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# CIFT

## Newsletter



### From the Director's Desk

The Central Institute of Fisheries Technology (CIFT), Cochin is the only National Institute in the country where research in all disciplines relating to fishing and fish processing is undertaken. The current mission of the Institute is to ensure responsible harvesting of fishery resources through eco-friendly, energy efficient and economical means; ensure total utilization of the harvested fish through appropriate processing, value addition, packaging and waste utilization; ensure food safety and nutritional security to the consumer and minimize carbon and water footprint per unit volume; and to ensure equitable benefits to the stakeholders, across the value chain.

The research work of the Institute is carried out in the Research Divisions viz., Fishing Technology Division, Fish Processing Division, Quality Assurance & Management Division, Biochemistry & Nutrition Division, Microbiology, Fermentation & Biotechnology Division, Engineering Division and Extension, Information & Statistics Division.

The technology development transfer programmes of CIFT and adoption in the fisheries sector have greatly contributed to the development of infrastructure and human resource as well as improvement in quality of products and have helped the country to achieve a coveted position in the global fisheries scenario. CIFT has worked for both the high technology needs of the industry and the needs of the traditional fishing sector to improve the socio-economic upliftment of the fisherfolk. The Institute is being looked upon for guidance, leadership and for technology innovation by both governmental agencies as well as private entrepreneurs.

CIFT, Cochin was awarded ISO 9001: 2008 Certificate and is also an ISO/IEC 17025:2005 accredited laboratory. The Institute is the proud recipient of the Sardar Patel Outstanding ICAR Institution Award, twice in the year 2000 and 2006.

CIFT has been publishing 'Fish Technology Newsletter' since last 25 years. The quarterly publication was an effective medium for disseminating the day to day activities of the Institute including research results to the stakeholders. 'CIFT Newsletter' is envisaged to bring out with a facelift. The research achievements will be brought out as a separate half yearly publication. Hope this change will be appreciated by the readers.



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*Agrisearch with a human touch*

(Ravishankar, C.N.)  
Director

**भाकृअनुप - केन्द्रीय मात्स्यिकी प्रौद्योगिकी संस्थान**

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## Dr. C.N. Ravishankar Assumes Charge as New Director of CIFT, Cochin

**D**r. C.N. Ravishankar, Principal Scientist and Head, Fish Processing Division assumed charge of Director, CIFT, Cochin. Born in Karnataka in 1963, Ravishankar earned his Bachelor Degree in Fisheries Sciences from College of Fisheries, Mangalore under the University of Agricultural Sciences, Bangalore in 1984, followed by Post Graduation and Ph.D. from the same University in 1986 and 1990. He joined CIFT, Cochin as Scientist in 1991. He had participated in the First Indian Antarctic Expedition and travelled widely abroad for training and consultancy programmes. His areas of specialization include fish processing and packaging technologies and he has developed, popularized and transferred many technologies to the seafood industry. He has more than 200 international and national publications

to his credit and has filed 17 patents. So far, he has guided six students for Ph.D. and 28 students for their Post Graduation. Outstanding Team Research Award in the field of Fish Products Technology from Indian



Council of Agricultural Research, K. Chidambaram Memorial Award of Fisheries Technocrats Forum, Gold Medal for his Ph.D. work, Merit Certificate from Royal Institute of Public Health & Hygiene, London are few among the recognitions received by Dr. Ravishankar. He was also instrumental for establishing the Business Incubation Centre of CIFT with office and pilot plant facility for promoting entrepreneurship in fish and other food products.

## Dr. T.K. Srinivasa Gopal, Director, CIFT, Cochin Retired from ICAR Service



**D**r. T.K. Srinivasa Gopal, Director, CIFT, Cochin retired from ICAR service on superannuation on 31 July, 2014. Dr. Srinivasa Gopal joined ICAR

service in 1976 as a Scientist at Krishi Bhavan, New Delhi. From 1977 onwards he was working as a Scientist at CIFT, Cochin and as the Head, Fish Processing Division since February, 2009. He became the Director of CIFT in August, 2010.

## CIFT Team Receives Technology Innovation Award

**A** team of researchers from CIFT, Cochin, received the 4<sup>th</sup> National Award for Technology Innovation in Petrochemicals & Downstream Plastics Processing Industry (Runner Up) in the field of Polymer Science and Technology from Hon'ble Minister of Chemicals & Fertilizers, Govt. of India, Shri Ananth Kumar. Also present was Shri Nihal Chand, MoS, Ministry of Chemicals and Fertilizers, Govt. of India. The award was presented on 17 July, 2014 at a function held at Manekshaw Centre, New Delhi. The award instituted by the Department of Chemicals and Petrochemicals, Ministry of Chemicals and Fertilizers, Government of India, was presented to the team for their work on "Upgradation of Treated Rubberwood Using FRP Sheathing for Fishing Boat Construction". Dr. Leela Edwin, Principal Scientist and Head of Fishing Technology Division was the team leader. Others in the team were Dr. P. Muhamed Ashraf, Dr. Nikita Gopal, Dr. M. Ajith Peter, Dr. A. Sreeja, Dr. Saly N. Thomas and Dr. B. Meenakumari.

The utilization of FRP for sheathing treated rubber wood has made the use of rubber wood possible for boat building. The researchers have studied in detail the leaching of the chemical wood preservative constituents into the aquatic environment and the role of FRP sheathing in preventing it, thus making the technology eco-friendly. The use of two layers of sheathing was standardized through mechanical strength studies. Prototypes of the fishing canoes were made and field



*Shri Ananth Kumar, Hon'ble Minister for Chemicals & Fertilizers, Govt. of India, presenting the Award to Dr. Leela Edwin, Team Leader and other team members (from left Dr. M. Ajith Peter, Dr. Nikita Gopal, Dr. B. Meenakumari and Dr. Saly N. Thomas). Shri Nihal Chand, MoS, looks on.*

tested in participatory mode with actual stakeholders, through fishermen cooperative societies and the trials have completed ten years. The simple and innovative technology developed by the project team has given the small scale fisheries sector a durable, maintenance free, environmentally friendly, and affordable artisanal fishing canoe, using treated rubber wood with a two layer FRP sheathing. This is expected to make a significant impact in the small scale marine and inland fishing sectors of the country. This technology spares the sparse and costly wood of our fast depleting forests, thus saving the



environment and ensures a good market for the hitherto less utilized rubber wood. The economic viability was acknowledged by the fishermen who carried out the extended field trials as the FRP sheathed rubber wood canoe were

practically maintenance free and had a life more than that of the conventional canoes. This is a laudable, simple, appropriate and relevant technology for the benefit of one of the weakest sections of the society.

