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(DARE, Ministry of Agriculture & Farmers' Welfare, Govt. of India)

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Kochi

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Marine Shrimp (*Penaeus monodon) headless*

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भाकृअनुप-केमाप्रौसं, कोचिन ने उल्लास और प्रसन्नता से नववर्ष 2020 का स्वागत किया और अपनी गतिविधियों को आगे निरंतर बढ़ाया, जब तक कि कोविड-19 महामारी ने अपने पंख नहीं फैलाये। दुनिया भर की अर्थव्यवस्थाएं ध्वस्त हो गईं, नौकरी की हानि चरमसीमा पर थी और कई क्षेत्रों में एक कयामत देखी गई। मात्स्यिकी क्षेत्र भी इस आपदा की चपेट में आ गया और गरीब मछुआरे अपने संपोषण को बनाए रखने के लिए संघर्षरत थे। दस महीने की निष्क्रियता के बाद स्थिति वापस सामान्य हो रही है। इसके प्रभाव को दूर करने के लिए संस्थान के साथ ख़डे होने वाले सभी कर्मचारियों की मैं प्रशंसा करता हूँ।

यह वार्षिक रिपोर्ट वर्ष 2020 (जनवरी से दिसंबर 2020) के दौरान की उपलब्धियों पर प्रकाश डालती है। महामारी के डर के बावजूद, केमाप्रौसं ने व्यावसायिक रूप से वाणिज्यिक प्रौद्योगिकियों से संबंधित 17 प्रौद्योगिकी हस्तांतरण समझौतों पर हस्ताक्षर किए और उद्यमियों और अन्य हितधारकों के लाभ के लिए परामर्श परियोजनाओं, सहयोगात्मक अनुसंधान, अनुबंध सेवा और अनुबंध अनुसंधान जैसे कई ऐसी गतिविधियों के लिए सुविधाएँ प्रदान किए। अंतर्राष्ट्रीय और राष्ट्रीय दोनों पीर समीक्षा पत्रिकाओं में अच्छी संख्या में वैज्ञानिक पांडुलिपियां प्रकाशित हुईं और साथ ही साथ वैज्ञानिक क्रियाकलपों के अन्य साधनों के माध्यमों से वैज्ञानिकों द्वारा विचार-विमर्श हुआ।

मुझे आपको सूचित करने में प्रसन्नता है कि भाकृअनुप-केंद्रीय मात्स्यिकी प्रौद्योगिकी संस्थान को राजभाषा विभाग, गृह मंत्रालय, भारत सरकार द्वारा वर्ष 2018-19 के लिए भारत के दक्षिण पश्चिम क्षेत्र में राजभाषा नीति के उत्कृष्ट कार्यान्वयन के लिए प्रथम पुरस्कार से सम्मानित किया गया। साथ ही, संस्थान में उत्कृष्ट राजभाषा कार्यान्वयन के लिए वर्ष 2018-19 के लिए भाकृअनुप, नई दिल्ली द्वारा प्रदत्त प्रतिष्ठित राजर्षि टंडन राजभाषा पुरस्कार, इसकी स्थापना के बाद से 8वीं बार मिला है। यद्यपि, महामारी के कारणवश गृह मंत्रालय, भारत सरकार के पुरस्कार वितरण समारोह को विलंब हुआ है। इसके अतिरिक्त, संस्थान के वैज्ञानिकों को कई अन्य पुरस्कार सहित एक दल पुरस्कार और उत्कृष्टता का एक व्यक्तिगत पुरस्कार भी प्राप्त हुआ है।

प्रौद्योगिकी संस्थान होने के नाते, अधिकांश गतिविधियाँ बुनियादी अनुसंधान और हितधारकों और उद्योग के लाभ के लिए उसी के अनुप्रयोग के चारों ओर केंद्रित होती हैं। संस्थान में 39 संस्थान वित्त पोषित अनुसंधान परियोजनाएं और 25 बाह्य वित्त पोषित परियोजनाएं प्रचालन में हैं। अंतरराष्ट्रीय संगठनों द्वारा वित्त पोषित कुछ परियोजनाएं उल्लेखनीय हैं। विश्व मत्स्य केंद्र द्वारा वित्त पोषित परियोजना ग्रामीण आबादी के लिए पोषण सुरक्षा के मुद्दे का समाधन करने के लिए, विकसित मत्स्यों में प्रोटीनयुक्त कार्यात्मक खाद्य और लौह-तत्व फोर्टिफाइड सूप दोनों को शामिल किया गया ताकि किशोर लड़कियों के कुपोषण और स्वास्थ्य संबंधी मुद्दों का समाधान किया जा सकें जिसे उपयुक्त चिकित्सा सहायता के साथ उत्तर पूर्व में परीक्षण किया जा रहा हैं। आबादी में प्रति-सूक्ष्मजीवीय प्रतिरोध महामारी विज्ञान और संचरण की गतिशीलता को समझने की दृष्टि से एफएओ द्वारा वित्त

पोषित शोध जारी है आबादी के प्रत्यक्ष निहितार्थ होने के कारण यह परियोजना विशेष उल्लेखनीय है, जिसमें एक स्वास्थ्य और उपयोगकर्ता द्वारा संचालित समाधानों के लिए निदान पर भारत-यूके परियोजना शामिल है, स्वीडबयो वित्त पोषित लिंग संबंध में समुद्री शैवाल मूल्य श्रृंखला, वर्ल्ड वाइड फंड फॉर नेचर-भारत ने एफएओ द्वारा वित्त पोषित सिफ्टटेड पर जागरूकता बढ़ाने और एएमआर में शमन के समर्थन के लिए वित्त पोषित किया। सभी परियोजनाओं को काफी सराहा गया और इस अवधि के दौरान अच्छी प्रगति हुई है।

केमाप्रौसं,मत्स्य प्रग्रहण एवं पश्च प्रग्रहण प्रौद्योगिकी के लिए समर्पित है और इसकी अनुसंधान और विकास गतिविधियाँ मुख्य रूप से वर्तमान समय के संदर्भ में हितधारकों के मुद्दों को संबोधित करती हैं। जैसा कि पहले से ही ज्ञात है, मत्स्यन प्रचालन में मछुआरों द्वारा किया जाने वाला प्रमुख खर्च ईंधन की खपत है और मत्स्यन में ईंधन दक्षता गियर और गियर सामग्री का योगदान पर पिछले वर्ष के दौरान शोध किया गया है और ईंधन की कमी में सकारात्मक संकेत स्लॉटेड वी-आकार ओटर बोर्ड की प्रचालन दक्षता में पाई गई। उत्तरदायी मत्स्यन के एफएओ सिद्धांतों के अनुसार मत्स्यन प्रचालन को सुव्यवस्थित करना केमाप्रौसं की अधिदेश है और भारत के चुनिंदा लघु समुद्री मत्स्यन के लिए समुद्र तट सीन मत्स्यन और क्लोमजाल के लिए दिशा-निर्देश दिए गए हैं। गोस्ट मत्स्यन तब होता है, जब उपेक्षित गियर 'मत्स्यन जारी रखता है' और यह समुद्री प्लास्टिक का सबसे घातक रूप है। निष्कर्ष है गोस्ट मत्स्यन के कारण 30% तक की पकड़ दक्षता हो रही है।

बेहतर विपणन और मछुआरों की आजीविका के लिए मूल्य संवर्धन के मुद्दे का समाधान हेतु, उत्पादों को खराब होने से बचाना एक महत्वपूर्ण चुनौती है और उत्पादों के संवेष्ठन के लिए खाद्य फिल्म को विकसित किया गया। पॉलीएलैक्टिक अम्ल (PLA) / काइटोसन बायोडिग्रेडेबल और एंटीमाइक्रोबियल फिल्म और जिलेटिन, काइटोसन, ZnO नैनोपार्टिकल और आवश्यक तेल पर आधारित खाद्य जीवाणुरोधी फिल्म रोगजनकों के विरुद्ध आशाजनक परिणाम दिखाए। ताज़े मत्स्य की गुणवत्ता का आकलन करने के लिए एक गैर-विनाशकारी और लागत प्रभावी वेब-आधारित प्रणाली (FISHQCheQ) की परिकल्पना, परिवेशी तापमान पर गोल्ड नैनोरोड्स (AuNRs) का संश्लेषण, जीवित मत्स्य परिवहन के लिए एक प्रोटोटाइप कंटेनर का विकास और समुद्री शैवाल आधारित कार्यात्मक पाउच, पर शोध आशाजनक परिणाम की पेशकश की। समुद्री शैवाल कुकुरमुत्ता और हरी चाय के एक शंकुवृक्ष का विकास प्री-क्लिनिकल अध्ययन में उत्कृष्ट कार्डियोप्रोटेक्टिव गतिविधि का प्रदर्शन और काइटोसन और वैनिलिक अम्ल के संयोजन में जलकृषि के लिए समुद्री शैवाल आधारित चारा पूरक के विकास ने भी आशाजनक परिणाम दिखाया।

