes of Squid (*Loligo duvauceli*) during various processing stages in the commercial fish processing establishments were assessed. For this, sampling from three different commercial fish processing factories from Veraval were drawn at different processing stages like, raw, pre-processing, processing, blanching and after individual quick freezing. pH of the raw squid was in the range of 6.2–6.3 which increased to 7.4–7.5 during processing stage due to chemical treatment, which maintained almost similar values after freezing. Initial bacterial count was in the range of 1,00,000 – 1,90,000 cfu/g which reduced to 80,000 – 92,000 after IQF. Studies on quality comparison of block frozen and IQF squid stored at -18°C is in progress. Freezing was carried out in a commercial establishment and sampling at equal intervals was drawn to assess the quality changes. Protein loss after cooking was higher for block frozen samples compared to IQF samples. After six months of storage, an increase in drip loss from 11.8% to 21.9% was observed for IQF Squid compared to 24.2% for block frozen Squid. Further storage studies are under way.

Bakery products incorporating fish mince

A preliminary study was undertaken to develop bakery products incorporating fish mince. Bakery products like Rusk, Bread (Pav) and Khari (Puff like bakery product) were prepared by incorporating freshwater fish (Rohu)



Fish mince incorporated Khari

mince at 10, 20 and 30% along with other ingredients and parameters like proximate composition, volume changes, water holding capacity and sensory acceptability were compared with the control samples. Increase in volume for fish incorporated bakery products were similar to that of control samples whereas higher protein content was observed for fish incorporated products. Sensorily, Khari and bread samples incorporated with 20% fish mince were rated slightly higher, whereas for Rusk 30% fish mince incorporation was rated higher.

Formaldehyde content of Skipjack tuna

Formaldehyde content of frozen long tail and Skipjack tuna was assessed. The formaldehyde levels in Skipjack tuna was in the range of 0.45–2.92 ppm whereas in Longtail tuna it was in the range of 0.64 – 4.99 ppm.

Studies on fish meal and squid meal

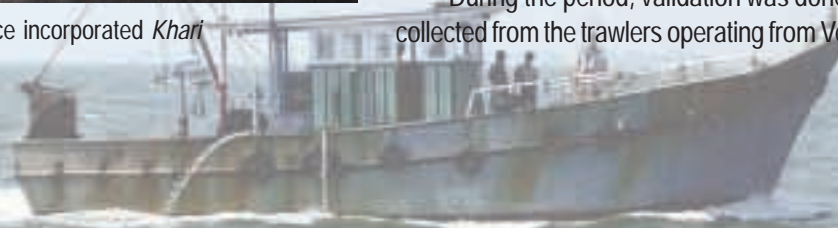
Quality comparison of commercially processed fish meal and Squid meal was undertaken. Crude protein content of Squid meal was higher (66.88%) compared to fish meal (63.88%). Water holding capacity and bulk density of Squid meal was 180.51% and 0.72 g/ml respectively compared to 140.23% and 0.6 g/ml for fish meal.

Heavy metals in fish and shellfish

Heavy metal (Cadmium, Lead, Mercury, Copper, Cobalt, Iron, Nickel, Magnesium, Manganese, Zinc and Chromium) levels in fish and shellfishes such as Black pomfret, Indian mackerel, Horse mackerel, Shrimps, White pomfret, Yellowfin tuna, Squid and Cuttlefish collected from landing centres and markets of Veraval and Mangrol was assessed. Cadmium content was very high in Cuttlefish (1.8 – 1.9 ppm) followed by Squid (1.37 – 1.67 ppm) and in fishes and shrimps, the levels were below 0.83 ppm. Lead content was also higher in cephalopods compared to fish and shrimps. Iron content was more in Yellowfin tuna (39 – 47 ppm) followed by shrimps (22 – 24 ppm), White pomfret (16 – 18 ppm) and cephalopods (7.8 – 9.4 ppm). High level of Cadmium was noticed in the commercial frozen cephalopod samples from the fish processing industry of this region.

Project validation of PFZ along Gujarat coast

During the period, validation was done using the data collected from the trawlers operating from Veraval, Mangrol,





Porbandar and Diu fishing harbours. Data regarding the operations were collected from similar class of vessels operating from these harbours. Feedback data were collected using pre-tested survey forms. Total of nine simultaneous fishing operations were also carried out in the PFZ and non-PFZ areas along the Gujarat coast using hired vessel.

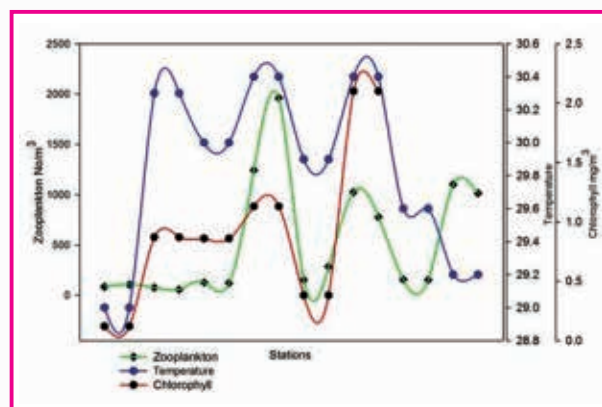
The average CPUE recorded from the vessels operating in the PFZ areas was noticed as 33.01 kgh⁻¹ and from the non-PFZ locations the CPUE recorded was 30.15 kgh⁻¹. It was noticed that fishing in the PFZ areas showed a significant increase in the revenue generated. There was an increase of approximately 15-20% in the revenue when vessels fished in the PFZ areas and this was estimated on the assumption that the skipper has no prior knowledge on the location of the INCOIS derived PFZ.

Zooplankton production modeling investigations

A total of 17 bongonet operations were carried out during the period under report. This included eight operations in which simultaneous radiometer data was collected with the help of Scientists from the Space Applications Centre (SAC), Ahmedabad and was carried out during the 4-7 October 2010. Bongo net operations were also carried out using the hired fishing vessels and seven hauls were carried out using private vessels. The water samples from different depths were collected using a Niskin type bottle (2.5 Litre) and stored in dark coloured containers and kept under dark and in cooled condition till the analysis at the laboratory of VRC of CIFT, Veraval. The parameters analyzed were Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Chlorophyll and Temperature. The nutrients Nitrate and Phosphate were also analyzed and the visibility of water was checked using a Secchi disc. Location of the stations sampled during the

October cruise (with Radiometer data) are as given in Table below:

The works related to the development of the zooplankton abundance model is under progress at the SAC. It was observed that temperature was the most important factor that affects the abundance of zooplankton along the coastal waters.



Variation in the zooplankton abundance with concurrent changes in the temperature and Chlorophyll along the coastal waters off Veraval

Measurement of inherent optical properties of seawater and development of inversion algorithms

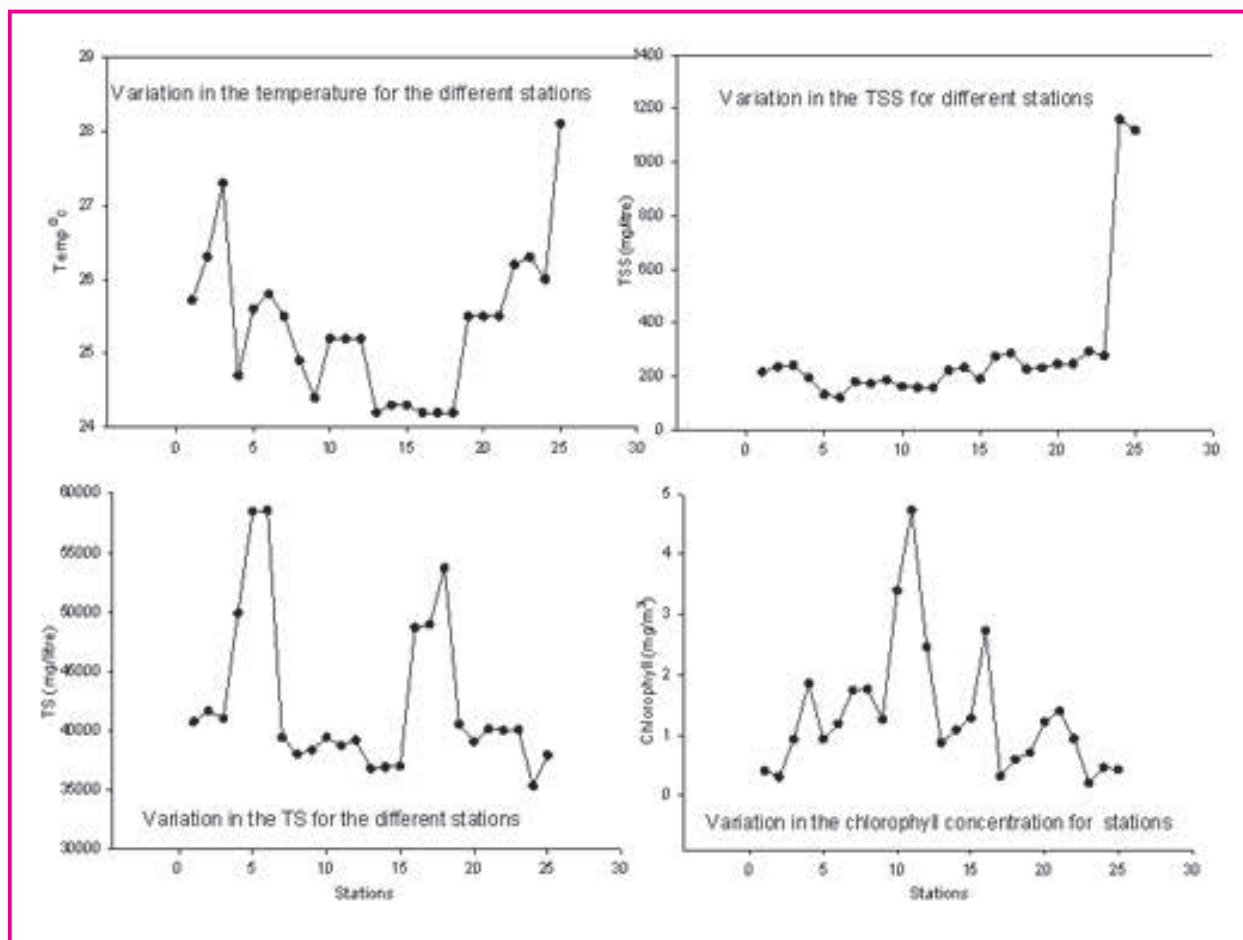
Experimental cruise was carried out on-board the CIFT vessel MFV Sagarkripa (15.5 m, LOA, 124 hp) during 4-7 October 2010 along the Veraval coast. The experiments were designed in such a way to collect the water samples using Niskin type water sampler and simultaneous operation of SATLANTIC underwater radiometer was carried out. Three transects were selected for carrying out the study and three sampling stations were fixed within a transect with approximate depths of 40, 35 and 25 m from the surface. The water samples from different depths were

Date	04 October 2010		05 October 2010		06 October 2010		07 October 2010	
	Station 1	Station 2	Station 1	Station 2	Station 1	Station 2	Station 1	Station 2
Position	N20 48 31.7 E 070 19 45.5	N20 53 25.3 E 070 21 48.5	N20 46 28.2 E 070 26 32.2	N20 49 04.9 E 070 27 07.9	N20 52 43.5 E 070 15 27.7	N20 53 56.3 E 070 20 56.5	N20 47 22.1 E 070 19 01.7	N20 53 10.0 E 070 22 06.7
Time	10.55 AM	1.10 PM	10.15 AM	12.15 PM	08.15 AM	10.20 AM	08.15 AM	10.15 AM
Depth	32m	17m	28m	22m	30m	20m	35m	20m
Temperature	29°C	30.3°C	30°C	30.4°C	29.9°C	30.4°C	29.6°C	29.2°C
Transparency	8m	5.5m	11m	5.5m	13m	3m	9m	2m

Cift Annual Report 2010 - '11

collected using a Niskin type bottle (2.5 Litre) and stored in dark coloured containers and kept under dark and in cooled condition till the analysis. The parameters analyzed were Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Chlorophyll and Temperature.

The data on the physico-chemical parameters observed and measured from the different locations were transmitted to SAC and the development of algorithms for inversion and algorithms, specifically for the Case 2 waters using ANN and other methods are under progress.



Variation in the physico-chemical parameters of seawater observed from 25 sampling stations along the Veraval coast





Mumbai Research Centre

Research project handled

- ☐ Technologies for utilization of fishery resources at Maharashtra

Chief findings

- ◆ During monitoring of pathogens in samples, *E. coli* with counts more than 20/g was found to be present in 50% fresh fish samples. Fecal Streptococci, Sulphite reducing Clostridia and Coagulase⁺ Staphylococci were present in almost all samples. Pathogens *V. parahaemolyticus*, *V. cholerae*, *Salmonella* and *Listeria* were absent in all samples.
- ◆ Histamine level in the muscle in very fresh juveniles of Grey mullet (*Mugil cephalus*) from Vashi creek was 3.5-5 mg%. Histamine level in the muscle of freshwater fish was highest i.e., 4.33 mg% in freshwater Eel (*Macroglythys pancalus*). Histamine level in the muscle of one sample of Seer fish was 22.66 mg%. Histamine forming bacteria was present in all species under study.
- ◆ Cadmium content in the muscle of all samples was below 0.03 ppm except in one Squid sample where its value was 0.093 ppm. Lead content in the muscle of freshwater fish samples was highest i.e., 1.023-1.029 ppm in freshwater Eel (*M. pancalus*) and freshwater Shark (*Wallago attu*). Squid meat contained 0.919 ppm lead which was highest among marine fish samples.
- ◆ Crispy golden brown ready to eat products from Jawala (*Acetopus indicus*) and Small kardi shrimp (*Palaemon* sp.) were prepared. TBC in the product was below 100/g. The moisture content was 3-5%.
- ◆ The preparation of freeze dried prawn flavor extract was being standardized. The product was stored for

12 months in sealed brown glass bottles with slow loss of carotene level.

- ◆ Insect infestation of *Necrobis rufipes* was observed in Bombay duck samples while *Dermestes* sp. beetles were observed in Ribbonfish samples.

Report of work done

Pathogens in fish

Quality of fresh fish was monitored from Vashi retail market and Vashi creek. A total of 69 fresh fish samples were analyzed for organoleptic and bacterial quality. Microbiological analysis included TBC, *E. coli*, fecal Streptococci, Coagulase⁺ Staphylococci, *V. cholera*, *V. parahaemolyticus*, *Salmonella* and *Listeria*. TBC of more than 10×10^5 was observed in 17 samples. Lowest TBC of 2700/g was in Silver mullet while it was highest i.e., 4,40,000 in catfish. *E. coli* was present in 54 samples. Thirty seven samples had counts more than 20 per gram. Fecal Streptococci was noticed in 61 samples and in one sample counts were more than 100 per gram. Sulphite reducing *Clostridia* was analyzed by MPN method and was present in 64 samples analyzed. Coagulase⁺ Staphylococci was present in 64 samples but only two samples had counts more than 100 per gram. Pathogens *V. parahaemolyticus*, *V. cholera*, *Salmonella* and *Listeria* were absent in all samples of fresh fish analyzed. Nine samples of creek water were analyzed and counts were more than 100 in all the samples.

Histamine in fish and fishery products

For monitoring 76 freshwater, marine and brackish water fish samples were collected from landing centres,

local markets and Vashi creek. Histamine level in the muscle of Pink perch (*Nemipterus japonicus*), Squid, Indian Salmon (*Polynemus* sp.), Seer (*Scomberomorus commersonii*) and Sole (*Cynoglossus* sp.) from local markets was above 5 mg%. The same in very fresh juveniles of Grey mullet (*Mugil cephalus*) from Vashi creek was 3.5-5 mg%. Histamine level in the muscle of freshwater Rohu (*Labeo rohita*) and Catla (*Catla catla*) was below 2 mg%. Histamine level in the muscle of freshwater fish was highest i.e., 4.33 mg% in freshwater Eel (*M. pancalus*). Histamine level in the muscle of one sample of Seer fish was 22.66 mg%.

Histamine forming bacteria was present in all species under study and the highest number (40/g at 30°C and 20/g at 15°C) was noticed in small Mullet among creek samples. The count was highest i.e., 30/g at 37°C in freshwater Eel among freshwater samples. Among marine fish samples, the highest count was noticed in Squid 60/g at 37°C and 40/g at 15°C.

Toxic metals in fish and fishery products

Seventy four fresh fish samples from landing centers, local markets and creeks were collected for monitoring the presence of toxic metals. Cadmium content in the muscle of all samples was below 0.03 ppm except in one Squid sample where its value was 0.093 ppm. The muscle of Black Pomfret (*Parastromateus argentus*), Sole (*Cynoglossus* sp.), Striped Catfish (*Pangasianodon hypophthalmus*) and Mackerel (*Rastrelliger kanagurta*) contained comparatively higher quantity of Cadmium.

Lead content in the muscle of freshwater fish samples was highest i.e., 1.023-1.029 ppm in freshwater Eel (*M. pancalus*) and freshwater Shark (*Wallago attu*). Grey mullet from Thane creek had Lead content of 0.552 ppm in its muscle. Squid meat contained 0.919 ppm Lead which was highest among marine fish samples. The presence of 3-10 times toxic metals was noticed in the gut of the samples. Copper, Nickel, Chromium and Zinc content in muscle of all the samples were also estimated. Lead content in creek water and sediment was 0.097-0.16 and

15.9-20.64 ppm respectively.

Products from penaeid prawn

Crispy golden brown ready to eat product from Jawala (*Acetus indicus*) was prepared. TBC in the product was below 100/g. The moisture content was below 5%. Ready to eat dried product from Jawala remains good and crispy during storage in desiccators for eight months. Moisture content in the products remained below 5%. It received good response from visitors and panel members.

Ready to eat dried product was prepared from Small kardi shrimp (*Palaemon* sp.) The product remained tasty and crispy during the storage of three months in desiccators at ambient temperature. Moisture content in the products was below 3%. It also received good response from visitors and panel members.

Flavor concentrate from prawn waste

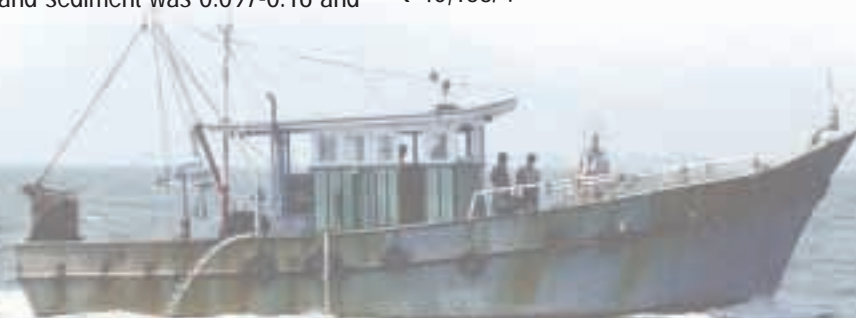
The preparation of freeze dried prawn flavor extract was being standardized. The products were stored in sealed brown glass bottles. Slow loss of carotene level was not noticed during the storage of 12 months; but slight change of flavor was noticed on long storage. Further studies are in progress.

Insect Infestation

Samples of dried fish *Harpodon nehereus* (Bombay duck), *Palaemon tenuipes* (Kardi) and *Trichiurus savala* (Ribbonfish) were analyzed for proximate composition and moisture was more than 20% in all three samples during October. Dried Ribbonfish samples were in poor quality. Insect infestation of *Necrobia rufipes* was observed in Bombay duck sample while *Dermestes* sp. beetles were observed in Ribbonfish samples. The quality of dried products was found to be deteriorating during storage due to insect activity. The samples were discarded after six months storage.

Analytical services to the industry

During the year under report a total of 24 samples were analyzed from fish processing industry as follows: Fish microbiology – 4, Cephalopods -3, Crustaceans – 11, Water – 3 and Ice – 3. The total revenue earned was ₹ 40,153/-.





GENERAL INFORMATION (1 April, 2010 to 31 March, 2011)

Training Programmes Conducted

Sl. No.	Subject	No. of beneficiaries	Venue and date
1.	Effect of lime on common bacteria of public health significance on drying of <i>Crassostrea madrasensis</i> and <i>Perna viridis</i>	1	Cochin 1 March – 2 May 2010
2.	Biochemical analysis of fish and fish products	3	Cochin 5-17 April 2010
3.	HACCP concepts	1	Cochin 6-9 April 2010
4.	Laboratory techniques for microbiological examination of seafoods	6 technologists	Visakhapatnam 12-27 April 2010
5.	Preparation of pickles	1 entrepreneur	Visakhapatnam 15 April 2010
6.	Laboratory techniques for microbiological examination of seafoods	3	Cochin 19 April – 20 May 2010
7.	A comparative study of frozen fish balls coated with conventional and extruded bread crumbs	1	Cochin 19 April – 30 June 2010
8.	Changes in quality parameters of frozen tuna burger packed in thermoformed poly propylene containers	1	Cochin 19 April – 30 June 2010
9.	Effect of high temperature short term processing on quality aspects of prawn Manchurian in opaque retortable pouches	1	Cochin 19 April – 30 June 2010
10.	Development of ready-to-eat snack from prawn (<i>Fenneropenaeus indicus</i>) using extrusion technology	1	Cochin 19 April – 30 June 2010
11.	Studies on the quality changes of tuna sausages in synthetic (Polyamide) casings during chilled and frozen storage	1	Cochin 19 April – 30 June 2010
12.	Shelf life studies of ready-to-eat and ready-to-fry dried condiment-incorporated anchovies (<i>Stolyphorus indicus</i>) in different packaging material	1	Cochin 19 April – 30 June 2010
13.	HACCP concepts	31	Cochin 21-24 April 2010

Indicates Outstation Training Programmes

Sl. No.	Subject	No. of beneficiaries	Venue and date
14.	Deployment of foldable traps for Tandava reservoir	30 fishermen	Salika Mallavaram, Tandava 25 April 2010
15.	Utilization of shellfish processing waste and its analytical methods	1	Cochin 26 April – 7 May 2010
16.	Value addition of freshwater fishes and the business horizons	30	College of Fisheries, GADVASU, Ludhiana 29-30 April 2010
17.	Methodology in relation to outreach activity-3 – Sampling and proximate analysis of fish	3	Cochin 1-15 May 2010
18.	Laboratory techniques for microbiological examination of seafoods	2	Cochin 3-15 May 2010
19.	Laboratory techniques in Microbial Biotechnology	2	Cochin 3-31 May 2010
20.	Analytical techniques in instrumentation such as HPLC, IC and LCMSMS	2	Cochin 3 May – 5 August 2010
21.	Application of HPLC, IC and LCMSMS in quality evaluation	1	Cochin 5 May – 28 June 2010
22.	Evaluation of handling practices of fish onboard and at harbour	1	Cochin 10 May – 10 June 2010
23.	HACCP concepts	20	Cochin 12-15 May 2010
24.	Laboratory techniques for microbiological examination of seafoods	1	Cochin 17 May – 2 June 2010
25.	Alterations in fatty acid profile of mackerel lipids (<i>Rastrelliger kanagurta</i>) on exposure to different temperature conditions	1	Cochin 17 May – 18 July 2010
26.	Nutritional loss in prawns	1	Cochin 17 May – 18 July 2010
27.	Personal hygiene in seafood processing	29	Moothakunnam, Ernakulam 21 May 2010
28.	Seafood quality assurance	17	Cochin 24 May – 5 June 2010
29.	Fish processing technology	7	Cochin 30 May – 10 July 2010
30.	Analytical methods and instrumentation training for assessing fish quality	1	Cochin 2 June – 9 July 2010
31.	Laboratory methods for the microbiological quality of seafoods	1	Cochin 7-19 June 2010



Sl. No.	Subject	No. of beneficiaries	Venue and date
32.	Preliminary phytochemical evaluation of two seaweeds from the Mandapam coast using modern analytical techniques	1	Cochin 7-26 June 2010
33.	Hygienic handling of fish and usage of insulated bags	6 membebrs from SHGs	Visakhapatnam 14-15 June 2010
34.	Utilization of shellfish processing waste and its analytical methods	1	Cochin 14-26 June 2010
35.	Microbial examination of seafoods	1 student	Visakhapatnam 14-27 June 2010
36.	Isolation of peptide from Lizard fish by HPLC method	1	Cochin 14 June – 17 July 2010
37.	Biochemical and nutritional composition of Indian mud crab	1	Cochin 14 June – 17 July 2010
38.	Changes in nutritional quality of meat of <i>Lutjanus bohar</i> during different cooking methods	1	Cochin 14 June – 17 July 2010
39.	Fish processing and value addition	25	Kanjikkuzhi, Alappuzha 24-26 June 2010
40.	Prevalence and characterization of hydrolytic bacteria in edible oyster (<i>Crassostrea madrasensis</i>)	1	Cochin 28 June – 28 July 2010
41.	Incidence and characterization of hydrolytic bacteria in <i>Fenneropenaeus indicus</i>	1	Cochin 28 June – 28 July 2010
42.	Occurrence and characterization of proteolytic and amyolytic bacteria from finfish and shellfish	1	Cochin 28 June – 28 July 2010
43.	Occurrence and characterization of lipolytic bacteria from finfish and shellfish	1	Cochin 28 June – 28 July 2010
44.	HACCP concepts	37	Cochin 6-9 July 2010
45.	Laboratory techniques for microbiological examination of seafoods	5	Cochin 16 July – 6 August 2010
46.	Food safety management system as per ISO 22000: 2005	1	Cochin 19-23 July 2010
47.	Modern analytical techniques in Biochemistry	5	Cochin 19-31 July 2010
48.	Solar drying techniques and operation of solar dryers	10	Cochin 20-24 July 2010
49.	Laboratory techniques in microbiological examination of seafoods	1	Cochin 26 July – 6 August 2010
50.	General laboratory practices	9	Cochin 27-30 July 2010

Sl. No.	Subject	No. of beneficiaries	Venue and date
51.	Fish value addition for empowerment of fisherfolk	20 members from Coastal Women Self Help Group	Calicut 28-29 July 2010
52.	Preservation of dried fish	35 fisherwomen	Cheppala Uppada, Visakhapatnam 30 July 2010
53.	Fish processing and Microbiology	1 student	Visakhapatnam 31 July – 31 August 2010
54.	Fish processing technology	13	Cochin 2-11 August 2010
55.	Seafood quality assurance	17	Cochin 2-13 August 2010
56.	Seafood quality assurance	3	Mumbai 2-23 August 2010
57.	Quality evaluation of fish and fishery products	2	Cochin 4 August – 4 September 2010
58.	Fish processing technology and value added fishery products	3	Cochin 4 August – 4 September 2010
59.	Use of potential fishing zone advisories along Gujarat coast	100 fishermen	Vanakbara fishing harbour, Diu 10 August 2010
60.	Introduction of steel trawlers in Gujarat coast	26 boat owners	Vanakbara fishing harbour, Diu 11 August 2010
61.	Preparation of value added fish products from marine and shellfish by scientific and hygienic method	7 fisherwomen	Visakhapatnam 10-11 August 2010
62.	Field experience training for M. F. Sc. students of CIFE, Mumbai	5	Cochin 16-17 August 2010
63.	Production and analysis of fish oil and fish meal	1	Cochin 16-21 August 2010
64.	Hygienic preparation of dried, salted fish products	1 entrepreneur	Visakhapatnam 18-19 August 2010
65.	Quality assurance in fishery products	19 technologists	Veraval 16-30 August 2010
66.	Modern analytical techniques in Biochemistry	16	Cochin 13-25 September 2010
67.	Hygiene and sanitation in fish markets	30	Panavally, Alappuzha 15 September 2010
68.	Net mending	25	Azheekkal, Kollam 16 September 2010



Sl. No.	Subject	No. of beneficiaries	Venue and date
69.	Laboratory techniques for microbiological examination of seafoods	2	Cochin 20 September – 5 October 2010
70.	HACCP concepts	43	Cochin 22-25 September 2010
71.	Microbiology in prawns	2 research scholars	Visakhapatnam 20-26 September 2010
72.	Fish processing technology	3 PG students	Veraval 20-30- September 2010
73.	Use of potential fishing zone advisories along Gujarat coast	50 fishermen of Koli Samaj	Bhidia, Veraval 7 October 2010
74.	Location specific livelihood interventions in fisheries sector for the empowerment of fisherwomen of Kerala	25 fisherwomen	Moothakunnam, Ernakulam 8 October 2010
75.	Hygienic fish handling and preparation of value added fish products	15 officials from Sri Lanka	Cochin 11-16 October 2010
76.	Seafood quality assurance	20	Cochin 12 October 2010
77.	Gill netting using PA multifilament nets	18	Ganga lake, Arunachal Pradesh 18-20 October 2010
78.	Laboratory techniques for microbiological examination of seafoods	12 technologists	Visakhapatnam 18 October – 2 November 2010
79.	Food safety, processing and quality assurance	15	Cochin 19-28 October 2010
80.	Value added products from fish	5	Cochin 25-26 October 2010
81.	Isolation and identification of bacteria of public health significance from fish	18	Cochin 1-6 November 2010
82.	General laboratory practices	20 officials of Dairy Development Department, Govt. of Kerala	Cochin 9-12 November 2010
83.	Value chain oriented fishery micro enterprises through women	20 fisherwomen	Kollam 11-12 November 2010
84.	HACCP concepts	25	Cochin 16-20 November 2010
85.	Hygienic fish processing and fish handling	30 fisherwomen	Visakhapatnam 25 November 2010

Sl. No.	Subject	No. of beneficiaries	Venue and date
86.	Development of value added fish products	25	Kannur 1-2 December 2010
87.	Value chain oriented fishery micro enterprises through women	22 fisherwomen	Kannur 2-3 December
88.	HACCP concepts	27	Cochin 7-10 December 2010
89.	Fermentation of marine bacteria for production of industrial enzymes	2	Cochin 9 December 2010 - 10 January 2011
90.	Molecular characterization of <i>Paenibacillus</i> spp.	1	Cochin 9 December 2010 - 10 February 2011
91.	Fish processing and value addition	18	Cochin 13-18 December 2010
92.	Characterization of Bhavani and Cauvery river waters to monitor the level of pollution and its impact on nutrient value of <i>Labeo rohita</i> (Rohu)	1	Cochin 13 December 2010 - 13 March 2011
93.	Studies on biochemical constituents of Mrigal from polluted waters of rivers Bhavani and Cauvery	1	Cochin 13 December 2010 - 13 March 2011
94.	Seafood based micro enterprises for fisherwomen empowerment	18 fisherwomen	Azheekkal, Kollam 15 December 2010
95.	Prawn processing techniques and value added products from prawn meat	8	Cochin 18 December 2010
96.	Hygienic handling of fish and value added fish products	30 fisherwomen	Ramballi village, Visakhapatnam 18 December 2010
97.	Molecular methods for characterization of seafood borne pathogens	1	Cochin 20 December 2010 - 19 January 2011
98.	Development of value added fish products	30	KVK, Vriddhachalam, Tamil Nadu 22-23 December 2010
99.	Thermal processing of seafoods	20 officials from Maldives	Maldives 23-30 December 2010
100.	Food safety and quality assurance	6	Cochin 27-28 December 2010
101.	Post harvest technology and value addition of freshwater fish	30	Baramati, Maharashtra 27-31 December 2010