### ICAR National Fellowship to Dr. R. Anandan



**D**r. R. Anandan, Senior Scientist, Biochemistry and Nutrition Division, CIFT, Cochin has been selected as ICAR National Fellow by ICAR, New Delhi. The project proposal submitted by him on "Biomodulation

of marine biopolymers for the preparation of biomaterials of healthcare importance" has been awarded ICAR National Fellowship for a period of five years (2014-2019). This award is given to Indian Scientists, active in research, working in the ICAR-Agricultural University system to promote excellence at national level in agricultural research and

education, and to recognize the meritorious contribution of individual agricultural scientists/teachers and facilitate their research and related activities in agriculture.

Biomaterials are either modified natural or synthetic materials which find applications in a wide spectrum of medical and dental implant and prosthesis for repair, augmentation, or replacement of natural tissues. Marine organisms produce many biomaterials and biominerals, which are having a lot of potential biomedical and pharmaceutical applications. The focus of the present study is to produce commercially important biomaterials and biominerals from marine organisms.

### Training Programmes

#### Cochin

S. No	Name of the programme and date(s)	Organizing Division	No. of participants	Topics covered
1.	Process engineering in fisheries (30 June – 4 July 2014)	Engineering	8	<ul style="list-style-type: none"> <li>Industrial training on process engineering in fisheries</li> <li>Value addition of fish</li> <li>Byproducts from fish waste</li> </ul>
2.	Modern food processing technology (30 June – 11 July 2014)	Fish Processing	1	<ul style="list-style-type: none"> <li>Modern food processing technology</li> <li>Development of value added products from fish and fish waste</li> <li>Exposure to packaging materials</li> </ul>
3.	Testing of packaging materials and thermal processing (7–29 July 2014)	Fish Processing	5	<ul style="list-style-type: none"> <li>Food processing technologies such as drying, canning and thermal processing</li> <li>Classification and identification of packaging materials</li> <li>Determination of various properties of packaging materials</li> </ul>
4.	Isolation and identification of bacteria of public health significance (16–22 July 2014)	Quality Assurance & Management	2	<ul style="list-style-type: none"> <li>Introduction to quality assurance in seafood</li> <li>Fundamentals of bacteriology</li> <li>Characteristics and incidence of <i>E. coli</i>, <i>F. streptococci</i>, <i>S. aureus</i>, <i>V. cholerae</i>, <i>V. parahaemolyticus</i>, <i>V. vulnificus</i>, <i>Salmonella</i> and <i>Listeria</i> in fish and fish products</li> <li>Practical sessions on Isolation and identification of bacteria of public health significance from fish</li> </ul>
5.	Modern food processing technology (1 May – 31 July 2014)	Fish Processing	3	<ul style="list-style-type: none"> <li>Production of chitin and chitosan</li> <li>Biochemical analysis of fishery products</li> <li>Canning</li> </ul>





S. No	Name of the programme and date(s)	Organizing Division	No. of participants	Topics covered
6.	Advanced analytical techniques in nutritional biochemistry (1 – 13 August 2014)	Biochemistry & Nutrition	13	<ul style="list-style-type: none"> <li>• Spectrophotometry and protein estimation by spectrophotometer</li> <li>• Gas chromatography and estimation of fatty acids/pesticides by GC</li> <li>• HPLC and analysis of amino acid composition by HPLC</li> <li>• Estimation of PAH by HPLC</li> <li>• Heavy metal analysis by AAS</li> <li>• Principles of enzyme assay and electrophoresis</li> <li>• Antibiotic residue analysis by LC-MS/MS</li> <li>• Theory on method validation and animal maintenance</li> </ul>
7.	Biochemical and molecular characterization of pathogenic and commensal bacteria from fish (5–21 August 2013)	Microbiology, Fermentation & Biotechnology	1	<ul style="list-style-type: none"> <li>• Enumeration of commensal bacteria from fish</li> <li>• Isolation of pathogenic bacteria in seafood</li> <li>• Identification of aerobic bacteria in fish</li> <li>• Identification of pathogenic bacteria using biochemical tests</li> <li>• Confirmation of pathogenic bacteria using molecular methods</li> </ul>
8.	Value added fish products (11–13 August 2014)	Fish Processing	15	<ul style="list-style-type: none"> <li>• Preparation of chilled dry fish and shrimp products</li> <li>• Preparation of fish mince, pickles and wafers</li> <li>• Canning of fish</li> </ul>
9.	Laboratory techniques in microbiological examination of seafoods (11–23 August 2014)	Microbiology, Fermentation & Biotechnology	2	<ul style="list-style-type: none"> <li>• Techniques for the enumeration of aerobic mesophilic bacteria in seafood</li> <li>• Identification of mesophilic bacteria using biochemical tests and morphology</li> <li>• Determination of microbial quality of fish and fish products</li> <li>• Identification of <i>Staphylococcus aureus</i>, <i>Escherichia coli</i> and Enterococci</li> <li>• Detection of pathogenic bacteria in seafoods</li> </ul>
10.	Thermal processing of fish (25 August 2014 )	Fish Processing	1	<ul style="list-style-type: none"> <li>• Training on canning</li> </ul>
11.	Isolation and identification of bacteria of public health significance from fish (25–30 August 2014)	Microbiology, Fermentation & Biotechnology	12	<ul style="list-style-type: none"> <li>• Introduction to quality assurance in seafood</li> <li>• Fundamentals of bacteriology</li> <li>• Characteristics and incidence of <i>E. coli</i>, <i>F. streptococci</i>, <i>S. aureus</i>, <i>V. cholerae</i>, <i>V. parahaemolyticus</i>, <i>V. vulnificus</i>, <i>Salmonella</i> and <i>Listeria</i> in fish and fish products</li> </ul>