जहां तक मत्स्य और मत्स्य उत्पादों की गुणवत्ता का संबंध रहा है, रोगजनकों और संदूषकों ने हमेशा एक महत्वपूर्ण भूमिका निभाई है, रोगाणुओं की गणना के लिए प्रोटोकॉल का विकास और राष्ट्रीय और अंतर्राष्ट्रीय दिशानिर्देशों के विपरित संदूषित पदार्थों और यौगिको के आकलन ने चुनौतीपूर्ण अनुसंधान की पेशकश की। मास स्पेक्ट्रोमेट्री द्वारा मत्स्य में कुल फ्लोर्फेनिकॉल अवशेषों सहित विधि का विकास, ऑर्गोक्लोरीन, पॉली एरोमैटिक हाइड्रोकार्बन, पॉलीक्लोरीनयुक्त बाइफिनाइल,

और जीसीएमएस / एमएस का उपयोग कर मत्स्य में अन्य अंत:स्रावी व्यवधानों सहित 300 से अधिक कार्बनिक संदूषणों की मात्रा के एकीकरण के लिए एक एकीकृत विधि का विकास और एलसीएमएस / एमएस और मत्स्य में इमामेक्टिन बेंजोएट की खाद्य सुरक्षा के मूल्यांकन ने अनुसंधान के इस क्षेत्र में दक्षता दिखाई है। रोगाणुरोधी प्रतिरोध (एएमआर) एक ऐसा क्षेत्र है जहां वर्ष के दौरान काफी शोध किए गए। निष्कर्ष यह है कि झींगा जलकृषि खेतों से वियुक्त हेटोट्रॉफ़िक बैक्टीरिया प्रमुख एंटीबायोटिक दवाओं के लिए प्रतिरोधी थे और 6.9% वियुक्तियां बहु-दवा प्रतिरोधी थे। केरल के जलकृषि फार्मों से प्राप्त *एस्चेरिचिया कोलाई* और *क्लेबसिएला न्यूमोनिया* विस्तारित-स्पेक्ट्रम बीटा-लैक्टामेस (ईएसबीएल) का उत्पादन करने वाले है, प्रचलन 24.3% था, जो काफी चिंताजनक हैं।

अभियांत्रिकी के क्षेत्र में, पोर्टेबल मत्स्य ताजगी संवेदक की थ्री डी प्रिंटिंग, स्वास्थ्यकर परिस्थितियों में उपभोक्ता के दरवाज़े पर मत्स्य उत्पाद बेचने के लिए कम लागत वाली ऊर्जा कुशल सौर ऊर्जा संचालित रेफ्रिजरेटेड मोबाइल मत्स्य वेंडिंग किओस्क की परिकल्पना और विकास, के एक प्रोटोटाइप के विकास में उच्च मूल्य मत्स्य और मत्स्य उत्पादों गर्म हवा (निरंतर अवरक्त शुष्कन प्रणाली) उल्लेखनीय उपलब्धियों में से कुछ रेखांकित हैं।

इसके अलावा, मछुआरों के सामाजिक आर्थिक परिदृश्य और उनके द्वारा प्रौद्योगिकी अपनाने, लिंग संबंधी मुद्दों, विपणन कार्यनीति आदि के संबंध में, मछुआरों और अन्य हितधारकों के लाभ और बड़े पैमाने पर हितधारकों हेतु उत्तम ज्ञान के लिए अनुसंधान जारी है।

मैं सभी हितधारकों का उनके निरंतर समर्थन के लिए बहुत आभारी हूँ। भाकृअनुप के विषय वस्तु प्रभाग द्वारा दिए गए समर्थन को कृतज्ञतापूर्वक मैं संस्थान को अग्रश्रेणी में लाने के लिए भाकृअनुप-केमाप्रौसं के कर्मचारियों के प्रयासों की सराहना करता हूँ और मैं ईमानदारी से उनके योगदान को अभिस्वीकृत करता हूँ।

सी.एन. रविशंकर

निदेशक

PREFACE

ICAR-CIFT, welcomed the New Year 2020 in the usual gale and gaiety and pursued its activities, until the pandemic COVID-19 spread its wings. Economies around the world collapsed, job losses are at a peak and several sectors witnessed a doom. The fisheries sector too struggled to catch up and sustain the lives of the poor fishermen who were hit by the disaster. The situation is limping back to normalcy after the 10 long months. My appreciation to the ICAR-CIFT fraternity who stood with the institute and did their might to overcome the impact.

This Annual Report 2020 highlights the achievement during 2020 (January 2020 to December 2020). Despite the fear of pandemic, ICAR-CIFT signed 17 technology transfer agreements related to commercially viable technologies and facilitated several such activities namely Consultancy Projects, Collaborative Research, Contract Service and Contract Research, for the benefit of the entrepreneurs and other stakeholders. There were good number of scientific manuscripts published in both International and National peer reviewed journals as well as good number of deliberations by the scientists in other modes of scientific pursuit.

I am also happy to share with you that ICAR-CIFT was awarded the Official Language Award of Department of Official Language, Ministry of Home Affairs, Government of India for the year 2018-19 as a first prize for excellence in Implementation of OL policy in the Southwest Region of India. ICAR-CIFT also received the prestigious Rajarshi Tandon Award for the year 2018-19 for the outstanding Official Language implementation in the Institute, for the 8th time since its inception. Besides, the institute scientist also received a couple of other awards including a team award and individual awards of excellence.

Being a technology institute, most of the activities revolved around the basic research and the application of the same for the benefit of stakeholders and the industry. There were 39 institute funded research projects and 25 externally funded projects, in operation in the institute. Some of the projects funded by the international organisations are worth mentioning. The project funded by World Fish Centre to address the issue of Nutritional Security for Rural Population, developed a fish incorporated protein rich functional food, a iron fortified soup to address the issue of malnutrition and health issues of adolescent girls, which are being tried in the North East with appropriate medical support. The other on the incidence of Anti-Microbial Resistance among the population, funded by FAO, with the view to understand the epidemiology and transmission dynamics. The project being direct implications to the population assumes special mention

among the other equally important funded projects, which include the Indo-UK project on diagnostics for one health and user driven solutions, SwedBio funded gender relation in seaweed value chain, World Wide Fund for Nature-India funded enhancing awareness on CIFT-TED and the support mitigation in AMR in aquaculture funded by FAO. All the projects are well appreciated and yielding good progress during the period.

ICAR-CIFT is dedicated harvest and post-harvest technology of fish and the R&D activities mainly address the issues of the stakeholders in the present-day context. As already known, fuel consumption is the major expenditure incurred by the fishermen in fishing operations and the studies on the contribution of gear and gear materials in contributing to the fuel efficiency in fishing operations demonstrated and the operational efficiency of the V-form double slotted otter boards in fuel reduction. The streamlining of fishing operations as per the FAO principles of responsible fishing led to developing guidelines for beach seine and gillnets for selected small scale marine fishes of India. It is well known that Ghost fishing happens when derelict fishing gear 'continues to fish' and is the deadliest form of marine plastics. This is being addressed in relation to fishing traps and the findings show a reduction in catch efficiency up to 30% due to ghost fishing.

While addressing the issue of value addition for better marketing and livelihood of the fishers, protecting the products from spoilage is a critical challenge and the research led to development of edible film for packaging of products. Polylactic acid (PLA)/chitosan biodegradable and antimicrobial film and edible antibacterial film based on gelatin, chitosan, ZnO nanoparticle and essential oil showed promising results against pathogens. Design of a non-destructive and cost-effective web-based system (FISHQCheQ) for assessing the quality of fresh fish, synthesis of Gold nanorods (AuNRs) at room temperature, development of a prototype container for live fish transport and seaweed based functional sachets, offered promising results. Development of a concoction of seaweed fucoidan and green tea demonstrating excellent cardioprotective activity in pre-clinical studies and development of a seaweed-based feed supplement for the aquaculture in combination of chitosan and vanillic acid also showed promising research.

