Research Highlights
2012-2013

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

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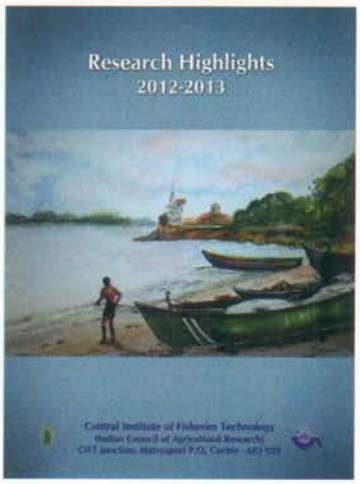

(Oil on canvas : Dr. P. Pravin)

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PREFACE

Dissemination of knowledge acquired through research is a basic necessity for effective transfer of technology. For any research institute, publications giving the highlights of its achievements is the best method for this. The highlights of the achievements accomplished in research and related field by the Institute during the year 2012-13 is briefed in this publication.

The year that went by, was a year of notable achievements for CIFT. Some of the most important ones can be listed as, research on alternate wood materials for craft construction, use of cassava leaf extract as a good bio-pesticide, development of 26 m multi seam demersal fish trawl and 28 m eight seam fish trawl for exploitation of fishery resources, a new design of bag type stake net, development of intermediate moisture product from Pangasius fillet, assessment of chitin hydrolysate for antimicrobial properties, ready to eat products from edible oyster meat, standardization of hydroxyapatite from catla and rohu scales, Quality Index Method for sensory grading of chilled Indian mackerel, a depuration system for edible oyster, standardization of Real time PCR-based methods for quantitative detection of *Listeria monocytogens* and *Shigella* spp. in seafood, detection of multi-drug resistance in *V. cholerae* isolates, amino acid profiling of cuttlefish, oysters, mussels etc., enzymatic and non-enzymatic method for the preparation of oyster peptide extract, studies on anti-aging effect of dietary chitosan, fabrication of solar dryer having capacity of 5 kg using solar PV panels, studies on the extent of awareness and adoption of selected improved practices in fishing and post harvest technologies.

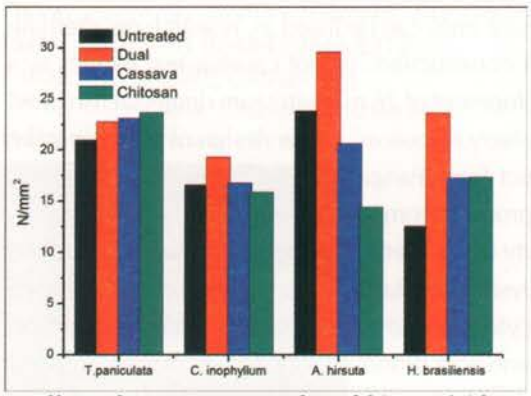
It is hoped that the highlights in a nutshell will help the prospective entrepreneurs to select the technology they want so that they can approach the Institute with a clear vision and plan. Hope it will serve the purpose and will yield the desired results.

Cochin
22 July, 2013

(Dr. T.K. Srinivasa Gopal)
Director

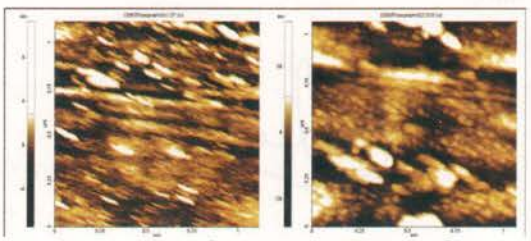
Fishing Technology Division

- Fouling on high-density polyethylene (HDPE) twisted monofilament netting of 25 mm mesh size caused occlusion of mesh opening by 60% within two months of exposure to estuarine waters.
- Rubber wood canoes were found to be in good condition even after 10 years of field trials which proves it as a successful substitute for conventional boat building timber.
- Cassava leaf extract can be used as a good bio-pesticide against bio-deterioration of wooden logs.



Effect of Cassava extract based bio-pesticide against bio-deterioration

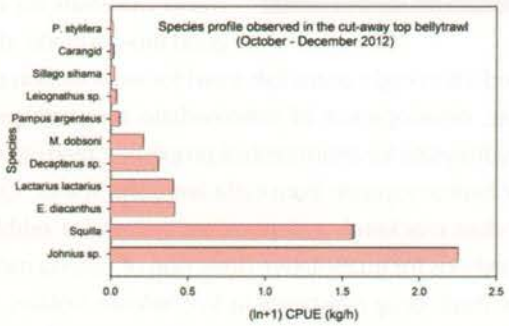
- Studies on corrosion resistance of graphene and nano cerium oxide surface treated stainless steel revealed that the coating did not have much effect on corrosion resistance.



Nano CeO_2 +graphene 0.002% each **0.005% graphene +0.002% Nano CeO_2**

Changes in the surface properties of graphene and nano cerium treated stainless steel

- Polyaniline-graphene-nano cerium composite for nano sensor application is being studied.
- The average CPUE of shrimps observed in the modified 18 m semi-pelagic trawls operated off Cochin was 0.16 kg/h and 0.69 kg/h respectively. The average catch in the modified net was 6.98 kg/h and the CPUE realized for the 18 m SPT was 10.5 kg/h.
- The total CPUE recorded in the cut-away top belly trawl operated along the coastal waters off Cochin was 7.0 kg/h. The CPUE for shrimps and fish were 1.05 and 1.93 kg/h respectively.



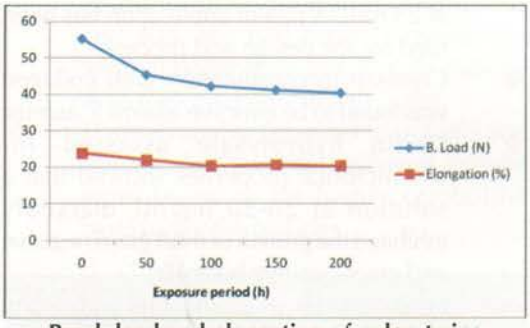
Species profile in cut-away top-belly trawl

- The mean length of *Tenualosa ilisha* juveniles escaping from the bagnets installed with BRD was found to be 56.5 mm at Tribeni centre, Hoogly-Matlah estuary.
- Evaluation of empirical algorithm at a coastal site off Cochin revealed three water types based on chlorophyll a and chromophoric dissolved organic matter.
- Bench marking and development of database of existing fishing vessel designs and energy efficiency is initiated.
- Available data of the existing fishing gear designs revealed an upward trend in the size of the net used, with the length of the head rope increasing significantly higher when compared to other reports

available from the region.

Data collection in progress

- Studies on the comparative efficiency of different synthetic materials revealed that there is a decrease of 42% breaking load and 36% elongation due to both wetting and knotting.



Break load and elongation of nylon twine exposed to weathering in Xenotest

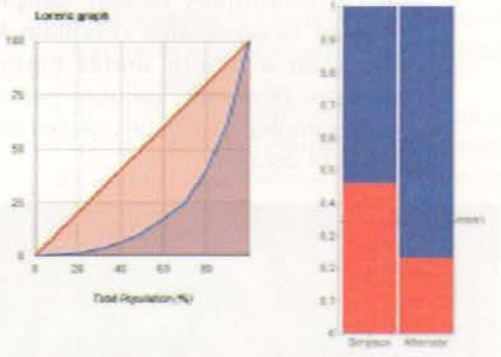
- A review of the different techniques used for preservation of coconut wood was carried out. A survey was also conducted to collect the details of traditional crafts used along the south west coast of India, covering the states of Goa, Karnataka and Kerala.

Survey at canoe construction site

- Designed and developed 26 m multi seam (14 seam) demersal fish trawl and 28 m eight seam fish trawl for exploitation of fishery resources.

Field trials of multi seam trawl

- A new design of bag type stake net was fabricated with HDPE attached with 50 mm square mesh window as BRD for elimination of juveniles.
- Biodiversity of trawl resources and bycatch was estimated off Visakhapatnam from commercial trawlers.



Alpha biodiversity of trawl catch

- The carbon foot print was estimated from Visakhapatnam (61563 tons/year), East Godavari (51622 tons/year), Krishna (9010 tons/year), Guntur (15949 tons/year) and Prakasham (4272 tons/year).
- Fishing gear survey was conducted at Visakhapatnam, Kakkinada, Bhimili, Uppada, Vasavanipalem, Odalarevu, Golgonda, Jogumpeta, Ammapeta and Pappusettypalem fishing villages of Andhra Pradesh. Three main types of trawls operated by commercial trawlers and three types of ring seines operated by

motorized boats were surveyed and published.

- Data collected during various deep-sea fisheries expeditions of Fisheries and Oceanographic Research Vessel (FORV) Sagar Sampada was analyzed. A total of 155 species belonging to 88 families and 33 orders are identified from the depths ranging from 50 to 1100 m.

Fish Processing Division

- An intermediate moisture product from Pangasius (*Pangasionodon hypophthalmus*) fillet prepared by a combination of pH modification (potassium sorbate and citric acid), controlled microwave heating and drying technique remained in acceptable condition for more than 45 days in chilled storage.
- Dip treatment of Rohu steaks in mint decoction has revealed that 1.5% of mint decoction was effective in reducing the chemical and microbial spoilage indices.
- Quality characteristics of Pabda (*Ompok pabda*) fish processed by *sous vide* technique indicated that both microwave and conventionally heated samples remained in acceptable condition for more than a month under chilled condition. However, vacuum packed control samples were to be rejected after 20 days of storage.

Microwave blanched gutted *Ompok pabda*

- Flash fried skinless, boneless Pangasius fillets canned in TFS cans with refined oil had good textural properties and the water content was less than 10% which is a requirement for canned product.
- Vacuum packing of gutted Pabda fish under iced condition was carried out. Results indicated that samples remained in acceptable condition till 24 days of storage in ice, whereas control samples packed in PE pouches gave less satisfactory results and were rejected after 18 days of storage in ice.
- A prototype of fish de-scaling machine was developed for descaling of fishes. For carps, the de-scaling process requires 10 min. at 30 rpm and for tilapia it is 8 min. at 25 rpm. A patent application has been filed for the design and process.
- Chitosan in combination with collagen was found to be effective against *S. aureus*.
- Chitin hydrolysate assessed for antimicrobial properties showed that a solution at 20-50 mg/mL markedly inhibited the growth of most gram-negative and gram-positive bacteria.
- Feeding trials in albino rats with Rohu bone calcium and tuna bone calcium-incorporated feed indicated that feed with Rohu bone calcium shows more retention than feed with Tuna bone calcium.
- Bio-availability of fish calcium powder prepared from tuna and Pangasius tested in albino rats along with supplemented vitamin D and peptide showed that incorporation of vitamin D increased the absorption of calcium in rats.
- Fish rolls prepared from frame meat of Rohu had a shelf life of 17 days whereas frozen stored product remained in acceptable condition till seven months of storage at -20 °C.
- Collagen peptide derived from Rohu fish scale was found to be a cheap alternative source for bacteriological media.
- Mineral composition of offal generated

Fish rolls from Rohu frame meat

from Croaker fish (*Johnius dussumerii*) indicated that head waste is rich in calcium (342.141 ± 10.83 ppm), potassium (82.47 ± 2.49 ppm) and sodium (60.33 ± 1.70 ppm).