S. No	Name of the programme and date(s)	Organizing Division	No. of participants	Topics covered
				<ul style="list-style-type: none"> <li>• Practical sessions on Isolation and identification of bacteria of public health significance from fish</li> </ul>
12.	Seafood quality assurance (25 August – 4 September 2014)	Quality Assurance & Management	1	<ul style="list-style-type: none"> <li>• Introduction to quality assurance in seafood</li> <li>• Postmortem changes in fish</li> <li>• Fundamentals of bacteriology</li> <li>• Characteristics and incidence of <i>E. coli</i>, <i>F. streptococci</i>, <i>S. aureus</i>, <i>V. cholerae</i>, <i>V. parahaemolyticus</i>, <i>V. vulnificus</i>, <i>Salmonella</i> and <i>Listeria</i> in fish and fish products</li> <li>• Practical sessions on Isolation and identification of bacteria of public health significance from fish</li> <li>• Regulations in fish and fishery products</li> <li>• Determination of heavy metal residues</li> </ul>
13.	Value added fish processing (1–3 September 2014)	Fish Processing	4	<ul style="list-style-type: none"> <li>• Training on value addition of fish</li> <li>• Development of fish products</li> </ul>
14.	Seafood quality control of fish and fish products (18–20 September 2014)	Quality Assurance & Management	14	<ul style="list-style-type: none"> <li>• Seafood quality assurance</li> <li>• Bacteriological evaluation of seafood quality</li> <li>• Chemical evaluation of seafood quality</li> <li>• Sanitation and hygiene</li> </ul>
15.	Value added fish products (19–20 September 2014)	Fish Processing	1	<ul style="list-style-type: none"> <li>• Development of value added fish products</li> </ul>
16.	Preparation of chitin, chitosan and glucosamine (22-23 September 2014)	Fish Processing	1	<ul style="list-style-type: none"> <li>• Extraction procedures for chitin and chitosan from fish waste</li> </ul>

### Visakhapatnam

1. Heavy metal analysis by AAS (1-31 July, 2014)
2. Laboratory techniques for microbiological examination of seafoods (11-22 August, 2014)
3. Exposure of CIFT technologies to Polytechnic students from Odisha (11 September, 2014)
4. Exposure of CIFT technologies to final year BFSc



Thermal processing of fish (Cochin)

students of Muthukur, AP (19 September, 2014)

### Veraval

1. Microbial quality of seafood (21-26 July, 2014)

### Mumbai

1. Analytical techniques in microbiology (23-26 July, 2014)
2. Seafood quality assurance (26-28 July, 2014)



Participants and faculty of Analytical techniques in microbiology (Mumbai)



# Outreach Programmes

During the quarter the following outreach programmes were conducted by the Institute:

1. Tribal Sub Plan programme on "Demonstration of FRP coracles, eco-friendly fishing gear and preparation of value added fish products" at Madduvalasa, Srikakulam, Andhra Pradesh on 11 July, 2014.
2. Training cum demonstration programme on "Preparation of value added fish employing low cost marine fish" at Gopinadpur village, Odisha during 16-17 July, 2014.
3. Training cum demonstration programme on "Hygienic handling of fish and preparation of value added fish products" at cyclone shelter district Ganjam village, Odisha during 18-19 July, 2014.
4. Training on "Preparation of value added fish products with low cost fish and post harvest handling and salt curing of fish by hygienic and scientific methods" at Chinnavalasa, East Godavari district, A.P. during 25-26 July, 2014.
5. Training cum demonstration programme on "Preparation of value added fish employing low cost fish" at Para and Pandi village, Katranu Kona Mandal, A.P. during 6-7 August, 2014.
6. Training cum demonstration programme on "Hygienic preparation of salt cured fish and preparation of value added fish employing low cost fish" at Ramanna Palem, Tallarevu Mandal, A.P. during 13-14 August, 2014.
7. Awareness programme on "Introduction of mid water trawling" at Andhra Pradesh Mechanized Boat Owners Association Hall, Visakhapatnam on 4 September, 2014.

## Short course on Practical Aspects of Seafood Safety

The Quality Assurance and Management Division of CIFT, Cochin has organized an ICAR sponsored Short Course on "Practical aspects of seafood safety" during 14-24 July, 2014. The 10 days short course aimed at providing the participants the latest information on food safety issues with emphasis on seafood and demonstrated the methods of its detection and control. The Course was designed to benefit young scientists/teachers/researchers in ICAR institutes/Agricultural/other Universities in the field of fisheries. About 25 participants from different R&D institutions and Universities across India attended the Course. "Food Safety is a Public Health Priority" was the mandate of the Short Course. Dr. K. Paulose Jacob, Pro Vice Chancellor, Cochin University of Science and Technology while inaugurating the Course, remarked on the importance



Dr. K. Paulose Jacob inaugurating the programme



Release of the training manual (L to R: Dr. S. Sanjeev, Dr. K. Paulose Jacob, Dr. T.K. Srinivasa Gopal, Dr. T.V. Sankar and Dr. K. Ashok Kumar)



Dr. K. Ashok Kumar taking class

of seafood safety and emerging safety problems of public health concern. Dr. T.K. Srinivasa Gopal, Director, CIFT





Faculty and participants of the Short Course

presided over the function and Dr. T.V. Sankar, Head, QAM welcomed the gathering. Dr. K. Ashok Kumar, Course Director introduced the course details. Dr. S. Sanjeev, Principal Scientist proposed vote of thanks.



Visit to food processing unit

Eminent experts from CIFT, EIA and MPEDA handled the various technical sessions related to the emerging problems in seafood industry and analytical methods used for the detection. The major topics covered during the Short Course included theory and practical classes *viz.* Good laboratory practices, HACCP, Chemical, physical and

biological hazards, Isolation and identification of food-borne pathogens, Ion chromatography and its application in food safety, Liquid chromatography and its application in food safety, Heavy metal residues and its determination, Gas chromatography determination of pesticides, LC-MS/MS as tool for antibiotic residue monitoring, Additives in seafood industry, Emerging chemical contaminants in seafood, PAH as contaminants in fish and fishery products, Histamine and other biogenic amines in seafood, Regulations and limits for residues, Validation of analytical methods and accreditation for food safety laboratories etc. The course also included a field visit to the Mangala Marine Exim, Cochin, a fish processing establishment for enabling the participants to assess the food safety measures adopted in the seafood sector.

In the valedictory function, Dr. T.K. Srinivasa Gopal, Director, CIFT distributed certificates to the participants. The feedback from the participants about the Short Course was positive and they mentioned that the programme helped them to understand the emerging food safety issues in seafood and its detection and control. The function ended with a vote of thanks by Dr. Femeena Hassan, Senior Scientist, CIFT.