Sl. No.	Subject	No. of beneficiaries	Venue and date
102.	Development of pet food from tuna canning waste	1	Cochin 3 January - 3 February 2011
103.	Development of canned fish (Lizard fish) in oil in TFS cans	1	Cochin 3 January - 3 February 2011
104.	Development of canned fish (Lizard fish) in its own body fluid	1	Cochin 3 January - 3 February 2011
105.	Seafood quality assurance	4	Cochin 10-22 January 2011
106.	Molecular methods for characterization of seafood borne pathogens	1	Cochin 10 January - 9 March 2011
107.	Detection and molecular characterization of <i>Vibrio cholerae</i> in seafood	1	Cochin 10 January - 9 March 2011
108.	Freshness and quality in seafood	25	Moothakunnam, Ernakulam 14 January 2011
109.	Fish processing technology and value addition in fish	7	Cochin 14-18 January 2011
110.	Changes in the biochemical constituents of green mussel during thermal processing in brine in TFS cans	1	Cochin 15 January -11 March 2011
111.	Changes in the nutritive value of squid during <i>Sous vide</i> process	1	Cochin 15 January -11 March 2011
112.	Comparative study on the spoilage rate in the squid and the fin fish pearl spot during ice storage	1	Cochin 15 January -11 March 2011
113.	Nutritional changes in the muscle of the oceanic squid during blanching	1	Cochin 15 January -11 March 2011
114.	Study of nutritional changes in Indian white prawn during two methods of heat processing viz., blanching and microwaving	1	Cochin 15 January -11 March 2011
115.	Comparative account on the kinetics of ATP degradation in Catla and Mullet on ice storage for quality determination	1	Cochin 15 January - 18 March 2011
116.	Studies on the biochemical and functional properties of fresh squid	1	Cochin 15 January - 18 March 2011
117.	Value chain oriented fishery micro enterprises through women	20	Chulliyar, Palakkad 18-19 January 2011
118.	Comparative studies on enumeration of <i>V. parahaemolyticus</i> in fish	1	Cochin 20 January - 28 February 2011

Sl. No.	Subject	No. of beneficiaries	Venue and date
119.	Isolation and identification of bacteria of public health significance viz., <i>E. coli</i> , faecal Streptococci, <i>S. urens</i> and <i>Salmonella</i> from fish	1	Cochin 20 January – 28 February 2011
120.	Prevalence of potentially pathogenic halophilic Vibrios in fish	1	Cochin 20 January – 28 February 2011
121.	Detection of antibacterial substances in fish and fishery products by bacteriological methods	1	Cochin 20 January – 28 February 2011
122.	Recent advances in fish processing and quality assurance	19	Cochin 21-24 January 2011
123.	Post harvest practices, hygienic handling and value added products	8	Cochin 24 January 2011
124.	Post harvest practices, hygienic handling and value added products	16 fisherwomen	Visakhapatnam 24 January 2011
125.	Value addition in freshwater fish	30	Karnal, Haryana 4-13 February 2011
126.	HACCP concepts	37	Cochin 7-11 February 2011
127.	Molecular methods for characterization of seafood borne pathogens	5	Cochin 9-10 February 2011
128.	Molecular diagnostics and fingerprinting of <i>Salmonella</i> and pathogenic Vibrios associated with seafood and aquatic environment	17	Cochin 14-16 February 2011
129.	Hygienic handling of fish in fish market	48 fish women vendors	Nehru Bazar, Visakhapatnam 18 February 2011
130.	Post harvest technology of fish	25	Thiruvizha, Alappuzha 22-23 February 2011
131.	Value added products	30 women entrepreneurs	KVK, Karaikal 22-23 February 2011
132.	Responsible fishing practices	100 mechanized trawl owners	SIFT, Kakinada 23 February 2011
133.	Value added products	30 women entrepreneurs	KVK, Nagapattinam 24-25 February 2011
134.	Health benefits of fish, hygienic handling of post harvest fish and exposure to value added fish products	100 fisherwomen	Repalle, A.P. 3 March 2011
135.	Studies on the biochemical alterations in the nutrient profile of Black Bream (<i>Acanthapagous butchui</i>)	1	Cochin 3 March - 21 April 2011



Sl. No.	Subject	No. of beneficiaries	Venue and date
136.	Electrophoretic separation of proteins using SDS-PAGE and quantitative analysis of amino acids using HPLC in <i>Johnius dussumieri</i>	1	Cochin 3 March - 21 April 2011
137.	Study on the nutrient properties of Milk fish (<i>Chanos chanos</i>) collected from Arabian sea	1	Cochin 3 March - 21 April 2011
138.	Biochemical studies on the amino acid composition, fatty acid profile and mineral status of Sharp tooth snapper (<i>Pristipomoides filamentosus</i>) caught off Indian West Coast	1	Cochin 3 March - 21 April 2011
139.	Evaluation of freshness and quality of Gar fish (<i>Xenentodon cancila</i>) using K-value and its amino acid profile	1	Cochin 3 March - 21 April 2011
140.	Tuna processing and value addition	20	Kavarathi, Lakshadweep 4 March 2011
141.	Health benefits of fish, hygienic handling of post harvest fish and exposure to value added fish products	15	Kothapalem, A.P. 4 March, 2011
142.	Hygienic production of salt cured fish and preparation of value added fish products	110 fishers and 60 fisherwomen	Nizampatnam, A.P. 9 March 2011
143.	Hygiene at fish landing centres/fishing harbours, utilization of low cost fish and conservation measures in relation to marine resources especially endangered species	6 executives from NGOs and hygiene inspectors	Visakhapatnam 9 March 2011
144.	Depuration system for oysters	16	Moothakunnam, Ernakulam 11 March 2011
145.	Microbiological examination of seafood	12 technologists	Visakhapatnam 14-18 March 2011
146.	Value chain oriented fishery micro enterprises through women	24 fisherwomen	Kannur 18-19 March 2011
147.	Seafood quality assurance	20	Cochin 21 March - 2 April 2011
148.	Post harvest practices, hygienic handling and value added products	6	Visakhapatnam 25 March 2011



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Handing over framed gill net to fisherman (Thandava)



Fish processing technology (Cochin)



Quality assurance in fishery products - Participants and faculty (Veraval)



HACCP concepts (Cochin)



Fish processing and value addition (Cochin)



Laboratory methods for microbiological examination of seafood - Participants and faculty (Visakhapatnam)





Hygienic fish processing and fish handling - Participants and faculty (Visakhapatnam)



General laboratory practices (Cochin)



HACCP concepts (Cochin)



Post harvest technology and value addition of freshwater fish - Inauguration (Baramati)



Value added fish products (Chulliyar)



Preparation of value added products (Visakhapatnam)





Dr. Leela Edwin handing over meat mincer to the fisherwomen (Visakhapatnam)



Inauguration of training on Value added products (Karaikal)



Fisherwomen salting fish (Thiruvizha)



Dr. G. Rajeswari delivering lecture (Kakinada)



Dr. M.M. Prasad addressing the participants (Nizampatnam)



Participants of the training programme on "Molecular diagnostics and finger printing" (Cochin)





Technologies Assessed and Transferred

- ◆ Designs 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 LOA, 20 m LOA and fuel efficient vessel of 18 m LOA
- ◆ Design of Aluminum craft for inshore waters and FRP pole and line fishing vessels for Lakshadweep
- ◆ Substitution of wooden boats by FRP canoes and treated rubber wood canoes for use in backwaters and near-shore waters
- ◆ Dual preservative treatment for low valued species of timbers for boat construction
- ◆ Painting schedules for Aluminum-Magnesium alloy and FRP sheathing for under-water hulls of fishing vessels
- ◆ 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
- ◆ Bycatch reduction devices such as square mesh codend and fish eye for reducing catch of 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 and solar dryer with LPG/electrical back-up
- ◆ Designs of deep fat fryer and cutlet moulding machine
- ◆ Fuel efficient propeller for fishing vessels and other fuel saving devices such as propeller nozzle
- ◆ Stainless steel tilting kettle for processing plants
- ◆ Oil fryer for battered and breaded products
- ◆ Meat bone separator for removal of bones including pin bones from Rohu
- ◆ 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 of different types of fish and shellfish
- ◆ An improved method for production of dried prawns
- ◆ Methods for production of quality dried fish products with attractive appearance and long storage life
- ◆ Hygienic drying of anchovies
- ◆ Method for economic utilization of low grade fish and conversion of fish wastes into useful byproducts
- ◆ Methods for production of value added products such as wafers, pickles and soup powder from fish/shellfish
- ◆ Ready-to-use isinglass from fish maws
- ◆ 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



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- ◆ Method for extraction of shark fin rays and processing shark cartilage
- ◆ High gel strength agar from seaweeds
- ◆ Method for isolation of squalene from shark liver oil for use in cosmetics
- ◆ Improved packaging materials for transportation and storage of fish
- ◆ Production of retort pouch packed fish products
- ◆ Specific requirements in setting up fish processing plants
- ◆ Cleaning schedules for fish processing establishments and boat decks and preparation of deodorant and antiseptic ointment
- ◆ 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
- ◆ Design of energy efficient treatment plant for effluent water from processing plants
- ◆ 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
- ◆ Method for preparation of n-3 poly unsaturated fatty acid (PUFA) concentrates from fish oils
- ◆ An 18h depuration method to eradicate pathogenic bacteria and grit from bivalves, especially clams and mussels
- ◆ 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.
- ◆ Device for drawing uniform samples from frozen fish blocks for microbiological evaluation
- ◆ Polymerase Chain Reaction (PCR) technique for detection of white spot disease syndrome in farmed shrimp

Outreach Programmes Conducted

Outreach training programmes

During the period (April 2010 to March 2011) about 36 training/awareness programmes on various aspects of harvest and post harvest technologies were conducted outside the Institute as indicated in screen in the Chapter on 'Training programmes conducted'.

Exhibitions

The Institute participated in the following exhibitions during the period:

- ◆ Exhibition on 'Technologies available on value addition of agricultural, horticultural, livestock, poultry and fisheries products' organized by ATMA, Namakkal at KVK, Namakkal on 17 April, 2010.
- ◆ 'Indian Aqua-Invest Congress and Expo 2010', organized by the Indian Fisheries Association and CIFE, Mumbai during 26-28 May, 2010.
- ◆ 'The Seafood Fest' – Exhibition organized by CIFT at Moothakunnam, Ernakulam district on 17 June, 2010



Exhibition at Namakkal





'Indian Aqua-Invest Congress and Expo 2010'

- ◆ 'Indian Fish Festival 2010' organized by National Fisheries Development Board, Hyderabad during 9-12 July, 2010. The distinguished visitors to the CIFT stall included Prof. K.V. Thomas, Hon'ble MOS for Agriculture, Food and Public Distribution, GOI, Shri G. Parthasarathy, Hon'ble MOF, Govt. of Andhra Pradesh, Shri N. Raguveera Reddy, Hon'ble MOA, Govt. of Andhra Pradesh and Shri Malladi Srinivas, Minister from Pondicherry. The CIFT pavilion bagged the second prize for best display under Governmental Institutions category.



Dr. B. Meenakumari, DDG (Fy.) visits CIFT stall at Hyderabad

- ◆ All India Livestock and Pet Show and Food Festival at Thiruvananthapuram during 23-26 July, 2010.
- ◆ Exhibition held as part of National symposium on Recent trends in algal biotechnology at Mar Athanasios College for Advanced Studies at Tiruvalla during 3-5 August, 2010
- ◆ Exhibition held in connection with the National seminar



Dr. M.M. Prasad, SIC, Visakhapatnam receiving best display award from Shri Parthasarathy, Hon'ble MOF, Govt. of A.P. at Indian Fish Festival

on Diversification of aquaculture through locally available indigenous fish species and Golden Jubilee Celebrations of Kolkata Research Center of CIFE during 27-28 August, 2010.



CIFT stall at CIFE exhibition

- ◆ 'Kalpakam – 2010'- Technology exposure campaign and exhibition held at CPCRI Regional Station, Kayangulam during 1-4 September, 2010.
- ◆ 14th National exhibition on 'Striving towards a glorious India' organized by Central Calcutta Science and Culture Organization for Youth at Kolkata during 5-7 September, 2010. The visitors to the CIFT pavilion included Shri Saugata Roy, Hon'ble Union Minister for Urban Development, Govt. of India.
- ◆ National Fish Festival and Exhibition, 'Benaqua – 2010', organized by Dept. of Fisheries, West Bengal at Kolkatta during 1-4 October, 2010. The dignitaries

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Shri Saugata Roy, Hon'ble Union Minister for Urban Development, Govt. of India visits CIFT stall at Kolkata

who visited the CIFT pavilion included Shri Kiranmoy Nanda, Hon'ble Minister for Fisheries, Govt. of West Bengal and Dr. P. Krishnaiah, Chief Executive, NFDB, Hyderabad.



'Benaqua - 2010'

- ◆ 'Agri Fair 2010' organized as part of the International conference on Coconut biodiversity for prosperity, CPCRI, Kasaragod during 25-28 October, 2010. The CIFT pavilion bagged the best stall award during the exhibition.
- ◆ 'Pondicherry Fish Festival 2010' held in connection with 'World Fisheries Day' organized jointly by the Govt. of Pondicherry, Department of Fisheries & Fishermen Welfare and NFDB, Hyderabad at Yanam, Pondicherry during 20-22 November, 2010
- ◆ 'Swasrayabharat-2010', Cochin during 15-20 December, 2010.
- ◆ 21st All India Congress of Zoology Exhibition at CIFRI,

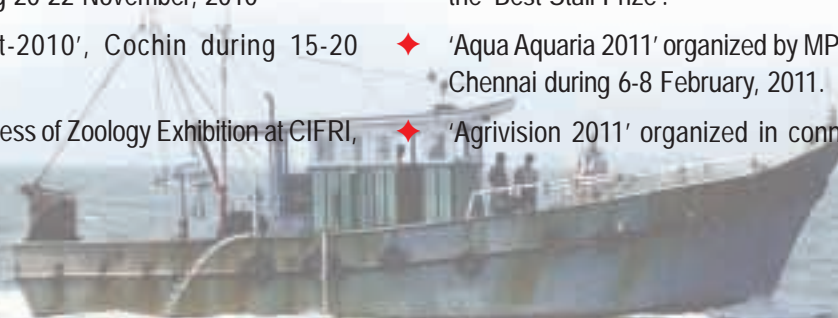
Barrackpore during 21-23 December, 2010.

- ◆ 'Matsyagandha Mumbai 2010 - Maha Fish Festival India' Exhibition organized by NFDB, Hyderabad at Mumbai during 26-28 December, 2010.



'Matsyagandha Mumbai 2010'

- ◆ 'Haritham - 10' Exhibition organized by IRTC, Palakkad at Thrissur during 26-31 December, 2010.
- ◆ Exhibition held in connection with the Public Information Campaign organized by PIB, Govt. of Kerala at Njarakkal during 9-11 January, 2011.
- ◆ Exhibition held in connection with Asian Pacific Aquaculture - 2011 at Cochin during 17-20 January, 2011.
- ◆ Exhibition held in connection with Workshop on Packaging of fresh and processed fish and seafood at Hyderabad on 22 January, 2011.
- ◆ 'Karshika Sankethika Darsanam-2011', exhibition held at IISR, Kozhikode during 27-29 January, 2011
- ◆ 'Fifth Assam Matsya Mahotsava-2011' exhibition held at Guwahati, Assam during 27-29 January, 2011
- ◆ 'Technology Week' exhibition held at KVK, Amadalavalasa, Srikakulam district, A.P. during 27-31 January, 2011.
- ◆ Rural Technology Mela exhibition, NIRD, Hyderabad during 2-5 February, 2011. CIFT stall was awarded the 'Best Stall Prize'.
- ◆ 'Aqua Aquaria 2011' organized by MPEDA, Cochin at Chennai during 6-8 February, 2011.
- ◆ 'Agrivision 2011' organized in connection with Xth





'Fifth Assam Matsya Mahotsava-2011'

Agricultural Science Congress at NBFGR, Lucknow during 10-12 February, 2011.

- ◆ 'Matsya Mela 2011' organized by Department of Fisheries, Govt. of Karnataka and NFDB, Hyderabad at Bangalore during 18-21 February, 2011.
- ◆ 'Fish Festival 2011' organized by the Department of Fisheries, Govt. of Kerala at Thiruvananthapuram during 24-28 February, 2011.
- ◆ 'Tech Festival' organized by Ilahia College of Engineering and Technology at Muvattupuzha during 25-26 February, 2011.
- ◆ 'Krishi Darpan – 2011' programme organized under the NAIP on Mobilizing mass media support for sharing agro information at Cochin during 28-29 March, 2011.



'Krishi Darpan – 2011'

Replies to technical queries

Technical queries received from the various categories of clients such as fish processors, technologists,

entrepreneurs, Self Help Groups, Government organizations and fisher folk were attended to. The queries were related to the topics such as harvest and post harvest technology of fish, participation in training programmes and payment of fees, technical guidance, analytical testing services, assistance under technology transfer programmes etc.

Radio Talks

The following radio talks were given by the Scientists/ Officers of the Institute during the year:

- ◆ **Dr. G. Rajeswari**, Senior Scientist – Diversified fishing methods (In Telugu), AIR, Visakhapatnam (4 April, 2010)
- ◆ **Dr. B. Madhusudana Rao**, Scientist (SG) – Utilization of fish and shrimp processing waste (In Telugu), AIR, Visakhapatnam (18 April, 2010)
- ◆ **Dr. G. Rajeswari**, Senior Scientist – Preventive measures for fouling organisms in traditional fishing crafts (In Telugu), AIR, Visakhapatnam (25 July, 2010)
- ◆ **Dr. M.M. Prasad**, Principal Scientist – Value added fish products for economic empowerment of traditional fisherwomen (In Telugu), AIR, Visakhapatnam (1 August, 2010)
- ◆ **Dr. G. Rajeswari**, Senior Scientist – Traditional fishing crafts – Protection and treatment procedure against marine wood borers (In Telugu), AIR, Visakhapatnam (7 August, 2010)
- ◆ **Shri M.S. Kumar**, Tech. Officer (T7-8) – Responsible fishing methods – Code of conduct (In Telugu), AIR, Visakhapatnam (15 August, 2010)
- ◆ **Dr. G. Rajeswari**, Senior Scientist – Preventive measures of bycatch in trawling operations (In Telugu), AIR, Visakhapatnam (3 October, 2010)
- ◆ **Shri M.S. Kumar**, Tech. Officer (T7-8) – Status and progress in fishing technology (In Telugu), AIR, Visakhapatnam (14 November, 2010)
- ◆ **Dr. M.P. Remesan**, Senior Scientist – Our fishing methods (In Malayalam), AIR, Kannur (27 January, 2011)
- ◆ **Dr. B. Madhusudana Rao**, Scientist (SG) – Role of HACCP in assuring quality of meat food products, (In

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Telugu), AIR, Visakhapatnam (27 March, 2011)

- ♦ **Dr. L.N. Murthy**, Scientist, Senior Scale – Preparation of analogue products from Surimi (In Telugu), AIR, Visakhapatnam (31 March, 2011)

- ♦ **Shri M.S. Kumar**, Tech. Officer (T7-8) – Interesting facts about fish and technologies developed from prawn/fish shell waste and their uses (In Telugu), AIR, Visakhapatnam (31 March, 2011)

Agricultural Technology Information Centre

Arrangements were made for the visitors like students, technologists, officials and other stakeholders from the industry. Various priced publications and value added fishery products were sold through ATIC. Non-priced

publications were distributed to the interested visitors. Various technical queries received were answered. Analytical samples were received at ATIC and test reports were sent after analyses.

Awards and Recognitions

CIFT bagged the 'Rajarshi Tandon Award – 2009' for the best Official Language Implementation among the ICAR Institutes situated in the 'C' Region. CIFT got this award for the fifth time. The award was received by Dr. T.K. Srinivasa Gopal, Director and Dr. C. Jessy Joseph, DD (OL) jointly during the ICAR Foundation Day on 16 July, 2010 from Shri Sharad Pawar, the Honourable Union Minister for Agriculture, Food and Public Distribution.



Dr. Srinivasa Gopal and Dr. Jessy Joseph receiving Rajarshi Tandon Award from Shri Sharad Pawar

The 'Bioved Research Society' based at Allahabad has conferred the Honorary Fellowship Award to **Dr. T.K. Srinivasa Gopal**, Director, CIFT, Cochin. The award was conferred in recognition of his excellent contributions in the field of fish processing technology. The award was given away at the 13th Indian Agricultural Scientists and Farmers Congress jointly organized by CSIR, DRDO and NABARD at Allahabad University.

Dr. C.O. Mohan, Scientist, Fish Processing received the 'Jawaharlal Nehru Award' for outstanding Post Graduate Agricultural Research-2009 of ICAR, New Delhion 16 July 2010 for the Ph. D. thesis entitled "Shelf-life extension of seer fish (*Scomberomorus commerson*) steaks using O₂ scavenger and CO₂ emitters in chilled condition" under the guidance of Dr. C.N. Ravishankar, Principal Scientist, FP Division, CIFT, Cochin.

Shri Damodar Rout, Technical assistant (T4), won the second prize in the Town Official Language Committee's 'Hindi Debate competition' held at Visakhapatnam on 8 November, 2010.





Dr. Mohan receiving the award from Shri Sharad Pawar and Prof. K.V. Thomas

The research paper entitled, "Optimization of process parameters for the extraction of gelatin from the skin of freshwater carps by response surface methodology" by **Dr. George Ninan, Dr. A.A. Zynudheen, Dr. Jose Joseph, Dr. P.T. Mathew and Dr. V. Geethalakshmi** published in the Journal of Fishery Technology (Vol. 46(2), pp 123-138, 2010) won the best scientific paper award of Society of Fisheries Technologists (India).

The **CIFT Sports Contingent** consisting of 49 people participated in various sports and games events in the ICAR Inter Institutional Tournaments (South Zone) sports meet held at Bengaluru during 7-11 February, 2011. The CIFT team has won the following items: Carroms (Women) – First (Smt. K.K. Sumathy), Second (Smt. V.P. Vijayakumari), Shuttle Badminton (Doubles-Women) - First (Smt. V.P. Vijayakumari & Smt Tessy Francis), Chess (Women) – Second (Smt. Tessy Francis), Javelin Throw (Women) –



Shri Damodar Rout receiving the 'Hindi Debate Competition prize'

Second (Smt. V.P. Vijayakumari), Long Jump (Women) – Second (Smt. P. Jeyanthi), Sprint – 100 M (Women) – Third (Smt. P. Jeyanthi), Sprint – 200 M (Women) – Second (Smt. P. Jeyanthi) and Sprint – 100 M (Men) – Third (Shri P.G. David).



CIFT sports contingent team

Analytical Services

The Head Quarters and Research Centres of the Institute undertook testing of samples of different types of raw materials and products received from various organizations, State and Central Govt. Departments and entrepreneurs and issued reports on their quality. The samples tested included fresh and frozen fish and shell fish products, byproducts, prawn larvae from hatcheries, swabs from processing tables and worker's hands,

chemicals, salt, water, ice, packaging materials, etc. Type testing of marine diesel engines was also carried out and performance certificates were issued to the concerned manufactures in addition to calibration of mercury, alcohol and digital thermometers received from different fish processing plants and the industry. Samples were tested in the different laboratories of the Institute during the year.



Patents Obtained/Filed/Under Filing

Patents Obtained

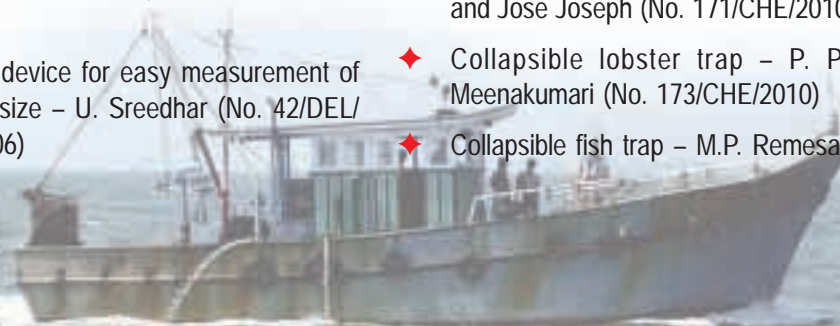
- ♦ Antifouling paints for ship bottom – A.G.G.K. Pillai, K. Ravindran and R. Balasubramanyam
- ♦ Production of absorbable surgical sutures from fish gut collagen – M.K. Mukundan, P.D. Antony and K. Devadasan

Applications filed at New Delhi Patent Office

- ♦ Shelf stable fish sausages in indigenous synthetic casings – C.N. Ravishankar, T.K. Srinivasa Gopal, K.G. Ramachandran Nair and K. Devadasan (No. 2581/DEL/2004 of 28-12-2004)
- ♦ Process for the production of high density bulk chitosan – K.G. Ramachandran Nair, George Ninan and P.T. Mathew (No. 2582/DEL/2004 of 28-12-2004)
- ♦ Fishing canoes from treated rubber wood – Leela Edwin, Saly N. Thomas and B. Meenakumari (No. 2583/DEL/2004 of 28-12-2004)
- ♦ Fibreglass sheathed rubber wood canoe – Leela Edwin and B. Meenakumari (No. 2584/DEL/2004 of 28-12-2004)
- ♦ Ready to serve pearlspot moilee in retortable pouches – T.K. Srinivasa Gopal, C.N. Ravishankar, K.G. Ramachandran Nair and K. Devadasan (No. 2585/DEL/2004 of 28-12-2004)
- ♦ A package of practice for improving the bacterial quality and food safety of farmed freshwater scampi (*Macrobrachium rosenbergii*) – K.V. Lalitha and P.K. Surendran (No. 3453/DEL/2005 of 23-12-2005)
- ♦ Production of edible fish powder from small bony fish by thermal processing using perforated aluminium trays – A.K. Chattopadhyay, B. Madhusudana Rao, S.S. Gupta and R. Chakrabarti (No. 3464/DEL/2005 of 23-12-2005)
- ♦ Mesh gauge – A device for easy measurement of fishing net mesh size – U. Sreedhar (No. 42/DEL/2006 of 04-01-2006)

Applications filed at Chennai Patent Office

- ♦ Carbon dioxide emitter for extending the shelf life of refrigerated fishery products – C.O. Mohan, C.N. Ravishankar and T.K. Srinivasa Gopal (No. 167/CHE/2010)
- ♦ Dual action active packaging system combining Carbon dioxide emitter and Oxygen scavenger for extending shelf life of refrigerated fish products – C.O. Mohan, C.N. Ravishankar and T.K. Srinivasa Gopal (No. 166/CHE/2010)
- ♦ Ready to serve Kerala style sardine curry in retortable pouches and a process for preparing the same – T.K. Srinivasa Gopal, C.N. Ravishankar and P.K. Vijayan (No. 168/CHE/2010)
- ♦ Ready to serve Punjabi style catla curry in retortable pouches and a process for preparing the same – C.N. Ravishankar, T.K. Srinivasa Gopal and P.K. Vijayan (No. 178/CHE/2010)
- ♦ Ready to serve Manipur style rohu curry in retortable pouches and a process for preparing the same – C.N. Ravishankar and T.K. Srinivasa Gopal (No. 169/CHE/2010)
- ♦ Ready to serve Mughali style rohu curry in retortable pouches and a process for preparing the same – T.K. Srinivasa Gopal and C.N. Ravishankar (No. 170/CHE/2010)
- ♦ Ready to drink calcium fortified shrimp soup in reportable pouches and a process for preparing the same – S. Kuberappa, C.N. Ravishankar, T.K. Srinivasa Gopal and Jose Joseph (No. 172/CHE/2010)
- ♦ Ready to drink iron fortified shrimp soup in retortable pouches and a process for preparing the same – S. Kuberappa, C.N. Ravishankar, T.K. Srinivasa Gopal and Jose Joseph (No. 171/CHE/2010)
- ♦ Collapsible lobster trap – P. Pravin and B. Meenakumari (No. 173/CHE/2010)
- ♦ Collapsible fish trap – M.P. Remesan, P. Pravin, P.





George Mathai and B. Meenakumari (No. 174/CHE/2010)

- ◆ Method of extracting *Eichhornia crassipes* root extract exhibiting analgesic, anti pyretic, anti ulcer, anti-inflammatory and wound healing effects for treatment of diseases – Suseela Mathew, K. Ashok Kumar, R. Anandan, P.G. Viswanathan Nair, K. Devadasan, K.K. Asha, T.V. Sankar and Sanitha (No. 176/CHE/2010)
- ◆ Ready to serve Goan style mackerel curry in retortable pouches and a process for preparing the same – C.N. Ravishankar, T.K. Srinivasa Gopal and J. Bindu (No. 177/CHE/2010)
- ◆ Ready to eat mussel meat in retortable pouches and a process for preparing the same for packaging – J. Bindu, T.K. Srinivasa Gopal and C.N. Ravishankar (No. 175/CHE/2010)

Applications ready for filing

- ◆ Extraction of Squalene from shark liver oil – T.K. Thankappan
- ◆ Collagen-chitosan – An absorbable GTR (Guided Tissue Regeneration) membrane – M.K. Mukundan, Suseela Mathew and T.V. Sankar
- ◆ Rapid test kit for identification of white spot disease and stress in shrimps – Suseela Mathew, K. Ashok Kumar, R. Anandan, P.G. Viswanathan Nair and K. Devadasan
- ◆ Fish enriched noodles using thermally processed whole meat or fish powder – A.K. Chattopadhyay, B. Madhusudana Rao and D.I. Khasim
- ◆ A low cost easy method for extraction of

carotenoprotein from tropical shrimp waste – R. Chakrabarti

- ◆ A process for the production of high purity Glucosamine hydrochloride from shrimp shell waste – K.G. Ramachandran Nair, K.A. Martin Xavier and K. Devadasan
- ◆ Cerium oxide and Titanium oxide incorporated aluminium metal matrix composites – P. Muhamed Ashraf and S.M.A. Shibli

Trade Marks

Trade Mark applications were filed for two products named, 'Fifers' and 'Maricream'. The Trade Mark for ready-to-eat fish wafer 'Fifers' was granted under registration No. 1946892 in Class 29 for 'Wafers made of fish and prawns, snacks, snacks foods made of marine products; snacks and savouries; fish crisps and chips; quick eats, ready-to-mix and ready-to-eat fish foods, products made from meat, fish, prawns; preserved, dried, cooked, canned and frozen fish and nbsp; prawns; fried fish, prawn and marine products; fish and nbsp; prawn pickles, sauces, soup, soup mixes, seafood and seafood products.

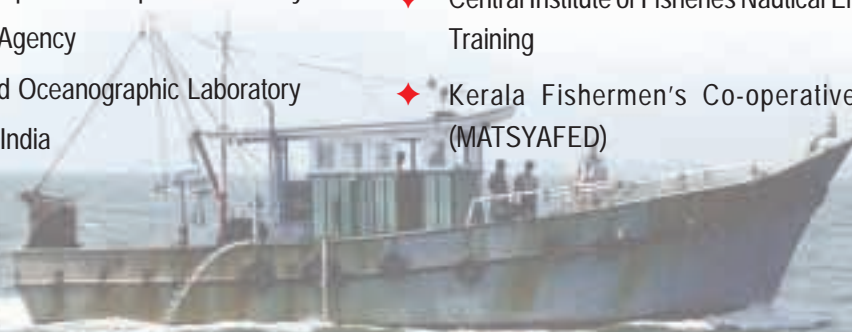


Interaction and Linkages

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
- ◆ Kerala Fishermen's Co-operative Federation (MATSYAFED)



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- ◆ National Institute of Fisheries Post Harvest Technology and Training

- ◆ Kerala State Pollution Control Board

Ministries, Departments, National Institutes and Agricultural Universities

- ◆ Kerala Agricultural University
- ◆ Ministry of Agriculture
- ◆ Ministry of Food Processing Industries
- ◆ Department of Ocean Development
- ◆ Department of Biotechnology
- ◆ Department of Science and Technology
- ◆ Department 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 Administration
- ◆ Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram
- ◆ College of Fisheries, Mangalore

International Institutions

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

Extension and Development Agencies

- ◆ Central Social Welfare Board

- ◆ Kannur District SC/ST Women Industrial Fish Products Manufacturing Co-operative Society Ltd.

- ◆ South Indian Federation of Fishermen Societies (SIFFS), Thiruvananthapuram

- ◆ Amala Mahila Samajam, Puthuvypu, Cochin

- ◆ AFPRD, Hyderabad

- ◆ Kanyakumari District Fishermen Sangam's Federation

- ◆ Madonna Rural Development Society, Kumarakom

- ◆ Centre for Research and Training in Poverty Alleviation and Women Welfare (CRATPAW), Cochin

- ◆ Bharat Sevak Samaj, Thiruvananthapuram

- ◆ Small Industries Development Bank of India (SIDBI)

- ◆ Matsya Mahila Vedi, Chellanam

- ◆ Alleppey Diocesan Charitable and Social Welfare Society, Alappuzha

- ◆ Vanitha Matsya Thozilali Bank, Neendakara

- ◆ Kerala Industrial and Technical Consultancy Organisation (KITCO)

- ◆ Avani Agro Society, North Paravur, Ernakulam

- ◆ Common Facility Service Centre, Changanacherry

- ◆ Kerala State Women's Development Corporation Ltd., Thiruvananthapuram

- ◆ Chellanam Panchayat SC/ST Co-operative Society Ltd., Cochin

- ◆ Fishermen Youth Welfare Association, Gangavaram P.O., A.P.