- Partial replacement of fish meat in fish cutlet by soy protein showed that the product with a combination of 70% meat and 30% soy had better acceptability, textural parameters and storage stability than the conventional fish cutlet.
- Hydroxyapatite prepared from Catla and Rohu scales by a heat treatment method were found to be highly crystalline hydroxyapatite particles.

Hydroxyapatite from Rohu scales

- Shelf life studies of chill stored Ghol (*Protonibea diacanthus*), Mahimahi (*Coryphaena hippurus*) and Horse mackerel (*Megalapsis cordyla*) packed under air and with O_2 absorber was found to have a shelf life of 24, 24 and 20 days for active packed samples compared to only 8, 10 and 9-10 days for control samples, respectively.
- Ready to eat products from edible oyster (*Crassostrea madrasensis*) meat like oyster fry (dry), oyster masala (semi gravy) and oyster curry were prepared in retortable pouches. The Fo value for oyster fry was 8 min., oyster masala 9 min. and oyster curry 8 min. The products were found to be acceptable even after the storage period of six months.
- Bromocresol purple (BCP), Bromocresol green (BCG) and Bromothymol blue (BTB) were used for development of freshness indicators for shrimps (*Parapenaeopsis stylifera*). BCP gave better indication of freshness and correlated well with the changes in volatile bases and sensory quality.
- Application of multiple hurdle technology extended the shelf life of Indian mackerel (*Rastrelliger kanagurta*) to 16 days in vacuum packed, 12 days in potassium sorbate treated and 18 days in *sous vide* treatment.
- High temperature short time (HTST) processing of fish curry using Cobia fillets in clear and opaque retort pouches was found acceptable based on biochemical and sensory evaluation even after a period of six months.
- Shelf life assessment of Longtail tuna (*Thunnus tonggol*) chunks packed under air and O_2 absorber during iced storage conditions revealed that chunks were in good condition up to 9-10 days for O_2 scavenger packs.
- The shelf life of high pressure treated (200 MPa, holding time - 5 min.) Yellowfin tuna (*Thunnus albacares*) chunks was extended to 28 days during chill storage. Control was rejected on 20th day of chill storage.

High pressure treated tuna chunks and control

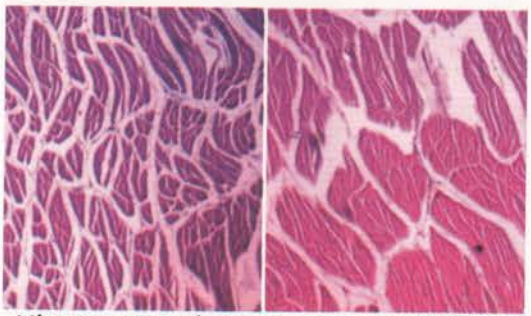
- High pressure treated (250 MPa) ready to cook condiment-incorporated prawns showed better acceptability and had a shelf life of 35 days at 2 ± 1 °C.

Control and HPP treated prawns

- High pressure (300 MPa) processed shucked oyster had a shelf life of 28 days during chilled storage.
- Sensory evaluation of high pressure treated prawn curry showed that at higher pressure above 400 MPa the prawns were harder in texture.

Prawn curry - Control and pressure treated

- Effect of HP treatment on microstructure of Indian white prawn (*Fenneropenaeus indicus*) at 250 MPa showed that muscles had a firmer texture than untreated sample and fibres look tightened and round.



Microstructure of control prawn and 250 MPa treated prawn

- Combined effect of chemical (sodium acetate and potassium sorbate) with pulsed light treatment of Yellowfin tuna steaks packed in cast polypropylene pouch had shelf life extension of 13 days than control samples.
- Catla (*Catla catla*) fillets sprayed with commercial liquid smoke was found to have superior shelf life capacity than control.
- Ready to eat product from Kardi (*Palaemon* sp.) remained tasty and crispy during storage even after one year in sealed glass containers at ambient temperature.
- Fish protein hydrolysate prepared from Bombay duck (*Harpadon neherius*) meat utilizing the endogenous proteolytic enzymes exhibited good bioactive and functional properties.

Protein hydrolysate from Bombay duck

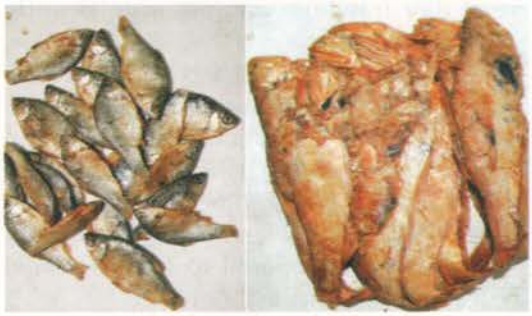
- Hydrolysate prepared from marine Catfish roe using alkalase enzyme indicated good metal chelating and metal reducing properties, but poor Di Phenyl Picryl Hydrazyl (DPPH) radical scavenging activity.

Hydrolysate from marine Catfish roe

- Chitin and chitosan hydrolysate was prepared from deproteinised Jawla shrimp. Chitosan hydrolysate solution at 20-50 mg/mL markedly inhibited the growth of most gram-negative and gram-positive bacteria tested.

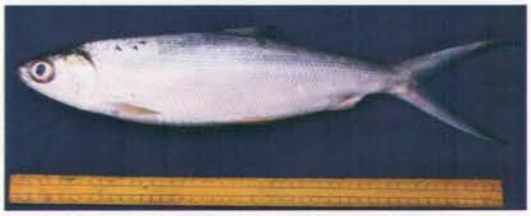
Jawla shrimp

- Hydroxyapatite prepared from Catla and Rohu scales were tested for their efficacy in removing the heavy metal content from aqueous solution of known concentration of heavy metals. The results indicated a significant reduction in the content of iron and toxic heavy metals.
- A comparative evaluation was carried out on the quality characteristics of Pabda (*Ompok pabda*) fish processed by *sous vide* technique employing two different modes of heating *viz.* microwave oven heating and conventional heating. Both microwave heated and conventionally heated samples remained in acceptable condition for more than a month.
- Gelation characteristics as well as microbial inoculation study of surimi from *Pangasius hypophthalmus* as affected by microwave heating indicated significant reduction in microbial count and solubility values of heat induced gel subjected to 60 and 90 sec. durations, whereas the gel heated for 30 sec. showed values similar to unheated sol.
- Treatment with salt followed by vacuum packaging considerably improved the quality characteristics of laminated Bombay duck during one year storage period.
- Fermented fish procured from North-East India revealed moisture content of 35.94% (range 31.14 to 41.98%), and fat 20.1% (range 13.01 to 29.54%).



Fermented fish products from NEH states

- The biochemical, microbiological, textural and sensory analysis of Milkfish during iced-storage indicated that the quality loss was relatively faster in ice-stored gutted Milkfish compared to whole fish.



Farmed Milkfish of about 1kg weight

- Changes in the textural properties of *Penaeus monodon* and *Litopenaeus vannamei* during different processing methods and changes in textural properties of *L. vannamei* and *Metapenaeus monoceros* during soaking condition were studied.
- A new product Peeled Double Deveined (PDD) Vannamei was made by removing the ventral bluish structure of *Litopenaeus vannamei* to improve appearance and quality.

Raw Peeled Double Deveined (PDD) Vannamei

- The biochemical quality of Horse mackerel caught from gillnet and single day trawlers was not significantly different.
- Blanching with 0.5 and 1.0% salt for 5 min. reduced the sun drying time by 15.5 and 17hrs respectively for shrimp (*Parapeaneopsis stylifera*) compared to samples dried without blanching. The yield was 6% less for the blanched samples compared to samples dried without blanching.

Solar and sun dried shrimps

- Solar drying (58-60 °C) of shrimp reduced the drying time by 9 h compared to sun drying. Yield was 39.5 and 32.5% for sun and solar dried samples. Total volatile base nitrogen content was 15.53 mg N_2/ 100g for fresh shrimps which increased to 24.45 and 38.09 mg N_2/100g for solar and sun dried shrimps, respectively. Total mesophilic counts reduced from an initial 5.38 log cfu g^{-1} to 2.0 and 2.39 log cfu g^{-1} for solar and sun dried shrimps respectively.
- Dried air bladder of Ghol (*Protonibea diacanthus* Lacepede), Koth (*Otolithoides biauritus* Cantor), Threadfins (*Eleutheronema tetradactylum* and *Polydactylus* spp.), Catfish, Eel (*Muraenesox talabonoides*) etc. had very good export market. The protein content of dried air bladder of different fishes ranged between 90-95% and ash content was 3-4%.
- Collagen prepared from Threadfin bream scales had protein content of 92% and ash content of 6%. Total aerobic plate counts were 85 cfu/g and total Enterobacteriaceae, faecal Streptococci, *S. aureus* and *E. coli* were absent.
- Keeping quality of traditional Gujarati style shark curry under frozen storage was 10 months.

Shark curry in HIPP trays

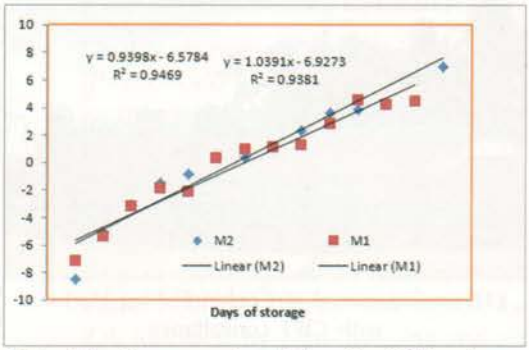
- Ginger essential oils were extracted using steam distillation by Clevenger's apparatus and antimicrobial properties at different concentration against *S. aureus* was evaluated.
- Barracuda (*Sphyraena jello*) steaks treated with 0.1, 0.2 and 0.3% ginger essential oil improved the flavor, odour and extended the shelf life under refrigerated storage condition.