## Training Programme on Microbiological Quality of Seafood

A training programme on 'Microbiological quality of seafood' was organized at Veraval Research Centre of CIFT during 21-26 July, 2014. Thirty three technologists, working in various fish processing factories of Gujarat, participated in the training programme. Shri Jayabal, Deputy Director, MPEDA was the Guest of Honour. Dr. G.K. Sivaraman, Course Director and SIC, VRC of CIFT delivered the Presidential Address and felicitations were offered by Shri Mohammad Koya, SIC, VRC of CMFRI. Shri G. Jayapalan, Deputy Director, Export Inspection Agency, inaugurated the programme. Smt. S. Remya, Scientist, VRC of CIFT welcomed the gathering and Dr. A.K. Jha, Scientist, VRC of CIFT



Participants and faculty of the training programme with guests

proposed the vote of thanks.

Theory and practical classes on 'Basic microbiological techniques, post-mortem changes in fish, hygienic fish handling, microbial spoilage of fish, isolation and identification of fish pathogens and spoilers, the impact of world trade organization agreements on fish trade etc.' were handled by Dr. G.K. Sivaraman, Shri G. Jayapalan, Shri Jayabal, Dr. A.K. Jha, Shri V. Chandrasekar, Smt. V. Renuka, Dr. K.K. Prajith and Smt. S. Remya.

In the valedictory session, Shri Lakham Bhai Bhensla, President, Seafood Exporters Association, Gujarat Chapter was the Chief Guest. Shri Piyush Fofandi, Vice-President, Seafood Exporters Association, Gujarat Chapter, Shri Jayabal, Deputy Director, MPEDA, and Shri K.R. Sreenath, Scientist, VRC of CMFRI also graced the occasion with their presence. The guests gave away the certificates to the participants and distributed prizes to the toppers in the written examination conducted prior to and after the training programme.



# Training Programme on Advanced Analytical Techniques



*Training in progress*

The Biochemistry & Nutrition Division of CIFT organized a training programme on “Advanced Analytical Techniques in Nutritional Biochemistry” during 1-13 August, 2014. Fifteen participants pursuing Post Graduation Degree in



*Trainees with faculty*

Biochemistry and in quality systems from College of Veterinary and Animal Sciences, Mannuthy and Government Engineering College, Kozhikode attended the training programme. The faculty at B&N imparted theory and practical skills to the participants in various techniques relevant to nutritional and contaminant profiling like Gas Chromatography for fatty acid and pesticide analysis, High Performance Liquid Chromatography for determination of amino acid and PAH residues, Spectrophotometric estimation of protein content of foods, Electrophoretic determination of changes in protein etc. On the concluding day of the training, Dr. S. Balasubramaniam, Head, EIS Division and Co-ordinator of the programme, distributed the certificates to the participants. An interactive session of the faculty with the trainees was arranged and feedback was obtained for further improving the training programmes of the Division in future.

## FRP Tuna Long Line Boats

A consultancy agreement was signed with Department of Fisheries, Andaman and Nicobar Administration to construct 13.7 m LOA FRP Tuna Fishing boats in Andaman and Nicobar islands. The fishermen in Andamans were using only 10-11 m wooden fishing boats without insulated store for fish and ice. These are open deck boats with

maximum endurance of one day. The new boats introduced in consultancy with CIFT are longer boats with deck, insulated fish store, hydraulic steering, wheel house and berth for fishermen. These boats are constructed with 5-days endurance. Nine boats are completed and transported to Andamans in 2014.



*The 13.7 m L<sub>OA</sub> FRP Tuna fishing boat under construction at Cuddalore for Andamans*



*13.7 m L<sub>OA</sub> FRP Tuna fishing boat for Andaman and Nicobar Islands ready for stability test at Cuddalore*

## Hindi Workshop

### Cochin

A one day Official Language workshop was conducted at CIFT, Cochin on 29 September, 2014 for the benefit of the Administrative Staff of the Institute. Dr. Santhosh Alex, Senior Technical Officer was the resource person of the Workshop.

### Visakhapatnam

A one day Hindi workshop on Marine fisheries management (Samudri Matsya Prabhandhan Sambhandith) Karyasala was held at the Visakhapatnam Research Centre of CIFT on 12 September, 2014.



One more intervention has been put forward by the Engineering Division of CIFT for helping the SC/ST fisherfolk engaged in inland fishing. Safe and durable fishing boats of Fibre Reinforced Plastics (FRP) following, scientific designs and making use of Nano-Resin Technology have been constructed by the Institute for the benefit of fisherfolk of Chellanam Panchayath of Ernakulam district. The 20 FRP boats fabricated under the SCA-SCP - scheme support provided to SC/ST Service Co-operative Society, Chellanam were handed over to the Society by Shri K. Babu, Hon'ble Minister for Fisheries, Port and Excise, Govt. of Kerala in an august function held at CIFT, Cochin on 4 July, 2014.

Unlike marine sector, the extent of appropriate technology applications in inland fishery sector is very low and the fisherfolk engaged in small scale fishing in reservoirs, lakes and rivers are in a socio-economically under-privileged condition. Dr. T.K. Srinivasa Gopal, Director, CIFT during his speech elucidated that the Institute has developed many technologies for improving the efficiency of inland fishery sector, under the Value chain project for Small pelagics and freshwater fishes (NAIP-RHSSP).



*Shri K. Babu, Hon'ble Minister addressing the audience as Chief Guest*

During the boat distribution function, Shri Dominic Presentation, MLA, Ernakulam called for development of more such appropriate technologies to equip the fisherfolk in the poor socio-economic sector. Shri M. Nasser, Principal Scientist & Senior Naval Architect who has designed and given the technical guidance for constructing the boats told

## Consultancy Agreement Signed

During the period under report CIFT, Cochin signed a consultancy agreement with M/s Rahul Foods, Goa for providing technical guidance for setting up of an Effluent Treatment Plant (ETP) at their factory premises at Goa for a consultancy amount of ₹ 1,50,000/- (+ Service Tax).

# Improved FRP Boats Handed Over to Beneficiaries



*Hon'ble Minister officially handing over the FRP boats*

that the new FRP boats are of 5.35 x 0.82 meter size and made after refinement of design based on feedback received from fisherfolk on the pilot level field trials. The boats costs ₹ 30,000/- and will last for minimum 25-30 years, without any maintenance and repair as against the traditional wooden boats costing ₹ 18,000/- to 20,000/- which last for only 3-4 years. It is resistant to borer attack or any other degradation which happens in wooden boats.