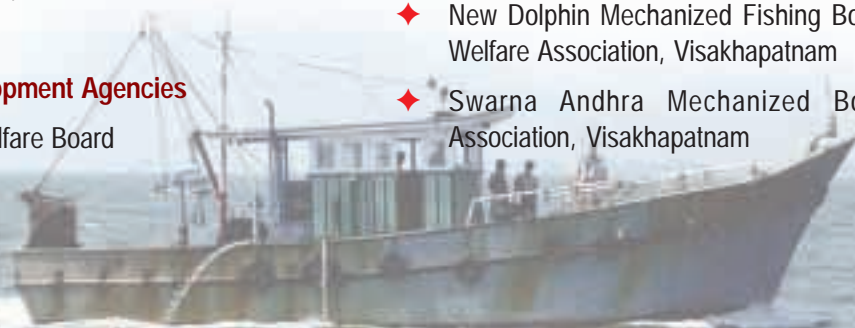
- ◆ Development Action through Self Help Network (DARSHN)

- ◆ Agency for Development of Aquaculture in Kerala (ADAK)

- ◆ Kudumbasree Community Development Society, Pallipuram

- ◆ New Dolphin Mechanized Fishing Boat Operators Welfare Association, Visakhapatnam

- ◆ Swarna Andhra Mechanized Boat Owners Association, Visakhapatnam





- ◆ A.P. Mechanized Boat Operators Association, Visakhapatnam
- ◆ Pattuvam Inland Fishermen Co-operative Society, Kannur
- ◆ Chellanam-Kandakadavu Fishermen Development and Welfare Co-operative Society, Cochin
- ◆ Karnataka Fisheries Development Corporation, Bangaluru
- ◆ Triptisagar Society for Fishermen Ltd., Jafarabad, Gujarat
- ◆ Gandhi Smaraka Seva Kendram, Alappuzha
- ◆ Kottappuram Integrated Development Society (KIDS), Kodungalloor
- ◆ MS Swaminathan Research Foundation, Chennai

Technical Guidance/Consultancy

Technical guidance/consultancy on various topics related to the fisheries industry were offered to interested entrepreneurs as shown below:

1. Consultancy for designing and setting up of milk testing laboratory for Kerala State Dairy Development Board.
2. Consultancy for design and construction of 250 lpd Effluent Treatment Plant for MS Swaminathan Research Foundation at Poompuhar, Tamil Nadu.
3. Consultancy for HACCP implementation in Sperm Station of Kerala State Livestock Development Board at Dhoni, Palakkad district, Mattupetti, Idukki district and Kulathupuzha, Kollam district.
4. Consultancy for NABL accreditation for State Laboratory of Marine, Agriculture and Livestock Products (SLMAP), Maradu, Ernakulam district.
5. Consultancy to National Fisheries Development Board, Hyderabad by providing design and estimate for modern hygienic fish markets at various states.
6. Consultancy to M/s Sulthan Fish Farm, Karnal, Haryana to design and construct a freshwater fish processing unit at Nilokheri, Karnal.
7. Consultancy for Society for Advancement of Fisheries, Govt. of Kerala to establish a value added fish production unit under the activity group, Swapna Activity Group, Kurankadavu, Payyannoor of Kerala.
8. Consultancy to Fisheries Regional Shrimp Hatchery, Azhikode to set up a PCR laboratory.
9. Consultancy to Haritha Farmers Club, Perumpalam, Cochin for a diagnostic study of the collection and processing of clam in Perumpalam Grama Panchayath of Thycattussery Block of Alappuzha district under the NABARD Cluster Development Programme.
10. Consultancy with M/s Britto Dry Seafoods, Tuticorin, Tamil Nadu for setting up two numbers of Solar dryer with LPG back-up (CIFT Dryer SDL-50 SM) for hygienic production of dry fish.

Committees

Grievance Cell

Chairman: The Director, CIFT

Members

1. Dr. T.V. Sankar, HOD, QAM
2. Shri Charles Ekka, Senior Administrative Officer
3. Shri C.J. Stephan, Finance and Accounts Officer
4. Dr. T.K. Thankappan, Principal Scientist
5. Shri P.T. Viswambharan, T-II-3
6. Shri P. Mani, UDC
7. Shri M.T. Mani, Cook

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8. Shri V. Deepak Vin, SSS

Nominated Member Secretary

Shri A. George Joseph, Asst. Admn. Officer, CIFT

Research Advisory Committee

Chairman

Dr. K. Devadasan, former Director, CIFT, Flat No. 7, Kalika Apartments, Cheruparampathu 2nd Cross Road, Kadavanthra, Cochin – 682 020

Members

1. Dr. A.K. Upadhyay, Prof. & Head, Fish Processing Technology Department, College of Fisheries, G.B. Pant University of Agriculture and Technology, Pant Nagar, Dist. Udham Singh Nagar, Uttarakhand – 263 145
2. Dr. C. Hridayanathan, former Director, School of Industrial Fisheries, CUSAT, Cochin, Suhas, 29/1069, Janatha Road, Vyttila, Cochin – 682 019
3. Dr. V. Venugopal, former Scientific Officer, BARC, Mumbai, B602, Skyline Villa, Opposite ITI Main Gate, Navabharath Compound, Powai, Mumbai – 400 076
4. Dr. (Mrs.) Indrani Karunasagar, College of Fisheries, Mangalore
5. Dr. C.K. Mukherjee, Indian Institute of Technology, Kharagpur, West Bengal
6. Dr. Madan Mohan, Asst. Director General (Marine Fisheries), ICAR, Krishi Anusandhan Bhavan, Pusa, New Delhi – 110 012
7. Dr. T.K. Srinivasa Gopal, Director, CIFT

Member Secretary

Dr. P. Pravin, Senior Scientist, CIFT

Management Committee

Chairman: Dr. T.K. Srinivasa Gopal, Director, CIFT

Members

1. Joint Director of Fisheries (Govt. of Kerala), Central Zone (Ernakulam), Near High Court, Cochin – 682 018
2. Director of Fisheries, Govt. of Andhra Pradesh

3. Dean, Faculty of Fisheries, Kerala Agricultural University

4. Shri A.D. Gadre, M/s Gadre Marine Exports Pvt. Ltd., Mirkarwada, Ratnagiri, Maharashtra – 415 612

5. Shri Kinattinkara Rajan, Laxmi Narayana, XIVth Mile Road, Melur P.O., Qualandy Via, Kozhikode dist.

6. Dr. M.R. Boopendranath, Principal Scientist, CIFT

7. Dr. N.G.K. Pillai, Former HOD, PED, CMFRI, Cochin – 682 018

8. Assistant Director General (M. Fy.), ICAR, Krishi Anusandhan Bhavan II, Pusa, New Delhi - 110 012

9. Senior Finance & Accounts Officer, CPCRI, Kasaragod

Member Secretary

Senior Administrative Officer, CIFT

Institute Joint Staff Council

Chairman: Dr. T.K. Srinivas Gopal, Director, CIFT

Members (Official Side)

1. Dr. S. Balasubramaniam, HOD, EIS
2. Shri P.K. Vijayan, Acting HOD, FP
3. Dr. Saly N. Thomas, Senior Scientist
4. Dr. K. Ashok Kumar, Senior Scientist
5. Shri C.J. Stephan, F&AO

Secretary (Official Side)

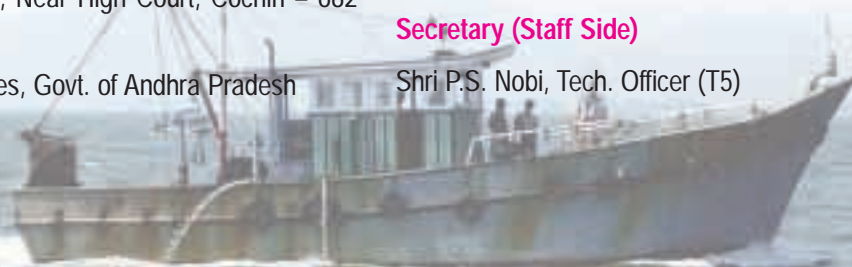
Shri Charles Ekka, SAO

Members (Staff Side)

1. Shri V.T. Sadanandan, T-I-3
2. Shri K. Das, Asst.
3. Shri K.B. Sabukuttan, Asst.
4. Shri C.D. Parameswaran, SSS
5. Shri K.R. Rajasaravanan, SSS

Secretary (Staff Side)

Shri P.S. Nobi, Tech. Officer (T5)





Participation in Training Programmes

Sl. No.	Name(s) of participant(s)	Training attended	Venue and Date
1.	Dr. A.R.S. Menon	Right to Information Act	IMG Regional Centre, Cochin 24 April 2010
2.	Shri K.J. Francis Xavier	Radar ARP Stimulator course	Indian Maritime College, Chennai 10-15 May 2010
3.	Shri Nithin Singh	Technology short listing and managing business incubator	ICRISAT, Hyderabad 13-15 May 2010
4.	Dr. V. Geethalakshmi	Strengthening statistical computing for NARS	UAS, Bangalore 21-22 June 2010
5.	Dr. S. Sanjeev Dr. S.K. Panda	Food safety management system as per IS/ISO 22000	BIS, Cochin 23-25 June 2010
6.	Dr. M.M. Prasad	Policy and prioritization, monitoring and evaluation (PME) support to consortia-based research in agriculture	NAARM, Hyderabad 1-6 July 2010
7.	Shri V. Chandrasekar	Technology forecasting methodologies	IASRI, New Delhi 13-17 July 2010
8.	Shri P.P. Anil Kumar	Internal auditing for effective management control	IC&WAI, Madurai 10-13 August 2010
9.	Dr. S.K. Panda Dr. V. Ronda	Metrology, pressure, thermal and electro technical measurement and calibration	FCRI, Palakkad 19-20 August 2010
10.	Dr. U. Sreedhar	Public private partnership for innovation in agriculture	IIM, Lucknow 27-28 August 2010
11.	Dr. George Ninan (As resource person)	Entrepreneurship development programme	DIC, Alappuzha 23 September 2010
12.	Shri Thomas Teles	Radar Observer Stimulator and Automated Radar Plotting Aid course	M/s Eurotech Maritime Academy, Cochin 5-20 October 2010
13.	Dr. A.R.S. Menon	Project Information and Management System (PIMS-ICAR)	NAARM, Hyderabad 25 October 2010

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Sl. No.	Name(s) of participant(s)	Training attended	Venue and Date
14.	Dr. V. Ronda	HPLC and GC: Operational, preventive and corrective measures	CFTRI, Mysore 25-29 October 2010
15.	Dr. Saly N. Thomas (As resource person)	Sea cage farming	CMFRI, Vizhinjam 27 October 2010
16.	Dr. George Ninan (As resource person)	Sea cage farming	CMFRI, Vizhinjam 1 November 2010
17.	Dr. S. Vishnu Vinayagam Dr. V. Murugadas	Current trends in microbial biotechnology: Genomics, diversity and gene mapping	CIFT, Cochin 9-29 November 2010
18.	Shri V.R. Madhu	Satellite data processing and enumeration of zooplankton for developing abandon models	SAC, Ahmedabad 15-19 November 2010
19.	Smt. P. Viji (As resource person)	Entrepreneurship development programme	DIC, Kollam 16 November 2010
20.	Shri K.J. Francis Xavier	Upgradation and revalidation course for Masters and Deck Officers	HIMT, Chennai 22 November – 2 December 2010
21.	Dr. L.N. Murthy Dr. C.O. Mohan	Nutraceuticals: Challenges and opportunities in 21st century	UAS, Bangalore 29 November – 19 December 2010
22.	Smt. Pushpalatha Viswambharan	Administrative vigilance	ISTM, New Delhi 6-10 December 2010
23.	Dr. J. Charles Jeeva	Information communication technologies mediated agricultural extension: Basics to advances	BHU, Varanasi 15 December 2010 – 5 January, 2011
24.	Shri Charles Ekka	Stress management	ISTM, New Delhi 20-24 December 2010
25.	Dr. K. Ashok Kumar Dr. Femeena Hassan (As resource persons)	HACCP – ISO 22000 FSMS	Cochin 28-30 December
26.	Dr. T.V. Sankar	Local auditors course on FSMS (IS/ISO-22000)	NITS, Noida 3-7 January 2011
27.	Shri T. Viswanathan Smt. V.K. Raji	Behavioral skills	ISTM, New Delhi 3-7 January 2011
28.	Dr. Toms C. Joseph	Statistical and computational genomics data analysis	IARI, New Delhi 11-21 January 2011
29.	Dr. J. Bindu (As resource person) Dr. S.K. Panda	Microbiological quality issues in bivalve molluscan farming	CMFRI Regional Centre, Calicut 15 January 2011



Sl. No.	Name(s) of participant(s)	Training attended	Venue and Date
30.	Smt. D.A.L. Satyanarayanamma Shri K.V. Mathai	Training course for Personal Assistants (Refreshers)	ISTM, New Delhi 24 January – 4 February 2011
31.	Dr. Nikita Gopal (As resource person)	Training programme on Free Trade Agreement for Officials of Department of Fisheries, Govt. of Kerala	IMG, Thiruvananthapuram 28 January 2011
32.	Dr. C.N. Ravishankar (As resource person)	Technology clinic on Agro food processing	DIC, Thiruvalla 5 February 2011
33.	Dr. S.K. Panda	Molecular diagnostics and finger printing of <i>Salmonella</i> and pathogenic Vibrios associated with seafood and aquatic environments	CIFT, Cochin 14-27 February 2011
34.	Shri V. Chandrasekar	Institutional change for inclusive agricultural growth	IASRI, New Delhi 15 February – 7 March 2011
35.	Dr. Femeena Hassan	Laboratory quality system and internal audit as per ISO/IEC-17025	BIS, Mumbai 15-18 February 2011
36.	Smt. P. Viji	Advanced analytical techniques for aquatic environment	CIFE, Mumbai 24 February – 16 March 2011
37.	Dr. M.P. Remesan Dr. George Ninan	Leadership for innovation in agriculture	IIM, Lucknow 21-25 February 2011
38.	Dr. V. Murugadas	Molecular methods for characterization, conservation and utilization of biodiversity	CCMB, Hyderabad 26 February - 15 March 2011
39.	Dr. L.N. Murthy (As resource person)	Technologies for fish preservation and development of value added fish products from low priced fish	College of Fishery Sciences, Muthukur 28 February 2011
40.	Shri V.R. Madhu	Data analysis using SAS	CTCRI, Thiruvananthapuram 3-9 March 2011
41.	Dr. P.T. Lakshmanan (As resource person)	Advanced analytical techniques for aquatic environment	CIFE, Mumbai 4 March 2011
42.	Dr. George Ninan Shri P. Vineeth Kumar	Business incubator operations, management and technology transfer	ICRISAT, Hyderabad 8-10 March 2011
43.	Smt. S. Tanuja (As resource person)	Agro food clinic	DIC, Kannur 16 March 2011

Sl. No.	Name(s) of participant(s)	Training attended	Venue and Date
44.	Dr. A.R.S. Menon	Improving transparency and accountability through effective implementation of the Right to Information Act – 2005	ISTM, New Delhi 18 March 2011
45.	Dr. K. Ashok Kumar Dr. P. Pravin	National Knowledge Network	Delhi University, Delhi 25 March 2011

Visits Abroad

Dr. C.N. Ravishankar, Principal Scientist, Fish Processing was deputed to visit the Agrivalue Processing Business Incubator Facility at Ledue, Edmonton, Canada to familiarize with the Business Incubation and Management Techniques during 21-26 March, 2011. The Agrivalue Processing Business Incubator (APBI) is a multi-tenant facility providing the infrastructure and services to support and enhance the establishment and growth of new companies and new business ventures in Alberta. The APBI is a federally registered establishment enabling resident companies to market their products nationally and internationally. A key component of this initiative is to provide opportunity to a range of services like business planning, cost accounting, legal advice, marketing, distribution, quality assurance and other related services to Incubator clients in a shared environment.

In order to understand more about establishment, operation and maintenance of business incubators, visit to various organizations like Food Processing Development Centre, Applied Research and Technology Development Centre, Tec Edmonton, Edmonton Research Park, Sobey's Super Store, Agri-Food Discovery Place, University of Alberta, Aliyas Foods, Agriculture and Rural Development, Govt. of Alberta, etc. was undertaken. Discussions were held with Mr. Robert Gibson, Senior Operations Manager, Food Processing Division, ARD, Mr. Grant Winton, Trade

Development Officer, Int'l Rel'n & Marketing Branch, ARD, Mr. Ken Gossen, Executive Director, ARD, Mr. Ron Lyons, Commercialization Manager, APBI, Mr. Bob Rimes, Agri-Food Discovery Place, University of Alberta, Mr. Neil Kaarsemaker, Manager, Edmonton Research Park, Mr. Joe Dermo, Manager, Agricultural Financial Service Corporation and Mr. Hugh Wyatt, Manager, Tec Edmonton.



Dr. Ravishankar with Mr. Robert Gibson, Senior Operations Manager, APBI

Dr. C.N. Ravishankar also visited Maldives during the period 23-30 December, 2010 to impart training on Thermal processing of seafoods to officials from MFDA, Govt. of Maldives.





Participation in Symposia/ Seminars/Workshops etc.

Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
1.	Shri P.K. Vijayan	PRMC meeting of DST, New Delhi project on Value addition of low value marine pelagic fishes	Tharangambadi, Tamil Nadu 6-7 April
2.	Dr. B. Meenakumari Dr. T.V. Sankar Shri M. Nasser	Special meeting of the ZTM & BPD Units	ICAR, New Delhi 8 April 2010
3.	Dr. K.V. Lalitha Dr. Toms C. Joseph	Seminar on Flow cytometry application in marine biotechnology	NIO, Goa 8 April 2010
4.	Dr. B. Meenakumari Dr. T.K. Srinivasa Gopal Shri M. Nasser	2 nd Annual Workshop for the Component – 2 Sub project of NAIP	TNAU, Coimbatore 16 April 2010
5.	Dr. J. Charles Jeeva	Exhibition-cum-conference on Technologies available on value addition of agricultural, horticultural, livestock, poultry and fisheries products	KVK, Namakkal 17 April 2010
6.	Dr. Saly N. Thomas	Meeting of the technical committee for supply of propylene rope to the fishermen of Kolleru lake in Andhra Pradesh	Hyderabad 20 April 2010
7.	Dr. B. Meenakumari	Expert consultation on marine biotechnology and biodiversity conservation	Goa 21 April 2010
8.	Dr. Femeena Hassan	Kerala Science Congress – Women scientists meet	Thiruvananthapuram 21 April 2010
9.	Dr. C.O. Mohan	Workshop on Combating environment degradation and climate change – A roadmap for Gujarat	Ahmedabad 22 April 2010
10.	Dr. J. Bindu	World Bank midterm review meeting of NAIP	CMFRI, Cochin 23 April 2010

Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
11.	Dr. M.P. Remesan	Workshop on Development of Kannur Parliament Constituency	Kannur 26 April 2010
12.	Dr. P. Muhamed Ashraf Shri V.R. Madhu	Workshop on Logical framework analysis	Andhra University, Visakhapatnam 27 April 2010
13.	Dr. P. Muhamed Ashraf	Annual review meeting of the INCOIS SATCORE project, 'In situ time series measurements of bio-optical parameters off Cochin coast'	Andhra University, Visakhapatnam 28 April 2010
14.	Shri V.R. Madhu	Review committee meeting of INCOIS project, 'Validation of PFZ along Gujarat coast	Andhra University, Visakhapatnam 28 April 2010
15.	Shri M.V. Baiju	Meeting of the tender committee for purchase of sea safety kits for Department of Fisheries, Govt. of Kerala	Thiruvananthapuram 30 April 2010
16.	Dr. T.K. Srinivasa Gopal Dr. P.N. Joshi	Brain storming meeting on Post harvest technology and value addition of agricultural produce: Scenario, issues and strategy	CIPHET, Ludhiana 1-2 May 2010
17.	Dr. M.M. Prasad	Fisheries stake-holders meeting	NFDB, Hyderabad 5 May 2010
18.	Dr. B. Meenakumari Dr. K. Ashok Kumar	NFDB Meeting on Project implementation and annual action plan 2010-11	ICAR, New Delhi 6 May 2010
19.	Dr. M.M. Prasad Dr. G. Rajeswari Dr. U. Sreedhar Dr. L.N. Murthy	National inception workshop of the FAO-GEF sponsored project of Bay of Bengal large marine ecosystems of Fisheries Survey of India	Visakhapatnam 6-7 May 2010
20.	Dr. J. Bindu	Annual workshop of the Component 4 of the NAIP sub project on "Studies on high pressure processing of high value perishable commodities"	CIAE, Bhopal 11-12 May 2010
21.	Dr. B. Meenakumari	ICAR Regional Committee No. VIII meeting and KVK interaction	Bangalore 13-15 May 2010
22.	Dr. B. Meenakumari	NAIP-PIU Agricultural Technology Innovation meeting	ICAR, New Delhi 21 May 2010



Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
23.	Dr. B. Meenakumari	Workshop on Aquatic biodiversity	NBFGR, Lucknow 22 May 2010
24.	Dr. Leela Edwin Dr. T.V. Sankar Shri M. Nasser Dr. C.N. Ravishankar Dr. Nikita Gopal Dr. S. Ashaletha Dr. Toms C. Joseph	Review meeting on NAIP projects by World Bank experts	CMFRI, Cochin 22-23 May 2010
25.	Dr. K.V. Lalitha	National consultation on Agro-biodiversity management	ICAR, New Delhi 26-27 May 2010
26.	Dr. T.K. Srinivasa Gopal	Symposium on Diversification of aquaculture and policy framework for fisheries and aquaculture sector in India	CIFE, Mumbai 27-28 May 2010
27.	Dr. M.M. Prasad	Interface meeting with Member of Planning Commission	NAARM, Hyderabad 31 May 2010
28.	Dr. T.K. Srinivasa Gopal	Central Technology Management Committee Meeting	ICAR, New Delhi 2 June 2010
29.	Dr. T.K. Srinivasa Gopal	7 th Foundation Day of NAAS, Delhi	New Delhi 4 June 2010
30.	Dr. T.K. Srinivasa Gopal	Annual GB meeting of NAAS, Delhi	New Delhi 5 June 2010
31.	Dr. V. Geethalakshmi	Meeting to discuss the report on Estimation of quantitative harvest and post harvest losses of major agricultural produces in India	ICAR, New Delhi 6 June 2010
32.	Dr. S.K. Panda	School of the sea	Cochin 7-8 June 2010
33.	Dr. T.K. Srinivasa Gopal	Meeting of the Shadow Committee of Codex on fish and fishery products	New Delhi 13-14 June 2010
34.	Dr. Leela Edwin Dr. R. Badonia Shri V.R. Madhu	National seminar on New avenues for fisheries and aquaculture development in Gujarat	Ahmedabad 14 June 2010
35.	Shri M.V. Baiju	Meeting of the subsidy committee for construction of insulated fish hold in fishing vessels	MPEDA, Cochin 15 June 2010

Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
36.	Dr. S. Sanjeev	Workshop on Coastal development and local bodies	Mararikulam, Alappuzha 17 June 2010
37.	Shri M.V. Baiju	Meeting of the tender committee for purchase of sea safety kits for Department of Fisheries, Govt. of Kerala	Thiruvananthapuram 19 June 2010
38.	Dr. T.K. Srinivasa Gopal	16 th Meeting of Food and Agriculture Division Council	BIS, New Delhi 21 June 2010
39.	Dr. Saly N. Thomas	Meeting of the technical committee for purchase of net making machines for the proposed net factory of Matsyafed	Kannur 29 June 2010
40.	Shri M.V. Baiju	Meeting of the committee to purchase sea safety kits for the Department of Fisheries, Govt. of Kerala	Cochin 29 June 2010
41.	Dr. J. Charles Jeeva	National workshop on ATICs (ATIC Interface – 2010)	ICAR, New Delhi 3 July 2010
42.	Dr. C.N. Ravishankar	Monitoring and evaluation workshop of NAIP	NAARM, Hyderabad 5-6 July 2010
43.	Dr. P. Pravin Shri M.V. Baiju	NAIP-OTFLS meeting	CMFRI, Cochin 12 July 2010
44.	Shri P.K. Vijayan	Meeting organized by Department of Industries and Commerce, Govt. of Kerala to showcase the agro-based technologies of the various organizations and Institutes in Kerala to prospective entrepreneurs, businessmen etc.	Thiruvananthapuram 13 July 2010
45.	Dr. T.K. Srinivasa Gopal Dr. Leela Edwin Dr. C.N. Ravishankar	Zonal Technology Management Committee-Business Process Development Unit Meeting	ICAR, New Delhi 14 July 2010
46.	Dr. P. Pravin	Consultancy meeting on mother vessel for UT of Lakshadweep	Cochin 14 July 2010
47.	Shri M.V. Baiju	Expert committee meeting regarding the subsidy for conversion of fishing vessels to tuna long liners and construction of insulated fish hold	MPEDA, Cochin 15 July 2010
48.	Dr. T.K. Srinivasa Gopal	ICAR Directors Meeting and Foundation Day celebrations of ICAR	ICAR, New Delhi 15-16 July 2010



Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
49.	Dr. Nikita Gopal	Capacity building workshop on WTO and trade issues	New Delhi 20-22 July 2010
50.	Dr. K.V. Lalitha	India food seminar	Bangalore 25-26 July 2010
51.	Dr. S. Ashaletha	Meeting under the NAIP Mobilizing mass media support for sharing agro-information	KAU, Thrissur 26 July 2010
52.	Dr. Toms C. Joseph	Interactive session on Biotechnology research in the ICAR	ICAR, New Delhi 26-27 July 2010
53.	Dr. T.K. Srinivasa Gopal Dr. Leela Edwin Dr. T.V. Sankar Dr. C.N. Ravishankar	ICAR Industry meet and meeting of ZTM & BPD Unit	ICAR, New Delhi 28-29 July 2010
54.	Dr. V. Geethalakshmi Dr. S. Ashaletha	Workshop on Use of potential fishing zones along Gujarat coast	Diu 10 August 2010
55.	Dr. M.R. Boopendranath	Seminar on Recent advances in fisheries research	College of Fisheries, Panangad 11 August 2010
56.	Dr. M.R. Boopendranath Smt. T. Silaja	Seminar on HP knowledge management solutions	Cochin 13 August 2010
57.	Dr. M.R. Boopendranath	Fourth meeting of the Vessel Management Committee – FORV Sagar Sampada	CMLRE, Cochin 17-18 August 2010
58.	Dr. T.K. Srinivasa Gopal Dr. L.N. Murthy	National seminar on Diversification of aquaculture through locally available fish species	CIFE Kolkata Centre, Kolkata 27-28 August 2010
59.	Dr. Leela Edwin Dr. Nikita Gopal	Preparatory workshop on work in fishing sector convention (C-188)	Cochin 31 August – 1 September 2010
60.	Dr. T.K. Srinivasa Gopal Dr. S. Sanjeev Dr. K. Ashok Kumar	Workshop on hygienic management of fishing harbours and fish landing centres	Cochin 2-3 September 2010
61.	Dr. K. Ashok Kumar	Meeting convened by NFDB to review the progress achieved in modernization/ construction of wholesale and retail fish markets	Hyderabad 4 September 2010

Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
62.	Dr. A.R.S. Menon Shri R. Anil Kumar Smt. Pushpalatha Viswambharan Shri K.B. Sabukuttan	Workshop on Right to Information Act	Cochin 4 September 2010
63.	Dr. T.V. Sankar Dr. C.N. Ravishankar Dr. K. Ashok Kumar Dr. Suseela Mathew Dr. A.A. Zynudheen Dr. George Ninan	Workshop on Antibiotic, pesticide and insecticide residue contamination in sea/aqua foods	VRC of CIFT, Veraval 6 September 2010
64.	Dr. C.N. Ravishankar	NAIP meeting	ICAR, New Delhi 10-11 September 2010
65.	Dr. P. Muhamed Ashraf	Review meeting of the research proposal submitted for the 5 th Southern Ocean (Antarctica) Expedition 2011	NCAOR, Goa 16 September 2010
66.	Dr. T.K. Srinivasa Gopal	3 rd Agricultural Leadership Summit and Leadership Awards – 2010	New Delhi 29-30 September 2010
67.	Dr. P. Pravin	National consultation on Biodiversity of high altitude aquatic resources, conservation and utilization	DCFR, Bhimtal 29-30 September 2010
68.	Dr. T.K. Srinivasa Gopal Dr. K. Ashok Kumar Dr. U. Sreedhar	Ben Aqua – 2010	CIFE Reg. Centre, Kolkatta 1-4 October
69.	Shri M.V. Baiju	Meeting of the Port State Control	MMD, Cochin 4 October 2010
70.	Dr. C.N. Ravishankar	Workshop on Performance review of NAIP projects	NDRI, Karnal 5 October 2010
71.	Dr. K. Ashok Kumar Dr. S.K. Panda	ISO/TC meeting on preparation of draft standards for traceability in shellfish including crustaceans and molluscs	NIPHATT, Cochin 8 October 2010
72.	Dr. K. Ashok Kumar Dr. S.K. Panda	ISO/TC meeting on preparation of draft standards for traceability in shellfish including crustaceans and molluscs	NIPHATT, Cochin 14 October 2010



Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
73.	Dr. B. Madhusudana Rao	Meeting of policy makers, administrators, technical experts, progressing entrepreneurs and farmers on the status of Pangasius fish farming in Andhra Pradesh	NFDB, Hyderabad 14 October 2010
74.	Dr. R. Badonia	XII Meeting of ICAR Regional Committee No. VI	RAU, Bikaner 21-22 October 2010
75.	Dr. V. Geethalakshmi Smt. P. Jeyanthi	International conference on Climate change and environment	CUSAT, Cochin 24-26 October 2010
76.	Dr. K. Ashok Kumar Dr. S.K. Panda	ISO/TC meeting on preparation of draft standards for traceability in shellfish including crustaceans and molluscs	NIPHATT, Cochin 28 October 2010
77.	Dr. T.K. Srinivasa Gopal	International conference on Greening food processing sector for sustainable, safe food supply	IICPT, Thanjavur 30 October 2010
78.	Dr. K. Ashok Kumar Dr. S.K. Panda	ISO/TC meeting on preparation of draft standards for traceability in shellfish including crustaceans and molluscs	NIPHATT, Cochin 31 October 2010
79.	Dr. K. Ashok Kumar Dr. S.K. Panda	ISO/TC meeting on preparation of draft standards for traceability in shellfish including crustaceans and molluscs	NIPHATT, Cochin 5 November 2010
80.	Shri P.K. Vijayan	Brainstorming workshop on Central-State technology partnership	KSCS&T, Thiruvananthapuram 6 November 2010
81.	Dr. T.K. Thankappan	20 th Swadeshi Science Congress	CMFRI, Cochin 6-8 November 2010
82.	Dr. M.P. Remesan	FIMSUL Project overview, orientation and methodology development workshop on fisheries management system	Chennai 9-10 November 2010
83.	Dr. Leela Edwin Dr. C.N. Ravishankar	Horticulture industry meet	Bangalore 11-12 November 2010
84.	Dr. R. Raghu Prakash	Workshop on Fishermen awareness and use of TED	Dia, Odisha 14-15 November 2010

Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
85.	Dr. Leela Edwin	First meeting of the Task force for Gap analysis of ILO Convention No. 1882	New Delhi 18 November 2010
86.	Dr. P. Pravin	Meeting regarding organizing training programmes to Coast Guard Officers	FSI, Mumbai 18 November 2010
87.	Dr. Nikita Gopal	Conference on Value chains of agricultural commodities and their role in food security and poverty alleviation	NAARM, Hyderabad 18-20 November 2010
88.	Dr. P. Muhamed Ashraf	Nanotech India 2010 Conference	Cochin 19-21 November 2010
89.	Dr. R. Chakrabarti	Seminar on Enhancing food safety, security and international trade through radiation technology	Mumbai 20 November 2010
90.	Dr. K. Ashok Kumar Dr. S.K. Panda	ISO/TC meeting on preparation of draft standards for traceability in shellfish including crustaceans and molluscs	NIPHATT, Cochin 20 November 2010
91.	Dr. P.N. Joshi	Meeting to discuss the proposal submitted to NRDC, New Delhi on establishment of solar fish drying plants	NFDB, Hyderabad 24 November 2010
92.	Dr. Leela Edwin	39 th Institute Management Committee Meeting	CIFRI, Barrackpore 29 November 2010
93.	Smt. K.K. Asha	Demonstration workshop on Software package for nutrient profile data compilation and clinico-epidemiological survey	CIFRI, Barrackpore 29-30 November 2010
94.	Dr. A.R.S. Menon	Inter Media Publicity Coordination Committee Meeting	Thiruvananthapuram 30 November 2010
95.	Dr. T.K. Srinivasa Gopal	National seminar on Inclusive growth of food processing industries	Mangalore 2 December 2010
96.	Dr. Suseela Mathew (As resource person)	Seminar on Biofuels	Mangalore 2 December 2010
97.	Shri M.V. Baiju	Meeting for finalizing the specification of Training-cum-Rescue boat	Cochin 2 December 2010
98.	Dr. R. Chakrabarti	21 st Meeting of ICAR Regional Committee No. VII	CIAE, Bhopal 2-4 December 2010



Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
99.	Dr. T.V. Sankar	Institute Management Committee Meeting	CIFRI, Barrackpore 6 December 2010
100.	Shri P.K. Vijayan Dr. M.R. Boopendranath Dr. M.P. Remesan Dr. A.A. Zynudheen Dr. George Ninan Shri P.K. Mahato Shri T. Jose Fernandez Shri K. Pradeep Shri Renju Revi	Symposium on Indian ocean marine living resources	Cochin 6-7 December 2010
101.	Dr. P. Pravin	Network meeting for sustainable development of aquaculture in NER	Guwahati 6-7 December 2010
102.	Dr. A.R.S. Menon	11 th International conference on Public communication of science and technology on the theme Science communication without frontiers	New Delhi 6-9 December 2010
103.	Dr. P. Pravin	Network meeting for Sustainable development of aquaculture in NER	Cochin 8 December 2010
104.	Smt. K.A. Anju Dr. Elizabeth Carolin Shri Rakesh T. Kurien	Workshop on Managing intellectual property rights in collaborative R&D and marketing of products	Bangalore 10-11 December 2010
105.	Dr. S. Balasubramaniam	National symposium on Extension management reforms: Initiatives and impact	TNAU, Coimbatore 11-12 December 2010
106.	Shri P.K. Vijayan	Interaction meeting on Post harvest technology and value addition	New Delhi 13 December 2010
107.	Dr. M.M. Prasad	Interface meeting on Review of implementation of NFDB funded schemes draft action plan for 2011-12 seed action plan	NFDB, Hyderabad 15-16 December 2010
108.	Shri M.V. Baiju	Meeting of the Committee to finalize the design of a new vessel	CMFRI, Cochin 17 December 2010
109.	Shri Nithin Singh	Evaluation, valuation and business development of technologies	TNAU, Coimbatore 19-24 December 2010

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Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
110.	Dr. Santhosh Alex	South and West Regional Official Language Conference	Visakhapatnam 21 December 2010
111.	Shri Manoj Kumar	National conference on National priorities in agricultural statistics and informatics	IASRI, New Delhi 23-24 December 2010
112.	Dr. Santhosh Alex	Town Official Language Committee meeting	Visakhapatnam 28 December 2010
113.	Dr. P.T. Lakshmanan Dr. Leela Edwin Dr. K.V. Lalitha Dr. T.V. Sankar Dr. S. Balasubramaniam Dr. P.N. Joshi Dr. M.R. Boopendranath Dr. T.K. Thankappan Dr. S. Sanjeev Dr. P. Pravin Dr. Suseela Mathew Dr. M.P. Remesan Dr. V. Geethalakshmi Dr. K. Ashok Kumar Dr. A.A. Zynudheen Dr. S. Ashaletha Dr. J. Bindu Dr. P. Muhamed Ashraf Shri V. Radhakrishnan Nair Shri V.R. Madhu Smt. K.K. Asha Dr. S.K. Panda Shri V. Chandrasekar Shri A.K. Jha Shri Manoj Kumar Smt. Arathy Ashok Dr. P.K. Binsi Smt. S. Tanuja	National seminar on Aquatic biodiversity and its conservation	CIFT, Cochin 31 December 2010



Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
	Dr. A.R.S. Menon Dr. K. Sobha Smt. P.K. Shyma Dr. G. Usha Rani Smt. G. Remani Smt. P.A. Jaya Smt. N. Lekha Ms. G. Archana Shri S.S. Shaju Shri B. Santhosh Kumar Ms. P. Minu Shri K.P. Manu		
114.	Dr. M.R. Boopendranath	Meeting of the Committee constituted by Govt. of Kerala to study issues related to registration of fishing vessels	Cochin 3 January 2011
115.	Shri V. Radhakrishnan Nair	National workshop on Design and development of digital libraries using DSpace	Univ. of Calicut, Thenhippalem 3-7 January 2011
116.	Dr. A.A. Zynudheen	National symposium on Waste management: Experiences and strategies	KAU, Thrissur 5-7 January 2011
117.	Dr. T.K. Srinivasa Gopal Dr. J. Bindu	3 rd CAC Meeting of the project on Studies on high pressure processing (HPP) of high value perishable commodities	New Delhi 10 January 2011
118.	Dr. S. Ashaletha	Review workshop under the NAIP on Mobilizing mass media support for sharing agro information	ICAR, New Delhi 11-12 January 2011
119.	Shri M.V. Baiju	Meeting of the Committee constituted by Govt. of Kerala for registration of fishing vessels	Thiruvananthapuram 12 January 2011
120.	Dr. T.V. Sankar (As resource person)	'Sastra – 2011', Children's Science Congress	Campion School, Cochin 13 January 2011
121.	Dr. M.R. Boopendranath	Meeting of the Committee constituted by Govt. of Kerala to study issues related to stakeholders	Cochin 13 January 2011
122.	Dr. K.V. Lalitha	Colloquium on R&D industry interface for biotech development in Kerala	Cochin 12 January 2011

Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
123.	Ms. P. Minu	Symposium on Contemporary trends in optics and optoelectronics	IIST, Thiruvananthapuram 17-19 January 2011
124.	Dr. T.K. Srinivasa Gopal Dr. Leela Edwin Dr. K.V. Lalitha Dr. S. Balasubramaniam Shri P.K. Vijayan Dr. T.K. Thankappan Dr. C.N. Ravishankar Dr. P. Pravin Dr. Suseela Mathew Dr. Saly N. Thomas Dr. Femeena Hassan Dr. M.P. Remesan Dr. A.A. Zynudheen Dr. George Ninan Dr. J. Bindu Shri M.V. Baiju Dr. J. Charles Jeeva Dr. Rakesh Kumar Shri V.R. Madhu Dr. V. Ronda Smt. P. Jeyanthi Shri V. Chandrasekar Shri D.K. Meena Dr. P.K. Binsi Smt. S. Tanuja Smt. P. Viji Shri A.K. Jha Smt. Arathy Ashok Dr. M. Baiju Shri Ginson Joseph Shri C.K. Kamalakanth Shri R. Yathavamoorthy Smt. V.R. Mumtaz	Symposium on Asian Pacific Aquaculture	Cochin 17-20 January 2011



Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
125.	Dr. Santhosh Alex	Official Language Workshop	Visakhapatnam 18-19 January 2011
126.	Dr. C.N. Ravishankar	Workshop on Performance review of NAIP projects	OUAT, Bhubaneswar 19-21 January 2011
127.	Dr. J. Bindu	National seminar on Climate change and food security: Challenges and opportunities for tuber crops	CTCRI, Thiruvananthapuram 20 January 2011
128.	Dr. Saly N. Thomas	International conference on Textiles light and weather-fastness	Mumbai 21 January 2011
129.	Dr. Leela Edwin	Stake holders meet-cum-tuber crops research – industry interface – Promotion and commercialization	CTCRI, Thiruvananthapuram 22 January 2011
130.	Dr. M.M. Prasad Dr. G. Rajeswari Dr. R. Raghu Prakash Dr. B. Madhusudana Rao Dr. L.N. Murthy Shri M.S. Kumar	Workshop on Packaging of fresh and processed fish and seafoods	Hyderabad 22 January 2011
131.	Dr. Leela Edwin	ILO Convention No. 188 concerning work in the fishing sector	Visakhapatnam 24-25 January 2011
132.	Dr. M.M. Prasad (As resource person)	'Technology Week' celebrations	KVK, Amdalavalasa 27 January 2011
133.	Dr. S. Balasubramaniam	Seminar held in connection with Fifth Assam Matsya Mahotsav - 2001	Guwahati 27-29 January 2011
134.	Dr. T.V. Sankar	BIS Sectional meeting of FAD 12	BIS, New Delhi 28 January 2011
135.	Dr. A.R.S. Menon	Inter Media Publicity Coordination Committee Meeting	Thiruvananthapuram 28 January 2011
136.	Dr. Leela Edwin	ZTM & BPD Meeting-cum-workshop 2010-11 (East Zone)	NIRJAFT, Kolkatta 28-29 January 2011
137.	Dr. Rakesh Kumar	One day partners meet on Application of bioinformatics in fisheries domain	NBFGR, Lucknow 29 January 2011

Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
138.	Dr. M.R. Boopendranath	Planning Commission interface meeting with ICAR Institutes, SAUs and State officials of Kerala	CMFRI, Cochin 31 January 2011
139.	Dr. G. Rajeswari (As resource person)	Seminar	Academic Staff College, Visakhapatnam 31 January 2011
140.	Dr. J. Bindu	Thematic annual workshop on Basic and strategic research in frontier areas of resource management and engineering/processing	CISH, Lucknow 2 February 2011
141.	Dr. T.K. Srinivasa Gopal	X th Agricultural Science Congress on Soil, plant and animal health for enhanced and sustained agricultural productivity	NBFGR, Lucknow 10-12 February 2011
142.	Shri Ankur Nagori	National workshop on Solar food processing technologies to rural women and youth for high income generation and job opportunities	Hyderabad 11-12 February 2011
143.	Dr. K. Ashok Kumar	BIS FAD 15 meeting	BIS, New Delhi 12 February 2011
144.	Dr. Santhosh Alex	Official Language Workshop	Visakhapatnam 15 February 2011
145.	Dr. T.K. Srinivasa Gopal	Workshop on Sustainability, livelihood and nutrition security	Allahabad 19 February 2011
146.	Dr. C.N. Ravishankar (As resource person)	Seminar on Harvesting innovations in food technology eminence	TKM Inst. of Technology, Kollam 19 February 2011
147.	Dr. T.K. Srinivasa Gopal	Workshop on Functional foods	BHU, Varanasi 20 February 2011
148.	Dr. G. Rajeswari	Meeting of the Tender committee held at the Office of the Commissioner of Fisheries	Hyderabad 21 February 2011
149.	Dr. T.K. Srinivasa Gopal	Director's and Vice Chancellor's interface meeting	ICAR, New Delhi 22 February 2011
150.	Dr. M.M. Prasad (As resource person)	Awareness programme on Fish quality management for exports	Visakhapatnam 22 February 2011



Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
151.	Dr. T.K. Srinivasa Gopal	Director's Conference	ICAR, New Delhi 23 February 2011
152.	Dr. V. Murugadas	Symposium on Genomics and biodiversity	CCMB, Hyderabad 23-25 February 2011
153.	Dr. P.N. Joshi	3 rd renewable energy Hyderabad – 2011 Conference on Accelerating the solar economies in India	Hyderabad 24 February 2011
154.	Smt. T. Silaja	National conference on Agricultural libraries in the knowledge hub	IARI, New Delhi 24-25 February 2011
155.	Dr. Santhosh Alex	International conference on Comparative literature: World culture and languages	Andhra University, Visakhapatnam 24-26 February 2011
156.	Shri Manoj Kumar	Seminar on Management of wetland resources for sustainable fisheries development: Current status and future challenges	BD College, Patna 25-26 February 2011
157.	Dr. M.R. Boopendranath	National seminar on Conservation and management of biodiversity	Govt. Motilal Vigyan Mahavidyalaya, Bhopal 26-27 February 2011
158.	Dr. T.V. Sankar (As resource person)	National seminar on Bio-security in aquaculture	Asmabi College, Kodungallur 28 February 2011
159.	Dr. B. Ganesan	National conference for the purpose of control and supervision of experiments on animals	Chennai 1 March 2011
160.	Dr. Leela Edwin Dr. T.V. Sankar Dr. C.N. Ravishankar Dr. K. Ashok Kumar Dr. Nikita Gopal Dr. A.A. Zynudheen Dr. George Ninan Dr. A.R.S. Menon Shri Rakesh T. Kurien Shri Abhilash Dr. Elizabeth Carolin	Zonal Technology Management Committee – Business Process Development Unit Annual meeting cum workshop	Cochin 4-5 March 2011

Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
	Smt. K.A. Anju Smt. A. Razia Mohamed Shri M. Kiran Das		
161.	Dr. S. Ashaletha Shri Aswin Antony	Review meeting on NAIP on Mobilizing mass media support for sharing agro information	Barapani 4-5 March 2011
162.	Dr. S. Sanjeev	Meeting of the Project Monitoring Committee on shellfish growing waters of Padanna, Kasaragod	MPEDA, Cochin 7 March 2011
163.	Dr. M.R. Boopendranath Dr. Nikita Gopal (As resource person)	International workshop on Towards a green fisheries and aquatic economy – Revisiting technology management and governance	CUSAT, Cochin 8-9 March 2011
164.	Dr. Leela Edwin	First global conference on Agri-business incubation	ICRISAT, Hyderabad 8-10 March 2011
165.	Dr. M.R. Boopendranath	Meeting of the Nodal Officers of Research Framework Document	ICAR, New Delhi 11 March 2011
166.	Dr. Saly N. Thomas	Meeting of the sectoral working group on coastal and fisheries resources to deliberate on the climate change related impacts and propose strategy for response of the state	Thiruvananthapuram 11 March 2011
167.	Dr. T.K. Srinivasa Gopal	Interaction meeting of the Secretary, DARE & DG, ICAR with the Chairs of RAC and Directors of the Fisheries Division Institutes	ICAR, New Delhi 17 March 2011
168.	Dr. M.R. Boopendranath	Meeting of the sub-committee constituted for establishing Faculty of Ocean Studies at Kerala University of Fisheries and Ocean Studies	Cochin 17 March 2011
169.	Dr. K. Ashok Kumar	Syllabus committee meeting	CIFNET, Cochin 21 March 2011
170.	Dr. T.K. Srinivasa Gopal Dr. M.M. Prasad Dr. G. Rajeswari Dr. R. Raghu Prakash Dr. U. Sreedhar Dr. A.A. Zynudheen	Pangasius festival	Elluru 21-26 March 2011



Sl. No.	Name(s) of participant(s)	Symposia/Seminars/Workshops etc. attended	Venue and Date
	Dr. George Ninan Dr. B. Madhusudana Rao Dr. L.N. Murthy		
171.	Dr. Saly N. Thomas (As resource person)	World water day celebrations	SH College, Cochin 22 March 2011
172.	Dr. P. Muhamed Ashraf Shri V.R. Madhu	Oceansat-2 International Announcement Opportunity Science Meet	SAC, Ahmedabad 23-25 March 2011
173.	Dr. Saly N. Thomas	Sensitization training-workshop-cum-meeting on E-publishing and knowledge system in agricultural research	ICAR, New Delhi 26 March 2011
174.	Smt. Arathy Ashok	Workshop on Statistical applications in industry, business, agriculture and ecology	St. Thomas College, Palai 26-28 March 2011
175.	Dr. Suseela Mathew	CAC meeting of NAIP on Oceanic Tuna off Lakshadweep seas – A value chain approach	CMFRI, Cochin 28 March 2011

Special Days and Events

Installation of COFISKI at Arunachal Pradesh

A team from CIFT Research Centre of Visakhapatnam consisting of Dr. M.M. Prasad, SIC, Shri V.V. Ramakrishna, Tech. Officer (T6) and Shri A.K. Panigrahi, Tech. Officer

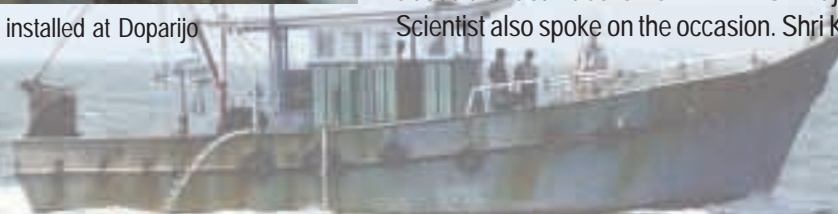


COFISKI installed at Doparijo

(T5) visited Arunachal Pradesh during 12-23 April, 2010. During the period a number of Community Fish Smoking Kilns were successfully installed at Aalo, West Siang district and also at Daprijo, Upper Sibinsiri district of Arunachal Pradesh. The team also demonstrated different methods of packaging of smoke cured fish and fishery products using high quality polythene bags employing heat sealing machines.

Training on Deployment of Foldable Traps

Visakhapatnam Research Centre of CIFT conducted an Awareness-cum-Training Programme on 'Deployment of foldable traps for Tandava reservoir' at Salika Mallavaram village, Tandava, Narasipatnam on 25 April 2010. Dr. M.M. Prasad, SIC presided over the programme. Dr. U. Sreedhar, Scientist (SG), welcomed the gathering and explained about the activities of CIFT. Dr. G. Rajeswari, Senior Scientist also spoke on the occasion. Shri Kollana Kondala





Dr. M.M. Prasad distributing foldable traps to fisherman

Rao, Sarpanch, Salika Mallavaram village thanked CIFT for adopting his village for the programme. Smt. Nirmala Kumari, FDO, Fisheries Department, Narasipatnam, Govt of Andhra Pradesh, explained about the various schemes for reservoir fisheries. Dr. L.N. Murthy, Scientist (SS) proposed vote of thanks. As part of the Human Resource Development programme of CIFT, a total of 30 numbers of foldable traps were distributed to the fishermen of Salika Mallavaram for their use. Four designs of improved Polyamide multifilament gill nets and one framed gill net were also distributed to the fishermen of Salika Mallavaram village for exploitation of fishery resources in Tandava reservoir. These improved gillnets were designed by incorporating all the corrections based on the survey conducted and the problems encountered by the fishermen fishing on this reservoir.

CIFT, Cochin Celebrated Foundation Day

CIFT, Cochin celebrated its 53rd Foundation Day on 29 April, 2010. As part of the Foundation Day celebrations an Open House was conducted. The laboratories of the Institute were open for public. A large number of interested public and students from various schools and colleges visited the exhibition conducted by the different laboratories of CIFT and witnessed the research activities. The first ever conducted Open House was an opportunity to show case the achievements of the Institute to the general public. A meeting was held also held in the afternoon, which was presided over by Dr. B. Meenakumari, Director, CIFT. The Chief Guests of the Day were Smt. Lakshmi Nair, Former Scientist, CIFT and Shri S. Sadanandan, Former Asst. Administrative Officer, CIFT. Felicitations were offered by



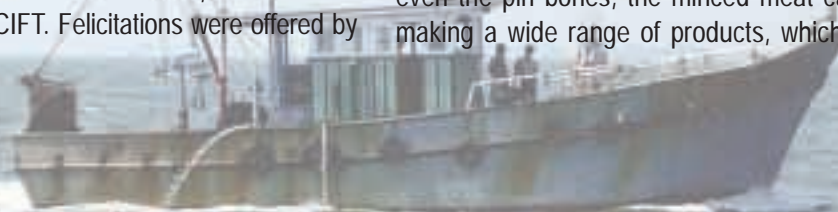
Visitors at Biochemistry and Nutrition Division

Dr. M.K. Kandoran, Former HOD, EIS Division, Dr. P.J. Cecily, Former Sr. Technical Officer, Shri P.A. Uthup, Former AF&ACO and Shri K.P.S. Gautam, SAO, CIFT.

Training Programme on Value addition of freshwater fishes

CIFT, Cochin in collaboration with College of Fisheries, GADVASU and Punjab Fish Farmers Association, Ludhiana organized a two days Awareness cum Training programme on "Value addition of freshwater fishes and the business horizons" at College of Fisheries, GADVASU, Ludhiana during 29-30 April, 2010.

The programme was inaugurated by Dr. O.S. Parmar, Director of Extension, GADVASU. The function was presided over by Shri S. Kanwaljith Sing Sidhu, Member, Board of Management, GADVASU. Dr. Kamaldeep Kaur, Dean, College of Fisheries explained about the activities of the College. The technical sessions of the training programme was lead by Shri P.K. Vijayan, Principal Scientist, CIFT, Cochin. The programme covered various aspects of value added products from freshwater fishes, methods of production and the business prospects of value added products. Demonstration of meat bone separator was conducted by Shri M. Nasser, Principal Scientist. At present, the domestic consumption of the farmed fish is at a minimal level due to the problem of pin bones and are consumed only by the migrant laborers. The CIFT had developed a fish meat bone separating machine for the College of Fisheries, GADVASU, which was also demonstrated for the trainees. As the machine separates even the pin bones, the minced meat can be used for making a wide range of products, which will boost the





domestic consumption as well as fish based business opportunities. More than 40 participants including fish farmers, State Department officials and students of the College of Fisheries were benefited by the programme.

FAO Experts Visits Visakhapatnam Research Centre

On 7 May, 2010, two FAO experts Dr. Rudolf Hermes, Chief Technical Adviser and Dr. Chris O'Brien, Regional Coordinator of Bay of Bengal Large Marine Ecosystem Project have visited the Visakhapatnam Research Centre of CIFT. The dignitaries were appraised of the Institute mandate and its activities and achievements. A group of fisherwomen belonging to Cheppala Uppada fishing village adopted by CIFT have also met the FAO team in the presence of CIFT scientists. The interaction between FAO team and the beneficiaries was facilitated by CIFT scientists.



Distribution of insulated bag to fisherwomen by FAO expert

Anti Terrorism Day Observed

Anti Terrorism Day was observed at the Institute on 21 May, 2010, The staff of the Institute assembled together and took Anti Terrorism Day Pledge.

Institute Research Council Meeting

The annual Institute Research Council meeting was held at CIFT, Cochin on 17-18 May, 2010 to discuss in detail about the ongoing research programmes and the new research proposals for the year 2010-2011. The house discussed in detail 18 ongoing research projects, besides six closed projects and six new projects apart from the various ad hoc projects being entertained at the Head Quarters and Research Centres.



Dr. T.V. Sankar, Secretary, IRC and Dr. B. Meenakumari, Director, CIFT

Training Programme on Personal Hygiene in Seafood Processing

CIFT, Cochin in association with the Department of Science and Technology (DST), New Delhi conducted a one-day training programme on 'Personal hygiene in seafood processing' at Moothakunnam in Ernakulam district on 21 May, 2010. The inaugural function of the programme was presided over by Shri Varghese Maniyara, Vice-President, Vadakkekara Panchayath. Smt. C.R. Sathyavathy, Joint Director of Fisheries, Govt. of Kerala spoke on the occasion and distributed 'hygiene kits' comprising head gear, mouth cover and aprons for the participants from different self help groups. Earlier, Dr. Femeena Hassan, Senior Scientist, CIFT and the Project Leader welcomed the gathering and briefed about the project objectives. In the technical sessions that followed the inaugural programme, a lecture on 'Importance of



Distribution of 'Hygiene Kits' to the trainees



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personal hygiene in seafood processing' was delivered by Dr. Femeena Hassan. Dr. J. Charles Jeeva, Scientist, Senior Scale, CIFT delivered a talk on 'Capacity building for fisherwomen self help groups'. More than 50 women members from different Self Help Groups in Moothakunnam participated in the programme.

World Bank Team Visited CIFT, Cochin

The officials from the World Bank reviewing the National Agriculture Innovation Project (NAIP) sub projects being implemented at CIFT, Cochin visited the Institute on 24 May, 2010. The World Bank is assisting seven projects under various components at CIFT. The team had detailed discussions with the Director and Scientists involved in the projects. A review of the facility being set up for the Business Planning and Development Unit under the NAIP, one among the five being set up in the country by ICAR, New Delhi was carried out by the team. The team visited the Pilot Plant which will be utilized by prospective entrepreneurs in incubating the technologies before actual commercialization. In the afternoon, the team visited the Community Based Processing Unit set up under the project, 'Responsible harvesting and utilization of selected small pelagics and freshwater fishes' at Chellanam. They interacted with the fisherwomen belonging to the activity clusters formed under the project to operate and manage the unit. These women had been trained earlier in hygienic handling and processing of fresh fish for the domestic market and they have been engaged in this activity for the past few months under the technical guidance of CIFT.



World Bank team at CIFT

World Environment Day Celebrated

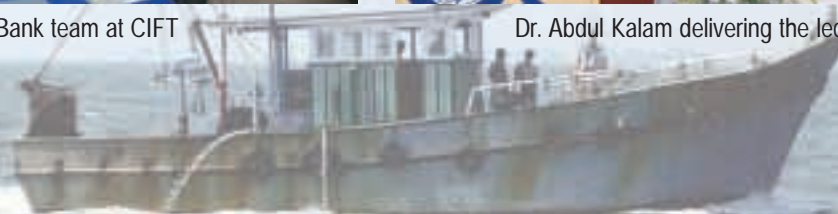
As part of the World Environment Day celebrations at CIFT, Cochin Dr. Renjan Mathew Varghese, State Director, World Wide Fund for Nature – India gave a talk on 'Sustainable development – Kerala scenario' on 5 June, 2010.

Bharat Ratna Dr. A.P.J. Abdul Kalam visited CIFT, Cochin

Bharat Ratna Dr. A.P.J. Abdul Kalam, former President of India visited CIFT, Cochin on 6 June, 2010 in connection with World Environment Day and International Year of Biodiversity celebrations. At CIFT, Cochin Dr. Kalam addressed a gathering of scientists, officials and students of R&D organizations at Cochin, on the theme 'Fisheries sector and national development – Technology leads to non-linear growth'. During his speech Dr. Kalam opined that, with the growing demand for food, upward trend in seafood exports and with growing constraints on land availability for agriculture, the fisheries sector will be playing a prominent role as a revenue earner, food supplier and job provider. In this connection, the role of fisheries technology institutions like CIFT, would be extremely important for taking the nation's fisheries sector to the next level of development. He proposed five missions for the economic prosperity of the fishing community and fishermen villagers, which the R&D organizations need to pioneer with the government and other organizations. Dr. Kalam also found time to answer a few questions from research students, ranging from mitigation of impacts of global warming to acceptability of Genetically Modified crops. An exhibition of the Institute activities was arranged and Dr. Kalam spent time going through various



Dr. Abdul Kalam delivering the lecture





programmes and achievements of the Institute. Dr. B. Meenakumari, Director, CIFT welcomed the gathering and Dr. P.N. Joshi, HOD, Engineering proposed a vote of thanks.

CIFT observed National Technology Day

CIFT, Cochin in association with the Gandhi Smaraka Grama Seva Kendram (GSGSK), S.L. Puram, Alappuzha conducted a workshop 'Greener technologies in fisheries' at Matsya Samridhi Industrial Fish Processing Unit, Kuthiathodu in Alappuzha district on 8 June 2010. The programme was organized in connection with the National Technology Day (2010) Celebrations, under the sponsorship of Kerala State Council for Science, Technology & Environment, Thiruvananthapuram. Dr. B. Meenakumari, Director, CIFT was the Chief Guest of the function and she also inaugurated the Seminar. The programme was presided over by Dr. S. Balasubramaniam, HOD, EIS Division. Smt. C.R. Sathyavathy, Jt. Director of Fisheries and Shri K.G. Jagadeesan, General Secretary, GSGSK, S.L. Puram offered felicitations on the occasion. In the technical sessions, lectures were delivered to the workers of fish processing sector on how to make the environment safe, avoiding pollution from fish processing waste. The sessions were on 'Waste management in fisheries-Technological solutions' by Dr. A.A. Zynudheen, Senior Scientist, CIFT, 'Management of environmental issues-Women's role' by Dr. S. Ashaletha, 'Micro enterprises in fisheries- The opportunities and challenges' by Shri M. Nasser, Principal Scientist, CIFT, and 'Sustainable development of coastal villages' by Smt. C.R. Sathyavathy. As part of the workshop, preparation of 'silage' from fishery wastes, which is a remunerative nutrition supplement for livestock feed was also demonstrated. More than 50 women fish processing workers participated in the programme.

'The Seafood Fest' – An exhibition of seafood cuisines organized by CIFT, Cochin

'The Seafood Fest' tickling the taste buds with exquisite seafood cuisines was hosted by the CIFT, Cochin at Moothakunnam on 17 June, 2010. The harvest of project initiative of 'rack and ren' culture of edible oyster was inaugurated during the function. The women groups participating in the project came out with flying colours with a bumper harvest of edible oysters and preparing seafood



Inauguration of 'Seafood Fest'

items and exhibiting the same before the panel of experts enabling recognition of outstanding recipes. The evaluators found it tough to rate from the variety of 'home-made' seafood delicacies exhibited by the women groups. An exhibition was also organized during the function demonstrating the mandate and significant research outputs of CIFT. Dr. S. Balasubramaniam, HOD, EIS, CIFT presided over the function and Shri M.D. Appukuttan, Block Panchayath President inaugurated the harvest. Outstanding recipes were recognized by cash awards by Shri T.G. Ashokan, Panchayath President, Vadakkekara. Dr. S. Sanjeev, Dr. Femeena Hassan and Dr. J. Charles Jeeva of CIFT spoke on the occasion. Felicitations were offered by Shri Varghese Maniyara, Vice President and Smt. Raphel, Kshemakarya Samithi Standing Committee Chairperson, Vadakkekara Panchayath.

Training on Quality Assurance and Personal Hygiene

The CIFT, Cochin conducted a training programme on Quality assurance through personal hygiene at Azheekkal in Kollam district for selected SHG groups under the DST project which envisages empowerment of women through scientific interventions suited to selected locations in Azheekkal in Kollam district and Moothakunnam in Ernakulam district in Kerala. Edible oyster culture is one such entrepreneurial option which can be easily adopted by women SHG groups. The culture had been initiated by women groups following the 'rack and ren' method during January 2010 and the inauguration of the harvest was done by Shri G. Babu, District Manager, Matsyafed, Kollam on 1 July 2010. Both the stakeholders and project team were motivated by the result of their half-year toil and has vowed to continue with such efforts till the end of the three year project with concerted efforts to ensure sustainability. Value





Inauguration of harvest of edible oysters

addition of seafood is another area where women groups can involve for generating earnings to support their livelihoods. Food safety is an upcoming issue in food processing and value addition as hygiene handling reduces chances of food borne infections. The training intended to induce food safety habits among the stakeholders. Dr. Femeena Hassan, Senior Scientist and Dr. J. Charles Jeeva, Scientist, Senior Scale, CIFT, Cochin led classes on importance of food safety and quality assurance in seafood. Meeting was presided over by Smt. Sobha, Panchayath Ward Member. Hygiene kits comprising head gear, mouth cover and aprons were distributed to group members of participating SHGs by Shri G. Babu, District Manager, Matsyafed, Kollam.

Training on Solar Drying Technique

A special training on 'Solar drying techniques' and 'Operation of solar dryers' for ten members of Kudumbasree micro enterprises sponsored by Urban Poverty Alleviation Department, Cochin Corporation was conducted during 20-24 July, 2010. Corporation of Cochin under People's Planning Project for Economic Development has formulated a project for starting a women group micro enterprise for hygienic production of dry fish and entrusted the work to implement the scheme with the co-operation and guidance of CIFT, Cochin. Three solar fish dryers with alternate electrical back-up heating system with 20 kg capacity (SDE-20) were fabricated and being installed at three locations in Cochin Corporation area under the technical consultancy of CIFT, Cochin. The Corporation has formulated three Kudumbasree micro enterprises consisting of five members each for the operation of the dryer.