Barracuda whole and packed samples

- Biodegradable antimicrobial packaging film was prepared using chitosan incorporating ginger essential oil and its antimicrobial properties were evaluated against *S. aureus* and physical properties were studied.

Quality Assuarance and Management Division

- A Quality Index Method (QIM) scheme for sensory grading of chilled Indian mackerel (*Rastrelliger kanagurta*) was finalized with 14 sensory descriptors and total demerit score of 33. Principal component analysis indicated retention of prime quality of fish for initial five days of chilled storage.

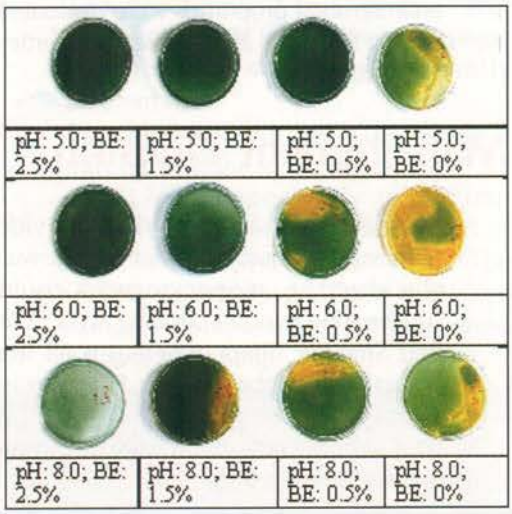


PCA plot of sensory descriptors for QIM scheme of Mackerel

- A draft QIM scheme validated with an array of biochemical, microbiological and instrumental parameters was developed for Oil sardine *(Sardinella longiceps)*.
- Challenge studies with enterohemorrhagic *Escherichia coli* O157 indicated that the pathogen could survive after freezing at -40 °C (90 minutes) and subsequent cold storage condition (-18 °C) for more than 24 months in fish substratum.
- Most Probable Number (MPN) method was observed to be the most suitable method for recovery and enumeration of injured Vibrios from high pressure processed shrimp.
- Prevalence of *Vibrio alginolyticus* in seafood was found to be 60% in different markets across Kerala. This pathogen could survive up to 18 days in Yellowfin tuna during chilled storage.
- Survival of *Listeria monocytogenes* and *Staphylococcus aureus* during *sous vide* processing and further chilled storage was elucidated. *L. monocytogenes* could survive nine minutes cooking at 63 °C in Red Snapper fillets, whereas 4.68 log reduction was observed for *S. aureus* in Tuna fish chunks cooked for 60 min. at 60 °C without any appreciable reduction during chilled storage.

Challenge studies with food-borne pathogens

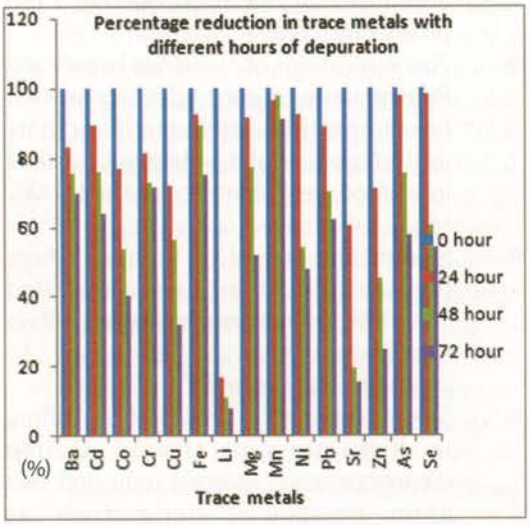
- The efficacy of an altered sanitation regime using a Response Surface Methodology optimized chlorination schedule was tested for real-time application in a fish processing plant.
- Phenolic extracts of *Averrohea bilimbi* and Pomegranate epicarp which possessed broad spectrum antibacterial activity against spoilage and pathogenic bacteria in seafood were characterized by LC-MS/MS.
- Studies on survival of Vibrios in high pressure (250 MPa; 6 min.) indicated complete elimination of pathogenic *Vibrio* species such as *V. cholerae, V. parahaemolyticus* and *V. vulnificus*.
- Studies on *in situ* survival of microflora in high pressure treated shrimp (*Fenneopeneaus indicus*) indicated that gram positive bacteria such as *Arthrobacter* spp., *Bacillus cereus,*



Survival of *V. alginolyticus* at different pH and concentrations of Bilimbi Extract (BE)

Brevibacterium spp., *Paenibacillus lautus* and *Rhodococcus* spp. could be isolated from 600 MPa treated shrimps.

- Imported frozen fishery products tested for antibacterial substances showed positive for 20% of the sample, but banned antibiotics were not detected by using LC-MS/MS method.
- A depuration system designed for edible oyster *(Crassostrea madrasensis)* could significantly reduce load of trace metals after 72hours of depuration.



- A ready to eat novel battered and breaded snack product named as 'Oyster pablano pepper fritter' prepared from edible oyster had a shelf life of 14 days in chilled storage conditions.
- Studies on elemental composition of wastes generated during fish processing revealed significant content of Ca, K, Fe and Mg in Croaker head and Pinkperch viscera, which could be further utilized.
- A 4.00 Lakh litres per day energy efficient Effluent Treatment Plant (ETP) was designed and commissioned at Cochin Fishing Harbour, for Cochin Port Trust on a consultancy basis.

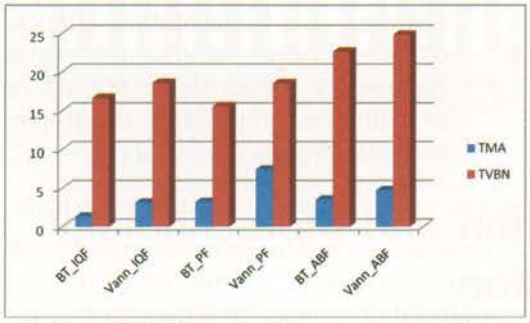
ETP commissioned at Cochin Fishing Harbour with CIFT consultancy

- Freshly caught Croaker from single day trawler maintained the keeping quality up to 14 days in refrigerated storage condition (1-2 °C). *Psuedomonas* spp. and H_2S forming bacteria formed the major spoilage bacteria.

***Johnius* spp. in headless gutted form packed in polyester polyethylene laminated pouch**

- Cryogenic freezing method like brine freezing reduced the freezing time and improved the quality of Tiger shrimps (*Peneaus monodon*) compared to air blast frozen samples. Freezing loss and thawing loss was higher for air blast frozen shrimps (2.24 and 0.86% respectively) compared

to brine frozen samples (1.84 and 0.38% respectively). Salt uptake was higher for brine frozen samples.

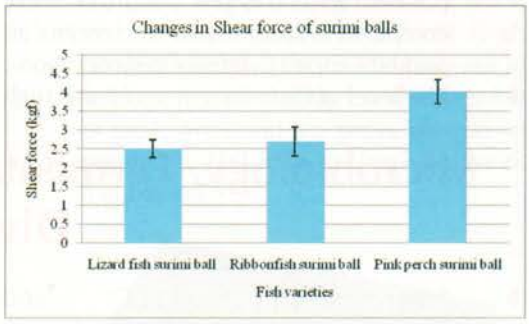


TMA and TVBN content in prawn and shrimp under different freezing treatments

- Quality changes of cultured Tiger prawn (*P. monodon*) and White shrimp (*L. vannamei*) processed by IQF, plate freezing and air blast freezing methods were studied. Textural changes, freezing loss, thawing loss and cooking loss was least for IQF processed samples followed by plate freezing and air blast freezing. Water holding capacity was highest for IQF followed by plate freezing and air blast freezing. Textural and biochemical quality of Tiger prawn was slightly better compared to White shrimp.

Tiger shrimp frozen by brine freezing

- Textural changes of raw and cooked commercially important fish (Shark, Rays, Goatfish, Pinkperch, Lizardfish, Cod, Ribbonfish, Bigeye, Seabream, Longtail tuna and Dhoma) and shellfishes (Tiger prawn, Vannamei, Karikkadi, Brown shrimp, Squid, Cuttlefish and Octopus) were evaluated. Hardness, chewiness and springiness of cooked samples were better compared to raw samples. Hardness of Tiger prawn and White shrimp increased 4.0 and 4.8 times with cooking whereas chewiness increased 9.7 and 14.2 times respectively.



- Quality of fish mince from the initial and final section of the refiner of Pinkperch (*Nemipterus japonicus*) surimi processing was evaluated. Protein content of mince ranged between 14-16% and fat content ranged between 0.54-2.67%. Pathogens of human significance was absent in both the samples.
- Seafood effluent discharge elevated the levels of microbial pollution indicators in the bar mouth of Bhidia landing centre.
- Longtail tuna packed under control air was in good condition up to 5-6 days when compared to 9-10 days for O_2 scavenger packs in refrigerated storage conditions.

Longtail tuna and tuna chunks

- Bromocresol purple gave better indication of freshness for shrimp and cuttlefish compared to Bromothymol blue, Bromocresol green and mixed indicators.
- Histamine formation rate in Mackerel packed with oxygen absorber were compared to vacuum pack and control air packed samples in refrigerated conditions.
- The level of cadmium in squid was high in ink sac followed by skin, tentacle and edible part.
- All Scombroid species of the local fish market of Vashi contained high level of histamine up to the level above 10mg%.
- 67.74% of sample of Vashi fish market contained > 0.2 ppm lead. But, in case of cadmium, only 6.45% of samples exceed 0.05 ppm.