Pathogens and contaminants always played a crucial role as far as quality of fish and fishery products are concerned and development of protocols for the enumeration of microbes and estimation of contaminants and additives against the National and International guidelines offered challenging research. Development of methods including total florfenicol residues in fish by Mass Spectrometry, development of a unified method for the quantification of more than 300 organic contaminants in fish using GC-MS/MS and LC-MS/MS and

evaluation of food safety of emamectin benzoate in fish showed proficiency in this area of research.

Antimicrobial Resistance (AMR) is an area where considerable research was focussed during the year. The findings that heterotrophic bacterial isolates from shrimp aquaculture farms were resistant to prominent antibiotics and alarmingly 6.9% isolates were multi-drug resistant and the prevalence of Extended-Spectrum Beta-Lactamases (ESBL) producing *Escherichia coli* and *Klebsiella pneumoniae* from aquaculture farms of Kerala to the extent of 24.3%, are quiet alarming.

On the engineering front, 3D printing of portable fish freshness sensor, designing and development of a low-cost energy efficient solar powered refrigerated mobile fish vending kiosk, development of a prototype of hot air assisted continuous infrared drying system for high value fish and fishery products are some of the notable advancements.

Besides, research is also taking place with reference to socioeconomic scenario of the fisherfolks, technology adoption, gender issues, marketing strategy etc, for benefiting the fishers and other stakeholders and the perusal for better knowledge continues unabated for the sake of stakeholders at large.

I am immensely thankful to all the stakeholders for their continued support. The support given by the subject matter division of ICAR is gratefully acknowledged. I appreciate the efforts of the staff of the ICAR-CIFT, to bring the institute to the forefront and I sincerely acknowledge their contributions.

Ravishankar C.N.
(Director)

कार्यकारी सारांश

भाकृअनुप-केंद्रीय मात्स्यिकी प्रौद्योगिकी संस्थान, कोचिन पश्च प्रग्रहण के सभी क्षेत्रों में अनुसंधान और विस्तार के लिए समर्पित है अर्थात मत्स्यन प्रौद्योगिकी, प्रसंस्करण और पश्च प्रग्रहण हस्तन, गुणता आश्वासन, जैव रसायन और पोषण, सूक्ष्म जीव विज्ञान सहित अभियांत्रिकी पहलुओं और हितधारकों के लिए प्रौद्योगिकियों का विस्तार। वर्ष 2020 के दौरान संचालित प्रमुख अनुसंधान कार्यक्रमों में 39 संस्थान परियोजनाएं और 25 बाह्य वित्तपोषित परियोजनाएं शामिल हैं। कोविड़-19 महामारी के दौरान कठिनाइयों के बावजूद गतिविधियों को आगे बढ़ाया गया और उल्लेखनीय उपलब्धियां नीचे दी गई हैं। अन्य उपलब्धियों को अनुसंधान शीर्ष के तहत शामिल किया गया है।

- वी-आकार डबल स्लॉटेड ओटर बोर्ड के प्रोटोटाइपों को परिकल्पित और संरचित किया गया। नए ओटर बोर्डों का उपयोग करने वाले प्रारंभिक परीक्षणों में समान आकार के पारंपरिक वी-आकार ओटर बोर्डों की तुलना में ईंधन की खपत में लगभग **2-3** लीटर / घ की कर्षण में कमी देखी गई।

- भारत के चुनिंदा छोटे पैमाने के समुद्री मात्स्यिकी के लिए जिम्मेदार समुद्र तट सीन मत्स्यन और क्लोम जालन के लिए तकनीकी दिशानिर्देश तैयार किए गए।

- 5 एनएम आकार वाले कार्बन नैनो डॉट्स को रोहू मत्स्य शल्क और जेली मत्स्य से संश्लेषण किया गया और उसका लक्षण चित्रण किया गया। एफटीआईआर स्पेक्ट्रोस्कोपिक परिणामों से पता चला कि सीडी सी = ओ और सी-ओ समूहों से समृद्ध हैं।

- क्रोमेटेड कॉपर बोरान (8%) से उपचारित नारियल की लकड़ी ने अधिकतम स्थैतिक बेंडिंग की मज़बूती को (एमओआर) दिखाया, जबकि पॉलीनीलिन उपचारित लकड़ी के साथ 0.02% नैनो कॉपर ऑक्साइड ने स्वस्थानी विरंजन प्रयोग (AWPA E11) के दौरान तांबे का न्यूनतम विरंजन को दिखाया।

- मछुआरों से एकत्र गुजरात-तट में जेलीफ़िश बहुतायत से संबंधित ITK को भौतिक-रासायनिक आंकड़ों से मानकीकरण किया गया। जेलीफ़िश बहुतायत के साथ उच्च हवाओं और कम उत्पादकता का सहसंबद्ध पाया गया।

- वेम्बनाड पश्च जल में चीनी डिपनेट के संरचनात्मक और परिचालन संशोधनों को प्रलेखित किया गया।

- खोई हुई जाल की गोस्ट मत्स्यन की क्षमता का आकलन भारत में पहली बार अनुकरण मत्स्य जाल की तैनाती के माध्यम से किया गया। खोए हुए जाल 54 दिनों तक मत्स्य पकड़ते रहते हैं और पकड क्षमता शुरुआती दर के 30% तक कम हो जाती है।

- एक गैर-विनाशकारी और लागत प्रभावी वेब-आधारित प्रणाली (FISHQCheQ) को स्वच्छ मत्स्य की गुणवत्ता का आकलन करने के लिए परिकल्पित और विकसित किया गया। इस विकसित प्रणाली को भारतीय बांगडे के वास्तविक समय के आंकड़ों के साथ मानकीकरण किया गया।

- अदरक के आवश्यक तेल के सार के साथ पॉलीएलैक्टिक अम्ल (पीएलए) / काइटोसन जैवविकृतीय और एंटीमाइक्रोबियल फिल्म शीत संग्रहीत सीर मत्स्य स्टीक की निधानी आयु को बढ़ाने में प्रभावी था।

- परिवेशी तापमान पर गोल्ड नैनोरोड्स (AuNRs) के संश्लेषण के लिए एक विधि विकसित की गई जिसे अपग्रेड किया जा सकता है।

- शीत लवण पानी शीतलन प्रणाली और वातन सुविधा के साथ जीवित मत्स्य परिवहन कंटेनर का एक प्रोटोटाइप विकसित किया गया।
- मत्स्य शल्क से हाइड्रोक्सीपाटाइट और नैनोकार्बन डॉट्स के सह-संश्लेषण के लिए एक प्रक्रिया का मानकीकरण किया गया।
- मत्स्य अवशिष्ट से पॉलीहाइड्रॉक्सीलॉनेटो (PHA) के उत्पादन के लिए प्रौद्योगिकी विकसित की गई।
- बहुत कम विस्कासिता वाले काइटोसन (<2 cP) की तैयारी के लिए एक विधि विकसित की गई।
- जिलेटिन, काइटोसन, ZnO नैनोपार्टिकल और आवश्यक तेल पर आधारित खाद्य फिल्म ने साल्मोनेला और स्टैफिलोकोकस ऑरियस के विरुद्ध अच्छी रोगाणुरोधी गतिविधि का प्रदर्शन किया।
- AB स्किएक्स QTRAP मास स्पेक्ट्रोमेट्री द्वारा मत्स्य में कुल फ़्लोरफ़ेनिकॉल अवशेषों के लिए एक विधि विकसित की गई।
- पंगासियानोडोन हाइपोफथलमस में और किशोर स्नब नोज़ पोम्पानो, ट्रैचिनाटस ब्लोची, में एंटीबायोटिक ऑक्सीटेट्रासाइक्लिन हाइड्रोक्लोराइड एलसी / एमएस / एमएस की जैवसक्रियता की जैवसुरक्षा निर्धारित की गई।
- नील तिलापिया (ओरोक्रोमिस निलोटिकस (एल.)), सिल्वर कार्प और साधारण कार्प के नमूनों के चारे में प्रशासित इमामेक्टिन बेंजोएट की सुरक्षा का मूल्यांकन किया गया।
- समुद्री शैवाल प्रजातियों से कार्यात्मक पाउच विकसित किया गया और इसके कार्यात्मक और भौतिक रासायनिक गुणों का मूल्यांकन किया गया।
- मत्स्य और मात्स्यिकी उत्पादों में FSSR अनुमोदित कृत्रिम खाद्य रंग योजक (इंडिगोटीन, पोनसीओ 4 आर, अल्लुर रेड और सनसेट येलो) के आकलन के लिए विधि विकसित की गई।
- व्यावसायिक रूप से महत्वपूर्ण फिनफिश और शेलफिश की 124 प्रजातियों में फॉर्मलाडेहाइड के प्राकृतिक स्तर का विश्लेषण और प्रलेखित किया गया।
- व्यावसायिक रूप से महत्वपूर्ण फिनफिश और शेलफिश किस्मों की 240 प्रजातियों के 18 तत्वों से युक्त धातु प्रोफाइल को मानकों के निर्माण के लिए संकलित और FSSAI को प्रस्तुत किया गया।
- खाद्य उत्पादों की विभिन्न श्रेणियों के लिए एफएसएसआर के तहत निर्धारित सभी परीक्षण मापदंडों के लिए विधि उपलब्धता के लिए गैप विश्लेषण संकलित और प्रलेखित किया गया।
- झींगा जलीय कृषि खेतों में पाए गए हेटरोट्रॉफिक बैक्टीरिया ऑक्सीटेट्रासाइक्लिन, एरिथ्रोमाइसिन, सह-ट्रिमोक्साजोल, सिप्रोफ्लोक्सासिन और क्लोरैमफेनिकोल के प्रतिरोधी थे। लगभग 6.9% आइसोलेट्स बहु-दवा प्रतिरोधी थे।
- थाने के मत्स्य संचयन से एकत्र मत्स्य के 3% नमूनों में लिस्टेरिया मोनोसाइटोजेनेस पाया गया।
- ईएसबीएल का उत्पादन करने वाले *ई.कोली* केरल के झींगा खेतों से वियुक्त किया गया। केरल के एक्वाकल्चर खेतों से *एस्चेरिचिया कोलाई* और *क्लेबसिएला निमोनिया* उत्पादन करने वाले विस्तारित-स्पेक्ट्रम बीटा-लैक्टामेस का प्रसार 24.3% था।