Rapid Rural Appraisal on Need Assessment

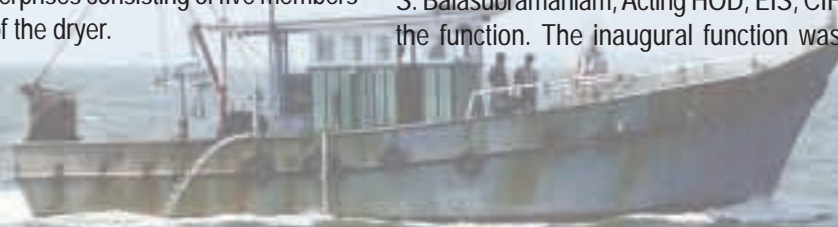
In response to the request from a Non Governmental Organization viz., Coastal People's Development Association (CPDA), Konark, a visit was made by Dr. J. Charles Jeeva, Scientist, Sr. Scale and Dr. Abha Singh, Scientist, DRWA, Bhubaneswar to Chandrabagha Fishing Village (Konark Notified Area Council) in Konark, Puri district, Odisha during 27-28 July, 2010. A Rapid Appraisal exercise was conducted to assess the technological and training needs, interventions to be proposed and the socio-technical feasibilities for organizing capacity building programmes for fisherwomen in the study area. The socio-economic profile of the fisherfolk and the general fisheries scenario were also studied. Necessary secondary data on fishing craft, gear, landings, population and other relevant details were collected from the records of the Office of Assistant Director of Fisheries (Marine), Puri.



Dr. Abha Singh and Dr. Charles Jeeva interacting with Assistant Director of Fisheries (Marine), Puri

Training on Fish Value addition

A training programme on 'Fish value addition for empowerment of fisher folk' for Coastal Women Self Help Group was conducted at Vellayil Beach, Calicut during 28-29 July, 2010. The programme was organized under the project on 'Technology assessment and transfer among the client system' by CIFT in association with a NGO working for fisheries sector, namely Theera Desa Raksha Social Welfare Society, Kozhikode. The Chief Guest, Smt. Hansa Jayanth, Standing Committee Chairperson, Kozhikode Corporation inaugurated the programme. Dr. S. Balasubramaniam, Acting HOD, EIS, CIFT presided over the function. The inaugural function was followed by a





seminar in which Dr. Balasubramaniam and Dr. Ashaletha, Senior Scientist, CIFT delivered lectures on marketing aspects of fish products, group formation and modalities of starting a small scale production unit by coastal women. Preparation of value added fish products like fish wafer, fish cutlet, fish pickle, fish ball and fish fingers were taught and demonstrated by Dr. A.A. Zynudheen and Dr. K.A. Martin Xavier of CIFT. Training on preparation of silage from fish waste was also demonstrated.

Workshop on Use of PFZ Advisories

One day workshop on 'Use of Potential Fishing Zone advisories along Gujarat coast' was organized in Vanakbara, Diu on 10 August, 2010 under the INCOIS funded research project. Shri Laxman Bhai Solanki, Vice President, District Panchayat, Smt. Chandrikaben Charania, Sarpanch, Vanakbara, Shri Sukur Anjini, Superintendent of Fisheries, Diu were the Guests for the programme. Over 100 fishermen participated in the workshop.



Dr. R. Badonia, SIC, Veraval speaking at the inaugural function

'Sadbhavana Diwas'

The Institute observed National 'Sadbhavana Diwas' on 20 August, 2010 in connection with the observance of 'Communal Harmony Fortnight'. The staff assembled together and took 'Sadbhavana Day Pledge'.

'Onam Celebrations'

'Onam' - the festival of Kerala was celebrated at Cochin on 20 August, 2010. The celebrations were marked with "Pookkalam" (floral carpet) competition, followed by traditional 'Onasadya' (feast). The Chief Guests of the afternoon function was Shri John Paul, noted Malayalam



Director, CIFT with 'Maveli'

Cine Script Writer and Munch Star Singer Fame Master Vishnu. The staff members and their family then presented a variety entertainment programme.

Awareness-cum-interactive Workshop

The Visakhapatnam Research Centre of CIFT conducted a one day workshop titled 'Antibiotic, pesticide and insecticide residue contamination in sea/aqua foods' on 6 September, 2010. Prof. (Dr.) G. Bhagya Rao, Principal, Andhra Medical College, Visakhapatnam was the Chief Guest of the workshop. Shri Vijaykumar Yaragal, Deputy Director, MPEDA, Visakhapatnam highlighted the present scenario of rejections of seafoods exported from India due to various residue contaminants. Twenty six participants working in fish processing plants attended the workshop. A manual titled on the line of workshop edited by L.N. Murthy, B. Madhusudana Rao and M.M. Prasad, was



Prof. (Dr.) G. Bhagya Rao, Principal, Andhra Medical College inaugurating the Workshop

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released on the occasion. Dr. T.K. Srinivasa Gopal, Director, CIFT, chaired the Plenary Session and interacted with the participants.

'Chetana Mass Celebrations'

The Institute celebrated Official Language Chetana Mass – 2010 during 16 August to 14 September, 2010. During the occasion various programmes/competitions were organized. The concluding ceremony was held on 14 September, 2010. Shri N. Ramesh, Director, MPEDA, Cochin, the Chief Guest of the function gave away prizes to the winners of various competitions. Based on the performance in competitions and exhibitions, the Administrative Section was adjudged as the best to receive the rolling trophy. Dr. Nikita Gopal, Senior Scientist who had obtained the highest marks in Chetana Mass competitions received the Rajbhasha Prathibha Puraskar. The function was followed by an entertainment programme.



Shri N. Ramesh, Director, MPEDA, Cochin delivering the Chief Guest address at Cochin

Hindi Diwas was also celebrated at the Research Centres of CIFT. Hindi week was observed at Visakhapatnam Research Centre and different competitions were held during the week-long celebrations which included Dictation, paragraph writing, paragraph reading, Quiz and singing competitions. The valedictory function was held on 17 September, 2010. The meeting was presided over by Dr. M.M. Prasad, SIC and Chairman OLIC. Shri Virendra Rai, Hindi Officer, Indian Bank, Visakhapatnam was the Chief Guest for the occasion. He spoke about the importance of Official Language Hindi and its use. Later he distributed prizes to the winners of different competitions.



Shri Virendra Rai, Hindi Officer, Indian Bank, Visakhapatnam delivering the Chief Guest address at Visakhapatnam

At Mumbai Research Centre on 17 September, 2010 several programmes such as letter writing competition, speech competition, singing competition, poetry competition and debate were conducted and prizes were distributed by the Chief Guest Smt. Sushmita Bhattacharya, Asst. Director, Regional Implementation Office (W), Dept. of Official language.

Awareness Programme on Hygiene and Sanitation in Fish Markets

Under the project 'Consumer preferences and its impact on domestic fish market' an awareness programme on maintenance of hygiene and sanitation in fish markets was held at Panavally, Alappuzha on 15 September 2010. A survey of different markets was carried out during July 2010 and it was observed that the market at Panavally was started under the aegis of Matsyafed by the Panavally



Dr. K. Ashok Kumar giving the talk on 'Hygiene and sanitation in fish markets'





Inland Fishermen Development Welfare Cooperative Society on 17 July 2010, and hence a programme to make the market functionaries aware about the steps to be taken in proper maintenance of the market would be beneficial. Both wholesalers and retailers operated in the market. About 270 members of the Society including market functionaries, wholesalers, retailers and women head load vendors participated in the programme. Shri N. Ramadas, District Manager, Matsyafed, Alappuzha and Smt. Rema Baburaj, Asst. Manager, Matsyafed also attended the programme. Dr. K. Ashok Kumar, Senior Scientist, CIFT delivered a talk on maintenance of hygiene and sanitation while marketing fish and stressed on the need to maintain hygiene as fish is a highly perishable food item. Dr. Nikita Gopal, Senior Scientist & PI of the project, spoke about the objectives of the project as well as described the leaflet that was prepared by the project team to explain about the simple steps to be taken in maintenance of hygiene and sanitation in markets, which was distributed among the participants. The team from CIFT demonstrated the proper method of chlorination, including testing of the strength of the chlorinated water using cloritest paper. The participants also experimented the same under the guidance of the team. An interactive session followed in which problems like poor availability of ice and the difficulties in following the practices suggested were highlighted.

International Co-operation Activities

The Institute organized an International Training Course on 'Hygienic fish handling and quality assessment' at CIFT, Cochin during 11-16 October, 2010. A delegation of 10 officials from Sri Lanka participated in the programme.



International training in progress

The programme was sponsored by Food and Agriculture Organization (FAO), Rome.

Monitoring Workshop and Training Conducted

Under the project on 'Location specific livelihood interventions in fisheries sector for the empowerment of fisherwomen of Kerala', culture of edible oyster was introduced among Self Help Groups (SHG) in the selected locations of Moothakunnam in Ernakulam and Azheekkal in Kollam district. The first round of culture activities was initiated in December 2009 and the harvest took place in May 2010. Training on value addition and net mending was also imparted to the groups. A field monitoring workshop was conducted on 8 October, 2010 at Moothakunnam to assess the performance of the participating groups. An appraisal was carried out to assess the group dynamics of the SHG groups. Groups were asked to appraise themselves by responding (scoring) to the questionnaire. Dr. Femeena Hassan, Dr. J. Charles Jeeva and Dr. Saleena Mathew, Project Investigators coordinated the group appraisal activity. Group dynamics of the participating respondents was in the workshop using the 'H' form method.

Another training programme was conducted at Azheekkal on 'Seafood based micro enterprises for fisherwomen empowerment' for the women stakeholders in Azheekkal on 15 December 2010. Smt. Sathyavathi, Joint Director of Fisheries and Shri Shan, Project Officer, Matsyafed spoke during the function. Smt. Sathyavathi spoke on 'Micro enterprises and financing support from State Fisheries Department'. Dr. Femeena Hassan also delivered a talk on 'Importance of micro enterprises producing value added seafood items as an alternative avocation'.



Dr. Femeena Hassan speaking to SHG groups at Azheekkal

Value Added Fish Products Unit Inaugurated

The CIFT, Cochin under the project on 'An alternate sustainable livelihood model for coastal fisherfolk through market-led extension of value added products' identified a Fishermen's Society at Munambam in Ernakulam district for setting up an industrial unit of fisheries value added products. For the purpose, the women members were motivated and efforts for building up entrepreneurship were done. Effort is being made to establish linkages with external agencies for establishing the unit at a commercial scale. The unit was inaugurated on 1 November, 2010 by Shri S. Sharma, Fisheries Minister, Govt. of Kerala. The inaugural function was presided over by Dr. T.K. Srinivasa Gopal, Director, CIFT. Dr. S. Ashaletha, Project Leader & Senior Scientist, CIFT welcomed the gathering. The logo of the unit named "FISHMAN" was launched by the Minister. The dignitaries who attended the function included Shri M.K. Purushothaman, MLA, Vypeen and Shri T.N. Prathapan, MLA, Nattika. Shri M. Nasser, Principal Scientist, CIFT delivered a talk on 'Fish industrial units'. The first sale of the products was done by Smt. Lalithamma Punnoose, General Manager, District Industrial Department. Shri N.D. Velunni, President, Dharmasastha Paripalana Samithi, Munambam explained about the 'Fishman' products. Dr. S. Balasubramaniam, Acting HOD, EIS Division, CIFT, Shri P.K. Vijayan, Acting HOD, FP Division, CIFT, Shri P.A. Joseph, Extension Officer, Industrial Department, Vypeen, Rev. Fr. Babu Muttikkal, Vicar, Holy Family Church, Shri P.F. Sadanandan, Manager, UCO Bank and Shri P.P. Gireesh, President, Araya Maha Sabha, Munambam offered felicitations during the function. Shri K.K. Velayudhan, Vice-President,

Dharmasastha Paripalana Samithi proposed vote of thanks.

The Industrial Unit is named as "Fresh n Fish" and their products are Fish Cutlet, Fish Samosa, Squid Roll, Fish Papad, Fish Pickle, Fish Sughian etc. They started selling these products in the brand name of "FISHMAN".

Winter School on Microbial Biotechnology

The Winter School sponsored by ICAR, New Delhi on "Current Trends in Microbial Biotechnology: Genomics, Diversity and Gene Mining" was conducted at CIFT, Cochin during 9 - 29 November, 2010. About 30 participants from various Central Institutes, State agricultural Universities and other colleges from different parts of the country participated in the Winter School. The purpose of the programme was to provide theoretical and hands on practical training on various aspects of microbial biotechnology to the teachers, researchers and other professionals associated with microbiology and biotechnology in fisheries, animal, agricultural and basic sciences. Dr. Toms C. Joseph, Scientist (SG), MFB Division was the Course Director of the Winter School. The Winter School gave participants an opportunity to learn and experience the various facets of microbial biotechnology. The frontier molecular topics such as recombinant DNA technology, real-time PCR, bacterial fingerprinting methods, next generation sequencing, DNA microarray technology, suppression subtractive hybridization, application of bioinformatics, and bio-computation potential, genetic aspects of bacterial virulence, bio-prospecting of marine microbes for novel genes and gene products etc. were covered. Molecular approaches in bacterial taxonomy, food-borne bacterial and viral pathogens, bioactive



Launching of the logo FISHMAN by Shri S. Sharma



Dr. A.G. Ponniah releasing the manual of the Winter School



Participants and Faculty of Winter School

compounds from marine sponges, anaerobic bacteria, understanding the structure and functions of genomics etc. were dealt in detail. Other related topics like mass spectrometry for metabolites, IPR issues in microorganisms, and laboratory accreditation were addressed during the Winter School. Apart from theory and practical classes, there were field trips to Kinfra Biotechnology Park and Genome Lab at Cochin Special Economic Zone, Kakkanad.

The Winter School was inaugurated by Dr. A.G. Ponniah, Director, CIBA, Chennai on 9 November. The meeting was presided over by Dr. T.K. Srinivasa Gopal, Director, CIFT. Dr. Toms C. Joseph introduced the Winter School to the participants and audience. Dr. Paul T. Kunnath, Deputy Director, State Laboratory for Livestock, Marine and Agri-products, Govt. of Kerala and Dr. V.I. Bishore, Director, *ubio* Biotechnology Systems Pvt. Ltd. offered felicitations on the occasion. Earlier Dr. K.V. Lalitha, Head, MFB Division welcomed the gathering. Dr. Rakesh Kumar, Scientist proposed vote of thanks.

Workshops on Fishery Micro Enterprises

Under the NAIP on 'Responsible harvesting and utilization of selected small pelagics and freshwater fishes' at CIFT, Cochin a Workshop on 'Value chain oriented fishery micro enterprises through women' was organized during 11-12 November, 2010, at Quilon Social Service Society, Kollam. Shri Prasannakumar, Deputy Director of Fisheries, Kollam, formally inaugurated the workshop by lighting the traditional lamp. Dr. S. Ashaletha, Co-PI of the project welcomed the gathering and briefly explained about the objectives of the workshop. Shri M. Nasser, PI, NAIP gave

the concept of the project. Rev. Fr. Rajesh Martin, Executive Director, QSSS, in his presidential address, gave an overview of the services of QSSS in coastal sector. Felicitations were offered by Dr. S. Balasubramaniam, Acting HOD, EIS and Dr. A.A. Zynudheen, Co-PI, NAIP. Ms. Roshni Pillai, Project Coordinator, QSSS proposed the vote of thanks. The Workshop was held in three Technical Sessions. On the first day the Technical Session I on 'Entrepreneurship in woman' was presented by Shri V.S. Sukumaran, Associate Senior Faculty, Entrepreneurship Development Institute (India). The Technical Session II on 'Small-scale enterprises development and management' was handled by Smt. Helen Jerome, Manager, DIC, Kollam. The Technical Session III in the afternoon on 'Development of value added products' was under the guidance of Dr. A.A. Zynudheen and Dr. K.A. Martin Xavier, CIFT. The Session continued in the second day of Workshop till evening. On the final day of Workshop, an interaction phase between



Shri Prasannakumar inaugurating the workshop at Kollam

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participants of the Workshop and organizers was conducted. The women explained their present livelihood options and issues. Traditional dry fish makers expressed their constraints, for which the organizers offered technological and market solution through the project. The participants got motivated and decided to start fishery based micro enterprises under the project with the financial support of QSSS, Kollam. Dr. Balasubramaniam extended the vote of thanks to all participants.

Another workshop was organized during 1-2 December, 2010, at Moplabay Fisheries Complex, Kannur. The workshop was organized in collaboration with Matsyafed, Kannur. Shri C.P. Kunjiraman, Matsyafed Board Member inaugurated the programme. In his presidential address Shri Kunjiraman gave an overview of the services of Matsyafed in Moplabay, Kannur. Smt. K. Vanaja, District Manager, Matsyafed welcomed the gathering and briefly explained the objectives of the Workshop. Shri Gangadharan Kalyadan, Assistant Manager, Matsyafed explained the importance of the workshop in his special address. Shri Madhu, Matsyafed proposed vote of thanks. The workshop was held in two Technical Sessions. On the first day the Technical Session on "Development of value added products" was lead by Dr. K.A. Martin Xavier, CIFT. In the afternoon practical classes on preparation of fishery based products such as fish cutlet, fish pickle, fish ball, fish fingers and fish ensilage were conducted. Participants also demonstrated the preparation of some of the traditional fish recipes. The training caught enough media attention. Shri Daniel Raj and Shri Muhammad Azharudeen of the project helped in conducting the practical classes. The participants got motivated and decided to start commercial

production of fishery based products as a micro-enterprise at St. Angelo Fort, Kannur under the guidance of the project in collaboration with Matsyafed. Smt. K. Vanaja, District Manager, Matsyafed extended the vote of thanks.

The third Workshop in the series was organized during 22-23 December, 2010, at Krishi Vigyan Kendra (KVK), Vriddhachalam, Cuddalore district, Tamil Nadu. In the inaugural ceremony Dr. S. Balasubramaniam, Acting Head, EIS Division, CIFT welcomed the gathering and briefly explained about the objectives of the Workshop. Dr. M. Raju, Asst. Professor (Agro), Head Incharge, KVK, Vriddhachalam, in his presidential speech gave an overview of the services and achievements of the KVK. Dr. R. Marimuthu, Professor and Head RRS, TNAU, Vriddhachalam explained the importance of the Workshop in his special address. Felicitations for the meeting were offered by Dr. A.A. Zynudheen, Senior Scientist & CO-PI of the project, CIFT. Dr. S. Kannan, Asst. Professor (H. Sc), KVK, Vriddhachalam proposed the vote of thanks. The workshop was held in two Technical Sessions. On the first day the Technical Session on "Entrepreneurship in women and small-scale enterprises" was presented by Dr. S. Balasubramaniam. The next Technical Session on "Development of value added products" was lead by Dr. A.A. Zynudheen. On the concluding day of the Workshop, an interaction phase between participants of the Workshop and the organizers was conducted. The participants expressed great enthusiasm to start a unit on value added fish products, for which the project personnel offered all technical support. Dr. Balasubramaniam and Dr. S. Kannan extended vote of thanks to the participants.



Participants and faculty of workshop at Kannur



Dr. S. Balasubramaniam explaining about the workshop at Vriddhachalam



Quami Ekta Week Celebrations

The Institute celebrated 'Quami Ekta Week' during 19-25 November, 2011. On 23 November, Flag Day was celebrated. The staff of the Institute assembled together and took National Integration Pledge.

Dr. S. Ayyappan, DG, ICAR visits Visakhapatnam Research Centre

Dr. S. Ayyappan, Secretary to the Department of Agriculture Research and Education (DARE), Government of India and DG, ICAR, New Delhi was at Visakhapatnam on 21 November, 2011 for a brief period of time en route official visit to Research Farm at Sunabeda, Koraput district, Odisha of CSWCR&TI. Scientists of the Visakhapatnam Research Centre of CIFT met with Dr. Ayyappan. The official engagements of Dr. Ayyappan included a visit to the Integrated Farming System established in 2008 at Sunabeda. In the ensuing discussion DG suggested that CIFT shall under take collaborative projects with CSWCR&TI.



Dr. S. Ayyappan, DG, ICAR in light hearted vein with CIFT scientists

SOFTI Award 2009 presented to Dr. S. Ayyappan, DG, ICAR

Dr. S. Ayyappan, eminent scientist, policy maker and academician, Secretary to DARE, Government of India and DG, ICAR, New Delhi received the Society of Fisheries Technologists (India), SOFTI Award 2009. Prof. V.N. Rajasekharan Pillai, Vice Chancellor, Indira Gandhi National Open University, New Delhi and Chairman, Distance Education Council, India handed over the biennial award consisting of a citation, a medallion and a cash

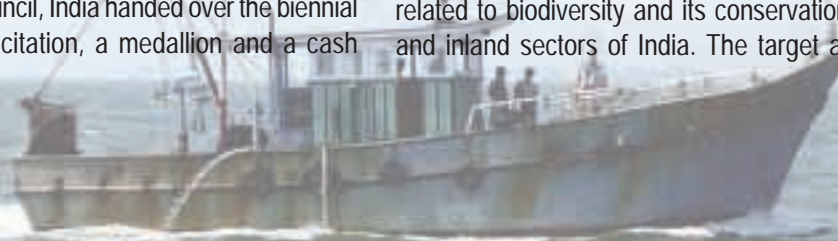


Dr. S. Ayyappan receiving the SOFTI Award 2009 from Prof. V.N. Rajasekharan Pillai

component of ₹ 25,000/- to Dr. Ayyappan for his outstanding contribution to the field of fisheries in a simple function held at CIFT, Cochin on 26 November, 2010. The award ceremony meeting held at CIFT was presided over by Dr. M.K. Mukundan, President, SOFTI. Prof. Rajasekharan Pillai in his address opined that for a country like India with a large coastal belt, and large population of coastal community, two aspects, ie. nutrition and basic education are the need of the hour. He also reiterated that there is a need for enhancing the livelihood options of the people. The technologies emanating from research institutions should be made available to the common man. He also mentioned that complementarity of agricultural production and fisheries has to be sustained for a better livelihood option. Felicitations were offered by Shri A.J. Tharakan, Chairman, Amalgam Foods, Cochin, Dr. B. Meenakumari, Deputy Director General (Fisheries), ICAR, New Delhi and Dr. G. Syda Rao, Director, CMFRI, Cochin. Earlier Dr. T.K. Srinivasa Gopal, Director, CIFT welcomed the gathering. Dr. T.V. Sankar, Secretary, SOFTI proposed the vote of thanks.

National Seminar on Aquatic Biodiversity

The SOFTI, Cochin in collaboration with CIFT, Cochin organized a National Seminar on 'Aquatic biodiversity and its conservation' at CIFT, Cochin on 31 December, 2010. The Seminar was organized recognizing the importance of conservation of biodiversity and long-term sustainability of ecosystem services. The Seminar focused on the issues related to biodiversity and its conservation in the marine and inland sectors of India. The target audience of the





Dr. V.V. Sugunan inaugurating the Seminar

Seminar were academicians, researchers, entrepreneurs, NGOs and students who were interested in the conservation of biodiversity and sustainability of aquatic resources. The Seminar was formally inaugurated by Dr. V.V. Sugunan, Former Asst. Director General (Inland Fisheries), ICAR, New Delhi. The meeting was presided over by Dr. M.K. Mukundan, President, SOFTI and Dr. G. Syda Rao, Director, CMFRI, Cochin delivered the Special address. The Technical Sessions which followed were chaired by Dr. K. Devadasan, Former Director, CIFT, Cochin.

MoA signed with Department of Fisheries, Govt. of Kerala

CIFT, Cochin has signed a Memorandum of Agreement with Society for Fisheries, Govt. of Kerala. The MoA is signed for a consultancy to establish a value added fish production unit under the activity group, Royal Fish

Processing Unit, Anapuzha, Thrissur district of Kerala. CIFT will help the Unit in setting up a Solar Dryer with Electrical back-up (CIFT Dryer SDE-10) for hygienic production of dry fish. The Memorandum of Agreement was signed between Dr. T.K. Srinivasa Gopal, Director, CIFT and Ms. Seema and Ms. Gayathry, Group Leader and Group Treasurer, Royal Fish Processing Unit, Anapuzha in presence of the members of Institute Technology Management Unit in a simple function held at CIFT, Cochin on 13 December, 2010.

MoU signed with UT of Lakshadweep

A Memorandum of Understanding was signed between The Director, Department of Fisheries, U.T. of Lakshadweep and The Director, CIFT, Cochin for providing consultancy services for acquiring two numbers of Tuna Long Liners for U.T. of Lakshadweep.

Workshop on Value Chain

To strengthen and improvise the concept of fishery micro enterprises, a two day Workshop was organized on "Value chain oriented fishery micro enterprises through women" on 18 and 19 January, 2011, at Chulliyar SC/ST Cooperative Society, Palakkad. The programme was inaugurated by Shri Selvan, Panchayath President, Muthalamada, Chulliyar. Felicitations were offered by Shri Ammanulla, Standing Committee Chairman, Chulliyar SC/ST Co-operative Society, Chulliyar. The Workshop was held in two technical sessions. On the first day the technical session on "Development of value added products from freshwater fishes" was conducted. In the afternoon practical classes were held on Preparation of products such as fish



Handing over of MoA to Royal Fish Processing Unit



Inauguration of the workshop on value chain



cutlets, fish fingers, fish pickle, fish balls, fish sandwiches, fish burgers and fish ensilage out of Rohu fish caught from Chulliyar dam.

Setting up of Community Processing Centre

The fish landings from reservoirs in the country are mainly sold as fresh fish resulting in low returns to the fishermen. Absolutely no value addition is taken up and the muddy flavour of the carps restricts trade in the premium consumption market. Chulliyar reservoir in Palakkad district of Kerala is a highly productive reservoir with average monthly production of Rohu up to 90 tonnes. The entire production is sold as fresh fish at the rates fixed by the State Fisheries Department through the Fish Sales counter at Chulliyar. Consumer preference studies conducted in Palakkad region indicated good demand for healthy fish based snack items among the consumers. A survey on willingness to pay conducted among the middle class group also indicated that the consumer is ready to pay more for a healthy and safe snack. Under the sub-project on 'Responsible harvesting and utilization of selected small pelagics and freshwater fishes' under the Component 2 (Production to Consumption System) of the NAIP being implemented at CIFT a potential group of women belonging to the Chulliyar SC/ST Reservoir Fisheries Co-operative Society was trained for commercial production of value added fish products in a sustainable manner from freshwater carps. Under the technical guidance from the project team the fish retail outlet "Meenoos" owned by the Society in Palakkad town was suitably modified as a modern fish vending joint. The formal inauguration of the outlet was held on 5 February, 2011 at Palakkad.

NAIP Meeting

NAIP Project Monitoring and Advisory Committee Review Meeting was organized at CIFT, Cochin during 9-11 February, 2011.

National Training Programme

The National Training on "Molecular diagnostics and fingerprinting of *Salmonella* and pathogenic *Vibrios* associated with seafood and aquatic environments" was conducted at CIFT, Cochin. The training sponsored by NAIP, ICAR, New Delhi was formally inaugurated by the internationally recognized scientist in food microbiology, Dr. Bala Swaminathan, Vice President, IHRC Inc., & Former



Dr. Bala Swaminathan inaugurating the training programme

Adviser to Centre for Disease Control (CDC), Atlanta, USA, at CIFT on 14, February. The meeting was presided over by Dr.T.K. Srinivasa Gopal, Director, CIFT.

The purpose of the training was to provide theoretical and hands-on-training on molecular diagnostics and fingerprinting of bacteria of public health significance such as *Salmonella* and pathogenic *Vibrios* in seafood and aquatic environments. The hands-on-training programme was designed to benefit the young Scientists/Teachers working in the field of Microbiology and Biotechnology in ICAR Institutes/Universities and other Colleges in the country. Seventeen participants from various Central Institutes, State Agricultural Universities and other colleges from different parts of the country participated in the two weeks training programme conducted during 14-27 February, 2011.

The valedictory function of the training was held on 26 February, 2011. Dr. T. Ramamurthy, Dy. Director, National Institute of Cholera and Enteric Diseases (NICED), Kolkata was the Chief Guest. Dr. P.T. Lakshmanan, Director-in-Charge, CIFT presided over the function. Dr. Rakesh Kumar, Scientist & Course Coordinator gave a brief report on the training.

Memorandum of Agreement Signed

A Memorandum of Agreement was signed by CIFT, Cochin with the Society for Advancement of Fisheries, Govt. of Kerala for a consultancy to establish a value added fish production unit under the activity group, Swapna Activity Group, Kurankadavu, Payyannoor of Kerala. CIFT will help the Unit in setting up a Solar Dryer with Electrical back-up





Handing over MoA to Swapna Activity Group, Payyanloor

(CIFT Dryer SDE-10) for hygienic production of dry fish. The Memorandum of Agreement was signed between Dr. T.K. Srinivasa Gopal, Director, CIFT and Smt. P.P. Annie, Group Leader, Swapna Activity Unit on 16 February, 2011.

Awareness Programme on Hygienic Handling of Fish

An awareness programme on 'Hygienic handling of fish in fish market' under the project 'Consumer preferences and its impact on domestic market' was conducted at Nehru Bazar Fish Market, Visakhapatnam on 18 February, 2011. Forty three fisherwomen who sell wet fish and five fisherwomen who sell dry fish in the Nehru Bazar Fish Market, Visakhapatnam participated in the awareness programme.



Fisherwomen using washable plastic sheet for display of wet fish

Capacity Building of Coastal Fisher Women

Under the ICAR-DRWA network project on 'Capacity building of coastal fisher women through post harvest technologies in fisheries' a two day training programme



Dr. Bindu demonstrating proper method of gutting fish

was organized by CIFT, Cochin in association with Gandhi Smaraka Grama Seva Kendram (GSGSK), Alappuzha at Thiruvizha, South Cherthala, Alappuzha during 22-23 February, 2011. The training was given to the fisherwomen group selected under the project. The main aim of the training was to give awareness for the need of hygiene in handling and drying of fish for better quality products. The training session included demonstration on hygienic method of gutting fish, proper salting and drying techniques. Simultaneously the method of maintaining proper records for production and accounts was also highlighted. The salted fish samples were dried hygienically on PVC racks which were provided by CIFT under the project. Demonstration on hygienic packing of dried fish samples were carried out on the second day.

Memorandum of Agreements Signed

A Memorandum of Agreement was signed by CIFT, Cochin with Fisheries Regional Shrimp Hatchery, Azhikode



Handing over MoA to Fisheries Regional Shrimp Hatchery, Azhikode





for a consultancy to set up a PCR laboratory at Fisheries Regional Shrimp Hatchery, Azhikode. The Memorandum of Agreement was signed between Dr. T.K. Srinivasa Gopal, Director, CIFT and Shri K.G. Suguna Prasad, Asst. Director of Fisheries, Regional Shrimp Hatchery, Azhikode, Thrissur district on 10 March, 2011.

Another MoA was signed with Haritha Farmers Club, Perumpalam, Cochin for a consultancy for a diagnostic study of the collection and processing of clam in Perumpalam Grama Panchayath of Thycattussey Block of Alappuzha district under the NABARD Cluster Development Programme. The Memorandum of Agreement was signed between Dr. T.K. Srinivasa Gopal, Director, CIFT and Shri Sreekumar, Convenor, Haritha Farmers Club, Perumpalam on 10 March, 2011.



Handing over MoA to Haritha Farmers Club, Perumpalam

Field level Demonstration of Depuration System for Bivalves

Under the DST project entitled "Location specific livelihood intervention in fisheries sector for the



Demonstration of depuration system for bivalves

empowerment of fisherwomen in Kerala", in operation at CIFT, Cochin a field level demonstration on depuration system for oysters was conducted at Moothakunnam, Cochin on 11 March, 2011. Dr. Femeena Hassan, Senior Scientist gave a brief introduction on food safety problems associated with consumption of contaminated oysters and need for depuration to the stakeholders. They were also given a demonstration on the depuration system designed by the project team.

Workshop on Official Language

A workshop in Official Language on 'Electronic media and science communication' was conducted at CIFT, Cochin during 23-25 March, 2011.