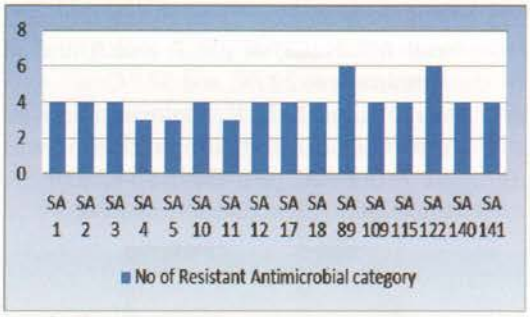
Microbiology, Fermentation and Biotechnology Division

- Enterotoxigenic (ETEC) and Enteropathogenic (EPEC) *Escherichia coli* were identified in 30 and 3.5% of the 225 *E. coli* isolates from 54 seafood samples.
- A Methicillin resistant *Staphylococcus aureus* (MRSA) was isolated from fish and PCR amplification showed presence of *mecA* gene.

mecA gene  nucA gene

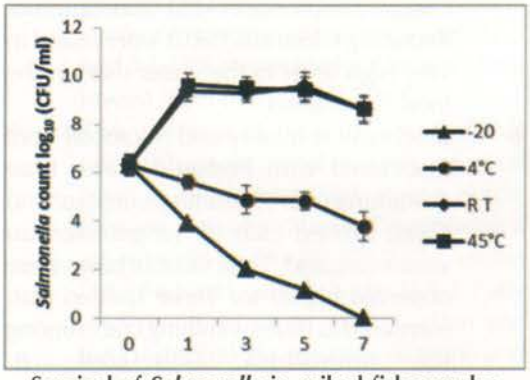
PCR assay for detection of Methicillin resistant *S. aureus* Lane 1 and Lane 4 - *S. aureus* ATCC 33591 positive control; Lane 2 and Lane 5 - *S. aureus* fish strain; Lane 3 and Lane 6 - *S. aureus* ATCC 25923 negative control for *mecA*; Lane M - Molecular weight marker; Lane 7 - *S. aureus* ATCC 12228

- Out of 60 *Vibrio cholerae* non-O1 and non-O139 strains isolates from seafood studied, all strains were found negative for *ctx* and *zot* genes. Presence of *ace* was detected in 12.8% strains and regulatory *tox* genes in 91% strains.
- *Yersinia enterocolitica* could not be detected in any of the 21 seafood samples collected from retail fish markets of Ernakulam district.
- Thermophilic *Campylobacter* (*C. upsalienesis*) was detected in one out of 48 seafood samples from retail outlets at Ernakulam district.
- *tdh* gene was not detected in any of the 153 *V. parahaemolyticus* isolates from 35 seafood samples.
- Real time PCR-based methods were standardized for quantitative detection of *Listeria monocytogenes* and *Shigella* spp. in seafood.
- Antimicrobial resistance to Ceftriaxone, a third-generation Cephalosporin antibiotic was found in one *L. monocytogenes* isolate from fish.
- Three Enterotoxigenic *E. coli* (ETEC) isolates from fish were resistant to Moxifloxacin, a fourth-generation synthetic Fluoroquinolone antibacterial agent, while six isolates were resistant to Cefpodaxime, a third-generation Cephalosporin antibiotic.
- Multi-drug resistance (MDR) against six drugs (Cefpodoxime, Ticarcillin, Augmentin, Colistin, Ceftriaxone and Moxifloxacin) was found in 12% of the 60 non-O1, non-O139 *V. cholerae* isolates. But O1 strains were found sensitive to all of the antibiotics tested.
- Sixteen multiple drug resistant strains of *Staphylococcus aureus* were isolated from fish sold in retail outlets at Ernakulam, Alappuzha and Kotttayam districts.



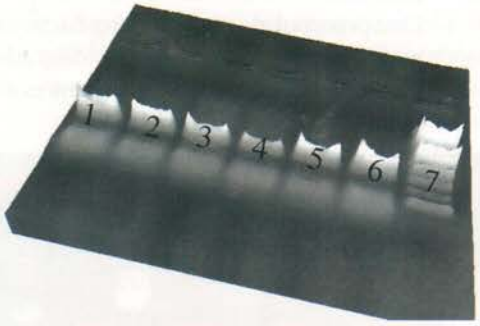
Multi-drug resistance in *Staphylococcus aureus*

- Microbial profile of farmed Gourami fish (*Osphronemus goramy*) showed dominance of Genera *Enterobacter, Aeromonas, Exiguobacter, Pseudomonas, Bacillus* and *Staphylococcus*.
- Microflora of farmed Catfish (*Pangasianodon hypophthalmus*) was dominated by Genera *Pseudomonas, Aeromonas, Burkholderia, Stenetrophomonas, Micrococcus, Staphylococcus* and *Bacillus*.
- Spoilage microflora of farmed Catfish was identified as Genera *Pseudomonas, Aeromonas* and *Burkholderia*. Pathogenic bacteria belonging to ETEC, *Aeromonas* and *Enterococcus* were detected.
- Studies on survival of *Salmonella* in seafood at different temperature exposure (-20 °C, 4 °C, room temperature (RT) and 45 °C) showed that at 4 °C, there is a continued reduction in the cell count and cell reduction was sharper at -20 °C from Day 1 to 3 and viable *Salmonella* was not detected after Day 5.



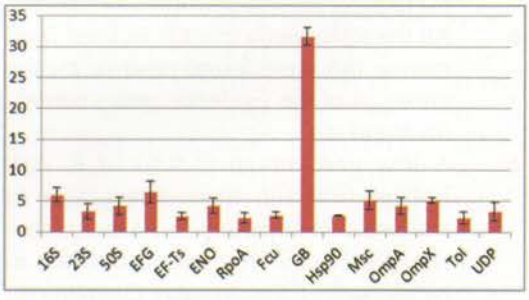
Survival of *Salmonella* in spiked fish samples under different storage conditions

- Studies on differential expression of *Salmonella enterica* serovars Weltevreden virulent genes when compared to endogenous reference gene (GAPDH) showed that there was up-regulation of *rpo* gene and down-regulation of *fimA, inv*, and *stn* genes at RT. At high temperature (45 °C), 15-fold increase in *fimA* expression on Day 1 and expression of *rpoE, invA* and *stn* genes was down regulated 100 fold during one week incubation.



***Salmonella* isolates showing the amplification of *invA* gene (284bp amplicon)**
Lane 1 to 5: *Salmonella* isolates from fish; Lane 6: Type culture; Lane 7: 100bp Marker

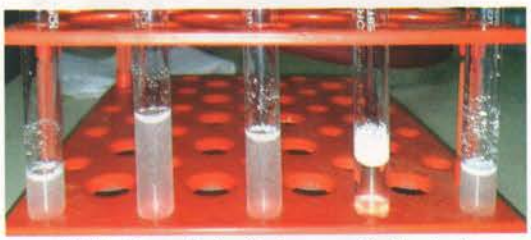
- Exotic viral shrimp pathogens such as YHV and TSV could not be detected in any of the 61 and 48 shrimp/larvae samples tested.
- Bacteria tolerant to 20% salt were identified as *Genera Kocuria, Haererehalobacter, Staphylococcus* and *Bacillus*.
- Relative quantitative real-time RT-PCR



Increase in expression of target and reference gene in *Mangroveibacter* spp. under salt stress by RT-qPCR analysis

assay for expression profiling of upregulated genes from cDNA SSH library of *Mangroveibacter* spp. revealed that Glycine betaine/L-proline transport system has a major role in *Mangroveibacter* spp. for overcoming salt-stressed conditions.

- Of the 89 hydrocarbon degrading bacteria isolated from petroleum contaminated fishery environment under different pH and salt concentrations, the dominant genera were identified as *Kocuria, Haererehalobacter, Staphylococcus* and *Bacillus*.
- One potential plastic degrading bacterium was isolated from partially degraded plastic collected from landing centres and was identified as *Gordonia* spp.



Utilization of plastic by aquatic bacteria

- Comparative genomics analysis of *L. monocytogenes* and non-pathogenic *Listeria innocua* using bioinformatic tools revealed the presence of 41 genes including the genes encoding Listeriolysin (*hly*), Phosphatidyl innositol specific phospholipase C (*plcA*), zinc metalloprotease precursor (*mpl*), actin-assembly protein precursor (*actA*), DNA topoisomerase III etc. which were exclusively present in *L. monocytogenes*.
- All the *Salmonella* (n = 12) isolated from marine fish were found positive for the presence of the virulence genes namely *invA* and *stn*.
- A low percentage (3.9%) of *E. coli* isolated from fish showed resistance to antibiotic Meropenem but Meropenem resistant *E. coli* were found resistant to Norfloxacin, Ciprofloxacin, Gentamicin, Amoxicillin, Penicillin, Methicillin, Nalidixic acid and Tetracycline.
- Vibrio isolates (75%) showed chitinase activity from Day 2, on media with 3% and 6% NaCl, at pH 7 and 9 and at temperatures 22 °C and 37 °C.
- All O1 and O139 *V. cholerae* produced chitinase; but chitinase production was variable in non-O1/non-O139 *V. cholerae*.

Chitinase production by *ctx* gene positive *V. cholerae* (centre well and wells 3, 4, 5) but no chitinase production in *ctx* gene negative *V. cholerae* (wells 1 and 2, clockwise)

- Natural microbial culture media supplement from Rohu scales was prepared. Incorporation of peptide extract at 1% level in culture media supplemented the growth of *E. coli*.
- Plant extract was prepared from orange peel and mint leaf powder and the mint extract was shown to exhibit higher antioxidant and antibacterial activities.
- Microbiological analysis revealed that 20% of the fishes in the Vashi market were unfit for human consumption due to high level of *E. coli* contamination. Faecal Streptococci (FS) and Sulphite Reducing Clostridia (SRC) were found in very high level in the water used in the local fish market.
- Biochemical quality and microbial flora associated with Portunid crabs, Blue swimming crab (*Portunus pelagicus*) and Three spotted crab (*P. sanguinolentus*) were evaluated. Total volatile bases were observed higher for Three spotted crab compared to Blue swimming crab. Among the microflora associated, *B. thermosphacta* dominated followed by *Pseudomonas* spp., H_2S forming bacteria,

faecal Streptococci and *Lactobacillus* spp.

- Quality evaluation of air blast frozen male and female Blue swimming crab in different style (whole and cut crab) indicated microbial load of cut crab as slightly higher compared to whole crab. Female crab had better microbial quality.

Blue swimming crab

- Biodegradable antimicrobial packaging film was prepared using chitosan incorporating ginger essential oil and its antimicrobial properties were evaluated against *S. aureus* and physical properties were studied.
- A total of 77 samples consisting of fresh, frozen and dried fish and shellfishes, ice and water were monitored for microbial quality like mesophilic bacterial counts, total Enterobacteriacae, *E. coli, S. aureus,* faecal Streptococci, *Salmonella, V. cholerae, V. parahaemolyticus* and *Listeria monocytogenes*.
- The *E. coli* isolates were confirmed by streaking on to EMB agar (small, dark with green metallic sheen colonies) and IMViC tests and *S. aureus* on Mannitol Salt Agar (Oxoid) and Rabbit coagulase plasma (Difco) and faecal Streptococci by catalase test. The isolates were preserved in liquid paraffin for further PCR characterization.
- *S. aureus* occurrence was 43.52% in seafood of which 12.77% were coagulase positive strains.
- Nearly 86.6% of the coagulase positive *S. aureus* bacteria were positive for beta lactamase production.