- तिलापिया बीज के नमूने में तिलापिया झील वायरस का पता लगाया गया।
- खेती किए स्वच्छ जल मत्स्य से वियुक्त एंटीबायोटिक प्रतिरोध जीन (ARG) अर्थात् टेट्रासाइक्लिन प्रतिरोध के लिए tetB और tetD जीन, बीटालैक्टम प्रतिरोध के लिए CTX-MGp1 जीन, aacA-aphd जीन के लिए एमिनोग्लाइकोसाइड प्रतिरोध और सल्फोनामाइड प्रतिरोध के लिए dfrA-Sul1 1 जीन खोजे गए।
- पौष्टिक अनुप्रयोगों के लिए समुद्री शैवाल से बायोएक्टिव यौगिकों के निष्कर्षण के लिए ग्यारह नए गहरे यूक्टेक्टिक सॉल्वेंट्स को संश्लेषित किया गया।
- समुद्री शैवाल कुकुरमुत्ता और हरी चाय निचोड़ के एक सूत्रीकरण से आहार अनुपूरक को विकसित किया गया। यह पूरक प्रीक्लिनिकल अध्ययनों में उत्कृष्ट कार्डियोप्रोटेक्टिव गतिविधि को दर्शाया।
- GC-MS / MS और LC-MS / MS का उपयोग कर मत्स्य में 300 से अधिक कीटनाशकों, ऑर्गेनोक्लोरिन, पॉली एरोमैटिक हाइड्रोकार्बन, पॉलीक्लोराइनेटेड बाइफिनाइल, और अन्य अंत:स्रावी व्यवधानों की मात्रा के परिमाणन के लिए एक एकीकत पद्धति का विकास किया गया।
- आहार में 10 से 15% तक कटलफिश प्रोटीन हाइड्रोलाइजेट की पूरकता ओरोक्रोमिस नाइलोटिकस फिंगरलिंस की वृद्धि और थर्मल सहिष्णुता को बढ़ाने में सहायक रही।
- जलकृषि के लिए समुद्री शैवाल आधारित चारा पूरक को काइटोसन और वैनिलिक अम्ल के संयोजन में विकसित किया गया।
- भूरे समुद्री शैवाल *टरबिनारिया कॉन्डोइड्स, सरगसुम व्हिट्टी* और *सरगसुम क्राइस्टिफोलियम* से सोडियम एल्गिनेट के निष्कर्षण के लिए एक पद्धति विकसित की गई।
- उद्योग के लिए एक Arduino-GSM मॉड्यूल आधारित वास्तविक समय ऊर्जा आंकडा अधिग्रहण और एसएमएस सतर्क प्रणाली विकसित की गई।
- अधिक कॉम्पैक्ट और उपयोगकर्ता के अनुकूल बनाने के लिए पोर्टेबल मत्स्य ताजगी संवेदक का 3 डी प्रिंटिंग किया गया। मत्स्य ताजगी संवेदक के लिए मोबाइल एप्लिकेशन का फ्रंटएंड विकास पूरा किया गया।
- भाकृअनुप-केमाप्रौसं, कोचिन, का अनुसंधान साझीदार लैंसॉल एनर्जी सॉल्यूशंस प्राइवेट लिमिटेड, बैंगलोर के सहयोग से, मत्स्य उत्पादों को स्वच्छ स्थिति के अधीन उपभोक्ता के दरवाजे पर मत्स्य उत्पादों को बेचने के लिए एक कम लागत वाली ऊर्जा कुशल सौर ऊर्जा संचालित प्रशीतित मोबाइल फिश वेंडिंग कियोस्क (30 किलो) को संयुक्त रूप से परिकल्पित और विकसित किया गया।
- एक सौर ऊर्जा आधारित चारा डिस्पेंसिंग प्रणाली (क्षमता - 6 किग्रा) को परिकल्पित और विकसित किया गया और प्रारंभिक क्षेत्र मूल्यांकन किया गया।
- थ्रेडफिन ब्रीम का उपयोग करके एक मिनी मत्स्य डिस्केलिंग मशीन की कार्यक्षमता का मूल्यांकन किया गया। 0.5 किलोग्राम और 1 किग्रा की मत्स्य लोडिंग के लिए क्रमश: 67.9% और 60.15% की डिस्केलिंग दक्षता देखी गई।

- उच्च मूल्य मत्स्य और मत्स्य उत्पादों के लिए निरंतर गर्म हवा सहायता प्राप्त अवरक्त शुष्कन प्रणाली के प्रोटोटाइप को विकसित किया गया। इस प्रोटोटाइप शुष्कक का कार्यक्षमता मूल्यांकन झींगा, एंकोवी और स्क्विड रिंग का उपयोग करके किया गया।
- बिजली और गर्म पानी की सह-प्रजनन के लिए एक हाइब्रिड फोटोवोल्टिक थर्मल सिस्टम (PVT) विकसित किया गया। शीतलन माध्यम के रूप में पानी और नैनोफ्लूड का उपयोग करके पीवीटी प्रणाली की कार्यक्षमता का परीक्षण किया गया।
- कारक विश्लेषण के माध्यम से, यह पाया किया गया कि मत्स्य और मत्स्य-आधारित उत्पादों के प्रति उपभोक्ताओं का व्यवहार उत्पाद वरीयता और व्यवहार्यता से अत्यधिक; उत्पाद सुविधा, गुणवत्ता पैकेजिंग और सेवा वितरण प्रणाली से मध्यम प्रभावित था।
- यह देखा गया कि प्रत्येक स्थान का उद्यमशीलता पारितंत्र क्षेत्र प्रासंगिक और कई कारकों के कारण अलग होता है।
- विपणन ने मत्स्य की उपलब्धी और मत्स्य के प्रबंधन के संबंध में लिंग अंतर के अस्तित्व का संकेत दिया जो, महिलाओं के प्रति पक्षपातपूर्ण थी।
- 'ट्रांसरेग' प्रक्रिया से पता चला कि केरल के लिए, 'मत्स्य की सुरक्षा' उपभोग के लिए सबसे महत्वपूर्ण ड्राइवर या बाधा था जबकि 'मत्स्य की कीमत' और पसंदीदा मत्स्य की उपलब्धता दूसरे और तीसरे सबसे महत्वपूर्ण ड्राइवर थे। ऑनलाइन मत्स्य उपभोक्ताओं के लिए, हालांकि, 24 x 7 बाजार पहुंच 'सबसे महत्वपूर्ण ड्राइवर था, जिसके बाद सुविधा ग्रहणबोध' था।

'अनुसंधान उपलब्धियों को अनुसंधान प्रकाशनों में समेकित दर अंतर्राष्ट्रीय और राष्ट्रीय पीर समीक्षित पत्रिकाओं में प्रकाशित किया गया यद्यपि संगोष्ठी, सम्मेलनों और अन्य शैक्षणिक आयोजनों में विचार-विमर्श भी किया गया। वर्ष के दौरान, 109 पांडुलिपियां पीर समीक्षित पत्रिकाओं में प्रकाशित हुई और सम्मेलनों और संगोष्ठियों में समान संख्या में प्रस्तुतियाँ दी गईं।