"Krishi Darpan 2011" - ICAR Window-showcasing of Agricultural Technologies

Under the NAIP sub-project, "Mobilizing mass media support for sharing agro information" under the leadership of Directorate of Knowledge Management in Agriculture (DKMA), ICAR, New Delhi in which the CIFT is one of the executing institutes, a two-day Agricultural Exhibition and Farmer's Meet was organized at Cochin on 28 and 29 March, 2011. The programme was inaugurated by Dr. M. Beena, IAS, Director, Department of Fisheries, Govt. of Kerala and Dr.T.K. Srinivasa Gopal, Director, CIFT presided over the function. Smt. Sathyavathy, Joint Director of Fisheries, Shri Jose Joseph, Director, HRC, VFPC and Dr. S. Balasubramaniam, HOD, EIS, CIFT offered felicitations during the inaugural function. During the two days' programme, 18 exhibition stalls were put up involving Scientific Institutions under ICAR, Commodity Boards,



Dr. M. Beena, IAS inaugurating 'Krishi Darpan'

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Developmental Departments, NGOs and Self-Help Groups who have successfully commercialized new technologies, and exhibited their technology support for the farming community. Another five common stalls were arranged outside the main hall for the sale of value added products produced with the technical know-how of ICAR technologies. The scientist-farmer interaction meet arranged during the meet provided a unique opportunity to the farmers for clarification of their doubts and for the institutions for identification and prioritization of problems of farmers. Free training on product formulation from agricultural produces like fruits, spices, fish etc., and classes on terrace farming, Pokkali-shrimp farming, coconut cultivation, pond aquaculture and fish processing by experts were also arranged.

Champion farmers who won awards in agriculture and fisheries were invited for deliberations with scientists as well as farmers. They were felicitated during the function by the Chief Guest. The best stall award was conferred to CTCRI, Thiruvananthapuram for displaying the stall attractively and most effectively. The valedictory function was held on 29 March 2011. Dr. Remani Gopalakrishnan, Deputy Director, Coconut Development Board, Cochin was the Chief Guest, who appreciated the efforts being done under the project for dissemination of technological information to the farmers at the grass root level. Dr. P.T.

Lakshmanan, HOD, B&N Division, CIFT presided over the function and explained about the necessity of the mass media project.

Memorandum of Agreement Signed

A Memorandum of Agreement was signed by CIFT, Cochin with M/s Britto Dry Seafoods, Tuticorin, Tamil Nadu for a consultancy for setting up two numbers of Solar Dryer with LPG back-up (CIFT Dryer SDL-50 SM) for hygienic production of dry fish. The Memorandum of Agreement was signed between Dr. T.K. Srinivasa Gopal, Director, CIFT and Shri J. Christian, Proprietor, Britto Dry Seafoods, Tuticorin on 29 March, 2011.



Handing over MoA to M/s Britto Dry Seafoods, Tuticorin

Administration

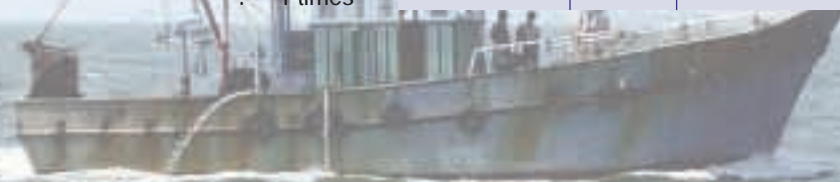
The Administration Section deals with recruitment, service and policy matters, discipline, staff welfare, land and building, procurement of stores, budget expenditure, settlement of claims etc.

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

1. Departmental Promotion Committee : 7 times
2. Departmental Selection Committee : Once
3. Assessment Committee : 7 times
4. Career Advancement Committee : Once
5. ACP Committee : 4 times
6. Selection test : 4 times

Cases considered by the Departmental Promotion Committee

Category	Promotion	Declaration of probation & Confirmation	Granting ACP
Scientific	04	03	-
Technical	21	-	-
Administrative	08	03	34
Supporting	06	02	52
Auxiliary	-	-	04





Technical Section

The Technical Section dealt with the following technical matters during the year:

Submission of monthly, quarterly and half yearly reports

Monthly reports on the important activities of the Institute and significant research findings were compiled and sent to ICAR regularly for inclusion in the ICAR monthly report to the Cabinet Secretariat. Also material for the monthly Research Framework Document was also compiled and furnished to Council.

Quarterly and six monthly reports on the targets and achievements of the Institute comprising both research and financial were regularly furnished to the Council. Six monthly targets and achievements of all individual Scientists were furnished to DG, ICAR, twice in the year under report.

Publication of the scientific papers

The scientific research papers meant for publication in research journals and for presentation in Symposia/Seminars by scientists of the Institute were arranged to be presented before the Scrutiny Committee and approval of the recommended papers communicated. During the year the Scrutiny Committee met four times for screening 18 papers.

Institute Research Council

The Institute Research Council meeting was convened during 17-18 May, 2010 to review the progress achieved in the ongoing research projects of the Institute during 2009-10 and to discuss the research project proposals for the year 2010-11. The Institute Research Project Document for the year 2010-11 was compiled and brought out for discussion at the Meeting. The House discussed in detail the 18 ongoing research projects, besides six closed projects and six new projects apart from the various ad hoc projects.

Updating Project files

Project Leader's files of all ongoing research projects were maintained up-to-date by collecting the consolidated

Quarterly/Annual/Final reports from the concerned Principal Investigators.

PERMISnet, IRS and PIMS-ICAR

The Technical Section helps in maintaining the Personal Management Information System network (PEERMISnet-II) of ICAR up-to-date. Further, the Section also furnishes quarterly inputs to the Intelligent Reporting System (IRS-II) being maintained by ICAR. Through this a set of 40 reports (both administrative and financial) are being furnished regularly online. During the year under report Project Information Management System (PIMS-ICAR) was introduced and the Institute research projects are being computerized and uploaded online.

Publication of newsletter and other reports

Four issues of Fish Technology Newsletter (English and Hindi versions separately) were published during the period. Besides, the Institute Annual Report 2009-10 (bilingual) and English and Hindi versions of Research Highlights 2009-10 were also brought out.

Implementation of Right to Information Act

The Technical Section functions as the office for implementing Right To Information Act-2005 at the Institute. During the period a total of 11 applications were received under RTIA and all were disposed in time.

Human Resources Development activities

The Human Resources Committee functions at the Technical Section. During the period HR Committee met four times to discuss 262 cases. As recommended by the HRD Committee the scientists and officers of the Institute participated in 45 training programmes during the period (Details under the Chapter - Participation in Training Programmes).

Other technical matters

The Section continued to answer queries on various technical matters received from other organizations and individuals. The queries received by the Officer in-charge in the additional capacity of Public Relations Officer, as



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well as from the feedback option in the Institute Website were attended to. Further, materials for various publications like ICAR News/ICAR Reporter, Agrinews, Fishing Chimes, MPEDA Newsletter, Seafood News, Aqua International, Sea Queen, ICAR Web page etc. were forwarded regularly, many of which have been published.

The publicity related and extension oriented activities

of the Institute are being regularly presented in the monthly meetings of the Inter Media Publicity Co-ordination Committee of Ministry of Information and Broadcasting, Govt. of India. Besides, the Technical Section functions as the nodal point for releasing Press Releases and Reports.

The Hindi translation work of the entire Institute is also under taken by the Section.

Library

Library is playing a vital role in acquisition, preservation and dissemination of knowledge in all subject areas related to harvest and post harvest technology of fish. It has been geared up with the latest information tools and updated resources. Activities like acquisition, cataloguing and serial control have been integrated using library management software SLIM++. A good collection of digital resources is made available to the CIFT community through the library portal, <http://library.cift.res.in>.

The library acquired 127 books. Forty seven foreign and 36 Indian scientific periodicals have been subscribed. Online databases viz., ASFA (Aquatic Science and Fisheries Abstracts), FSTA (Food Science and Technology

Abstracts) and Indiastat.com have also been acquired. More than 2000 journals are available online through CeRA (Consortium of E-resources on Agriculture).

Library's digital resources continued to grow during the period and at present 1874 scientific papers of CIFT are available in the digital form. The library promptly supplies copies of articles under Document Delivery Request (DDR) facility of CeRA.

Issues of "Current Contents on Fishery Technology" were brought out on quarterly basis. The library in association with National Institute of Oceanography (NIO), Goa continued to act as a National Input Centre of ASFA database.

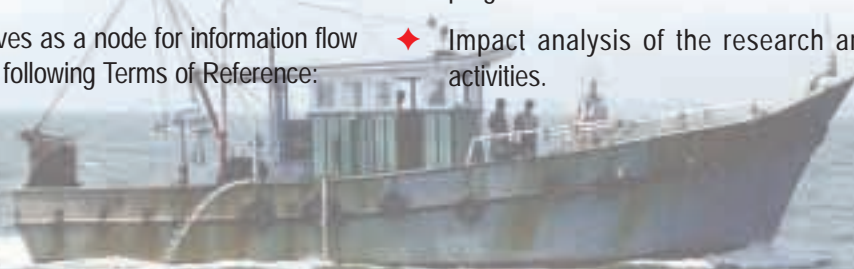
PME Cell

Priority setting, Monitoring and Evaluation (PME) cell functions in the Institute with the following composition:

Dr. M.R. Boopendranath, Principal Scientist, FT Division	: Chairman
Dr. C.N. Ravishankar, Principal Scientist, FP Division	: Member
Dr. Nikita Gopal, Senior Scientist, EIS Division	: Member
Dr. K. Ashok Kumar, Senior Scientist, QAM Division	: Member
Dr. A.R.S. Menon, OIC, Technical Section	: Member

The PME Cell serves as a node for information flow and action and has the following Terms of Reference:

- ◆ Sensitization of policy makers, managers, scientists and others about PME activities.
- ◆ Interface with Agricultural Research Information System (ARIS), Strategic Research and Extension Plan (SREP), Agricultural Technology Management Agency (ATMA), Institute Village Linkage Program (IVLP), Technology Assessment and Refinement (TAR) and Krishi Vigyan Kendras (KVKs), publication of annual reports, activities related to EFC Memo and other reports to the Council.
- ◆ Facilitate monitoring and evaluation of research programmes.
- ◆ Impact analysis of the research and extension activities.



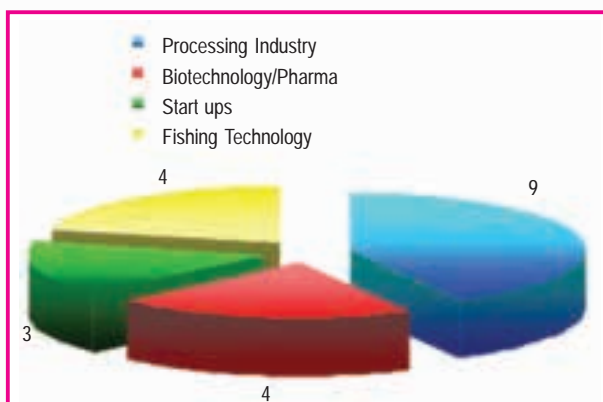


ZTM & BPD Unit

The Zonal Technology Management & Business Planning and Development Unit established at CIFT, Cochin is a "One Stop Shop" for entrepreneurs who can receive pro-active, value-added support in terms of technical consultancy, and access to critical tools such as entrepreneur-ready technologies, vast infrastructure and other scientific resources. The unit provides links to industry; business support services to enhance and develop business; upgrades skills and techniques; gives technological advice and assistance with intellectual property protection; initial test marketing; and access to potential investors and strategic partners.

Enrollment of members for direct and virtual incubation

A total of 20 entrepreneurs who wish to start commercial ventures with the technical assistance and services of CIFT have enrolled as incubatees under the ZTM-BPD Unit. Steps have been initiated to provide financial assistance to the incubatees through MSME.



Incubatees Profile

Organizing business meets and promotional events for showcasing ICAR technologies

ICAR - Industry Meet 2010: The ICAR conducted ICAR-Industry Meet 2010, at NASC Complex, New Delhi during 28 and 29 July 2010. The ZTM-BPD Unit, South Zone coordinated among seven member institutes under the zone (CIFT-Cochin, IIHR-Bangalore, CIBA-Chennai, DOR-Hyderabad, DRR-Hyderabad, CPCRI-Kasaragod and NRCB-Trichy) and has assisted in showcasing



Inauguration of ICAR-Industry Meet 2010



Showcasing technologies at ICAR Industry Meet. Shri Sharad Pawar, Hon'ble Union Minister for Agriculture visiting CIFT stall

entrepreneur-ready technologies during the ICAR Industry Meet 2010.

International Animal Industry Expo 2010: The International Animal Industry Expo – 2010 took place during 27 – 29 October 2010 at HUDA Ground, Sector-32, Karnal witnessing participation of 243 national and international exhibitors and 12,117 visitors from different sectors of animal husbandry viz. dairy, poultry, aquaculture and meat processing. The Expo enabled the visitors to meet the major players in the industry, to know about the latest technologies and innovations, and their applications in boosting the livestock industry in India. The ZTM-BPD Unit, along with three member institutes under the zone, viz. PDP, Hyderabad, NRCM, Hyderabad and CIFT, Cochin



Ready to eat products from ZTM-BPD stall

participated in the Expo and showcased the potential technologies to the entrepreneurs. The team explained about the technological innovations and the research results obtained by the research institutions under ICAR.

Innovations for Industry Meet in Fisheries: In continuation of the efforts initiated by ICAR towards scientific enterprising through the industry meets, ZTM-BPD Unit organized a business meet titled "Innovations for Industry – Fisheries" at Visakhapatnam on 8 September 2010 in collaboration with the National Fisheries Development Board (NFDB), Hyderabad. Nine Research Institutes under ICAR (CIFT, Cochin; CIBA, Chennai; CMFRI, Cochin; CIFA, Bhubaneswar; CIFRI, Barrackpore; CIFE, Mumbai; DCFR, Bhimtal; NBFGR, Lucknow and CARI, A&N Islands) specialized in the field of fisheries and aquaculture exhibited various technologies and entrepreneur-ready innovations, ranging from culture,

capture, to value addition, for the fisheries industry. The institutes were given specific formats and guidelines for preparing presentations, brochures, pamphlets, etc. for showcasing their potential technologies. The technologies were exposed to about 60 entrepreneurs who were interested in taking up business ventures in the field of fisheries.

In the inaugural ceremony Dr. T.K. Srinivasa Gopal, Acting Director, CIFT, Cochin welcomed the gathering and briefed about the idea behind the Innovations for Industry Meet. The event was inaugurated by Dr. P. Krishnaiah, IAS, Chief Executive, NFDB. Dr. B. Meenakumari, Deputy Director General (Fisheries), ICAR delivered the presidential address. Dr. Bangali Baboo, National Director, NAIP addressed the gathering. Dr. S. Mauria, Assistant Director General (IP&TM), Dr. N.T. Yaduraju, National Co-ordinator, NAIP, Dr. A.G. Ponnaiah, Director, CIBA, Chennai and Shri V. Padmanabhan, Regional President, Seafood Exporters Association of India offered felicitations during the ceremony.

In the Technical Session which followed, all commercially viable technologies were presented in front of industry people. Nine research institutes under ICAR specialized in the field of fisheries and aquaculture exhibited about 55 technologies and entrepreneur ready innovations. About 60 industry representatives from the field of fisheries and aquaculture attended the exhibition. The participants dwelt upon the investment opportunities by making use of various technologies and innovations exhibited.

Horticulture Industry Meet: The Indian Institute of Horticultural Research (IIHR) along with the ZTM-BPD Unit,



Dr. B. Meenakumari, DDG (Fy.), ICAR and Dr. P. Krishnaiah, Chief Executive, NFDB inaugurating the event



Dr. S. Ayyappan, DG, ICAR visiting ZTM-BPD stall



South Zone organized the Horticulture-Industry Meet on 11 November, 2010 at Bangalore. A total of 14 Research Institutes under the Horticulture Division of ICAR participated in the deliberations and displayed their technologies ready for commercialization for the benefit of participating private sector companies and entrepreneurs.

Pangasius Festival: A business promotion programme titled "Pangasius Festival" was organized by the ZTM-BPD Unit, South Zone in collaboration with the National Fisheries Development Board (NFDB) and State Fisheries Department, Government of Andhra Pradesh at Elluru, Andhra Pradesh on 24 March 2011. The event was successful in popularizing the farming, processing and consumption of Striped Catfish in the State by presenting different value added products among fish farmers, fish entrepreneurs and general public.



Dr. T.K. Srinivasa Gopal, Director, CIFT inaugurating 'Pangasius Festival'

Technical consultancies in the field of fisheries

Establishment of Processing Unit for value added products from freshwater fish: The CIFT, Cochin has set a model for the public private partnership through the establishment of India's first inland fish processing facility in the village of Bhutana, Karnal district of Haryana. The hard work and consistent efforts of a progressive fish farmer cum entrepreneur, Shri Sultan Singh has brought the village of Bhutana into the limelight. He is the man behind the establishment of the 'Sultan Singh's Fish Seed Farm', 'Sultan Singh's Food Court' and the Processing Unit for the production of value added products from fish. The unit was inaugurated by Dr. S. Ayyappan, Secretary, DARE and DG, ICAR on 26 February 2011.



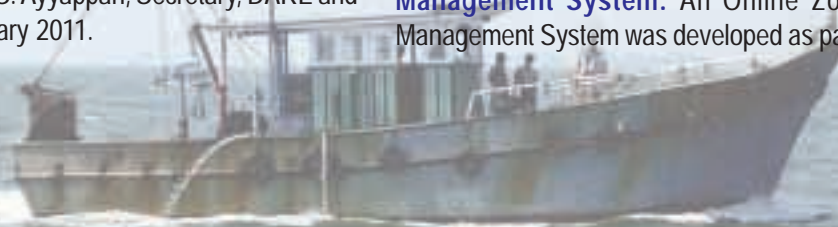
Dr. S. Ayyappan presenting the Incubatee Plaque to Shri Sultan Singh

Shri Sultan Singh, a registered incubatee under the ZTM-BPD Unit, South Zone has set up a processing unit with facilities as per international norms and standards at Karnal, in technical collaboration with CIFT, Cochin. He is the first incubatee from ZTM-BPD Unit, to establish a successful business venture in the field of inland fisheries in India. Scientists from CIFT have provided technical guidance in setting up a zero waste fish processing unit and have imparted training in the production of fish based value added products.

Establishment of processing Unit for chilled and frozen fish products at Nagercoil: A production unit for chilled and frozen fish products was established at Nagercoil under the technical consultancy of CIFT. The company named M/s Pathinathan Seafood Exports was inaugurated on 20 February 2011. It is registered under Small Scale Industry and has received export-import code. CIFT has also given training to Shri Kumar Pathinathan on 'Hygienic handling and preparation of ready-to-cook chilled fishery products'.

Establishment and management of Advanced Training Centre on Food Safety: An Advanced Training Centre on Food Safety (ATCFS) is being established at CIFT under Public Private Partnership between CIFT, Cochin and Biomérieux India Pvt. Ltd, New Delhi. The ZTM-BPD Unit is entrusted with the management of ATCFS and training programmes.

Development of Online Zonal Database Management System: An Online Zonal Database Management System was developed as part of the project



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website, www.agriincubator.com with the aim of efficiently managing the IP and technological assets owned by the Member Institutes of South Zone. The system will help ICAR in understanding and evaluating the value of potential technologies and scientific know-how developed, and the commercialization and revenue generation activities taken up by the Member Institutes. The ITMUs can access the system using a Login ID and password. They can update, review and monitor the complete database information relevant to their Institute and thereby develop and organize the practice of technology management and innovation.

Development of infrastructure facilities for the ZTM-BPD Unit

Incubation Office Space: Dr. S. Ayyappan, Secretary, DARE and Director General, ICAR has laid the Foundation Stone for the new ZTM-BPD Block at CIFT, Cochin on 26 November 2010. The facility is being constructed within the office premises of CIFT, Cochin and has an approximate area of 5000 sq.ft with exclusive in-house facilities such as air-conditioned office suites, shared facilities of secretarial assistance, video conferencing, communication facilities etc. for the incubatees.

Pilot level Production Facility: The pilot plant facility is being set up with state-of-the-art generic semi-commercial production facility for fish and meat based products. Pilot plant facility includes production lines for pre-processing, freezing and chilling, preparation of value added products, utilization of byproducts from fish, retort pouch processing, sausage and extruded products, breeding and battering, cooking, canning and packaging. Purchase of equipment and the installations of processing lines are under progress.



Dr. S. Ayyappan unveiling the plaque

ZTM-BPD Annual Meeting-cum-Workshop 2010-11

The ZTM-BPD Unit, South Zone conducted the Annual Meeting-cum-Workshop 2010-11 on 4 and 5 March 2011 at Cochin. The members of Institute Technology Management Committees (ITMCs) from 20 ICAR Research Institutes in South Zone participated in the event. The Meeting-cum-Workshop was aimed at providing an opportunity for the institutes to deliberate on the issues faced by them in IP management and technology commercialization. The event was inaugurated by Dr. N. K. Jayakumar, Vice Chancellor, National University of Advanced Legal Studies (NUALS), Cochin on 4 March 2011. Dr. K. Gopakumar, former Deputy Director General (Fisheries), ICAR, New Delhi presided over the function.



Dr. N. Jayakumar delivering the inaugural speech of ZTM-BPD Annual Workshop

Consultants for patent and legal aspects

Under the ZTM-BPD Unit, a consultant has been appointed for providing assistance in patent and legal aspects, whose services can be availed by the ICAR member institutes under the South Zone. The consultant will provide support for IP evolution and protection, conduct patent database search and interpretation of search results, provide technology assessment concerning prior art, selection of optimal IP protection route in agreement with ZTM-BPD Unit, drafting patent applications based on inventions to the appropriate patent offices, composing response explanations to the patent examiner and/or performing revisions of the patent application as necessary, and supporting in legal aspects of technology transfer process. Legal advice will be given in the commercialization



of the technologies on a case to case basis and the agreements will be drafted in compliance with the enforced rules and guidelines of ICAR.

Assistance to other ICAR institutes

The ZTM-BPD Unit has provided assistance to the member institutes under the South Zone in commercializing and protecting their intellectual assets, on a case to case basis. ITMUs of member institutes are given guidelines for

preparing technology profiles/ business proposals, brochures, flyers and MoU's for the selected technologies. Some of the commercialization activities taken up are Area specific mineral mixture (NIANP, Bangalore), Cadalmin™ Green Mussel Extract (CMFRI, Cochin), Bio-pesticide from cassava leaves (CTCRI, Trivandrum) and Pearl production technique through tissue culture (CMFRI, Cochin). The Unit has also assisted IISR, Calicut in preparing an agreement for sharing photographs and digital images.

Institute Technology Management Unit

Intellectual Property Management and Technology transfer/Commercialization Unit at Institute level, ie. IPM & TU was established by ICAR at Institute level to manage the issues related to Intellectual Property (IP) as per ICAR guidelines for Intellectual Property Management and Technology Transfer/Commercialization which is effective from 6 June, 2008. Institute Technology Management Committee (ITMC) is the high power committee to take the final decision on commercialization of technologies generated at the Institute.

Constitution of the Committee

Institute Technology Management Committee (ITMC)

Dr. T.K. Srinivasa Gopal,
Director, CIFT : Chairman

Dr. Leela Edwin, Head,
Division of Fishing Technology : Member

Dr. P.N. Joshi, Acting Head,
Division of Engineering : Member

Dr. M.R. Boopendranath,
Principal Scientist,
Division of Fishing Technology : Member

Dr. T.V. Sankar, Head, Division of
Quality Assurance and Management : Member Secretary

Institute Technology Management Unit (ITMU)

Dr. T.V. Sankar, Head, Division of
Quality Assurance and Management : Officer In Charge

Dr. C.N. Ravishankar,
Principal Scientist,
Division of Fish Processing : Member

Dr. K. Ashok Kumar, Senior Scientist,
Division of Quality Assurance and
Management : Member

Dr. Nikita Gopal, Senior Scientist,
Division of Extension, Information
and Statistics : Member

Dr. A.R.S. Menon,
Technical Officer (T9) & OIC,
Technical Section : Member

Shri M. Kiran Das : Research Associate

Smt. K.A. Anju : Research Associate

IP Assets handled during 2010-11

IP	In process/ Maintained	New applications (ready for filing)	Granted
Patent	13	8	2
Trade mark	1	1	1

Technical Guidance/Consultancy

Name of the party	Consultancy offered	Amount released
Royal Fish Processing Unit, Anapuzha	Design specification of solar fish drier with electric back-up	₹ 1,000/-
Swapna Activity Group, Kurankadavu, Payyannur	Solar dryer with electrical back-up	₹ 1,000/-
Haritha Farmer's Club, C/o SBT, Perumpalam	Diagnostic study for the development of the clam cluster	₹ 11,030/-
Regional Shrimp Hatchery, Azhikode, Thrissur District	Setting up of a PCR-Laboratory	₹ 1,15,815/-
Directorate of Fisheries, UT of Lakshawep, Kavaratti	23 M Tuna long liner vessel	₹ 3,60,000/- (first installment)
Kerala Livestock Development Board, Mudavoor P.O., Muvattupuzha	Renewal of the HACCP certificate	₹ 60,000/-

Participation in Trainings/Workshops/Seminar etc.

Title	Organized by	Date
Zonal Meetings-cum-Workshops conducted during 2009-10 at Cochin	ICAR – ZTM & BPD Units	12-13 March, 2010
ICAR Industry Meet 2010 at New Delhi	ICAR, New Delhi	8 July, 2010
Innovations-4-Industry Meet at Visakhapatnam	ZTM & BPD Unit South Zone	8 September, 2010
IAI Expo (International Animal Industry Expo), India at Karnal, Haryana	PIXIE Consulting Solutions Ltd., Karnal, Haryana	27-29 October, 2010
Workshop on Managing intellectual property rights in collaborative R&D marketing of products at Bangalore	NRDC, New Delhi	10-11 December, 2010
Horticulture Industry Meet 2010 at Bangalore	ITMU, IIHR, Bangalore	11 November, 2010
ZTM & BPD Meeting – cum – Workshop 2010-11 at Cochin	ZTM-BPD, South Zone	4-5 March, 2011

Publications of ITMU

Bulletins

- ♦ ITMU bulletins

Flyers

- ♦ Eco-friendly hybrid solar drier for hygienic preservation of fish
- ♦ Production of chitosan from crustacean waste

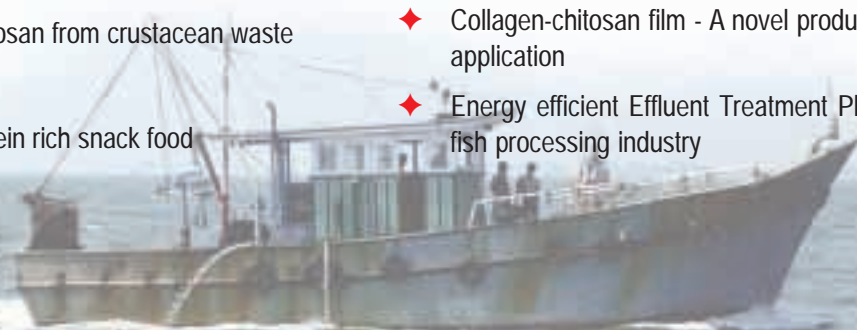
Pamphlets

- ♦ Fish Kure - A protein rich snack food

- ♦ Energy efficient Effluent Treatment Plant (ETP) for fish processing industry
- ♦ Ready to serve fish curry in retort pouch
- ♦ Chitin and chitosan from crustacean waste

Posters

- ♦ Chitin and chitosan from crustacean waste
- ♦ Collagen-chitosan film - A novel product for medical application
- ♦ Energy efficient Effluent Treatment Plant (ETP) for fish processing industry





- ◆ Ready to serve fish curry in retort pouch
- ◆ Fish Kure - A protein rich snack food
- ◆ Glucosamine hydrochloride - A valuable nutraceutical from prawn shell
- ◆ Poly Unsaturated Fatty Acid (PUFA) concentrate from fish oil
- ◆ Eco-friendly hybrid solar drier for hygienic preservation of fish
- ◆ Squalene - Shark liver oil
- ◆ CIFT- TED for turtle safe trawl fisheries
- ◆ Diagnostic kit for white spot syndrome virus

Business Proposals

- ◆ Chitin from crustacean waste
- ◆ Chitosan from crustacean waste
- ◆ Energy efficient Effluent Treatment Plant (ETP) for fish processing industry
- ◆ Ready to serve fish curry in retort pouch
- ◆ Fish Kure - A protein rich snack food
- ◆ Glucosamine Hydrochloride - A valuable nutraceutical from prawn shell
- ◆ Eco-friendly hybrid solar drier for hygienic preservation of fish

Post Graduate Studies

Shri B. Ganesan, Technical Officer (T5), Biochemistry & Nutrition Division, CIFT, Cochin was awarded Ph. D. degree in Biochemistry of Vinayaka Missions University, Salem, for his thesis titled, "Biochemical studies on the protective effect of betaine on experimentally induced myocardial infarction in rats". He worked under the guidance of Dr. R. Anandan, Senior Scientist, B&N Division, CIFT, Cochin.



Dr. B. Ganesan

Shri P.G. Sreenath, Senior Research Fellow, Fish Processing Division, CIFT, Cochin was awarded Ph. D. degree of Cochin University of Science and Technology, Cochin for his thesis entitled "Standardization of process parameters for ready to eat fish products in polymer coated tin free steel cans". He worked



Dr. P.G. Sreenath

under the guidance of Dr. C.N. Ravishankar, Principal Scientist, FP Division, CIFT, Cochin.

Dr. B. Madhusudana Rao, Scientist (SG), Visakhapatnam Research Centre of CIFT was awarded Ph. D. degree of Cochin University of Science and Technology, Cochin, for his thesis titled, "Biochemical and molecular characterization of pathogenic *Vibrios* from hatcheries and aquaculture farms". He worked under the guidance of Dr. P.K. Surendran, former Principal Scientist & Head, Microbiology, Fermentation & Biotechnology Division, CIFT, Cochin.



Dr. B. Madhusudana Rao

Shri Santhosh Alex, Technical Officer (T5) Visakhapatnam Research Centre of CIFT was awarded Ph. D. in Hindi from VIT University, Vellore for his thesis titled "Humanism in the poems



Dr. Santhosh Alex

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of Kedarnath Singh and K. Satchidanandan - A comparative study". The research work was carried under the guidance of Dr. K. Jailakshmi.

Dr. Toms C. Joseph, Scientist (SG), Microbiology, Fermentation & Biotechnology Division, CIFT, Cochin was awarded Ph. D. degree of Cochin University of Science and Technology, Cochin, for his thesis titled, "Molecular and biological investigations on viral diseases affecting farmed penaeid shrimps in Kerala". He worked under the guidance of Dr. P.K. Surendran, former Principal Scientist & Head, MFB Division, CIFT, Cochin.



Dr. Toms C. Joseph

Shri Rakesh Kumar, Scientist, Sr. Scale, Microbiology, Fermentation & Biotechnology Division, CIFT, Cochin was awarded Ph. D. degree of Cochin University of Science and Technology, Cochin, for his thesis titled, "Biochemical and molecular investigations on *Salmonella* serovars from seafood". He worked under the guidance of Dr. P.K. Surendran, former Principal Scientist & Head, MFB Division, CIFT, Cochin.



Dr. Rakesh Kumar

Shri Gipson Edappazham, Senior Research Fellow, Fishing Technology Division CIFT, Cochin was awarded Ph. D. degree of Cochin University of Science and Technology, Cochin, for his thesis titled, "Performance evaluation of commercially important Indian and imported fishing hooks". He worked under the guidance of Dr. Saly N. Thomas, Senior Scientist, FT Division, CIFT, Cochin.



Dr. Gipson Edappazham

Shri S. Hari Senthil Kumar, Senior Research Fellow, Biochemistry & Nutrition Division CIFT, Cochin was awarded Ph. D. degree of JNTU, Hyderabad for his thesis titled, "Biochemical studies on the effect of glutamine on experimentally induced myocardial infarction in rats". He worked under the guidance of Dr. R. Anandan, Senior Scientist, B&N Division, CIFT, Cochin



Dr. S. Hari Senthil Kumar

Shri Mathen Mathew, Research Fellow, Biochemistry & Nutrition Division, CIFT, Cochin has been awarded Ph. D. degree of Cochin University of Science and Technology, Cochin for his thesis titled, "Biochemical and pharmacological evaluation of liver oils of selected deep sea sharks and chimaeras of the Indian EEZ". He worked under the guidance of Dr. Suseela Mathew, Senior Scientist, B&N Division, CIFT, Cochin.