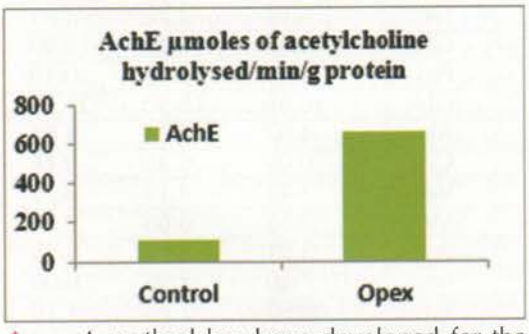
Biochemistry and Nutrition Division

- Evaluation of biochemical composition of common food fishes and shellfishes indicated that squid and cuttlefish have higher levels of protein; ie. 24.12 and 25.45%, respectively. Under the category finfishes, tuna had the highest level of protein (~20%) and fat (~4%). Protein content in oysters and mussels were 17.5 and 17.25% respectively. Clams had the lowest level of protein (7.25%).
- The amino acid profiling showed that cuttlefish, oysters and mussels are good sources of all essential amino acids. Glycine was found to be the prominent amino acid in mussel (21.25%), oyster (18.50%) and cuttlefish (16.56%). Fatty acid profile of green mussel, clam and tuna indicated the presence of mono and poly unsaturated fatty acids in rich proportions.

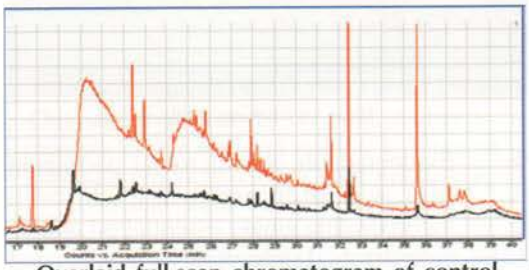
Amino acid composition of common shellfishes (g/16g N_2)

Amino acids	Cuttlefish	Oyster	Mussel
Asp	13.10	11.15	12.96
Thr	3.93	6.08	4.68
Ser	4.64	4.78	4.61
Glu	15.95	10.16	12.90
Pro	0.63	0.79	0.19
Gly	16.56	18.50	21.25
Ala	4.82	2.24	3.84
Cys	0.09	0.35	0.16
Val	5.42	7.19	6.75
Met	2.55	0.66	0.29
Ileu	3.91	4.12	4.55
Leu	7.10	3.96	6.00
Tyr	0.93	1.20	1.18
Phe	4.08	3.60	4.67
His	4.73	10.86	4.80
Lys	8.35	12.61	8.52
Arg	1.95	0.23	1.55
Try	1.21	1.48	0.97

- Omega-3 fatty acids compositional studies on lipid moiety of tuna, green mussel and clam have shown that they are rich in docosahexaenoic acid (DHA).
- Proximate composition and nutrient profile of edible Jellyfish (*Rhopilema* sp.) caught from Arabian sea off Cochin revealed essential amino acids (especially Valine, Isoleucine, Leucine and Threonine) and non-essential amino acids (Alanine, Glycine, Glutamic acid and Aspartic acid) in considerable quantities, suggesting that the species may be effectively utilized in poultry, fish and animal feed formulations.
- Jellyfish was found to be rich in elements such as Fe, Mn, Zn and Se.
- *In vitro* investigations on the antioxidant potential of cuttlefish ink revealed its utility in attenuating oxidative deterioration and nutraceutical formulations.
- A non-enzymatic method and an enzymatic method were developed for the preparation of Oyster peptide extract possessing antioxidant and anti-inflammatory activities.
- *In vitro* and *in vivo* studies on antioxidant defense of Opex (Oyster peptide extract) revealed its potential utility in ameliorating neurological dysfunction associated with reactive oxygen species-induced oxidative stress in experimental animals.



- A method has been developed for the isolation and purification of astaxanthin from deep sea shrimp and Blood spotted swimming crab (*Portunus sanguinolentus*) having good antioxidant activity.
- A simple and cost effective method was developed for the preparation of fatty acid ethyl esters from sardine oil.
- A multi residue QuEChERS based method for analysis of 22 Organo Chloro Pesticides (OCPs), 15 Poly Aromatic Hydrocarbons (PAHs) and 82 currently used multiclass pesticides in fatty fish muscle involving a triple partitioning extraction between water, acetonitrile and hexane followed by dispersive clean-up was developed that considerably reduced lipid co-extracts prior to GC-MS/MS analysis.



Overlaid full-scan chromatogram of control matrix without clean-up (red) and with clean-up (black) showing effect of clean-up on co-extractive removal

- A modified HPLC method for the determination of amino acid composition in fish and fishery products was developed.
- Studies on the antiaging effect of dietary chitosan supplementation in young and aged rats have shown that the dietary intake of chitosan was capable of restoring the depleted myocardial antioxidant defense and suggest that dietary chitosan is an effective therapeutic agent in treatment of age-associated disorders.
- Oral intake of glutamine counteracted the Ibuprofen-induced oxidative stress in ulcerated rat mucosa.
- The dietary chitosan intake ameliorated the age-associated hypercholesterolemic aberrations in experimental rats.
- A simple modified method for the purification and isolation of collagen from aquatic sources was developed.
- Succinyl chitosan was synthesized and

Collagen extracted from *Johnius amblycephalus* fish

characterized with the help of IR spectroscopy and atomic force microscopy. This synthetic polymer may serve as an effective tool in micro/nano encapsulation of nutraceuticals for controlled and efficient drug delivery.

- The gel strength of surimi prepared from Threadfin bream was highest followed by Bigeye, mixed surimi from Croaker, Lizardfish, Ribbonfish and Goatfish. Mixing different varieties of fish improved the gel strength of surimi.
- Oil recovery from surimi waste was more in heat extraction method (50.62%) compared to solvent extraction method (4%). Fat oxidation and hydrolysis reduced significantly for the surimi oil with natural antioxidant.

Engineering Division

- Development of cost effective and eco-friendly slurry ice machine using renewable energy is in progress.
- Fabricated a prototype of solar fish dryer having a capacity of 5 kg using solar PV panels.
- Designed and fabricated a 10 kg capacity fish meal plant.
- Designed and developed an Electronic Power Generator using solar PV panels.
- Designed and fabricated a portable and battery operated High Speed Digital Water Current Meter for water current measurements in Hoogly Estuary, West Bengal.
- Re-fabricated the head cutting machine of tuna with reduced RPM and other modifications in feeding and collection mechanisms.

Small scale fish meal plant

Prototype of solar fish dryer

Electronic power generator using solar panels

Extension, Information and Statistics Division

- Data collected from fishermen respondents at Thaikkal fishing village in Alappuzha district and Thayyil fishing village in Kannur district revealed that fishermen were involved in mainly three categories of fishing such as 'Thangu vala' fishing (20 m ring seiners), disco vala fishing (14.5 m marine plywood 'vallams') and gillnet fishing with smaller 'vallams' (9 m).

FRP boats in landing centre

- Fishermen respondents were interested in technology interventions in the subject areas such as hygienic fish handling in the landing centres, reduction of post harvest loss, use of responsible fishing methods, use of improved packing methods for transport/sale, and production of value added fishery products. The extent of awareness and adoption of 10 selected improved practices were studied among the fishermen respondents.
- Data were also collected from 34 fisherwomen in Njarakkal fishing village (Ernakulam) and 10 fisherwomen respondents in Quilandi fishing village (Kozhikode). It was seen that all the respondents were interested in food/fish based micro enterprises and expressed their interest in attending a training on the production of value added fishery products.
- Rapid Rural Appraisal (RRA) techniques were used in the four centres and the technological interventions were determined.
- Lack of access to the research/extension organizations and lack of awareness on availability of technologies were reported as constraints in obtaining technologies.
- The social participation of the fishermen was observed to be restricted to membership in Co-operative Societies and the major sources of information for improved technologies were reported to be their friends and fellow fishermen.
- Escalating fuel costs, inadequate fuel subsidy, diminishing catches, lack of adequate measures for safety at sea and poor landing centre facilities were reported as operational constraints.
- The fishermen/fisherwomen respondents preferred participatory extension models involving the fisherfolk/voluntary organizations. The other preferred technology transfer models were; mobile based extension/advisory services, and horizontal transfer through peer groups/ progressive fishermen.
- Under the study on the economic efficiency of the fishing units, it was seen that 17% fisherfolk of Alappuzha district and 23% of fisherfolk of Ernakulam district were operating ring seines. The variables for assessing the economic efficiency of fishing units were finalized.
- A Canonical discriminant function analysis was done on socio-economic variables and technology adoption indicators from data collected among fishermen operating OBM crafts in four districts of Kerala.
- Using a Probability Proportional to Size sampling design, a sample of 63 fish processing plants were selected, and the energy use and GHG emission associated with Kerala fish processing sector were estimated. The CO_2 equivalent per kg of the finished product was computed as 0.487 kg at 50% production capacity and

0.397 kg at 33% production capacity.