Project leader, Dr. K.V. Lalitha, HOD, MFB, CIFT welcomed the audience. Shri K.P. Thankachan, President, Chellanam Panchayath; Shri K.J. Leenus, Member, District Panchayath and Smt. Sudhambika, President, Palluruthy Block Panchayath offered felicitations and Shri K.P. Sadanandan, President, Chellanam Panchayath SC/ST Service Co-Operative Society proposed the vote of thanks. The programme was co-ordinated by Dr. S. Ashaletha, Co-PI of the Project.

## QRT Meeting

The Quinquennial Review Meeting of the Mumbai Research Centre was conducted on 27 August, 2014 under the Chairmanship of Dr. S.D. Tripathi.

# Ghost Fishing - A Threat to Marine Life

These days, we are all concerned about the depleting marine fish stock and finding ways to replenish the marine resources. In contrast, fish and other aquatic animals are being caught regularly and are being used

for nothing. Do you know, how? Broken fishing nets floating in the marine environment due to negligence of human beings float in the water and continue to fish and trap animals, which is called "Ghost fishing". These floating

gears entangle and potentially kill marine life, smother habitat, and act as a hazard to navigation.

Neglected fishing nets, sometimes referred to as "ghost gear," is any discarded, lost, or abandoned, fishing gear (ALDFG) in the environment. This derelict fishing gear, such as nets or traps and pots, is one of the main types of debris impacting the marine environment today. The total input of marine litter into the oceans per year has been estimated at approximately 6.4 million tonnes annually, of which nearly 5.6 million tonnes (88 percent) comes from merchant shipping. It is estimated that abandoned, lost or discarded fishing gear in the oceans makes up around 10 percent (6,40,000 tonnes) of all marine litter.

The ALDFG, though have a very low fishing efficiency, attract scavengers and continue the cycle of catch and sink, thus improving its fishing efficiency in the longer run. The ALDFG may entangle sea birds, turtles, cetaceans or get ingested by these organisms. Moreover, when the 'ghost gear' settles on the bottom, it can damage or smother the bottom fauna when moved by strong currents and many of the fragile organisms can be killed. Also, these nets, like any modern plastics can last up to 600 years in the marine environment, depending on the water conditions and can transform into micro plastics, forming a new contaminant in the marine environment.

Coming to the reasons for increase in the ALDFG, we can see that fishers discard non-legal nets fearing legal implications in some countries, operational difficulties which makes the net to tear off or lost, or economic reasons like the cost involved in disposing the net offshore.

Since the reasons for ALDFG are varied, no single method could be effective for the control. The menace of ALDFG can only be squarely addressed by suitable measures to prevent, mitigate and cure the ALDFGs in the marine environment. The preventive measure includes marking the nets for easy location and legal measures to control abandoning of gears. Mitigation measures include use of biodegradable twines to cut the cycle of fishing of the ALDFG. Curative measures include the actual removal of ALDFG from the marine environment using different techniques. Most important is creating awareness regarding the environmental issues of ALDFG among fishers to reduce the menace.

Photo Source : Internet

## Publications

### Research Papers

1. Bindu, J., Mallick, A.K. and Srinivasa Gopal, T.K. (2014) – Thermal processing of fishery products in flexible and rigid containers, *Fish. Technol.*, **51 (3)**: 137-148.
2. Jose Fernandez, T., Pradeep, K., Anandan, R., Zynudheen, A.A. and Sankar, T.V. (2014) – Comparison of nutritional characteristics of myctophid fishes (*Diaphus effulgens* and *D. hudsoni*) with common Indian food fishes, *Fish. Technol.*, **51 (3)**: 173-178.
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# Deputation Abroad

**Dr. Suseela Mathew**, Head, Biochemistry & Nutrition Division, CIFT, Cochin was deputed to Japan to attend the "1<sup>st</sup> Asian Conference on Oleo science" held at Hokkaido, Japan during 8-10 September, 2014. Dr. Suseela Mathew also delivered an invited talk on "Marine lipids of deep sea fishes" in the Conference.

**Dr. Nikita Gopal**, Principal Scientist, Extension, Information & Statistics Division, CIFT, Cochin was deputed to Thailand to attend the Workshop on "NACA market thematic studies and outreach on Gender in aquaculture" held at Bangkok, Thailand during 29 September to 2 October, 2014.

**Dr. V.R. Madhu**, Senior Scientist, Fishing Technology Division, CIFT, Cochin was deputed to Thailand to attend the Workshop on "Use of available science in developing and promoting best practices for trawl fishing operations in South and South East Asia" held at Bangkok, Thailand during 13-14 September, 2014.

## Celebrations

### ICAR Foundation Day

CIFT, Cochin celebrated the 86<sup>th</sup> ICAR Foundation Day on 16 July, 2014. To commemorate the Day, the Institute organized an "Open House" in the forenoon. The Institute remained open for the public to get acquainted with the activities and technological achievements of the Institute. The expert scientists and technicians of the organization facilitated the visit of students in large numbers from in and around Cochin.



*Students being explained in 'Open House'*



*ICAR Foundation Day celebrations (R to L: Shri P.P. Anil Kumar, Dr. Leela Edwin, Dr. T.K. Srinivasa Gopal and Dr. Beena Manoj)*

A formal function was held in the afternoon. Dr. T.K. Srinivasa Gopal, Director, CIFT presided over the function. In his presidential address he gave a brief account of the activities and achievements of ICAR. This was followed by a talk on "Creating a better work environment" by Dr. Beena Manoj, Faculty, Art of Living, Cochin Chapter. Dr. Leela Edwin, HOD, Fishing Technology welcomed the gathering while Shri P.P. Anil Kumar, AF&ACO proposed the vote of thanks.

### Hindi Chetana Mas

The Institute celebrated "Hindi Chetana Mas" during 16 August to 14 September, 2014. Various competitions were held during the period. Dr. B. Madhusudana Kurup, Vice Chancellor, KUFOS, Cochin was the Chief Guest of the valedictory function held on 14 September, 2014



*Dr. B. Madhusudana Kurup delivering the Chief Guest's address*

### Sadbhavana Diwas

The Institute observed National "Sadbhavana Diwas" on 20 August, 2014 in connection with the observance of 'Communal Harmony Fortnight'. The Director and staff of the Institute assembled together and took the Sadbhavana Day Pledge.

**'Onam'**

The state harvest festival of Kerala, 'Onam' was celebrated at CIFT, Cochin on 4 September, 2014 with pomp and gaiety. Floral carpet competition was held in the morning followed by traditional 'Sadya' (feast). Shri Ramesh Pisharadi, noted mimicry artist and actor was the Chief Guest of the afternoon function. A cultural programme also followed.