Dr. Mathen Mathew

Shri Ganugula Rao, Research Fellow, Mumbai Research Centre of CIFT has been awarded Ph. D. degree of Acharya Nagarjuna University, Guntur for his thesis titled, "Study on proteolytic activity in different types of shrimp wastes: Extraction, purification and characterization of protease isolates". He worked under the guidance of Dr. R. Chakrabarti, Principal Scientist, Mumbai Research Centre of CIFT.



Dr. Ganugula Rao

Shri R. Rajesh, Research Fellow, Biochemistry & Nutrition Division, CIFT, Cochin has been



Dr. R. Rajesh





awarded Ph. D. degree of Vinayaka Missions University, Salem for his thesis titled, "Biochemical studies on the protective effect of dietary squalene supplementation on

arsenic poisoning in rats". He worked under the guidance of Dr. P.T. Lakshmanan, Principal Scientist & Head, B&N Division, CIFT, Cochin.

Invited Talks

The following scientific/technical talks were delivered by experts at CIFT, Cochin:

1. Dr. Renjan Mathew Varghese, State Director, World Wide Fund for Nature, India – Sustainable development – Kerala scenario (5 June, 2010)



Dr. Renjan Mathew Varghese

2. Dr. C.K. Eapen, Honorary Professor of Medicine and Dr. M. Abraham Ittyachen, Associate Professor of Medicine, MOSC Medical College, Kolencherry – Communicable diseases (25 June, 2010)



Dr. C.K. Eapen

3. Smt. K.A. Anju, Research Associate, CIFT, Cochin - Role of food in healthy living (13 July, 2010)
4. Dr. Soman, Associate Professor, School of Legal Studies, CUSAT, Cochin – Criminal law and human rights (28 October, 2010)



Dr. Soman

5. Ms. Bindu, Brahmakumari Samaj, Cochin – Stress management and positive thinking (27 January, 2011)
6. Dr. Bala Swaminathan, Vice President, Technical and Business Development, IHRC Inc., Atlanta, USA –



Smt. Bhadra Satheesh



Revolutionary food borne disease outbreak investigations in the United States (17 February, 2011)

7. Smt. Bhadra Satheesh, Deputy Mayor, Corporation of Cochin – Women empowerment (8 March, 2011)

Representation in Committees

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

Dr. T.K. Srinivasa Gopal, Director

As Member

- ◆ Technical committee, Food Safety Standards Authority of India, New Delhi
- ◆ Collaborative project by MPEDA, CIFT and IFP on up-gradation of seafood packaging
- ◆ Assessment Committee for scientists, CFTRI, Mysore
- ◆ Board of Studies in Food Science and Technology of University of Mysore and University of Kerala
- ◆ Examiner for Ph.D. and M.F.Sc. in University of Mysore, CUSAT, Cochin, College of Fisheries, Mangalore, College of Fisheries, Panangad and College of Fisheries, Tuticorin
- ◆ Institute Management Committee, NRC Meat, Hyderabad

Dr. P.T. Lakshmanan, Head, Biochemistry & Nutrition Division

As Member

- ◆ Supervisory Audit Team for approving seafood export to EU
- ◆ Inter Departmental Panel of experts of EIA for approval of seafood processing plants for EU
- ◆ Subsidy Committee of MPEDA, Cochin
- ◆ Examiner, M.Sc. Environmental Technology, CUSAT, Cochin
- ◆ Task force committee on Fisheries, Govt. of Kerala

Dr. Leela Edwin, Head, Fishing Technology Division

As Member

- ◆ Task force for Gap analysis of ILO Convention No. 1882, Ministry of Labour and Employment, Govt. of India
- ◆ Board of Studies, M. Sc. Industrial Fisheries, CUSAT, Cochin

Dr. K.V. Lalitha, Head, Microbiology, Fermentation & Biotechnology Division

As Member

- ◆ Consultancy team to set up a biological testing laboratory for the Regional Shrimp Hatchery, Azhikode

Dr. T.V. Sankar, Head, Quality Assurance & Management Division

As Member

- ◆ Management Committee, CIBA, Chennai
- ◆ Inter Department Panel of experts for approval of fish processing plants for export to EU
- ◆ Board of Studies, Faculty of Marine Sciences, CUSAT, Cochin
- ◆ Section committee for fish and fishery products (FAD 12) and hygiene (FAD 15), BIS, Govt. of India

Dr. S. Balasubramaniam, Head, Extension, Information & Statistics Division

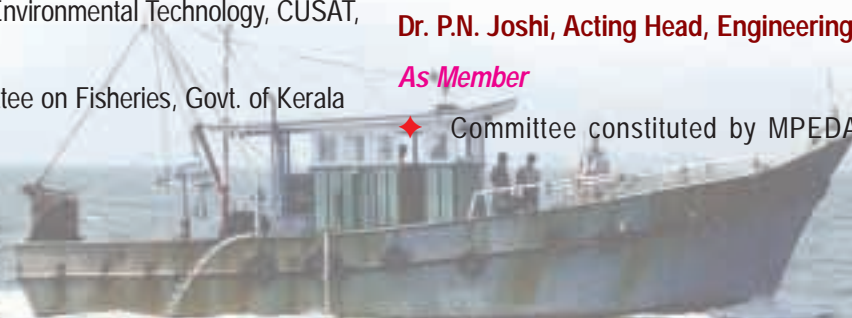
As Member

- ◆ Committee on extension and training constituted by MPEDA, Cochin

Dr. P.N. Joshi, Acting Head, Engineering Division

As Member

- ◆ Committee constituted by MPEDA, Cochin for





technical scrutiny of Subsidy Schemes to modernize the seafood processing industry in India

- ◆ Task force on Fisheries infrastructure development, Govt. of Kerala

Shri P.K. Vijayan, Acting Head, Fish Processing Division

As Member

- ◆ Project review and monitoring committee of DST project on Value addition of low value marine pelagic fishes at Tharangambadi, Tamil Nadu
- ◆ Inter Department Panel of experts for approval of fish processing plants for export to EU
- ◆ DPC, Coir Board, Cochin and MPEDA, Cochin
- ◆ Technology upgradation scheme for marine products, MPEDA, Cochin
- ◆ Interest subsidy committee for seafood processing units, MPEDA, Cochin

Dr. M.M. Prasad, Scientist Incharge, Visakhapatnam Research Centre

As Member

- ◆ Institute Management Committee, CIFRI, Barrackpore
- ◆ Inter Department Panel of experts for approval of fish processing plants for export to EU

Dr. R. Badonia, Scientist Incharge, Veraval Research Centre

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

Dr. R. Chakrabarti, Scientist Incharge, Mumbai Research Centre

As Member

- ◆ Board of Studies, CIFE, Mumbai

Dr. M.R. Boopendranath, Principal Scientist

As Member

- ◆ Board of Studies in Industrial Fisheries and Marine Biology, CUSAT, Cochin

- ◆ Task force on Aquarium reforms in fisheries sector, Govt. of Kerala

- ◆ Task force on Fisheries research (Govt. of Kerala)

- ◆ Expert Committee for the Diversification of aquaculture, Govt. of Kerala

- ◆ Expert Committee on Registration of fishing vessels, Govt. of Kerala

- ◆ Technical team for purchase of equipment for deep sea fishing project of Matsyafed

Dr. S. Sanjeev, Principal Scientist

As Chairman

- ◆ National Mirror Committee of ISO/TC 34/SC 9 on Microbiology, BIS, Govt. of India

As Member

- ◆ Inter Department Panel of experts of EIA for approval of seafood processing plants for EU
- ◆ Expert Group on Export of live bivalve molluscs constituted by EIC, Govt. of India
- ◆ Assessment Board for the approval of technologists of MPEDA at Cochin and Chennai
- ◆ Committee for monitoring the fish/shellfish growing waters at Padanna, Kasaragod dist. constituted by MPEDA, Cochin
- ◆ Expert panel – Implementation of MPEDA Logo Scheme
- ◆ Section Committee for fish and fishery products, BIS, Govt. of India

Shri M. Nasser, Principal Scientist

As Member

- ◆ Inland Harbour Crafts and Fishing Vessel Sectional Committee, Bureau of Indian Standards, New Delhi
- ◆ Transport Engineering Division Council, BIS, New Delhi
- ◆ Marine Engineering and Safety Aids Sectional Committee, BIS, New Delhi
- ◆ Committee for review of long pending infrastructure projects in fisheries sector, State Planning Board,

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Govt. of Kerala

- ◆ Expert committee for the finalization of the technical specifications of the mother vessels proposed to be procured by Lakshadweep Administration at Kavaratti

Dr. C.N. Ravishankar, Principal Scientist

As Member

- ◆ Technical committee, Food Safety Standards Authority of India, New Delhi
- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU
- ◆ Expert Committee on Science and Societies, DST, New Delhi
- ◆ Committee on Upgradation of seafood packaging by MPEDA, CIFT and IIP
- ◆ As external examiner for Ph.D. and M.F.Sc. in College of Fisheries, Mangalore, Panangad, Ratnagiri, Vernal, Tripura and Tuticorin

Dr. P. Pravin, Senior Scientist

As Member

- ◆ Examiner and paper setter of Fishing Gear Technology for B.F.N.Sc., CIFNET, Cochin, B.F.Sc., College of Fisheries, Mangalore and College of Fisheries, Panangad

Dr. K. Ashok Kumar, Senior Scientist

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU
- ◆ Assessment Board for the approval of technologists at MPEDA, Cochin and Chennai
- ◆ Expert group on Export of live bivalve molluscs constituted by EIC, Govt. of India
- ◆ Consultative committee for construction and modernization of fish markets with the financial assistance of NFDB, Hyderabad
- ◆ Expert group for review of standard conditions for sanitary import of various fish/fishery products of Ministry of Agriculture, Govt. of India
- ◆ Expert Committee for the construction of modern

hygienic fish markets in all states, NFDB, Hyderabad

Dr. Saly N. Thomas, Senior Scientist

As Member

- ◆ Expert committee constituted by Matsyafed for the proposed fish net factory at Kannur
- ◆ Examiner for M.Sc. Fishing Technology and Fishing Engineering, TNUVAS, Chennai
- ◆ Paper setter for M.Sc. Industrial Fisheries, CUSAT, Cochin and B.F.Sc., College of Fisheries, Panangad

As Alternate Member

- ◆ Textile material for marine fishing purpose, Sectional Committee TX18, BIS, New Delhi

Shri S.P. Damle, Senior Scientist

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU
- ◆ Regional Committee of MPEDA for evaluation of assistance in acquisition of GPS, Fish Finder, Radiotelephone and Fish holds to fishermen of Mumbai

Dr. G. Rajeswari, Senior Scientist

As Member

- ◆ Regional Committee of MPEDA for evaluation of assistance in acquisition of GPS, Fish finder, Radiotelephone and Fish holds to fishermen of Mumbai

Dr. Femeena Hassan, Senior Scientist

As Member

- ◆ Interest subsidy committee, MPEDA, Cochin
- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

Dr. Suseela Mathew, Senior Scientist

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU





- ◆ Examiner and question paper setter, B.F.Sc, KAU, Thrissur
- ◆ Examiner and question paper setter for Department of Marine Biology and Biochemistry, CUSAT, Cochin

Dr. M.P. Remesan, Senior Scientist

As Member

- ◆ Committee for the selection of Chief Executives and State Coordinators for the Society (NETFISH and IOAP) under MPEDA, Cochin

Dr. A.A. Zynudheen, Senior Scientist

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU
- ◆ Inter Departmental Panel for assessment of technologists, EIA, Cochin
- ◆ Board of examiners, M.Sc. Aquaculture, University of Calicut

Dr. R. Anandan, Senior Scientist

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

Dr. J. Bindu, Senior Scientist

As Member

- ◆ Board of examiners, M.Sc. Aquaculture, University of Calicut

Dr. U. Sreedhar, Senior Scientist

As Member

- ◆ Regional Committee of MPEDA for evaluation of assistance in acquisition of GPS, Fish finder, Radiotelephone and Fish holds to fishermen of Mumbai

Dr. George Ninan, Senior Scientist

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU
- ◆ Committee for financial aid for setting up of modern

ice plants constituted by MPEDA, Cochin

- ◆ Board of examiners, M.Sc. Aquaculture, University of Calicut

- ◆ Vidyalaya Management Committee, Kendriya Vidyalaya No. 1, Naval Base, Cochin

Dr. Sanjoy Das, Senior Scientist

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

Shri M.V. Baiju, Senior Scientist

As Member

- ◆ Expert committee for conversion of mechanized boats for deep sea fishing of Directorate of Fisheries, Govt. Kerala
- ◆ Committee for providing subsidy for conversion of fishing vessels to tuna long liners by MPEDA, Cochin
- ◆ Committee for providing subsidy for insulated fish hold inside fishing vessels by MPEDA, Cochin
- ◆ Tender committee for the procurement of training vessel for CIFNET, Cochin
- ◆ Tender committee for the procurement of sea rescue boats for Department of Fisheries, Govt. of Kerala
- ◆ Tender committee for purchase of sea safety kits for Department of Fisheries, Govt. of Kerala
- ◆ Monitoring committee for the acquisition of Mother Vessel for UT of Lakshadweep
- ◆ Expert member for finalizing the specifications of Junghar for NPOL, Cochin
- ◆ Examiner and paper setter, B.F.Sc., College of Fisheries, Panangad

Dr. B. Madhusudana Rao, Scientist (SG)

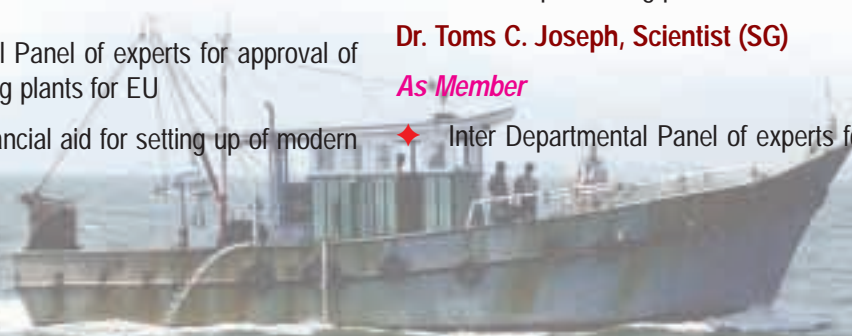
As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

Dr. Toms C. Joseph, Scientist (SG)

As Member

- ◆ Inter Departmental Panel of experts for approval of



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seafood processing plants for EU

- ◆ Consultancy team to set up a biological testing laboratory for the Regional Shrimp Hatchery, Azhikode
- ◆ Animal Ethics Committee, CMFRI, Cochin

Dr. Rakesh Kumar, Scientist (Sr. Scale)

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

Dr. L.N. Murthy, Scientist (Sr. Scale)

As Alternate Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

Dr. S.K. Panda, Scientist (Sr. Scale)

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

As Alternate Member

- ◆ Expert group for drafting international standard (ISO/TC 234) on Traceability of shell fishes including crustacean and molluscs
- ◆ Expert group for review of standard conditions for

sanitary import of various fish/fishery products of Ministry of Agriculture, Govt. of India

Smt. K.K. Asha, Scientist (Sr. Scale)

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

Shri V.R. Madhu, Scientist

As Member

- ◆ Regional Committee of MEPEDA for evaluation of assistance in acquisition of GPS, Fish finder, VHF and Fishhold on-board mechanized fishing vessels

Dr. C.O. Mohan, Scientist

As Member

- ◆ Inter Departmental Panel of experts for approval of seafood processing plants for EU

Dr. A.R.S. Menon, Technical Officer (T9)

As Member

- ◆ Inter Media Publicity Co-ordination Committee (Kerala), Ministry of Information and Broadcasting, Govt. of India
- ◆ Editorial Board, Applied Science Periodicals, Siwan
- ◆ Editorial Board as Chief Editor, Science India, Cochin

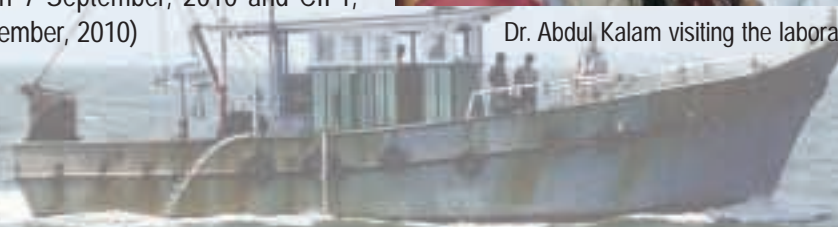
Visitors

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

1. Dr. Rudolf Hermes, Chief Technical Adviser and Dr. Chris O' Brien, Regional Coordinator, Bay of Bengal Large Marine Ecosystem Project (CIFT, RC, Visakhapatnam on 7 May 2010)
2. Bharat Ratna Dr. A.P.J. Abdul Kalam, former President of India (CIFT, Cochin on 6 June, 2010)
3. Dr. B. Meenakumari, Deputy Director General (Fisheries), ICAR, New Delhi (CIFT, RC, Visakhapatnam on 7 September, 2010 and CIFT, Cochin on 26 November, 2010)



Dr. Abdul Kalam visiting the laboratories





4. Dr. Madan Mohan, Assistant Director General (Marine Fisheries), ICAR, New Delhi (CIFT, Cochin on 13 October, 2010)
5. Dr. A.E. Eknath, Director, CIFA, Bhubaneswar (CIFT, RC, Visakhapatnam on 27 October, 2010)
6. Dr. A.G. Ponnaihi, Director, CIBA, Chennai (CIFT, Cochin on 9 November)
7. Dr. S. Ayyappan, Director General, ICAR, New Delhi & Secretary, DARE (CIFT, RC, Visakhapatnam on 21 November, 2010 and CIFT, Cochin on 26 November, 2010)
8. Prof. V.N. Rajasekharan Pillai, Vice Chancellor, IGNOU, New Delhi (CIFT, Cochin on 26 November, 2010)
9. Dr. M. Syda Rao, Director, CMFRI, Cochin (CIFT, Cochin on 26 November, 2010)
10. Dr. Bangali Baboo, National Director, NAIP, ICAR, New Delhi (CIFT, Cochin on 26 November)
11. Dr. J. Jena, Director, NBFGR, Lucknow (CIFT, Cochin on 30 November)
12. Dr. N.K. Tyagi, Member, ASRB, New Delhi and Dr. V.N. Sharda, Director, CSWCRT, Dehra Dun (CIFT, RC, Visakhapatnam during 10-11 December, 2010)



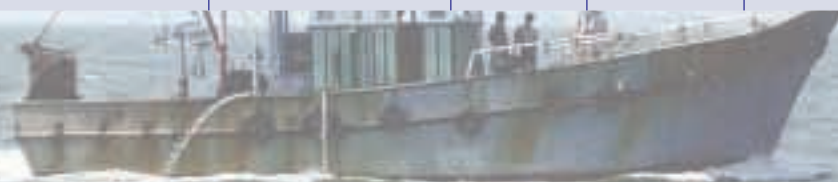
Dr. N.K. Tyagi and Dr. V.N. Sharda recording the observations in visitor's book

13. Dr. V.V. Sugunan, former Assistant Director General (Inland Fisheries), ICAR, New Delhi (CIFT, Cochin on 31 December, 2010)
14. Dr. Bala Swaminathan, Vice President, IHRC Inc. & former Advisor to Centre for Disease Control, Atlanta, USA (CIFT, Cochin on 14 February, 2011)
15. Smt. Sadhna Tripathi, Regional Implementation Office (West), Dept. of Official Language, Navi Mumbai (CIFT, RC, Veraval on 22 February 2011)
16. Dr. T. Ramamurthy, Deputy Director, National Institute of Cholera and Enteric Diseases (NICED), Kolkatta (CIFT, Cochin on 26 February, 2011)

On-going Research Projects

Institute Projects

Sl. No.	Name of project	Principal Investigator	Location of project	Co-Investigators	
1.	Studies on fortified natural bioicides and corrosion resistant composite materials for protection of fishing craft and gear	Dr. Saly N. Thomas	Cochin	Cochin	Dr. Leela Edwin Dr. P. Muhamed Ashraf
2.	Fishing systems for recreation	Dr. P. Pravin	Cochin	Cochin	Dr. Saly N. Thomas Dr. M.P. Remesan



Sl. No.	Name of project	Principal Investigator	Location of project	Co-Investigators	
3.	Development of protection measures and composite materials for fishing craft and gear	Dr. Saly N. Thomas	Cochin	Cochin	Dr. Leela Edwin Dr. P. Muhamed Ashraf
4.	Responsible fishing using improved bottom and semi-pelagic trawls	Dr. M.P. Remesan	Cochin & Veraval	Cochin Veraval	Dr. M.R. Boopendranath Dr. P. Pravin Shri V.R. Madhu
5.	Resource specific large mesh purse seine for large pelagics in Indian EEZ	Dr. P. Pravin	Cochin	Cochin	-
6.	Assessment of demersal fishery resources along the Indian continental slop and central Indian ocean	Dr. U. Sreedhar	Visakha-patnam	Visakha-patnam	Dr. R. Raghu Prakash Dr. G. Rajeswari
7.	Development of sustainable fishing technologies for exploitation of fishery resources in the East Coast of India	Dr. G. Rajeswari	Visakha-patnam	Visakha-patnam	Dr. R. Raghu Prakash Dr. U. Sreedhar
8.	Development and evaluation of Juvenile Excluder Device for trawl fisheries along East Coast of India	Dr. R. Raghu Prakash	Visakha-patnam	Visakha-patnam	Dr. G. Rajeswari Dr. U. Sreedhar
9.	Post harvest processing of commercially important large pelagic, demersal and bycatch fishes for high value products for modern markets and NEH	Shri P.K. Vijayan	Cochin	Cochin	Dr. C.N. Ravishankar Dr. George Ninan Dr. Femeena Hassan Dr. J. Charles Jeeva
10.	Studies on handling, processing, preservation and product development of commercially important farmed and wild freshwater fish	Dr. George Ninan	Cochin	Cochin	Dr. K.V. Lalitha Dr. T.V. Sankar Shri P.K. Vijayan Dr. A.A. Zynudheen Dr. J. Bindu Dr.V. Geethalakshmi Dr. V. Ronda
11.	Improved utilization of fish and shellfish waste	Dr. A.A. Zynudheen	Cochin	Cochin	Dr. T.K. Thankappan Dr. George Ninan Dr. R. Anandan (Dr. S. Suresh Kumar)
12.	Innovative packaging techniques for processing and preservation of fish products	Dr. C.N. Ravishankar	Cochin	Cochin	Dr. T.K. Srinivasa Gopal Dr. K.V. Lalitha Dr. T.V. Sankar



Sl. No.	Name of project	Principal Investigator	Location of project	Co-Investigators	
					Dr. J. Bindu Dr. S.K. Panda Dr. C.O. Mohan Dr. V. Ronda
13.	Technologies for utilization of fishery resources at Maharashtra	Dr. R. Chakrabarti	Mumbai	Mumbai	Shri S.P. Damle
14.	Technological innovations on improved utilization and value addition of marine and cultured fishery resources in Gujarat	Dr. R. Badonia	Veraval	Veraval	Dr. C.O. Mohan
15.	Studies on the detection, surveillance and implications of hazards in seafood meant for export market	Dr. Femeena Hassan	Cochin & Visakha-patnam	Cochin Visakha-patnam	Dr. P.T. Lakshmanan Dr. S. Sanjeev Dr. T.K. Thankappan Dr. K. Ashok Kumar Dr. L.N. Murthy
16.	Studies on effect of different processing methods, additives and natural preservatives on spoilage and pathogenic bacteria in fish and fishery products	Dr. S. Sanjeev	Cochin & Veraval	Cochin Veraval	Dr. C.N. Ravishankar Dr. K. Ashok Kumar Dr. Femeena Hassan Smt. K.K. Asha Dr. S.K. Panda Dr. C.O. Mohan
17.	Assessment of resident time of antibiotics in farmed aquatic animals by evaluating the metabolites	Dr. K. Ashok Kumar	Cochin	Cochin	Dr. S. Sanjeev Dr. Suseela Mathew Dr. R. Anandan Dr. Femeena Hassan Dr. Sanjoy Das Dr. S.K. Panda (Dr. C. Mohana-kumaran Nair) (Dr. K.R. Salin)
18.	Assessment of microbial seafood safety hazards and bio-prospecting of aquatic microbial resources for enzymes	Dr. K.V. Lalitha	Cochin & Visakha-patnam	Cochin Visakha-patnam	Dr. Sanjoy Das Dr. G.K. Sivaraman Dr. R. Anandan Dr. Toms C. Joseph Dr. Rakesh Kumar Dr. S. Vishuvinayagam Dr. V. Murugadas Dr. B. Madhusudana Rao

Sl. No.	Name of project	Principal Investigator	Location of project	Co-Investigators	
19.	Bio-evaluation and purification of natural bioactive compounds of therapeutic and nutraceutical significance from aquatic resources	Dr. Suseela Mathew	Cochin	Cochin	Dr. P.T. Lakshmanan Dr. T.V. Sankar Dr. K. Ashok Kumar Dr. A.A. Zynudheen Dr. R. Anandan Smt. K.K. Asha
20.	Nutritional profiling and hazard assessment of fish and fishery products of marine and lacustrine environs of east coast of India	Dr. M.M. Prasad	Visakha-patnam	Visakha-patnam	Dr. B. Madhusudana Rao Dr. L.N. Murthy
21.	Design and development of renewable energy, solar-biomass hybrid dryers	Dr. P.N. Joshi	Cochin	Cochin	Dr. S. Ashaletha
22.	Changing consumer preferences and its impact on domestic market	Dr. Nikita Gopal	Cochin & Visakha-patnam	Cochin Visakha-patnam	Dr. V. Geethalakshmi Shri V. Radhakrishnan Nair Dr. S.K. Panda Smt. P. Jeyanthi Dr. B. Madhusudana Rao
23.	Studies on technology assessment and transfer among the client system	Dr. Balasubramaniam	Cochin, Veraval & Visakha-patnam	Cochin Veraval Visakha-patnam	Dr. V. Geethalakshmi Dr. S. Ashaletha Dr. A.A. Zynudheen Dr. J. Charles Jeeva Smt. P. Jeyanthi Dr. L.N. Murthy Dr. B. Madhusudana Rao
24.	An alternate sustainable livelihood model for coastal fisher folk through market-led extension of value added fish products	Dr. S. Ashaletha	Cochin	Cochin	Dr. P.T. Lakshmanan Shri P.K. Vijayan Smt. P. Jeyanthi
25.	Studies on sustainability parameters for the Indian fish processing industry and the forward and backward linkages	Dr. V. Geethalakshmi	Cochin & Visakha-patnam	Cochin Visakha-patnam	Dr. Nikita Gopal Shri V. Radhakrishnan Nair Smt. P. Jeyanthi Shri Manoj Kumar Dr. L.N. Murthy



NAIP Projects

Sl. No.	Name of project	Principal Investigator	Location of project	Co-investigators	
26.	Responsible harvesting and utilization of selected small pelagics and freshwater fishes	Shri M. Nasser	Cochin & Veraval	Cochin	Dr. Leela Edwin Dr. K.V. Lalitha Dr. T.V. Sankar Dr. M.R. Boopendranath Dr. S. Sanjeev Dr. C.N. Ravishankar Dr. Saly N. Thomas Dr. M.P. Remesan Dr. R. Anandan Dr. A.A. Zynudheen Dr. V. Geethalakshmi Dr. Nikita Gopal Dr. J. Charles Jeeva Shri Diju Das* Shri M.A. George* Ms. Anju* Ms. C.S. Jyothi* Shri Sunil P. Hassan* Ms. A. Razia Muhammed* Ms. R. Parvathy* Shri S. Jayakrishnan*
27.	Bioprospecting of genes and allele mining for abiotic stress tolerance	Dr. Toms C. Joseph	Cochin	Cochin	Dr. K.V. Lalitha
28.	Oceanic tuna fisheries off Lakshadweep seas – A value chain approach	(Dr. E.V. Radhakrishnan, CMFRI, Cochin)	Cochin & Lakshadweep	Cochin	Dr. P. Pravin Dr. K. Ashok Kumar Dr. Suseela Mathew Dr. J. Bindu Dr. Toms C. Joseph Shri K.V. Aneesh Kumar* Shri P.S. Kanolkar* Shri R. Yathavamoorthy*
29.	Nutrient profiling and evaluation of fish as a dietary component	Dr. T.V. Sankar	Cochin	Cochin	Dr. Suseela Mathew Dr. R. Anandan Smt. K.K. Asha Shri A. Mathivanan* Shri Jones Varkey*

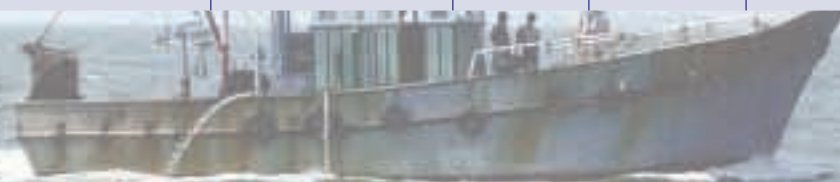
Sl. No.	Name of project	Principal Investigator	Location of project	Co-Investigators	
30.	Effect of high pressure processing on high value perishable commodities	Dr. J. Bindu	Cochin	Cochin	Dr. Sanjoy Das
31.	Mobilizing mass media support for sharing agro information	Dr. S. Ashaletha	Cochin	Cochin	Shri Aswin Antony*

MoES/CMLRE Projects

Sl. No.	Name of project	Principal Investigator	Location of project	Co-Investigators	
32.	Resource assessment of deep-sea fishes along the continental slope of Indian EEZ	Dr. U. Sreedhar	Visakha-patnam & Cochin	Visakha-patnam & Cochin	Dr. R. Raghu Prakash Dr. G. Rajeswari Shri Uma Maheswar Rao* Dr. Suseela Mathew Shri Nav Jyothi Biswas*
33.	Assessment of Myctophid resources in the Arabian sea and development of harvest and post harvest technologies	Dr. M.R. Boopendranath	Cochin & Visakha-patnam	Cochin Visakha-patnam	Shri P.K. Vijayan Dr. T.V. Sankar Dr. M.P. Remesan Dr. Sanjoy Das Shri K. Pradeep* Shri P.M. Vipin* Shri T. Jose Fernandez* Shri Renju Ravi* Dr. G. Rajeswari Dr. R. Raghu Prakash

DBT Projects

Sl. No.	Name of project	Principal Investigator	Location of project	Co-Investigators	
34.	Isolation and characterization of collagen and gelatin from aquatic sources and development of pharmaceutical and food grade products of commercial importance	Dr. Suseela Mathew	Cochin	Cochin	Ms. K. Shiny* Ms. G.S. Hema
35.	Location specific livelihood interventions in fisheries sector for the empowerment of fisherwomen in Kerala	Dr. Femeena Hassan	Cochin	Cochin	(Dr. Saleena Mathew) Dr. J. Charles Jeeva





DOD Project

Sl. No.	Name of project	Principal Investigator	Location of project	Co-Investigators	
36.	Resource assessment and biology of deep sea fisheries along the continental slope of Indian EEZ	Dr. U. Sreedhar	Visakha-patnam & Cochin	Visakha-patnam Cochin	Dr. G. Rajeswari Dr. R. Raghu Prakash Shri G.V. Sudhakar* Dr. Suseela Mathew

INCOIS Project

Sl. No.	Name of project	Principal Investigator	Location of project	Co-investigators	
37.	<i>In situ</i> time series measurements of bio-optical parameters off Kochi coast	Dr. P. Muhamed Ashraf	Cochin	Cochin	Shri S.S. Shaju* Ms. P. Minu*
38.	Project validation of PFZ along Gujarat coast	Shri V.R. Madhu	Veraval	Veraval	Shri Vishal Gohel*