केमाप्रौसं ने वाणिज्यिक व्यवहार्य प्रौद्योगिकियों से संबंधित 17 प्रौद्योगिकी हस्तांतरण समझौतों पर हस्ताक्षर किया है जिसमें मत्स्य/समुद्री शैवाल से मूल्यवर्धित उत्पाद, मत्स्य कोलेजन पेप्टाइड, न्यूट्रास्युटिकल्स, सैनिटाइज़र, शीत/अवरूद्ध मत्स्य उत्पाद, रेट्रोट पाउच उत्पाद, सौर शुष्कक, प्रशीतित मत्स्य वेंडिंग कियोस्क निजी क्षेत्र और सरकारी एजेंसियों को शामिल है और 22 पेशेवर सेवा कार्यों की सुविधा जैसे परामर्श परियोजाएं, सहयोगी अनुसंधान, अनुबंध सेवा और अनुबंध अनुसंधान (अनुदान-सहायता / प्रायोजित)।

संस्थान के कर्मियों को निरंतर क्षमता निर्माण प्रदान करने के लिए, वर्ष के दौरान 26 प्रशिक्षण कार्यक्रमों द्वारा 84 वैज्ञानिक, 75 तकनीकी और 83 प्रशासनिक और वित्त सहित संस्थान के कुल 242 कर्मचारी सदस्यों ने भाग लिया। संस्थान ने उद्यमियों, परामर्श सेवाएँ, अनुबंध अनुसंधान आदि के लिए कई प्रौद्योगिकियों के हस्तांतरण में भी भाग लिया।

वर्ष 2020 के दौरान अपनी उपलब्धियों पर संस्थान के बारे में एक त्वरित संदर्भ प्रदान करने के लिए इस रिपोर्ट में विभिन्न अधिदेशों के तहत संस्थान के क्रियाघटनाओं और गतिविधियों को सम्मिलित किया गया है।

EXECUTIVE SUMMARY

ICAR-Central Institute of Fisheries Technology, Cochin is dedicated to research and extension in all the areas of post-harvest technology viz., fishing technology, post-harvest technology including processing and post-harvest handling, quality assurance, biochemistry and nutrition, microbiology, engineering aspects and extension of technologies to the stakeholders. The major research programmes handled during the year 2020 includes 39 institute projects and 25 externally funded projects. Despite the difficulties during the COVID-19 pandemic the activities were taken forward and the notable achievements are given below. The other achievements are included under the head research separately.

- Designed and fabricated prototypes of V-form double slotted otter boards. Initial trials using the new otter boards showed reduction in fuel consumption by approximately 2-3 litres/h of dragging compared to conventional V-form otter boards of almost same size.
- Technical guidelines for the responsible beach seine fishing and gillnetting were drafted for selected small scale marine fisheries of India.
- Carbon nano dots having 5 nm size synthesized from Rohu fish scale and jelly fish were characterized. FTIR spectroscopic results showed that the CDs are rich with C=O and C-O groups.
- Chromated Copper Boron (8%) treated coconut wood showed the maximum static bending strength (MoR) whereas 0.02% nano copper oxide along with polyaniline treated wood showed the minimum leaching of copper during the in-situ leaching experiment (AWPA E11).
- ITKs related to jellyfish abundance along Gujarat coast collected from fishermen were validated using physico-chemical data available. High winds and lower productivity were positively correlated with jellyfish abundance.
- The structural & operational modifications in Chinese dipnets in Vembanad backwaters were documented.
- Ghost fishing capacity of lost traps was assessed through deploying simulated fish traps for the first time in India. The lost traps continue to fish up to 54 days and the catching efficiency was reduced to 30% of the initial catch rate.
- A non-destructive and cost-effective web-based system (FISHQCheQ) was designed and developed to assess the quality of fresh fish. The developed system was validated with real time data of Indianoil sardine.
- Polylactic acid (PLA) /chitosan biodegradable and antimicrobial film with ginger essential oil extract was effective in extending the shelf life of chilled stored seer fish steaks.
- A method for synthesis of Gold nanorods (AuNRs) at room temperature was developed which can be upscaled.

- A prototype of live fish transport container was developed with chilled salt water cooling system and aeration facility.
- Standardised a process for the co-synthesis of hydroxyapatite and nanocarbon dots from fish scale
- Developed technology for production of Polyhydroxyalkanoates (PHA) from fish waste.
- A method was developed for the preparation of very low viscosity chitosan (< 2 cP).
- Edible film based on gelatin, chitosan, ZnO nanoparticle and essential oil prepared exhibited good antimicrobial activity against Salmonella and *Staphylococcus aureus*.
- A method was developed for total florfenicol residues in fish by AB Sciex QTRAP Mass Spectrometry.
- Determined biosafety of the antibiotic Oxytetracycline hydrochloride LC/MS/MS in *Pangasianodon hypophthalmus* and in juvenile snub nose pompano, *Trachinotus blochii*.
- Evaluated the safety of Emamectin benzoate administered in feed to Nile tilapia (*Oreochromis niloticus (L.)*), Silver carp and common carp samples.
- Developed functional sachet from seaweed spp. and evaluated its functional and physicochemical properties.
- Method was developed for estimation of FSSR approved artificial food colour additives (Indigotine, Ponceau 4R, Allur Red and Sunset Yellow) in fish and fishery products
- Natural level of Formaldehyde in 124 Species of commercially important finfish and shellfish were analyzed and documented.
- Metal profile comprising of 18 elements of 240 species of commercially important finfish and shellfish varieties were compiled and submitted to FSSAI for formulation of standards.
- Gap analysis for method availability for all test parameters stipulated under FSSR for various categories of food products were compiled and documented.
- Heterotrophic bacterial isolates from shrimp aquaculture farms were resistant to oxytetracycline, erythromycin, co-trimoxazole, ciprofloxacin and chloramphenicol; alarmingly 6.9% isolates were multi-drug resistant.
- *Listeria monocytogenes* was detected in fish collected from fish hold and the prevalence was 3%
- ESBL producing *E. coli* were isolated from shrimp farms in Kerala. The prevalence of Extended-Spectrum Beta-Lactamases producing *Escherichia coli* and *Klebsiella pneumoniae* from aquaculture farms of Kerala was 24.3%.
- Tilapia Lake Virus was detected in Tilapia seed sample.
- Antibiotic resistance genes (ARGs) namely *tet*B and *tet*D genes for tetracycline resistance, CTX-

MGp1 gene for beta-lactam resistance, aacA-aphd gene for aminoglycoside resistance and *dfr*A-*Sul*1 gene for sulfonamide resistance were detected in *E. coli* isolated from farmed freshwater fish.

- Eleven new deep eutectic solvents were synthesized for extraction of bioactive compounds from seaweeds for nutraceutical applications.
- A formulation of seaweed fucoidan and green tea extract was developed as dietary supplement. The supplement demonstrated excellent cardioprotective activity in preclinical studies.
- A unified method was developed for the quantification of more than 300 pesticides, organochlorines, poly aromatic hydrocarbons, polychlorinated biphenyls, and other endocrine disruptors in fish using GC-MS/MS and LC-MS/MS.
- Cuttlefish protein hydrolysate supplementation at 10 to 15 % in the diet has proven to enhance the growth performance and thermal tolerance of *Oreochromis niloticus* fingerlings.
- Seaweed based feed supplement for the aquaculture was developed in combination of chitosan and vanillic acid.
- A methodology developed for the extraction of sodium alginate from brown seaweeds *Turbinaria conoides, Sargassum whitti* and *Sargassum cristaefolium.*
- Developed an Arduino-GSM module based real time energy data acquisition and SMS alert system for Industry.
- 3D printing of portable fish freshness sensor was done to make the device more compact and user friendly. Front-end development of mobile application for fish freshness sensor was completed.
- ICAR-CIFT, Kochi, in collaboration with research partner M/s Lanasol Energy Solutions, Pvt. Ltd, Bangalore, jointly designed and developed a low-cost energy efficient solar powered refrigerated mobile fish vending kiosk (30 kg) to sell fishery products at consumer's door step under hygienic conditions.
- Designed and developed a solar energy-based feed dispensing system (capacity - 6 kg) and preliminary field evaluation was carried out.
- Performance of a mini fish descaling machine was evaluated using threadfin bream and observed the descaling efficiency of 67.9% and 60.15% for the fish loading of 0.5 kg and 1 kg, respectively.
- Developed prototype of hot air assisted continuous infrared drying system for high value fish and fishery products. Performance evaluation of prototype dryer was carried out using shrimp, anchovy and squid rings.
- Developed a hybrid photovoltaic thermal system (PVT) for co-generation of electricity and hot water. Performance of PVT system was tested using water and nanofluid as cooling medium.
- Through factor analysis, it was found that the consumers' behaviour towards fish and fish-based

products was highly influenced by product preference and feasibility; moderately affected by product convenience, quality packaging and service delivery system.