- von Bertlanffy Growth Model was fitted to the growth data on carps stocked at Kanjirapuzha reservoir and annual growth rates of catla and mrigal obtained were 0.69 and 0.60. Virtual population analysis was done on the data on length-weight of catla and mrigal, using Jones Length Cohort Analysis. Biomass for exploitation available in the reservoir for catla was estimated as 33 tonnes and mrigal was estimated as 209 tonnes.
- Density-dependent growth model suggested by Lorenzen (1996) was employed to suggest appropriate stocking regime to Kanjirapuzha reservoir.
- A two phase sampling design was developed for the study on fuel efficiency of mechanized fishing system and to classify the mechanized fishing fleet spread along the nine coastal districts and to standardize a mechanized fishing system for fuel efficiency. In the first phase, utilizing a large sample, a database on dimensions, hardware components and vessel operating behavior of the existing mechanized fishing fleet of Kerala was created.
- Response surface methodology was used to study the optimum process parameters for extraction of glucosamine hydrochloride.
- Based on two-stage sampling methodology developed for estimation of seafood waste from processing sector, quantity of waste generated annually was estimated.
- Conjoint model was fitted to consumer preference data comparing innovative fish products and other snack products. The part-worth utilities estimated for various product combinations showed high preference for fish-based snack food.
- Harvest losses in marine fisheries was estimated from Ernakulam district as 1.14% for traditional sector, 3.65% for motorized sector, 14.15% for mechanized trawlers undertaking up to seven days fishing and 18.73% for trawlers fishing more than seven days. Estimates were also computed by utilizing information on number of hauls during the fishing trip which were more précised than the usual estimator.
- Post harvest losses in pre-processing sector was estimated for Ernakulam and Alappuzha districts as 0.38% whereas the losses amounted to 1.19% in processing sector. Loss estimates computed for dry fish production stood at 36.97% and wholesale marketing of dry and fresh fish recorded 7.56% and 3.79% losses. From retail marketing of fresh and dry fish, 3.13% and 8.23% losses were reported whereas road-side market channel reported losses of 2.54% and 5.43% for fresh and dry fish respectively.
- The extent of harvest losses at landing centres of Nagarjunasagar reservoir was assessed as 8 to 10%. The causes were discards of spoiled fishes due to physical damages in entangling, discards of dead fishes in the nets, spoilage due to adverse weather, spoilage due to non-usage of ice, spoilage due to delay in taking out the already caught fishes from gillnets, etc.

Interaction with fishermen

- Preliminary study and analysis of the data of boat building facilities throughout Kerala has been made.
- Data collection based on general technology changes with respect to size, type and power of boats, construction materials, equipment use, and operational methods on-board fishing vessels were made.
- Documentation of profiling of mechanized fishing system presently in use with respect to hull characteristics,

construction methods, installed power, propulsion characteristics and on-board equipments was done.

- Survey conducted among fishermen engaged in gillnet fisheries using FRP crafts with out-board engines of 9-10 Hp in Vasuvanipalem and Peddajalaripeta fishing villages of Visakhapatnam revealed that the mean average investment on the fishing system is ₹3.12 lakhs with an average number of fishing days of 289 per year. Investigations on fishermen awareness and adoption of various fishing related innovations and practices showed that majority of them belong to medium level of awareness and adoption.

FRP boat used in the fishing villages

- As a part of assessing the role, functioning and gendered impacts of stakeholder organization in fisheries, a study was conducted on fisherwomen Co-operative Societies of Visakhapatnam. During the survey it was found that membership in Co-operative Societies is imperative for fisherwomen to get access to many government schemes. The livelihood outcome of fisherwomen Co-operatives Society members showed an average income of ₹ 2727.30 per month from fish drying and curing activities.
- Study was conducted on the impact of introduction of Pacific white shrimp in Andhra Pradesh. Data was collected from aqua farmers, processors/exporters and administrator regarding perceived reason for wide spread adoption of Pacific white shrimp and its perceived socio-economic and environmental impacts.

Survey among women engaged in fish drying activities

- Surveyed the gillnetters of Veraval and collected data regarding fuel consumption.
- Questionnaires were prepared to collect the information about economics of dry fish like Ribbonfish, Horse mackerel and Croakers by traditional sun drying method at Veraval.
- The mean benefit/cost (B/C) ratio observed during experimental fishing in the PFZ and NPFZ locations were 1.42 ± 0.12 and 1.21 ± 0.11 respecively.

Trainings and Outreach Programmes

During the period 1 April, 2012 to 31 March, 2013 a total of 123 training programmes were organized both within the Institute campuses and outside. The programmes were on different topics in which a large number of people including technologists from fish processing establishments, fisherwomen and fishermen, students, officials from state and central government organizations and other interested participated. Trainings were mostly imparted on subject such as:

- Fish processing technology
- HACCP concepts
- Microbial quality of freshwater and

marine fish

- Modern analytical techniques in biochemistry
- Laboratory techniques for microbiological examination of seafood
- Preparation of value added fish products
- Seafood quality assurance
- Hygiene, sanitation and food safety
- Use of PFZ data in fisheries
- Scientific rigging and gill netting
- Nutrient profiling of fish
- Design and operation of responsible fishing gear
- PCR method for detection of WSSV
- Heavy metal analysis
- Packaging material testing of processed food
- Extraction of gelatin from tuna fish skin
- Community based fish processing

During the period under report 33 training/ awareness programmes on various aspects of harvest and post harvest technologies were conducted outside the Institute. Some of them are listed as follows:

Laboratory methods for microbiological examination of seafood (Visakhapatnam)

Microbiological quality of seafood (Veraval)

Modern analytical techniques in biochemistry (Cochin)

Hygienic handling of fish (Visakhapatnam)

Fish processing and extension methods (Cochin)

Microbiological quality control of seafood (Mumbai)

- Value addition and hygienic handling of dry fish, Repelli, Guntur, A.P. (1-2 April, 2012)
- Food safety issues in bivalves, Moothakunnam, Ernakulam, Kerala (20 July, 2012)
- Hygienic handling of fish, Tallaveru, East Godavari, A.P. (31 August-2 September, 2012)
- Post harvest utilization and value addition of trout and carp, Champawat, Uttarakhand (9-10 September, 2012)
- Harvest and post harvest fisheries technologies, Jeypore, Odisha (13-15 September, 2012)
- Fabrication of improved gillnets and eco-friendly fishing gears, Shillongani, Assam (23-25 September, 2012)
- Hygienic fish handling and processing techniques, Barpetta, Assam (27-29 September, 2012)
- Value added products, Roing, Arunachal Pradesh (1-3 November, 2012)
- Ecofriendly fishing gear, Ziro, Arunachal

Value addition of trout (Champawat)

Fabrication of improved gillnets (Shillongani)

Fabrication of multi mesh gillnets (V.V. Sagar)

Preparation of value added products (V.V. Sagar)

Value added products from freshwater fish (Ranchi)

Hygienic handling of fish (Kakkinada)

Pradesh (3-5 November, 2012)

- Fish canning, Yazali, Arunachal Pradesh (5-7 November, 2012)
- Interventions of CIFT technologies for the benefit of scheduled tribe fisherfolk, Vani Vilasa Sagar, Karnataka (16-18 November, 2012)
- Harvest and post harvest technologies for exploitation of reservoir fish and preparation of value added fish products, Doyang, Nagaland (20-24 November, 2012), Dumbur, Tripura (24-25 November, 2012) and Rudrasagar, Tripura (26-28 November, 2012)
- Hygienic handling and preparation of value added products from fish, Amalapuram, A.P. (5 December, 2012)
- Value added products from freshwater fish for employment and income generation, Ranchi, Jharkhand (16-19 December, 2012)
- Hygienic handling and minimization of post harvest losses, Kakkinada , A.P. (20 December, 2012)
- Preparation of value added products from fish, Palluruthy, Cochin, Kerala (13 February, 2013)
- Fabrication of square mesh net, Vanakbara, Gujarat (22 February, 2013)
- Hygienic handling and fresh fish trading and Hygienic production and marketing of dry fish, Poompuhar, T.N. (26-27 February, 2013)
- Hyginic production of smoke cured fish using Community Fish Smoking Kiln, Ranipol, Sikkim (4 March, 2013), Roing, Arunachal Pradesh (8 March, 2013), Dimapur, Nagaland (11 March, 2013), Nagthymain, Meghalaya (16 March, 2013), Lengpoui, Mizoram (18 March, 2013), Lembucherra, Tripura (20-23 March, 2013)
- Fabrication and operation of improved gill nets, Kabani, Karnataka (25 March, 2013)
- Harvest and post harvest technologies, Jangareddygudem, A.P. (26-28 March, 2013)

Exhibitions

The Institute participated in the following exhibitions during the period:

- 'Sagar Khedu' exhibition organized by Gujarat State Govt. at Ahmedabad on 13 August, 2012.
- Exhibition organized on the occasion of National seminar on Official Language at CIFT, Cochin during 17-18 August, 2012.
- Seminar cum exhibition on Environmental awareness, Dr. V.S. Krishna College, Visakhapatnam during 17-18 August, 2012.
- Exhibition held in connection with National consultation meet at Karwar, Karnataka during 31 August - 2 September, 2012.
- Exhibition held on the occasion of National Convention on The next frontier of agri-business and technology at Gandhinagar, Gujarat during 3-6 September, 2012.
- 16th National exhibition organized by Central Calcutta Science and Culture Organization for Youth at Kolkata during 7-11 September, 2012.
- Exhibition held in connection with the Seminar on Mountain fisheries: Challenges and opportunities, DCFR, Bhimtal during 5-7 November, 2012.
- Exhibition organized by Press Information Bureau at Piravom Panchayath during 5-7 November, 2012.
- 'Swasraya Bharat - 2012' at Cochin during 30 November to 5 December, 2012.
- Exhibition held in connection with Global symposium on Aquatic resources for eradicating hunger and malnutrition: Opportunities and challenges at Mangalore during 4-6 December, 2012.
- 'Fish and Food Fest 2012' held at Pathanamthitta during 16-21 December, 2012.

- 'Karshika Mela 2012' held at Thodupuzha during 26 December, 2012 to 5 January, 2013.
- Exhibition (ICAR Pavilion) held in connection with 100th Indian Science Congress, Kolkata during 3-7 January, 2013.
- Global Konkan Festival, Mumbai during 4-7 January, 2013.
- Exhibition held in connection with International symposium on Genomics in aquaculture, CIFA, Bhubaneswar during 22-23 January, 2013.
- Exhibition held in connection with 25th Kerala Science Congress, Thiruvananthapuram during 28 January to 3 February, 2013.
- 'Kisan Mela', Regional Research Station (Acharya N.G. Ranga Agricultural University), Anakapalli during 5-6 February, 2013.
- Exhibition held in connection with XIth Agricultural Science Congress, OUAT, Bhubaneswar during 7-9 February, 2013.
- Exhibition held in connection with PAF Congress on Public-private partnership in

Cochin

Kolkata

Dr. N.K. Krishnakumar, DDG (Hort.), ICAR visiting CIFT stall at Vejalpur

Dr. B. Meenakumari, DDG (Fy.) ICAR in CIFT stall at Bhubaneswar

Dr. B. Meenakumari and Shri Giriraj Singh, FIsheries Minister, Bihar visiting CIFT stall at Barrackpore

Prof. Lazlo Orban (Temasek Life Sciences Lab., Singapore) and Dr. A.S. Ninawe (Advisor, DBT) at CIFT stall at Bhubaneswar

aquaculture, CIFRI, Barrackpore during 9-11 February, 2013.