*Shri Ramesh Pisharadi inaugurating the celebrations*

# Awards and Honours

## Dr. Santhosh Alex Receives Poetry Award

Dr. Santhosh Alex, Senior Technical Officer, CIFT, Cochin received the 2014 Thalassery Raghavan Memorial Poetry Award instituted by Chennai 'Kerala Samajam' on 27 July, 2014. The award was given to him by Shri V.V. Dakshinamurthy, Chief Editor, Deshabhimani for the collection of poems in Malayalam entitled, "Njungalude Colony" (Our Colony).



*Dr. Santhosh Alex receiving the award*

## Hospitals for fish coming up !

An Aquatic Animal Health Laboratory, the first of its kind in the government sector in the country, has been sanctioned in the state, of Kerala. National Fisheries Development Board (NFDB), Hyderabad has accepted a proposal forwarded by the state for establishing the facility at the Kerala University of Fisheries and Ocean Studies (KUFOS) in Kochi. A one-time grant of ₹ 56 lakh has also been announced by the NFDB.

The Centre at KUFOS campus at Panangad is envisaged as a virtual Research and Support Centre for fish farmers and as a 'Hospital for Fish' to address various diseases related to fish species, which are being reported seasonally from various parts of the country.

In a similar move, a hospital to treat abnormalities and diseases in fish is set to come up in Kolkata by mid-2015 in West Bengal University of Animal and Fishery Sciences. The hospital will have 50 glass aquariums, 25 circular water tanks, each with a capacity of 500 litres, to admit and treat diseased fish. The hospital will also have a separate well-equipped pathological lab to diagnose various fish diseases and the diseased fish would be kept in aquariums for observation. After ascertaining the disease/abnormality, medicines and tips would be provided to the growers. The fish hospital is said to be funded by the Indian Council of Agricultural Research, New Delhi.

## Invited Talks

During the quarter the following invited talks were held at CIFT, Cochin:

- Dr. Beena Manoj, Faculty, Art of Living, Cochin Chapter – "Creating a better work environment" (16 July, 2014).
- Dr. Mohan Joseph Modayil, Former ASRB Chairman and President, Association of British Scholars, Cochin Unit – "Time management" (26 July, 2014).



*Dr. Mohan Joseph Modayil giving the lecture*



# Charity



Under the auspices of the Recreation Club at the Headquarters donations were collected from the staff. Special medicines for the cancer patients worth ₹ 20,700/- was purchased and handed over to the District Government Hospital, Ernakulam by Dr. T.K. Srinivasa Gopal, Patron of the Club on 8 July, 2014.

*Dr. Srinivasa Gopal handing over the medicines*

## Post Graduate Studies

**Shri P. Shankar**, Technical Officer, CIFT, Cochin was awarded Ph.D. (Hindi) degree for his thesis entitled, “Dr. Abdul Kalamkrit vision 2020 ka anuvad Bharat 2020 navanirman ki rooprekha: Samiksha” from the Post Graduate and Research Institute, Dakshina Bharath Hindi Prachar Sabha, Chennai. Shri Shankar worked under the guidance of Prof. S.V.S.S. Narayana Raju, Assistant Director, Distance Education Regional Office, DBHPS, Cochin.



## Personnel News

### Participation in Seminars/Symposia/Workshops etc.

- **Dr. T.K. Srinivasa Gopal**, Director – ICAR Foundation Day Celebrations and Conference of the Director's of ICAR Institutes and Vice Chancellors of Agricultural Universities, ICAR, New Delhi (29 July)
- **Dr. C.N. Ravishankar**, Director and **Dr. P. Pravin**, Principal Scientist – Brain storming session on Reservoir fisheries development in India: Management and policy options, ICAR, New Delhi (19 September)
- **Dr. C.N. Ravishankar**, Director, **Dr. Leela Edwin**, HOD, FT, **Dr. Nikita Gopal**, Principal Scientist and **Dr. A.R.S. Menon**, Chief Tech. Officer – Curtain Raiser meeting of 1<sup>st</sup> World Ocean Science Congress-2015, Cochin (23



*Dr. Ravishankar being felicitated by Dr. Shailesh Naik, Secretary, Ministry of Earth Sciences, Govt. of India*

August). Dr. Ravishankar was felicitated on the occasion of assuming the charges of Director, CIFT, Cochin.

- **Dr. Leela Edwin**, HOD, FT and **Dr. P. Pravin**, Principal Scientist – Lobster consultation of the Tamil Nadu Fisheries Department, Nagercoil (2 September)
- **Dr. K.V. Lalitha**, HOD, MFB - National seminar on Translational biotechnology for a better tomorrow, St. Peter's College, Kolencherry (3-4 September). Dr. Lalitha delivered an invited talk on “Diagnostics for microbial food safety” in the Seminar.
- **Dr. T.V. Sankar**, HOD, QAM – National seminar on Food, environmental and medical toxicology, Cochin College, Cochin (30 September). Dr. Sankar gave an invited talk on ‘Food safety issues with reference to chemical hazards’ in the Seminar.
- **Dr. Suseela Mathew**, HOD, B&N – Symposium on Nutritionally sensitive and environmentally sustainable agriculture for India's food and nutrition security: Challenges and opportunities, NAARM, Hyderabad (23 August)
- **Dr. Suseela Mathew**, HOD, B&N – 1<sup>st</sup> Asian Conference on Oleo science, Hokkaido, Japan (8-10 September). Dr. Suseela Mathew also delivered an invited talk on “Marine lipids of deep sea fishes” in the Conference.
- **Dr. M.M. Prasad**, SIC, Visakhapatnam – National seminar on Recent trends in aquaculture for sustainable





environment, Theresa's Autonomous College for Women, Elluru (8-9 September). Dr. Prasad also presented an invited paper on "Post harvest utilization and value addition to aquaculture products for sustainable development" by M.M. Prasad, L.N. Murthy, B. Madhusudana Rao, Jesmi Debbarma and P. Viji in the Seminar.