SAC Project

Sl. No.	Name of project	Principal Investigator	Location of project	Co-Investigators	
39.	Euphotic zone production estimation using satellite data as an input to assess potential yield of pelagic herbivores in the Indian EEZ	Dr. P. Muhamed Ashraf	Cochin	Cochin	Ms. G. Archana* Shri K.P. Manu*
40.	Zooplankton production modeling investigations	Shri V.R. Madhu	Veraval	Veraval	Shri P.T. Sreejith*
41.	Coastal <i>in situ</i> data collection for Case 2 algorithms	Shri V.R. Madhu	Veraval	Veraval	Shri Shabir Ahmad Dhar*
42.	Measurement of inherent optical properties of seawater and development of inversion algorithms	Shri V.R. Madhu	Veraval	Veraval	Ms. M.R. Roshini*

*Research Fellow

Papers Published in Refereed Journals

- ◆ Anburajan, L., Toms C. Joseph, Nirmala Thampuran and Roswin James (2010) – Studies on the microbial diversity of salted fishes under aerobic conditions, *Microbiol. Res.*, 2: 22-25.
- ◆ Anburajan, L., Toms C. Joseph, Nirmala Thampuran and Roswin James (2010) – Functional characterization and sequence analysis of choline dehydrogenase from *Escherichia coli*, *Genetic Engg.*

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- Biotech. J.*, 12:
- ◆ Asha, K.K. and Devadasan, K. (2011) – Effect of Taurine glucose metabolism in experimentally-induced fulminant hepatic failure in rats, *Fish. Technol.*, **48(1)**: 51-58.
 - ◆ Balasubramaniam, A., Meenakumari, B., Boopendranath, M.R., Pravin, P. and Erzni, K. (2010) – Mesh selectivity of drift gillnet for *Caranx sexfasciatus* and *Caranx tille*, *Fish. Technol.*, **47(2)**: 111-120.
 - ◆ Boopendranath, M.R., George, V.C. and Hameed, M.S. (2010) – Energy efficiency in trawling operations, *J. Coast. Env.* **1(1)**: 53-70.
 - ◆ Boopendranath, M.R., Sabu, S., Gibinkumar, T.R. and Pravin, P. (2010) – Soft bycatch reduction devices for bottom trawl: A review, *Fish. Technol.*, **47(2)**: 99-110.
 - ◆ Chakrabarti, R. (2010) – Improvement of cooking quality and gel formation capacity of Bombay duck (*H. nehereus*) fish meat, *J. Food Sci. & Technol.*, **47(5)**: 534-540.
 - ◆ Charles Jeeva, J., Vasanthakumar, J., Balasubramaniam, S. and Ashaletha, S. (2011) – Innovation decision efficiency on selected fishing technologies among the steel fishing trawler operators, *Fish. Technol.*, **48(1)**: 87-94.
 - ◆ Chintu M. Raju, Suseela Mathew and Mathen Mathew (2010) – Comparative evaluation of non-protein nitrogenous compounds in fishes of fresh and brackish water environments, *Fish. Technol.*, **47(2)**: 161-166.
 - ◆ Dileep, A.O., Shamsundar, B.A., Binsi, P.K. and Howel, N.K. (2010) – Composition and quality of rice flour-fish mince based extruded products with emphasis on thermal properties of rice flour, *J. Texture Studies*, **41**: 190-207.
 - ◆ Farvin, K.H.S., Surendraraj, A. and Anandan, R. (2010) – Protective effect of squalene on certain lysosomal hydrolases and free amino acids in isoprenaline-induced myocardial infarction in rats, *J. Phramacol.*, **6**: 97-103.
 - ◆ Ganesan, B. and Anandan, R. (2010) – Antioxidant defense of betaine against isoprenaline-induced myocardial infarction in rats, *Mol. Biol. Rep.*, **37(3)**: 1319-1327.
 - ◆ Ganesan, B., Yathavamoorthy, R., Farvin, K.S.H. and Anandan, R. (2010) – Supplementation of betaine attenuates HCl-ethanol induced gastric ulcer in rats, *Intl. J. Biol. Chem.*, **4**: 79-89.
 - ◆ Ganga, U., Radhakrishnan, C.K. and Anandan, R. (2010) – Fatty acid signatures of the Indian mackerel *Rastrelliger kanagurta* (Cuvier) from the Arabian sea along the Indian coast, *J. Marine Biol. Assoc. India*, **52(1)**: 8-13.
 - ◆ George Ninan, Jose Joseph and Zynudheen, A.A. (2010) – Physical, mechanical and barrier properties of carp and mammalian skin gelatin films, *J. Food Sci.*, **75(9)**: 620-626.
 - ◆ George Ninan, Zynudheen, A.A. and Jose Joseph (2011) – Physico-chemical and textural properties of gelatins and water gel desserts prepared from the skin of freshwater carps, *Fish. Technol.*, **48(1)**: 67-74.
 - ◆ Gipson Edappazham, Saly N. Thomas and Muhamed Ashraf, P. (2010) – Corrosion resistance of fishing hooks with different surface coatings, *Fish. Technol.*, **47(2)**: 121-126.
 - ◆ Leela Edwin and Sreeja, A. (2011) – Ecological impact of chromated copper arsenate (CCA) treated wood for marine applications: A review, *Fish. Technol.*, **48(1)**: 1-12.
 - ◆ Madhusudana Rao, B. and Surendran, P.K. (2010) – Genetic heterogeneity of non-O1 and non-O139 *Vibrio cholerae* isolates from shrimp aquaculture system: A comparison of RS-, REP- and ERIC-PCR fingerprinting approaches, *Lett. Appl. Microbiol.*, **51**: 65-74.
 - ◆ Madhu, V.R., Meenakumari, B. and Panda, S.K. (2011) – Codend mesh selectivity of *Uroteuthis* (*Photololigo*) *duvauceli* (d'Orbigny, 1848), *Fish. Technol.*, **48(1)**: 33-40.
 - ◆ Mohan, C.O., Ravishankar, C.N., Lalitha, K.V. and Srinivasa Gopal, T.K. (2010) – Effect of chitosan edible coating on the quality of double filleted Indian oil sardine (*Sardinella longiceps*) during chilled storage, *Food Hydrocolloid* (In press).
 - ◆ Muhamed Ashraf, P. and Saly N. Thomas (2011) – Bio-accumulation of trace metals in biofilms formed on aluminium and steel in aquatic environment, *Fish. Technol.*, **48(1)**: 25-32.

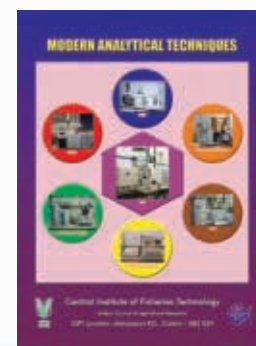
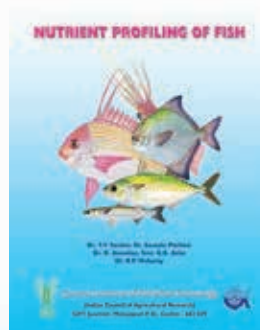




- ◆ Murthy, L.N., Panda, S.K. and Shamsundar, B.A. (2011) – Physico-chemical and functional properties of proteins of tilapia (*Oreochromis mossambicus*), *J. Food Process Engg.*, **34**: 83-107.
- ◆ Nikita Gopal, Charles Jeeva, J., Parvathy, R. and Nasser, M. (2010) – Assessment of group dynamics among fisherwomen self help groups: A participatory monitoring approach, *J. Global Commun.*, **3(2)**: 23-28.
- ◆ Pravin, P., Baiju, M., Baruah, D., Barman, J. and Kakati, B. (2010) – Fishing trials with trawls in Brahmaputra river. *J. Inland Fish. Soc. India*, **41(2)**: 84-87
- ◆ Rakesh Kumar, Surendran, P.K. and Nirmala Thampuran (2010) – Evaluation of culture media for selective enrichment and isolation of *Salmonella* in seafood, *J. AOAC Intl.*, **93**: 1468-1471.
- ◆ Rekha D. Chakraborty, Surendran, P.K. and Nirmala Thampuran (2010) – Growth kinetics and survival of urease positive and negative strains of *Vibrio parahaemolyticus*, *Fish. Technol.*, **47(2)**: 179-184.
- ◆ Roswin James, Nirmala Thampuran, Lalitha, K.V., Anburajan, L. and Toms C. Joseph (2010) – Differential gene expression profile of the hepatopancreas of White Spot Syndrome Virus infected *Fenneropenaeus indicus* by suppression subtractive hybridization, *Fish Shellfish Immunol.*, **29**: 884-889.
- ◆ Sabu, S., Gibinkumar, T.R., Pravin, P. and Boopendranath, M.R. (2011) – Performance evaluation of bigeye bycatch reduction device in the seas off Cochin, India, *Fish. Technol.*, **48(1)**: 41-50.
- ◆ Sivaperumal, P. and Sankar, T.V. (2011) – Toxic effects of methyl parathion on antioxidant enzymes and acetylcholinesterase activity in freshwater fish, *Labeo rohita*, *Fish. Technol.*, **48(1)**: 59-68.
- ◆ Smitha, N.R., Leejee James, Iyer, T.S.G. and Sanjeev, S. (2011) – Quantitative studies on halophilic pathogenic *Vibrios* in fish and fish products, *Fish. Technol.*, **48(1)**: 75-80.
- ◆ Stuart, V., Platt, T., Sathyendranath, S. and Pravin, P. (2010) – Remote sensing and fisheries: An introduction. *ICES J. Marine Sci.*, **68**: 639-641.
- ◆ Yathavamoorthy, R., Sankar, T.V. and Ravishankar, C.N. (2010) – Effect of ice storage and washing on the protein constituents and textural properties of surimi from *Labeo calbasu*, *Indian J. Fish.* **57(4)**: 85-91.
- ◆ Yesudhasan, P., Srinivasa Gopal, T.K., Ravishankar, C.N. and Lalitha, K.V. (2010) – Effect of potassium sorbate and modified atmosphere packaging on the shelf life extension of seer fish (*Scomberomorus commerson*) steaks during iced storage, *J. Food Biochem.*, **34(2)**: 399-414.

Publications Brought Out

- ◆ Nutrient profiling of fish – T.V. Sankar, Suseela Mathew, R. Anandan, K.K. Asha and B.P. Mohanty (2010)
- ◆ Modern analytical techniques – P.T. Lakshmanan, A.R.S. Menon, T.V. Sankar, Suseela Mathew, R. Anandan and K.K. Asha (2010)
- ◆ Coastal fishery resources of India – Conservation and sustainable utilization, SOFT(I), Cochin, 894 p Meenakumari, B., Boopendranath, M.R., Leela Edwin, Sankar, T.V., Nikita Gopal and George Ninan (Eds.) (2010)
- ◆ CIFT semi pelagic trawl system: An eco-friendly alternative to bottom trawling for small-scale



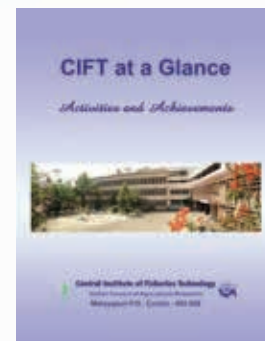
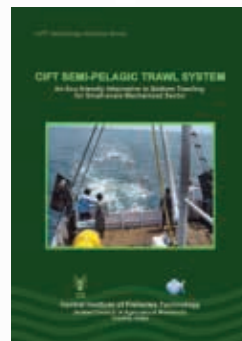
mechanized sector (2011), CIFT Technology Advisory Series, CIFT, Cochin

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Release of the book on Modern Analytical Techniques
(L to R : Shri Anil Agarwal, Dr. P.T. Lakshmanan,
Dr. B. Meenakumari, Dr. T.K. Srinivasa Gopal and
Dr. Madan Mohan

- ◆ Antibiotic, pesticide and insecticide residue contamination in sea/aqua foods - L.N. Murthy, B. Madhusudana Rao and M.M.Prasad (Eds) (2010) Manual prepared for one day workshop titled "Antibiotic, Pesticide and Insecticide Residue Contamination in Sea/Aqua Foods" organized by Visakhapatnam Research Centre of CIFT, 6



September, 2010, Visakhapatnam.

- ◆ CIFT at a glance – Activities and achievements - S. Balasubramaniam and V. Geethalakshmi (2011)
- ◆ Value added products from tuna – J. Bindu, V.R. Mumtaz, R. Yathavamoorthy and T.K. Srinivasa Gopal (2010) (In Malayalam)
- ◆ NAIP Tuna Technology Information Series 1-4
 - i. Tuna kure
 - ii. Smoked masmin flakes
 - iii. Masmin powder
 - iv. Ready to serve smoked tuna in oil

List of Personnel in CIFT

(as on 31st March, 2011)

Managerial Personnel

Director : Dr. T.K. Srinivasa Gopal

Heads of Division

Biochemistry & Nutrition Division	: Dr. P.T. Lakshmanan, Principal Scientist
Fishing Technology Division	: Dr. Leela Edwin, Principal Scientist
Microbiology, Fermentation & Biotechnology Division	: Dr. K.V. Lalitha, Principal Scientist
Quality Assurance & Management Division	: Dr. T.V. Sankar, Senior Scientist
Extension Information & Statistics Division	: Dr. S. Balasubramaniam, Principal Scientist
Engineering Division (Acting)	: Dr. P.N. Joshi, Principal Scientist
Fish Processing Division (Acting)	: Shri P.K. Vijayan, Principal Scientist





Scientist-Incharge of Research Centres

Visakhapatnam Research Centre	: Dr. M.M. Prasad, Principal Scientist
Veraval Research Centre	: Dr. R. Badonia, Principal Scientist
Mumbai Research Centre	: Dr. R. Chakrabarti, Principal Scientist

Administration & Accounts

Senior Administrative Officer	: Shri Charles Ekka
Finance & Accounts Officer	: Shri C.J. Stephan

Other Personnel

HEADQUARTERS, COCHIN

Scientific Personnel

Principal Scientist

1. Dr. T. K. Thankappan
2. Dr. M.R. Boopendranath
3. Shri S. Sanjeev
4. Shri M. Nasser
5. Dr. C.N. Ravishankar

Senior Scientist

1. Dr. K. Ashok Kumar
2. Dr. Saly N. Thomas
3. Dr. P. Pravin
4. Dr. V. Geethalakshmi
5. Dr. Suseela Mathew
6. Dr. R. Anandan
7. Dr. Nikita Gopal
8. Dr. Femeena Hassan
9. Dr. M.P. Remesan
10. Dr. A.A. Zynudheen
11. Dr. S. Ashaletha
12. Dr. Sanjoy Das
13. Dr. G.K. Sivaraman
14. Dr. J. Bindu

15. Dr. P. Muhamed Ashraf

16. Dr. George Ninan

17. Shri M.V. Baiju

Scientist (Selection Grade)

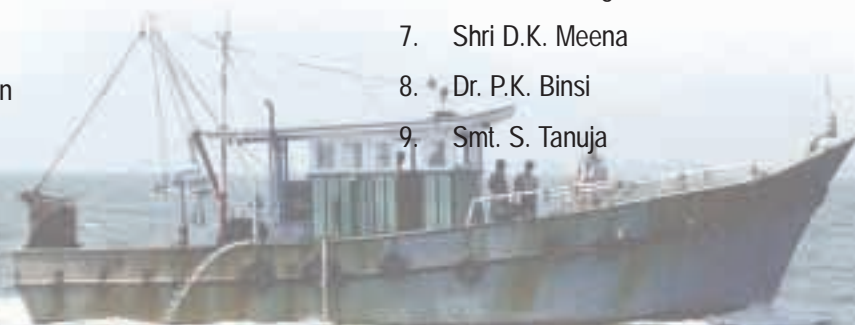
1. Dr. Toms C. Joseph

Scientist (Senior Scale)

1. Shri V. Radhakrishnan Nair
2. Dr. J. Chales Jeeva
3. Dr. Rakesh Kumar
4. Smt. K.K. Asha
5. Dr. S.K. Panda

Scientist

1. Shri V.R. Madhu
2. Smt P. Jeyanthi
3. Dr. Venkateswaralu Ronda
4. Dr. S. Vishnuvinayagam
5. Shri Manoj Kumar
6. Shri Ankur Nagori
7. Shri D.K. Meena
8. Dr. P.K. Binsi
9. Smt. S. Tanuja



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10. Smt. P. Viji
11. Dr. V. Murugadas
12. Shri V. Chandrasekar
13. Shri A.K. Jha
14. Shri C.G. Joshy

Technical Personnel

T-9 (Technical Officer)

1. Shri K.J. Francis Xavier
2. Dr. A.R.S. Menon

T-6 (Technical Officer)

1. Shri C.R. Gokulan
2. Smt. K.B. Beena
3. Dr. K. Sobha
4. Shri V. Gopalakrishna Pillai
5. Dr. M. Baiju
6. Dr. G. Usha Rani
7. Smt. M.K. Sreelekha
8. Smt. T. Silaja
9. Smt. P.K. Shyma

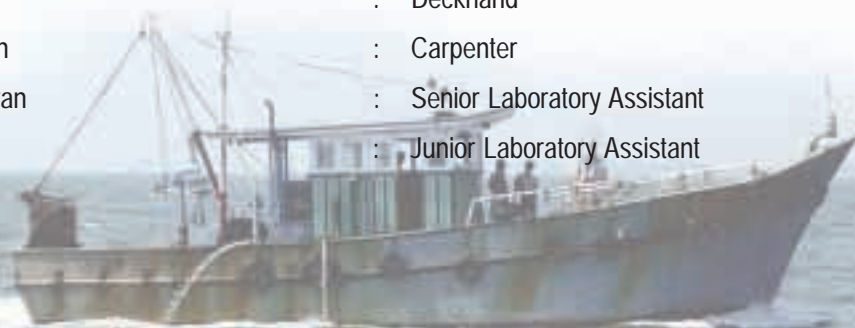
T-5 (Technical Officer)

1. Shri T.N. Sukumaran

T-4

- | | |
|--------------------------------|-------------------------------|
| 1. Smt. Ancy Sebastian | : Technical Assistant |
| 2. Shri P.N. Sudhakaran | : Net Making Supervisor |
| 3. Shri Aravind S. Kalangutkar | : Senior Field Assistant |
| 4. Smt. K.P. Leelamma | : Junior Laboratory Assistant |
| 5. Shri P.S. Raman Namboodiri | : Junior Laboratory Assistant |
| 6. Shri A.K. Unnikrishnan | : Cook |
| 7. Shri Arockia Sami | : Deckhand |
| 8. Shri T.P. Haridasan | : Carpenter |
| 9. Shri T. Gangadharan | : Senior Laboratory Assistant |
| 10. Smt K.S. Mythri | : Junior Laboratory Assistant |

2. Shri Jose Kalathil
3. Smt. K.K. Sumathy
4. Shri Thomas Teles
5. Shri K.B. Thampi Pillai
6. Smt V.C. Mary
7. Shri K.P. Vijayan
8. Shri D. Padmanabhan
9. Shri T.R. Sreekumaran
10. Shri P.T. Viswambharan
11. Smt. M. Rekha
12. Shri C. Rajendran
13. Shri K.D. Jos
14. Dr. B. Ganesan
15. Smt. K.G. Sasikala
16. Smt. K.K. Kala
17. Shri Sibasis Guha
18. Shri P.S. Babu
19. Shri V.N. Dileepkumar
20. Shri G. Omanakuttan Nair
21. Shri P. Shankar
22. Shri T.V. Bhaskaran
23. Smt. G. Remani





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|------------------------|-------------------------|
| 11. Shri Tomy Rebellow | : Boilerman |
| 12. Shri P.S. Nobi | : Net Making Supervisor |

T-3

- | | |
|---------------------------------|-------------------------------|
| 1. Smt P.K. Geetha | : Junior Laboratory Assistant |
| 2. Shri C. Subash Chandran Nair | : Project Operator |
| 3. Smt. P.A. Jaya | : Junior Laboratory Assistant |
| 4. Shri T.P. Saju | : Engineer - Civil |
| 5. Shri P. Bhaskaran | : Senior Library Assistant |
| 6. Shri T. Mathai | : Junior Laboratory Assistant |
| 7. Smt. N. Lekha | : Junior Laboratory Assistant |
| 8. Shri P.D. Padmaraj | : Junior Laboratory Assistant |
| 9. Smt. Bindu Joseph | : Media Assistant |
| 10. Shri T.B. Assisse Francis | : Driver |
| 11. Smt. N.C. Shyla | : Field Assistant |
| 12. Shri N. Sunil | : Plant Attendant |
| 13. Shri P.S. Sunil Kumar | : Driver |
| 14. Shri R.N. Sahoo | : Driver (Launch) |
| 15. Shri K.K. Narayanan | : Boilerman |

T-II-3

- | | |
|------------------------|--------------------------|
| 1. Shri Sajith K. Jose | : Draughtsman |
| 2. Shri P.V. Sajeevan | : Draughtsman |
| 3. Shri V.K. Siddique | : Refrigeration Mechanic |
| 4. Shri K.S. Babu | : Turner |

T-I-3

- | | |
|-------------------------|-------------------------------|
| 1. Shri R. Rangaswamy | : Driver |
| 2. Shri V.T. Sadanandan | : Junior Laboratory Assistant |

T-2

- | | |
|-------------------------|--------------------|
| 1. Shri G. Gopakumar | : Carpenter |
| 2. Shri V.A. Sudhakaran | : Plumber |
| 3. Shri K.V. Mohanan | : Driver |
| 4. Shri K. Nakulan | : Driver |
| 5. Shri C.K. Suresh | : Machine Operator |



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- | | |
|----------------------------|-------------------------------|
| 6. Shri N. Krishnan | : Junior Laboratory Assitant |
| 7. Shri K.D. Santhosh | : Junior Laboratory Assistant |
| 8. Shri K. Dinesh Prabhu | : Plant Attendant |
| 9. Smt. Tessy Fransis | : Field Assisstant |
| 10. Shri T. Jijoy | : Junior Laboratory Assistant |
| 11. Shri K.C. Anish Kumar | : Junior Laboratory Assistant |
| 12. Dr. K.A. Martin Xavier | : Field Assistant |

T-1

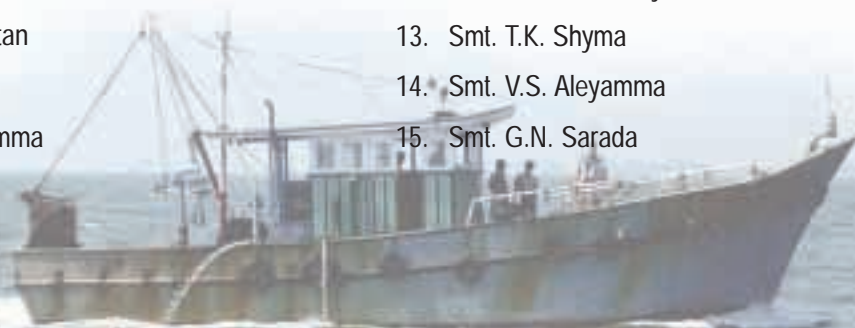
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|-----------------------------|-------------------------------|
| 1. Shri G. Vinod | : Junior Laboratory Assistant |
| 2. Shri Ajith V. Chellappan | : Junior Laboratory Assistant |
| 3. Ms. N. Karthika | : Junior Laboratory Assistant |
| 4. Shri M.T. Udayakumar | : Junior Laboratory Assistant |

Administrative Personnel

- | | |
|----------------------------------|------------------------------------|
| 1. Smt. D. Geetha | : Admn. Officer |
| 2. Dr. C. Jessy Joseph | : Dy. Director (Official Language) |
| 3. Shri A. George Joseph | : Asst. Admn. Officer |
| 4. Smt. T.K. Susannamma | : Asst. Admn. Officer |
| 5. Smt. Pushpalatha Viswambharan | : Asst. Admn. Officer |
| 6. Shri R. Viswanathan | : Asst. Admn. Officer |
| 7. Shri K.S. Sreekumaran | : Asst. Fin. & Accts. Officer |
| 8. Shri P.P. Anil Kumar | : Asst. Fin. & Accts. Officer |
| 9. Smt. R. Vasantha | : Private Secretary |
| 10. Smt. V.P. Vijayakumari | : Private Secretary |

Assistant

- | | |
|--------------------------|-------------------------|
| 1. Smt. K. Gracy | 8. Smt. A.A. Cousallia |
| 2. Shri P. Krishna Kumar | 9. Shri K.K. Sasi |
| 3. Shri P.V. Venugopalan | 10. Shri P. Padmanabhan |
| 4. Smt. N.I. Mary | 11. Smt. A.R. Kamalam |
| 5. Shri K.B. Sabukuttan | 12. Shri Udekar Pandey |
| 6. Smt. T.D. Usheem | 13. Smt. T.K. Shyma |
| 7. Smt. P.K. Thankamma | 14. Smt. V.S. Aleyamma |
| | 15. Smt. G.N. Sarada |





16. Shri C.K. Sukumaran
17. Smt. V.K. Raji
18. Smt. K. Renuka
19. Shri M.N. Vinodh Kumar
20. Shri K. Das

Personnel Assistant

1. Shri P.K. Raghu
2. Smt. S. Kamalamma
3. Smt. N. Leena
4. Shri K.V. Mathai
5. Shri R.D. Goswamy
6. Smt. Anitha K. John
7. Shri T. Viswanathan

Upper Division Clerk

1. Shri P.K. Somasekharan Nair
2. Shri P. Mani
3. Smt. Jaya Das
4. Smt. P.R. Mini
5. Shri T.N. Shaji
6. Smt. A.R. Raji
7. Smt. E. Jyothilakshmy
8. Smt. Shiji John
9. Shri P.G. David
10. Shri Santhosh Mohan

Lower Division Clerk

1. Smt. G. Surya
2. Shri P. Rajeev
3. Shri D.L. Pattanayak
4. Smt. R. Anantha Rani
5. Shri T.D. Bijoy
6. Shri Amit Vengraj
7. Shri P.P. George

Cook

1. Shri V. Ramachandran

Supporting Personnel

Skilled Support Staff

1. Shri M.R. Bharathan
2. Shri P.A. Sivan
3. Shri G.B. Mahanandia
4. Shri C.D. Parameswaran
5. Smt. C.G. Radhamoney
6. Shri E. Damodaran
7. Shri P.V. Raju
8. Shri A.V. Chandrasekharan
9. Shri M.M. Radhakrishnan
10. Shri K.K. Karthikeyan
11. Shri M.N. Sreedharan
12. Smt. U.K. Bhanumathy
13. Shri O.P. Radhakrishnan
14. Shri P. Raghavan
15. Shri T.M. Balan
16. Shri V. Deepak Vin
17. Shri T.K. Rajappan
18. Smt. P.T. Mary Vinitha
19. Shri K.R. Rajasaravanan
20. Shri K. Thinakaran
21. Shri P.N. Nikhil Das
22. Shri A. Vinod
23. Shri Kedar Meher
24. Shri K.S. Ajith

Auxiliary

1. Shri M.T. Mani : Cook
2. Shri M.V. Rajan : Bearer



VISAKHAPATNAM RESEARCH CENTRE

Scientific Personnel

Senior Scientist

1. Dr. G. Rajeswari
2. Dr. R. Raghu Prakash

1. Dr. U. Sreedhar

Scientist (SG)

1. Dr. B. Madhusudana Rao

Scientist

1. Dr. L.N. Murthy

Technical Personnel

T (7-8) (Technical Officer)

1. Shri M.S. Kumar

T-6 (Technical Officer)

1. Shri V.V. Ramakrishna
2. Shri K.V.S.S.S.K. Harnath
3. Shri C. Srihari Babu
4. Shri B.K. Panda

T-5 (Technical Officer)

1. Shri U. Alagumalai
2. Shri A.K. Panigrahi
3. Dr. Santhosh Alex

T-4

1. Shri Damodar Rout
2. Shri N. Venkata Rao
3. Shri K.C. Gopala
4. Shri P. Radhakrishna

T-3

1. Shri M. Venkateswara Rao
2. Shri M. Prasanna Kumar

Administrative Personnel

Assistant Administrative Officer

1. Shri G.C. Adhikari

Assistant

1. Smt. B. Hemalatha

Personal Assistant

1. Smt. D.A.L. Satyanarayanamma
2. Shri G. Chinna Rao

Upper Division Clerk

1. Shri Y. Kanakaraju

Lower Division Clerk

1. Shri S. Appa Rao

Supporting Personnel

Skilled Support Staff

1. Shri S. Chakram
2. Shri V.V. Ramana
3. Shri B.K. Deo
4. Shri Sanyasi Ganik
5. Shri M.S. Prabhakar Rao
6. Smt. Nalla Naveena
7. Smt. Neelima Besra
8. Smt. Gyana Netri Nag

VERAVAL RESEARCH CENTRE

Scientific Personnel

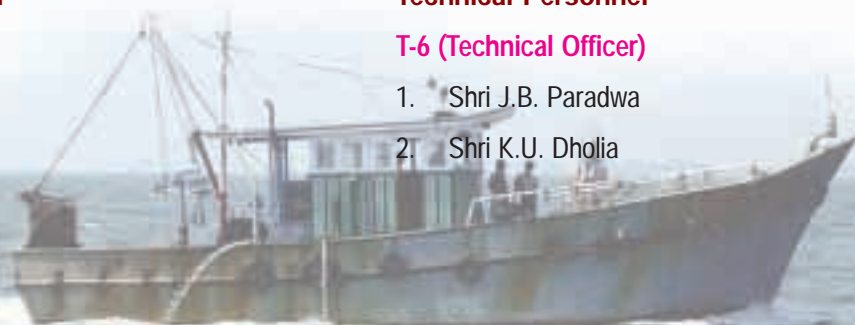
Scientist

1. Dr. C.O. Mohan

Technical Personnel

T-6 (Technical Officer)

1. Shri J.B. Paradwa
2. Shri K.U. Dholia





T-5 (Technical Officer)

1. Shri K.U. Sheikh

T-2

1. Shri H.V. Pungera
2. Shri G. Kingsely

T-I-3

1. Shri S.H. Ummer Bhai

T1

1. Shri K. Ajesh
2. Shri J.B. Malmadi

Administrative Personnel

Assistant

1. Shri M.M. Damodara
2. Shri S.B. Purohit

Upper Division Clerk

1. Shri D.P. Parmar

Lower Division Clerk

1. Shri Arockia Shaji

Supporting Personnel

Skilled Support Staff

1. Shri B.M.A. Khokhar
2. Shri D.B. Chudasama
3. Shri K.J. Damor
4. Smt. Gangaben Naren Chorwadi
5. Shri D.K. Viram
6. Shri R.N. Gosai
7. Shri A.M. Vala
8. Shri M.K. Kana
9. Smt. Harshaban A. Joshi
10. Shri N.K. Masani
11. Smt. Pushpaben P. Chudasama
12. Smt. Motiben K. Fofandi
13. Shri P. Ramakrishna

Auxiliary

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

MUMBAI RESEARCH CENTRE

Scientific Personnel

Senior Scientist

1. Shri S.P. Damle

Technical Personnel

T-6 (Technical Officer)

1. Smt. Sangeetha D. Gaikwad
2. Smt. Triveni G. Adiga

T-5 (Technical Officer)

1. Shri P.S. Gadankush

T-2

1. Shri T.A. Waghmare

Administrative Personnel

Assistant Administrative Officer

1. Shri M.S. Bhatkar

Assistant

1. Shri A.N. Agawane

Supporting Personnel

Skilled Support Staff

1. Shri B.M. Ghare
2. Shri C.B. Kolvalkar
3. Shri V.S. Salvi



BURLA RESEARCH CENTRE

Technical Personnel

T-6 (Technical Officer)

1. Shri B.K. Pradhan

T-4

1. Shri Kirtan Kisan (Electrician)
2. Shri A.K. Naik (Mechanic)

T-3

1. Shri H.S. Bag (Driver)

Administrative Personnel

Upper Division Clerk

1. Shri L.N. Badi

2. Shri K.C. Naik

Supporting Personnel

Skilled Support Staff

1. Shri B.N. Guru
2. Shri Jaisingh Oram
3. Shri T.N. Banchoor
4. Shri S.N. Dash
5. Shri S.K. Mehar