- 'Kisan Mela' organized by Central Horticultural Experimental Station at Vejalpur, Godhra on 16 February, 2013.
- Kerala Agri Food Pro Meet, Cochin during 18-19 February, 2013.
- 'Krishi Darpan - 2013', North Parur, Ernakulam on 27 March, 2013.

Seminars/Workshops/Winter Schools etc.

The important Seminars/Workshops etc. organized by the Institute during the period are as follows:

- National Brainstorming Workshop on

Workshop on Gender in fisheries. Dr. B. Meenakumari, DDG (Fy.) offering her introductory remarks

Workshop on Intellectual property rights. Shri Dominic Presentation, MLA, Cochin delivering the inaugural address

Prof. Anil K. Gupta inaugurating the Seminar on Traditional knowledge

Dr. E.G. Silas, former VC, KAU inaugurating the Winter School on Fish harvesting systems

Inauguration of the pre-conferance tutorials

Workshop on Energy saving in fishing vessels

gender in fisheries: A future roadmap, CIFT, Cochin (4 April, 2012)

- National Brainstorming Workshop on Harvest and post harvest losses in fisheries, CIFT, Cochin (22 June, 2012)
- Awareness Workshop on Intellectual property rights for seafood industry, Cochin (30 July, 2012)
- Workshop on Networking opportunities for entrepreneurs, Cochin (14 August, 2013)
- National Seminar on Traditional knowledge and management systems in fisheries, CIFT, Cochin (30-31 October, 2012)
- Pre-conference Tutorials of International Pan Ocean Remote Sensing Conference, CIFT, Cochin (30 October - 3 November, 2012)
- Winter School on Fish harvesting systems for resource conservation, CIFT, Cochin (20 November - 10 December, 2012)
- Workshop on Fuel efficient fishing, Nattika, Thrissur (6 January, 2013)
- Seminar on Emerging technologies in fish processing, CIFT, Cochin (8 January, 2013)
- Workshop on Energy saving in fishing vessels, CIFT, Cochin (18 January, 2013)
- Technical Workshop of the project 'Green fishing systems for the tropical seas', CIFT, Cochin (16 February, 2013)
- Workshop on Technology management for researchers, NAARM, Hyderabad (28 February - 6 March, 2013)
- National Workshop on Business opportunities in freshwater fisheries, Patna (23 March, 2013)

Technology Transfer Programmes in NEH Region

The following programmes were conducted during the period under report in various parts of NEH region:

- Training programme on 'Fabrication of improved gillnets and eco-friendly fishing gears' at Shillongani, Nagoan district, Assam (24-25 September, 2012)
- Training programme on 'Hygienic fish handling and processing techniques' at Howly, Barpeta district, Assam (27-29 September, 2012)
- Training programme on 'Fabrication of improved gillnets and eco-friendly fishing gear' at Hapoli, Ziro in Lower Subansiri district, Arunachal Pradesh (3-5 November, 2012).
- Training-cum-demonstration programme on 'Harvest and post harvest technology for exploitation of reservoir fish and preparation of value added fish products, at Doyang reservoir area, Wokha district, Nagaland (20-24 November, 2012).
- Training programme on 'Improved gillnets and eco-friendly fishing gear for reservoir fisheries', at Gandacherra, Tripura (24-25 November, 2012).
- Training-cum-demonstration programme on 'Hygienic handling of fish and

Participants and faculty of the training at Shillongani

Frontline demonstration of eco-friendly gillnet fishing at Hapoli

Practical session in progress at Doyang

Demonstration session in progress at Lengpui

Participants and resource persons of the training at Roing

Participants of the training at Dumbur

preparation of value added products for the benefit of fisherwomen' at Rudrasagar Reservoir area, Melaghar, Tripura (26-28 November, 2012).

- Training-cum-demonstration programme on 'Hygienic production of smoke cured fish using COFISKI' at Krishi Vigyan Kendra, Ranipool in Sikkim (3-4 March, 2013).
- Training-cum-demonstration on 'Interventions of CIFT technologies' for the benefit of fisherfolk, progressive farmers and women self help groups at Iduli and Jia villages of Roing, Lower Dibang Valley district, Arunachal Pradesh (17-19 March, 2013).
- Training-cum-demonstration programme on 'Hygienic production of smoke-cured fish using Community Fish Smoking Kiln' at ICAR Research Complex, Lembucherra, Tripura and KVK, South Tripura (20-23 March, 2013).
- Training-cum-demonstration programme on 'Harvest and post harvest technologies' at Krishi Vigyan Kendra (KVK), Lengpui, Mamit district, Mizoram (26-28 March, 2013).

Tribal Sub Plan Programmes

Distribution of FRP Aluminium Boat and Gillnets at Wayanad, Kerala: Under the Tribal Sub Plan, a programme for distribution of aluminium boat and gillnets to tribal fishermen was organized by CIFT, Cochin in association with Nellarachal ST Fisheries Co-operative Society at Karapuzha, Ambalavayal in Wayanad district of Kerala on 27 February, 2013.

Distribution of FRP Coracles and Gillnets at Kabini, Karnataka: Under the Tribal Sub Plan, a programme for distribution of FRP coracles and gillnets to tribal fishermen was organized by CIFT, Cochin in association with Karnataka State Co-operative Fisheries Federation (KSCFF) at Krishna Raja Sagar, Mysore district, Karnataka on 3 March, 2013.

Aluminium boat after the distribution ceremony

FRP coracle after the distribution ceremony

Celebrations

Foundation Day and Agricultural Education Day: The 55th Foundation Day of the CIFT, Cochin was celebrated on 28 April 2012. Shri R.C. Sinha, Director, CIFNET, Cochin inaugurated the function. Four senior-most retired persons from different categories were honoured at the function. There were cultural programmes by the staff and children of staff. As part of the Agricultural Education Day celebrations, the research laboratories of the Institute were kept open to the public in the forenoon of 28 April and large number of students from Kendriya Vidyalaya visited the Institute and had first-hand information on the research activities.

Anti Terrorism Day: The Institute observed Anti Terrorism Day on 21 May, 2012. The staff of the Institute assembled together and took Anti Terrorism Day Pledge.

World Environment Day: The Visakhapatnam Research Centre of CIFT in collaboration with the CMFRI Regional Centre observed World Environment Day on 8 June, 2012. Saplings were planted in the CMFRI-CIFT Residential Complex on the day in order to create awareness about protecting environment.

Sadbhavana Day: National Sadbhavana Diwas was observed by the Institute on 21 August, 2012 in connection with the observance of Communal Harmony Fortnight. The staff of the Institute assembled together and took Sadbhavana Day Pledge.

Shri R.C. Sinha delivering the inaugural address of Foundation Day celebrations

Students being explained on Agricultural Education Day

Meetings

Research Advisory Committee Meeting: The Research Advisory Committee (RAC) under the Chairmanship of Dr. K. Devadasan, former Director, CIFT met during the period 9-10 April, 2012 to discuss about the research activities of the Institute.

Institute Staff Research Council Meeting: The Institute Research Council (IRC) under the

Chairmanship of Dr. T.K. Srinivasa Gopal, Director, CIFT met during 19-21 April, 2012 to discuss the progress in the ongoing research programmes as well as to finalize the research projects for the next year.

ZTM-BPD Meeting: The ZTM-BPDU (South Zone) organized the Annual Meeting 2012-13 on 7 March, 2013 at DOR, Hyderabad

RAC meeting in progress

IRC meeting in progress

Consultancy Agreements

CIFT, Cochin signed a series of consultancy agreements with various firms during the year under report. The most significant ones are reported below:

With Fisheries Institute of Technology and Training, Chennai: For technical assistance for fabrication of a 40 feet long Fiberglass Reinforced Plastic (FRP) boat (₹1,50,000/-).

With M/s Blue Water Foods & Exports (P) Ltd., New Mangalore: For technical guidance and assistance relating to the setting up of an Effluent Treatment Plant (ETP) (₹4,76,2000/-).

With M/s Mangala Marine Exim Pvt. Ltd., Cochin: For technical guidance and assistance relating to the setting up of an Effluent Treatment Plant (ETP) (₹2,00,000/-).

With Marine Products Export Development Authority (MPEDA) (Ministry of Commerce & Industry, Govt. of India), Cochin: For setting up of Quality Control Labs at Bhubaneswar, Nellore, Bhimavaram and Chennai (₹1,87,500/-).

With Meat Products of India Ltd., Edayar, Koothattukulam, Ernakulam District (A Government of Kerala undertaking firm): For assistance for the production of ready to serve food products in retortable pouches and implementation of HACCP system (₹4,50,000/-).

With National Research Centre on Pig, Rani, Guwahati: For providing technical advice and assistance relating to establishment of HACCP system for pig slaughter house cum pork processing plant at NRC on Pig (₹1,00,000/-).

With Cochin Port Trust, Cochin: For providing technical guidance for the setting up of an Effluent Treatment Plant (ETP) at Cochin Fisheries Harbour in connection with the up-gradation of infrastructure.

Handing over MoU to M/s Mangala

Handing over MoU to MPI

Awards and Recognitions

"Certificate of Appreciation" from ICAR: The Zonal Technology Management-Business Planning and Development (ZTM-BPD) Unit at CIFT, Cochin was awarded a Certificate of Appreciation for the outstanding work on establishment of Business Incubation Centre and commercialization of technology in fish processing, from NAIP, ICAR. Dr. C.N. Ravishankar, PI, ZTM-BPD Unit, CIFT received the Award from Dr. S. Ayyappan, Director General, ICAR and Secretary, DARE, Govt. of India during the Regional Committee Meeting of ICAR held at Central Arid Zone Research Institute (CAZRI), Jodhpur during 16-17 November, 2012.

Dr. C.N. Ravishankar receiving the award from Dr. Ayyappan

Official Language Implementation Prize: The Visakahapatnam Research Centre of CIFT was adjudged first in promoting the use of Official Language Hindi during the year 2011-2012 among government offices in and around Visakhapatnam. The prize was given during the meeting held on 4 May, 2012 at DRM Office at Visakhapatnam. Dr. M.M. Prasad, SIC & Principal Scientist received the prize and Dr. Santosh Alex, Technical Officer (T5) received the commendation certificate .