- **Dr. M.M. Prasad**, SIC, Visakhapatnam and **Dr. G. Rajeswari**, Principal Scientist – Workshop with scientific organization and academicians on fish processing methods, DFYWA, Visakhapatnam (24 July). They also presented the following lead talks:
  - i. Value addition to low cost fish for sustainable and entrepreneurial development in women fishers – Dr. M.M. Prasad
  - ii. Conservation of marine fisheries: Role of CIFT technologies – Dr. G. Rajeswari
- **Dr. M.M. Prasad**, SIC, Visakhapatnam and **Shri M. Prasanna Kumar**, Tech. Asst. - Special session of Town Official Language Implementation Committee, DRM Office, Waltair (26 August)
- **Dr. G.K. Sivaraman**, SIC, Veraval – Workshop on Sustainable genetic improvement, utilization and conservation of livestock breeds: Conventional and biotechnological approaches, Gurukul, Ahmedabad (6-7 September)
- **Dr. G.K. Sivaraman**, SIC, Veraval – XXIII Meeting of ICAR Regional Committee No. VI, AAU, Anand (12-13 September)
- **Dr. L.N. Murthy**, SIC, Mumbai – Winter school on Empowerment of fish farmers and entrepreneurship development, FR&IC, Bangalore (19 August) (As resource person). The following lectures were also delivered by Dr. Murthy:
  - i. Value addition as means for empowering rural fisherfolk with simple interventions
  - ii. Promoting innovations and entrepreneurship in fisheries through business incubation
- **Dr. L.N. Murthy**, SIC, Mumbai, **Dr. S. Visnuvinayagam** and **Dr. P.K. Binsi**, Scientists – 6<sup>th</sup> Symposium on Ready to eat foods, Mumbai (4 August)
- **Dr. Saly N. Thomas**, Principal Scientist – Meeting of the Technical expert committee for the implementation of fish net factory, Matsyafed, Thiruvananthapuram (17 September)
- **Dr. P. Pravin**, Principal Scientist – MDP on Technology management for researchers, NAARM, Hyderabad (19-23 August)
- **Dr. P. Pravin**, Principal Scientist – Training programme on Knowledge management and knowledge sharing, IIPA, New Delhi (22-26 September)
- **Dr. K. Ashok Kumar**, Principal Scientist and **Dr. S.K. Panda**, Senior Scientist - Seafood HACCP Train the Trainer (TTT) Course, New Delhi (11-13 September)
- **Dr. M.P. Remesan**, Principal Scientist and **Dr. V.R. Madhu**, Senior Scientist - Meeting of the National Plan of Action (NPOA) Hilsa, CIFRI, Barrackpore (30 August). Dr. Remesan presented a report on Harvest and post harvest technologies for the preparation of a roadmap for the fisheries development in West Bengal
- **Dr. M.P. Remesan**, Principal Scientist and **Dr. V.R. Madhu**, Senior Scientist – Training for Journal editors, CMFRI, Cochin (1-2 September)
- **Dr. Nikita Gopal**, Principal Scientist - Workshop on NACA market thematic studies and outreach on Gender in aquaculture, Bangkok, Thailand (29 September to 2 October)
- **Dr. R. Raghu Prakash**, Principal Scientist, **Dr. B. Madhusudana Rao**, Senior Scientist and **Kum. Jesmi Debbarma**, Scientist – Training on The application of EU requirements for fishing vessels and landing sites, CITD, Visakhapatnam (16-19 July)
- **Dr. Femeena Hassan** and **Dr. V.R. Madhu**, Senior Scientists – Consultative workshop on Benefits of MSC certification of Ashtamudi Lake Short-neck clam fishery, CMFRI, Cochin (4 September)
- **Dr. J. Bindu**, Senior Scientist and **Kum. S. Vimalakumari**, JRF – Short course on Recent trends and developments in bioplastics and their applications, CBPST, Cochin (22-23 August)
- **Dr. George Ninan**, Senior Scientist – State level seminar held in connection with 'Karshakasree' Fair, Thiruvananthapuram (27 September). Dr. George Ninan also delivered an invited talk on "Incubation centres in agriculture" in the Seminar.
- **Dr. U. Sreedhar**, Senior Scientist – Meeting on "MS Swaminathan Research Foundation interventions for expansion of Fisher Friend Mobile Application (FFMA) in Visakhapatnam", Andhra University, Visakhapatnam (4 July)
- **Dr. U. Sreedhar**, Senior Scientist – Workshop on Deep sea fishing policy review, FSI, Visakhapatnam (19 September)
- **Dr. S.K. Panda**, Senior Scientist – Meeting of the FSSAI Scientific Panel on Fish and Fishery Products, New Delhi (19 September) (As special invitee). Dr. Panda presented the finalized version of Microbiological specifications of fish and fishery products and comments on vertical standards of fish and fishery products, pharmacologically active substances and food additives in the Meeting
- **Dr. V.R. Madhu**, Senior Scientist – Workshop on Exploring effective projects in small-scale fisheries, KILA, Thrissur (23 July)