- It was observed that the entrepreneurship ecosystem of each country or region is different owing to the interplay of many factors relevant to the regions.
- A study indicated existence of gender difference with respect to access to fish and management of unsold fish, skewed against women.
- 'Transreg' procedure revealed that for Kerala, 'safety of fish' was the most important driver or barrier for consumption while 'price of fish' and 'availability of favourite fish' were the second and third most important drivers. For online fish consumers, however, '24x7 market accessibility' was the most important driver followed by 'convenience perception'.

The research output has been consolidated in research publications and published in International and National peer reviewed journals, besides deliberating in symposia, conferences and other academic events. 109 manuscripts were published in peer reviewed journals and an equal number of presentations were made in conferences and Symposia.

ICAR-CIFT has signed 17 technology transfer agreements related to commercially viable technologies which included value added products from fish/seaweed, fish collagen peptide, nutraceuticals, sanitizers, chilled/ frozen fish products, retort pouched products, solar dryers, refrigerated fish vending kiosks to the private sector and government agencies and facilitated 22 professional service functions viz., Consultancy Projects, Collaborative Research, Contract Service and Contract Research (Grant-in-Aid / sponsored).

In order to provide continued capacity building to institute personal, a total of 242 staff members of the institute including 84 scientific, 75 technical and 83 administrative & Finance personal participated in 26 training programmes during the year.

The report covers the events and activities of the institute under the different mandates for providing a quick reference about the institute on its achievements during the year 2020.

THE INSTITUTE

The **ICAR-Central Institute of Fisheries Technology** (named at the time of inception as Central Fisheries Technology Research Station) was set-up following the recommendation of a high power committee constituted by the Ministry of Food and Agriculture, Government of India. It started functioning at Kochi on 29th April, 1957 under the Department of Agriculture of the then Ministry of Food and Agriculture with a small nucleus of staff for research work in fishing craft and gear. Other Divisions soon followed. The administrative control of the Institute was brought under the Indian Council of Agricultural Research on 01 October, 1967.

Vision

To facilitate sustainable harvesting and total utilization of fishery resources through innovations in harvest and post-harvest technologies.

Overview

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

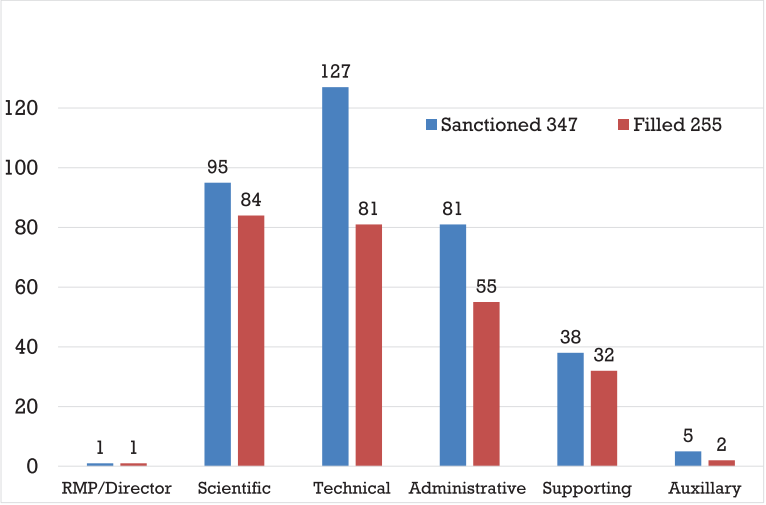
Mission

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.

Mandate

- Basic and strategic research in fishing and processing, bioactive compounds and food safety.
- Design and develop energy efficient fishing systems for responsible fishing and sustainable management.
- Development of implements and machinery for fishing and fish processing.
- Consultancy services, human resource development through skill development, training, education and extension.

STAFF POSITION

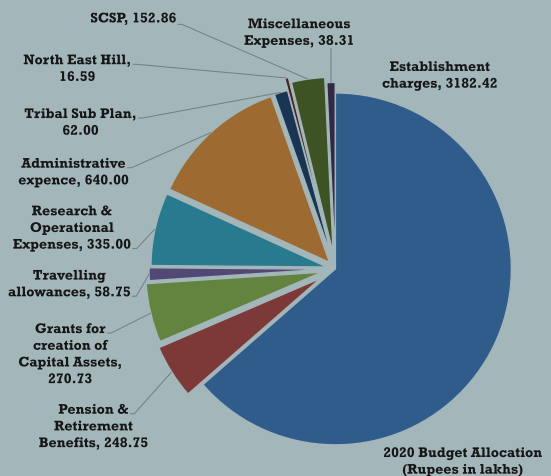


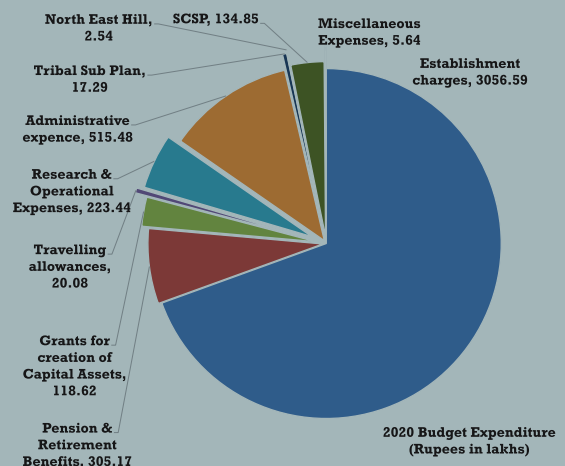
ICAR-CIFT has total staff strength of 347. Of the total staff, 27.4% are scientific personal, 36.6% technical, 23.3 % administrative, 11% supporting staff and the rest auxiliary staff. Of the sanctioned positions in different categories, 88% of the scientific, 64% of the technical, 68% of the administrative, 84% of supporting and 40% of the auxiliary staff are in position.