Dr. M.M. Prasad receiving the prize from Shri Kashinath, Chairman, TOLIC

Jawaharlal Nehru Award: Dr. Rakesh Kumar, Senior Scientist received the 'Jawaharlal Nehru Award - 2011 for P.G. Outstanding Doctoral Thesis Research in Agriculture and Allied Sciences (Fisheries)' instituted by ICAR, New Delhi for his Ph. D. thesis entitled, "Biochemical and molecular investigations on *Salmonella* serovars from seafood" under the guidance of Dr. P.K. Surendran, former Head, MFB, CIFT, Cochin. The award was received from Shri Sharad Pawar, Honourable Union Minister for Agriculture, Food and Public Distribution on 16 July, 2012.

Dr. Rakesh Kumar receiving the award from Shri Sharad Pawar

Peter Howgate Award: Dr. A. Jeyakumari, Scientist was selected for the 'Peter Howgate Award for Young Fish Technologists-2012, based on merit and her Ph.D. programme. The training programme was carried out under the guidance of Dr. Utai Klinkesorn, Assistant Professor, Department of Food Science and Technology, Faculty of Agro-Industry, Kasetsart University, Chatuchak, Bangkok, Thailand.

Best Paper Award: Dr. Femeena Hassan, Senior Scientist received the 'Dr. Ravindran Endowment Award' for best paper presented in the technical session 'Ocean technology and fisheries sciences' at the 22nd Swadeshi Science Congress held at CPCRI, Kasaragod

during 6-8 November, 2012. The title of the award winning paper is "Isolation of squid chromatophores and its commercial application as a natural pigment in lipsticks". Prof. B. Madhusudana Kurup, VC, KUFOS, Cochin gave away the award to Dr. Femeena Hassan.

Dr. Femeena Hassan receiving the award from Dr. Madhusudana Kurup

Other Important Activities

Inauguration of Business Incubation Centre: The Business Incubation Centre established at CIFT, Cochin under the project ZTM-BPD Unit was inaugurated by Dr. S. Ayyappan, Secretary DARE and Director General, ICAR on 5 April, 2012.

Dr. S. Ayyappan inaugurating the Business Incubation Centre

DG, ICAR and Secretary, DARE Visits MV Bharat Darshan: Dr. S. Ayyappan, Director General, ICAR and Secretary, DARE visited the Manasseri Fishermen Development Co-operative Society, Cochin owned boat 'Bharat Darshan' at Cochin Fisheries Harbour to inspect the power block installed on-board the vessel by CIFT under the Institute project 'Resource specific large mesh purse seine for tuna and large pelagics in the Indian EEZ'. Dr. Ayyappan also visited another vessel belonging to the same Society at Cochin Fishing Harbour, 'Bharat Sagar' where the Institute has installed a hydraulic tuna long liner winch and setter under the new Institute project on 'Responsible line fishing'.

DG, ICAR inspecting tuna long line branch lines on-board Bharat Sagar

DG, ICAR and Secretary, DARE Visits ETP Designed by CIFT: Dr. S. Ayyappan, Director General, ICAR and Secretary, DARE visited M/s Mangala Seafoods, Aroor to inspect the performance of the Energy Efficient Treatment Plant (ETP) designed, developed and installed by CIFT at the factory.

Dr. S. Ayyappan visiting ETP

Launching of 'Fish Maid' Products: Under the project, 'Responsible harvesting and utilization of selected small pelagics and freshwater fishes' an array of life style snack products have been developed from small pelagic fishes like oil sardine, mackerel, anchovies and freshwater fishes. The 25 products branded 'Fish Maid'

Product launch of 'Fish Maid' by Chief Minister of Kerala

selected from more than 40 products developed under the project was formally launched on 17 July, 2012 at Thiruvananthapuram. Shri K. Babu, Minister of Excise, Fisheries and Ports, Govt. of Kerala and president of the function introduced the variety 'Fish Maid' products. Shri Oommen Chandy, Honorable Chief Minister of Kerala, launched the products by handing over a complementary packet to Shri G. Karthikeyan, Speaker, Kerala Legislative Assembly.

Launching of Project on Green Fishing Systems for Tropical Seas: 'Green fishing systems for tropical seas', a research project funded by National Fund for Basic, Strategic and Frontier Application Research in Agriculture (NFBSFARA), ICAR, New Delhi, was formally launched by Shri K. Babu, Hon'ble Minister for Exercise, Ports and Fisheries, Govt. of Kerala on 16 February, 2013 at CIFT, Cochin.

CIFT Designed Solar Fish Dryer at Yanam, Puducherry: As a part of the project of Department of Fisheries and Fishermen Welfare, Puducherry, a wholesale hygienic fish market and solar fish dryer designed under the technical guidance of CIFT was inaugurated at Savithri Nagar, Yanam by Honorable Chief Minister of Puducherry Shri N. Rangasamy on 6 January, 2013.

Launching of the project (L to R: Dr. K. Gopakumar, Dr. T.K. Srinivasa Gopal, Shri K. Babu, Dr. Mohan Joseph Modayil and others)

Inauguration of whole sale hygienic fish market and solar fish dryer at Yanam

Visits Abroad

Dr. R. Raghu Prakash, Senior Scientist was deputed to attend the International fisheries symposium held at Can Tho, Vietnam during 6-8 December, 2012. Dr. Raghu Prakash also presented a paper entitled, "Role of fishing technology in responsible fishing for sustainable fisheries development and conservation of resources".

Dr. Toms C. Joseph, Senior Scientist was deputed to Thailand to attend the Workshop on Regional

Dr. Raghu Prakash making the presentation

proficiency testing programme for aquatic animal disease in Asia-Pacific at Network for Aquaculture Centre for Asia Pacific (NACA), Bangkok during 25-26 July, 2012.

Dr. A. Jeyakumari, Scientist was deputed to Thailand to undergo a training programme on "Encapsulation of fish oil" at Kasetsart University, Thailand during 17-21 December, 2012. Dr. Jeyakumari was selected for the 'Peter Howgate Award for Young Fish Technologists-2012', based on merit and her Ph.D. programme. The training programme was carried out under the guidance of Dr. Utai Klinkesorn, Assistant Professor, Department of Food Science and Technology, Faculty of Agro-Industry, Kasetsart University, Chatuchak, Bangkok, Thailand.

Shri C.K. Suresh, Junior Technical Assistant. (T3), Fish Processing Division, CIFT, Cochin was deputed to attend training in the maintenance and care of Isostatic Press System at M/s Stanstead Fluid Power Ltd., Harlow, U.K. during 19-23 November, 2011.

Dr. Jeyakumari at Kasetsart University

Shri Suresh undergoing training

Visitors

The following were some of the dignitaries who visited the Institute during the period:

- Dr. S. Ayyappan, Secretary, DARE and Director General, ICAR, New Delhi (CIFT, Cochin on 5 April, 2012)
- Dr. B. Meenakumari, Deputy Director General (Fisheries), ICAR, New Delhi (CIFT, Cochin on 5 April, 21 April & 22 June, 2012)
- Dr. K.D. Kokate, Deputy Director General (Extension), ICAR, New Delhi (CIFT, Cochin on 17 August, 2012)
- Dr. G. Syda Rao, Director, CMFRI, Cochin (CIFT, Cochin on 5 April & 17 August, 2012)
- Shri R.C. Sinha, Director, CIFNET, Cochin (CIFT, Cochin on 28 April, 2012)
- Shri A.K. Sreevastava, Deputy Director (Implementation), Official Language, Bangalore (CIFT, RC, Visakhapatnam on 4 May, 2012)
- Dr. S. Mauria, Assistant Director General (IP & TM), ICAR, New Delhi (CIFT, Cochin on 5 April, 2012)
- Dr. K.K. Singh, Assistant Director General (Engineering), ICAR, New Delhi (CIFT, Cochin on 22 June, 2012)
- Dr. Bangali Baboo, National Director, NAIP, ICAR, New Delhi (CIFT, Cochin on 5 April, 2012)
- Shri J. Purnachandra Rao, Commissioner of Police, Visakhapatnam (CIFT, RC, Visakhapatnam on 7 August, 2012)
- Shri P.A. Sheik Pareeth, IAS, District Collector, Ernakulam (CIFT, Cochin on 17 August, 2012)
- Dr. Karunasagar Iddya (FAO Senior Research Officer), Shri Fransisco Blaha

(FAO Consultant) and Shri Raju K. Joseph (Deputy Director, MPEDA) (CIFT, RC, Visakhapatnamn on 21 August, 2012)

- Dr. C. Mohana Kumaran Nair, Pro-Vice Chancellor, KUFOS, Cochin (CIFT, Cochin on 14 September, 2012)
- Prof. Anil K. Gupta, Indian Institute of Management, Ahmedabad and Shri P. Mohanasundaram, Director, MPEDA, Cochin (CIFT, Cochin on 30 October, 2012)
- Dr. Y.S. Yadava, Director, BOBP-IGO, Chennai (CIFT, Cochin on 31 October, 2012)
- Dr. E.G. Silas, former Vice Chancellor, Kerala Agricultural University, Thrissur and former Director, CMFRI, Cochin (CIFT, Cochin on 20 November, 2012)
- Dr. D.K. Gulati, Zonal Director, Fishery Survey of India (CIFT, Cochin on 20 November, 2012)
- Dr. A. Ramachandran, Registrar, CUSAT, Cochin (CIFT, Cochin on 10 December 2012)
- Shri K. Praveen Kumar, Commissioner of Fisheries, Govt. of Andhra Pradesh (CIFT, RC, Visakhapatnam on 18 December, 2012)
- Dr. K. Gopakumar, former DDG (Fisheries), ICAR, New Delhi (CIFT, Cochin on 4 April, 2012, 18 January & 16 February, 2013)
- Shri K. Babu, Hon'ble Minister for Fisheries, Ports and Excise, Govt. of Kerala (CIFT, Cochin on 16 February, 2013)
- Dr. A. Bandyopadhyay, National Coordinator, NFBSFARA, ICAR, New Delhi (CIFT, Cochin on 16 February, 2013)

Visit of Shri A.K. Sreevastava

Visit of Shri Purnachandra Rao

Shri Anwar Hashim, Dr. K. Gopakumar, Dr. Bangali Baboo, Dr. S. Ayyappan, Dr. T.K. Srinivasa Gopal, Dr. B. Meenakumari, Dr. S. Mauria and Dr. G. Syda Rao releasing the book on Oyster Delights on 5 April, 2012