- **Dr. V.R. Madhu**, Senior Scientist - Workshop on Use of available science in developing and promoting best practices for trawl fishing operations in South and South East Asia, Bangkok, Thailand (13-14 September)
  - **Dr. Toms C. Joseph**, Senior Scientist – International Seminar on Modern trends in biotechnology, St. Teresa's College, Ernakulam (14 July). Dr. Toms also delivered an invited talk on "Marine microbial diversity and trends in bioprospecting of marine genetic resources" in the Seminar
  - **Dr. Toms C. Joseph**, Senior Scientist and **Shri V.N. Sreejith**, Technician – Training programme on Data analysis of bacterial transcriptome in the CLC Bio software, IASRI, New Delhi (20-28 August)
  - **Shri M.V. Baiju**, Senior Scientist, **Shri Ankur Nagori**, Scientist, **Shri V. Vipinkumar**, Tech. Assistant, **Shri P.T. Sreejith**, **Shri Rithin Joseph**, SRFs, **Shri V.R. Kiran** and **Shri Ashish H. Nair**, Project Assistants - National Seminar on Re-engineering marine fishing industry for the second blue revolution in India, CIFNET, Cochin (30-31 August)
  - **Shri V. Radhakrishnan Nair**, Scientist – Training programme on Geospatial knowledge management for sustainable agriculture using open source GIS, NAARM, Hyderabad (2-12 September)
  - **Dr. V. Ronda**, **Smt. S. Remya** and **Dr. Niladri Sekhar Chatterjee**, Scientists – National conference on Application of the derivatives of chitin and chitosan, The Gandhigram Rural Institute, Dindugal (22-23 August). Dr. Ronda delivered an invited lecture on "Glucosamine: Past, present and future" in the Conference. Following research papers were also presented by them in the Conference:
    - i. Development of a new chitosan based active packaging film for fish preservation by S. Remya, C.O. Mohan, V. Renuka, A.K. Jha, G.K. Sivaraman, C.N. Ravishankar and T.K. Srinivasa Gopal
    - ii. Synthesis of Gallic acid grafted chitosan: Antioxidant and antimicrobial activity by N.S. Chatterjee, S.K. Panda, K.K. Asha, R. Anandan and Suseela Mathew.
- Both the presentations won the prize for best paper presentation.
- **Shri Ankur Nagori**, Scientist and **Shri C. Gokulan**, Asst. Chief Tech. Officer – Workshop on Solar steam generating systems and solar driers, ANERT, Thiruvananthapuram (18 September)
  - **Dr. M.S. Kumar**, Chief Tech. Officer – Farm and home rural unit programme sub committee, AIR, Visakhapatnam (3 September)
  - **Smt. T. Silaja**, Sr. Tech. Officer – National Seminar on Technology management in libraries, KAU, Thrissur (29-30 August). Smt. Silaja also presented a paper entitled, "Re-engineering the library of Central Institute of Fisheries Technology for e-resources management - A roadmap" by T. Silaja in the Seminar
  - **Smt. T. Silaja**, Sr. Tech. Officer – National seminar on Library – Publisher Partnership Knowledge Creation, Extraction, Discovery and Delivery, Cochin (19 September)
  - **Shri T.V. Bhaskaran**, Sr. Tech. Officer – Brain storming session on Insects related to veterinary and fisheries sciences, NBAIL, Bengaluru (2 August)
  - **Shri J. Saju**, Tech. Asst. – National workshop on Intelligent and energy efficient LED lighting systems: A step towards a green future, KMEA Engineering College, Edathala (13-14 August)
  - **Kum. P. Minu**, SRF – 3<sup>rd</sup> International Phytoplankton workshop, Plymouth, UK (7-18 July)
  - **Shri K.A. Roshan**, **Shri James J. Pulikottil**, SRFs and **Shri H. Akhildas**, Tech. Asst. – Short term course on Wood technology, RRIL, Kottayam (24-26 September).

## Personalia

### Appointments

1. Dr. C.N. Ravishankar, Principal Scientist & HOD, Fish Processing Division as the Director, CIFT, Cochin
2. Dr. Suseela Mathew, Principal Scientist as HOD, Biochemistry and Nutrition Division, CIFT, Cochin
2. Shri Gouri Sankar Sahoo, LDC, CIFT, Cochin

### Promotions

1. Smt. G. Remani, Tech. Officer, CIFT, Cochin as Senior Tech. Officer
2. Smt. Tessa Francis, Tech. Asst., CIFT, Cochin as Sr. Tech. Asst.

3. Shri S.N. Dishri, Sr. Technician, CIFT RC, Visakhapatnam as Tech. Asst.
4. Smt. V.S. Aleyamma, Assistant, CIFT, Cochin as AAO, CIFT RC, Visakhapatnam
5. Smt. P.R. Mini, UDC, CIFT, Cochin as Assistant

### Transfers

1. Dr. A. Jeyakumari, Scientist, CIFT, Cochin to CIFT RC, Mumbai
2. Smt. P. Viji, Scientist, CIFT RC, Mumbai to CIFT RC, Visakhapatnam

### Retirements

1. Dr. T.K. Srinivasa Gopal, Director, CIFT, Cochin



## List of priced publications available from ICAR-CIFT

1. Improved trawls developed at CIFT (₹ 50/-)
2. Biochemical composition of Indian food fishes (₹ 100/-)
3. 'Kadalekum Kanivukal' (Bounties of the sea) (Hindi) (₹ 75/-)
4. Laboratory Manual – Enzyme linked immunosorbent (ELISA) for Chloramphenicol residue in shrimp (₹ 50/-)
5. Manual – PCR technique for detection of white spot syndrome virus (₹ 50/-)
6. Spl. Bulletin – 11 Synthetic fish netting yarns (₹ 25/-)
7. Spl. Bulletin – 12 CIFT – TED for turtle-safe trawl fisheries (₹ 30/-)
8. Spl. Bulletin – 12 CIFT – TED for turtle-safe trawl fisheries (Tamil) (₹ 50/-)
9. Spl. Bulletin – 12 CIFT – TED for turtle-safe trawl fisheries (Telugu) (₹ 50/-)
10. Fish canning – Principles and practices (₹ 125/-)
11. Laboratory Manual on Microbiological examination of seafood (₹ 90/-)
12. Spl. Bulletin – 13 – Rubber wood for marine applications (₹ 40/-)
13. Value added products from low priced fish (Malayalam) (₹ 50/-)
14. The seafood canning industry in India (Monograph) (₹ 35/-)
15. Gillnets in marine fisheries of India (Monograph) (₹ 100/-)
16. Manual of biochemical methods for determining stress and disease status in Crustaceans (₹ 90/-)
16. Electronic Instrumentation Technology developed by CIFT (₹ 60/-)
17. Immunological and metabolic alterations during infection and stress in Crustacea (₹ 60/-)
18. Responsible fishing contribution of CIFT (₹ 70/-)
19. Fish dishes for healthy living (₹ 75/-)
20. Seafood packaging (₹ 65/-)
21. Sensors and measurement systems for environmental, marine, fisheries and agricultural applications (₹ 180/-)
22. Stake nets of Kerala (₹ 40/-)
23. Fishtoons (Hindi) (₹ 80/-)
24. Seafood Quality Assurance (₹ 120/-)
25. Community fish smoking kilns (₹ 40/-)
26. HACCP concepts in seafood industry (₹ 100/-)
27. Food safety guidelines for common food items (₹ 50/-)
28. Fishing traps of Assam (₹ 300/-)
29. Handbook of Fishing Technology (₹ 500/-)
30. Inland fisheries gears and methods of Northern Kerala (₹ 150/-)
31. Modern analytical techniques (₹ 100/-)
32. Semi pelagic trawl system – An eco-friendly alternative to bottom trawling for small scale mechanized sector (₹ 50/-)
33. Biochemical composition of fish and shellfish (₹ 5/-)
34. Gill nets (₹ 5/-)
35. Technology of coating fish products (₹ 5/-)
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46. Processing and utilization of *Acetes indicus* (Jawla prawn) (₹ 30/-)
47. Mussel meat products (₹ 25/-)
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49. Availability and uses of Ambergis (₹ 5/-)
50. Important fishery resources of Madhya Pradesh (₹ 8/-)

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