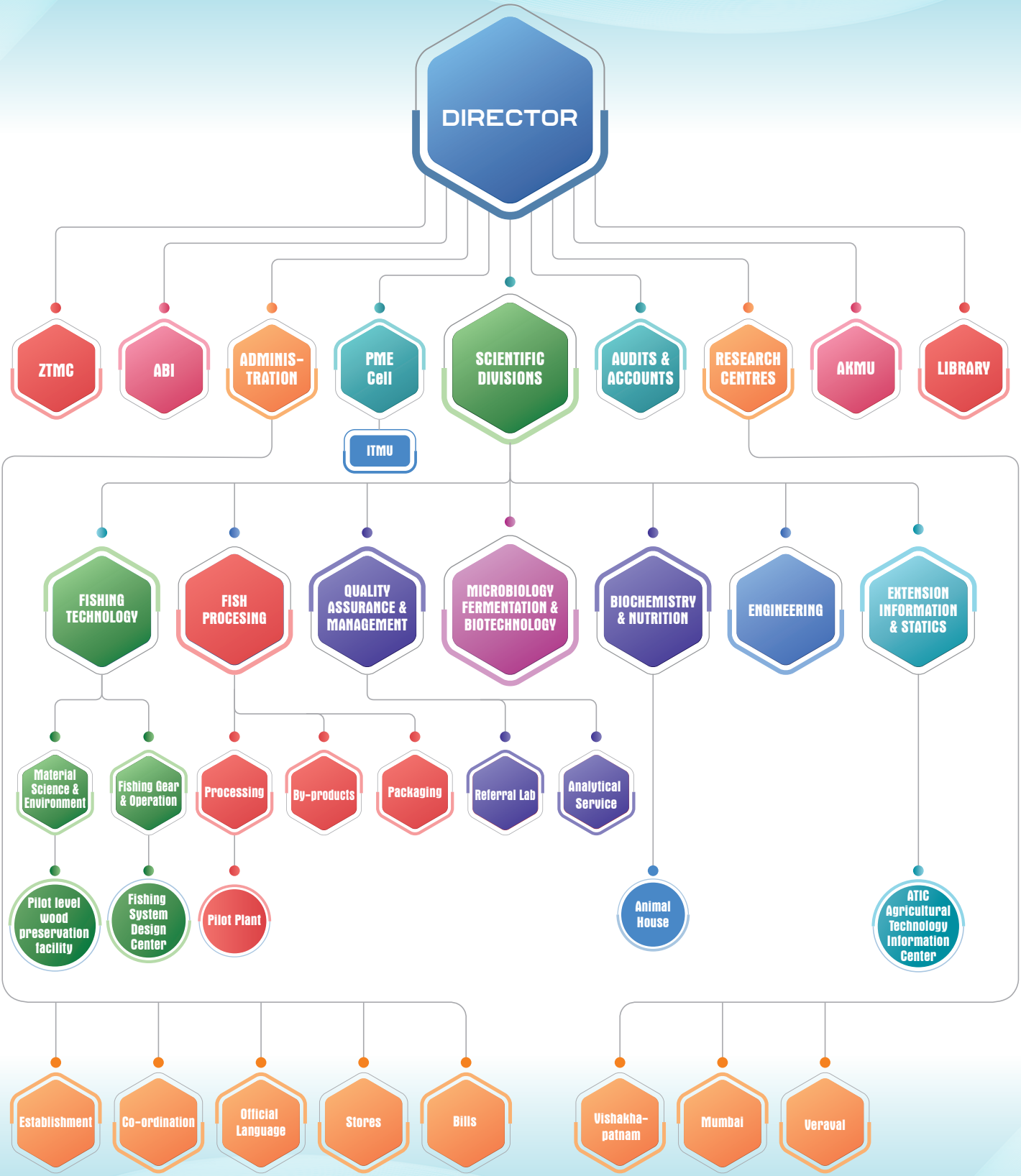
BUDGET

Budget Allocation and Expenditure (Rupees in lakhs)
(For the year 2020)

Allocation	Expenditure
5005.41	4399.71






DIRECTOR
ZTMC
ABI
ADMINIS-TRATION
PME Cell
ITMU
SCIENTIFIC DIVISIONS
AUDITS & ACCOUNTS
RESEARCH CENTRES
AKMU
LIBRARY
FISHING TECHNOLOGY
FISH PROCESING
QUALITY ASSURANCE & MANAGEMENT
MICROBIOLOGY FERMENTATION & BIOTECHNOLOGY
BIOCHEMISTRY & NUTRITION
ENGINEERING
EXTENSION INFORMATION & STATICS
Material Science & Environment
Fishing Gear & Operation
Processing
By-products
Packaging
Referral Lab
Analytical Service
Pilot level wood preservation facility
Fishing System Design Center
Pilot Plant
Animal House
ATIC Agricultural Technology Information Center
Establishment
Co-ordination
Official Language
Stores
Bills
Vishakha-patnam
Mumbai
Veraval

IMPORTANT PERSONALITIES VISITED

Honourable Vice President of India visited Visakhapatnam Centre of ICAR-CIFT

The Hon'ble Vice President of India, **Shri M. Venkaiah Naidu** visited Visakhapatnam Research Centre of ICAR-Central Institute of Fisheries Technology and Visakhapatnam Regional Centre of ICAR-Central Marine Fisheries Research Institute on 07.12.2020. The Honourable Vice President of India visited the ICAR-CIFT museum and interacted with the Scientists and staff of the centre. Dr. Raghu Prakash, Principal scientist, Scientist-in-Charge, Visakhapatnam Research Centre of CIFT explained the functioning and use of these devices for sustainable and responsible fishing. Shri.Muttamsetti Srinivasa Rao, Minister for Tourism, Culture and Youth advancement, Government of Andhra Pradesh was the guest of honor.

Dr. J K Jena, DDG (Fy. Sci.), ICAR, Delhi visited Visakhapatnam Centre of ICAR-CIFT

Dr. J. K. Jena, DDG (Fy. Sci.), ICAR, Delhi; Dr. Rajesh Bathia, FAO, Delhi; Mr. Rajesh Dubey, FAO, Delhi and Scientists from fisheries and veterinary ICAR institutes such as CMFRI, CIFE, Mumbai; NBFGR, Lucknow; CIFA, Bhubaneswar; CIFT, Kochi; NIVEDI, Bangalore; IVRI, Izatnagar and VTCC were visited ICAR-CIFT, Visakhapatnam Research Centre on 01.02.2020. DDG interacted with the scientists of the centre and had an exposure visit to the laboratories.

Shri. Paramjit Yadav, AD (OL), DARE, Delhi visited ICAR-CIFT, Visakhapatnam Research Centre on 21.02.2020 for inspection of official language implementation under official language rule 10(4). He has briefed the importance of official language implementation in the office to the staff.

OFFICIAL LANGUAGE AWARD

ICAR-Central Institute of Fisheries Technology, Cochin has been awarded the most prestigious Official Language Award of Department of Official Language, Ministry of Home Affairs, Government of India. Official Language Shield for the year 2018-19 as a first prize for excellent Implementation of OL policy in the Southwest Region of India will be awarded to ICAR-Central Institute of Fisheries Technology, Cochin. The Award distribution ceremony was postponed due to Coronavirus Pandemic.

RAJARSHI TANDON AWARD

ICAR-CIFT has bagged Rajarshi Tandon Award under Rajarshi Tandon Award Scheme for the year 2018-19 for the outstanding Official Language implementation in the Institute for the 8th time.

The award was bestowed during the 92nd Foundation Day of Indian Council of Agriculture Research by the Honourable Union Minister of Agriculture, Farmers Welfare Shri Narendra Singh Tomar by virtual platform in the presence of Union Minister of state for Agriculture and Farmers welfare and Panchayat Raj, Shri Parshottam Rupala and Shri Kailash Choudhary, Union Minister of state for Agriculture and Farmers welfare and also Dr. Trilochan Mohapatra, Secretary (DARE) & Director General, ICAR, New Delhi on 16 July 2020.

LOW-COST TECHNOLOGY TEAM AWARD

Low-cost technology award (Team award) instituted by AFST(I), Mysore, for renewable energy initiatives was awarded to Engineering Division The award was presented at 27th ICFoST Annual Conference at Tezpur University, Tezpur, Assam. **Dr. Manoj P. Samuel,** Principal Scientist and Head Engineering division ICAR-CIFT Cochin received the Award.

WOMEN IN ANALYTICAL SCIENCE AWARD, 2020

Smt. Laly S. J., Scientist, ICAR-CIFT received AOAC-India's "Women in Analytical Science" Award, 2020 at 7th Annual Conference of India Section of AOAC International at New Delhi from 28-29 February 2020

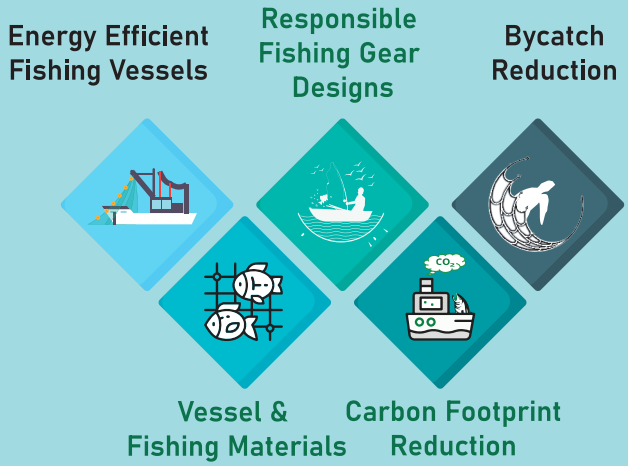
ALL INDIA BEST PH.D. AWARD

Dr. Parvathy U., Scientist, ICAR-CIFT received the Dr. C. V. Kulkarni All India Best Ph.D. Student Research Award (2019-2020) organized by ICAR-Central Institute of Fisheries Education, Mumbai.

Research Achievements


एफ.वि.सागर हरिता
F.V.SAGAR HARITA

Fishing Technology



The Fishing Technology Division activities are geared to promote the use and development of fishing gear and practices in accordance with the guidelines in the Code of Conduct for Responsible Fisheries. Activities and research programmes of the division are aimed at conducting research in the fields of fishing craft and gear materials, fishing gear technology, materials protection and pollution in coastal aquaculture environment, upgrade and maintain expertise within these fields and to disseminate proven technologies and expertise through publications, training and consultancy. The Fishing Technology Division strives to address the major issues facing the fishing industry today viz., development of boat designs for different fishery, long-term sustainability of the fishery resources, protection of biodiversity, environmental safety, energy conservation in fish harvesting, fishery legislation, by-catch, discards and protection of endangered species and fishery enhancement.

Research Projects Handled

Institute Projects

- Studies on fishing operations and energy use for formulation of guidelines for selected small scale marine fisheries of India
- Studies on fish behaviour as an input for developing responsible fishing systems
- Studies on resource and energy conservation in trawl systems
- Optimization of harvest and post-harvest techniques for Mesopelagic in south western Arabian sea
- Improved techniques for protection of materials in marine environment
- Development of region- and species-specific pots/traps
- Fishing technological interventions for sustainable marine ecosystem services along the East coast of India
- Technological interventions for improvement of fishing systems in selected inland water bodies of India

Most significant achievements

- Technical guidelines for the responsible beach seine fishing and gillnetting were drafted for selected small scale marine fisheries of India.
- Biochemical tests of the fishes after the trawling stress experiments were carried out and observed that the pyruvates and oxaloacetates were high in the muscle, gill and liver of fishes subjected to stress, when compared to the control fishes.
- Designed and fabricated prototypes of V-form double slotted otter boards of size 1500 mm x 900 mm with 120 kg each. Initial trials using the new V-form double slotted otter boards showed reduction in fuel consumption by approximately 2-3 liters/h of dragging compared to conventional V-form otter boards of almost same size.
- Nano carbon dots having 5 nm size were synthesized from Rohu fish scale and characterized using UV-Vis, Fluorescence spectroscopy, FTIR, AFM and TEM. Showed excellent fluorescence under UV light.
- Nano carbon dots synthesized from Jelly fish showed a spherical shape with diameter of about 50 nm with multiple layers and the distance between the layers was about 10 nm. FTIR spectroscopic results showed that the CDs are rich with C=O and C-O groups.
- Documented the structural & operational modifications in Chinese dipnets in Vembanad backwaters
- Among different copper-based biocides, Chromated Copper Boron (8%) treated coconut wood showed the maximum static bending strength (MoR) whereas 0.02% nano copper oxide along with polyaniline treated wood showed the minimum leaching of copper during the in-situ leaching experiment (AWPA E11).

- Surveys were conducted in the major landing centers in Kerala to study the impact of disposed and burned boat building FRP. The extend and quantity of disposal was assessed from the Kerala coast and found that majority of the abandoned fishing boats were FRP sheathed on plywood either traditional or motorized below 12 m LOA. In most of the landing centers specific disposal sites were identified (not a demarcated area but intensity was maximum). Intensity of disposal was marked in GIS map.
- ITKs related to jellyfish abundance along Gujarat coast collected from fishermen were validated using physico-chemical data available. High winds and lower productivity were positively correlated with jellyfish abundance.
- For the first time in India, Ghost fishing capacity of lost traps was assessed through deploying simulated fish traps at Enayam and Kanyakumari in Tamil Nadu. The lost traps continue to fish upto 54 days and the catching efficiency was reduced to 30% of the initial catch rate.
- Conducted awareness and demonstration programmes on CIFT- Turtle Excluder Device and CIFT collapsible fishing traps.

Chief findings

Study on fishing operations and energy use for formulation of guidelines for selected small scale marine fisheries of India

A review was made and published on the beach seine fishery of India which gives an overview of designs, catch composition, prospects, issues for the beach seine operations in India.

Technical guidelines for the responsible gillnetting in Kerala were drafted.

Line fishing including handline and troll line operated from Tuticorin and Cochin coast were observed. Handline operates hooks of size 5, 6 and 7 and troll line uses bigger hooks of size 3.5 and 4. According to fishermen, troll line fishing consumes fuel of 70-80 lit/trip whereas handlining consumes 100-120 lit fuel/trip due to distant voyaging and longer operational time.

Gillnetting of Gujarat was surveyed at Veraval and Jaleshwar fishing villages.

Optimised small-scale vessel designs by incorporating safety/ stability measures

- A longitudinal rod has to be fitted just below the chine line to protect fishermen during boat capsize.
- Sufficient number of life jackets (no of crews +1) with light & whistle are to be carried on board the vessel.
- The fishermen are advised to wear life jackets while fishing at deep sea.
- Two life buoys are to be fixed in the forward part of the boat and two at the aft area under the seat so that they can release these buoys immediately during an emergency.
- The forward compartment and space below the working deck and other spaces are to be made water tight so that the boat will have sufficient buoyancy and will float even in the capsized condition.

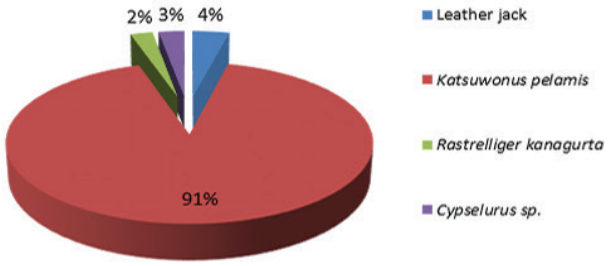
A study was conducted to estimate reduction in fuel consumption and carbon emission by motorized fishing boats off Alleppy, during nationwide lockdown due to COVID-19 pandemic. Due to the complete lock down in phase-I, hardly 10-15% of total fishing vessels were in operation that led to the reduction of fuel consumption as well as emission of CO_2. There was a reduction of fuel consumption in motorized vessels of Alleppy region about 19.2-20.1 lakh lit/month during the period. This corresponds to 45.12-47.25 lakh kg of CO_2 emission due to burning of reduced fuel.

Studies on fish behaviour as an input for developing responsible fishing systems

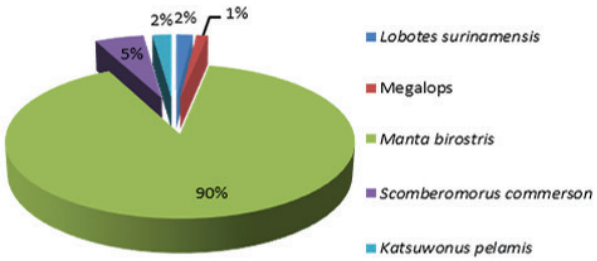
Trials to determine the mortality associated with simulated trawling was continued using Tilapia as a model in moving gantry system. Survival analysis using Kaplan-Meier curve showed the hazard ratio of 0.77, with a confidence interval of 0.14-4.21%.

Comparative field trials using baited and non-baited gillnets in the marine waters, showed high efficacy of baiting in gillnets with high catches in the baited portion of the fleet.

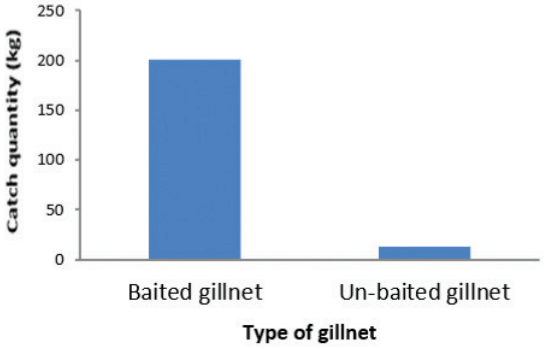
Species composition in non-baited gillnet

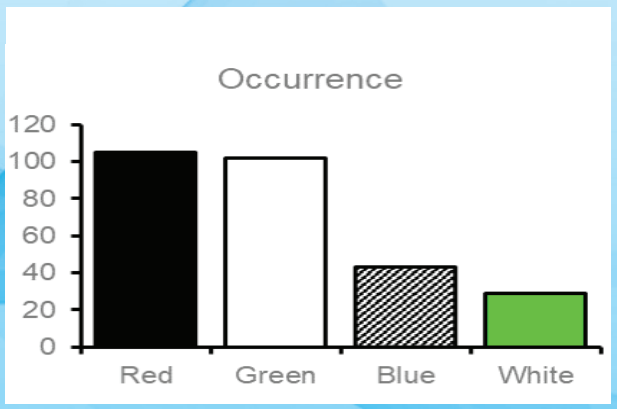


Species composition in baited gillnet



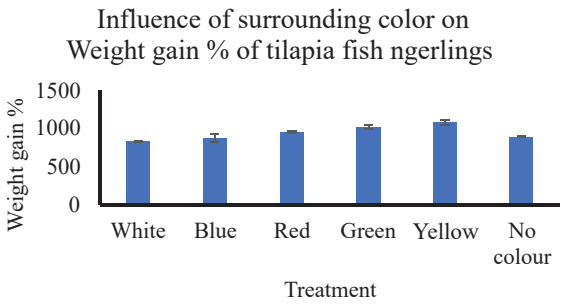
Catch in baited and unbaited gillnet

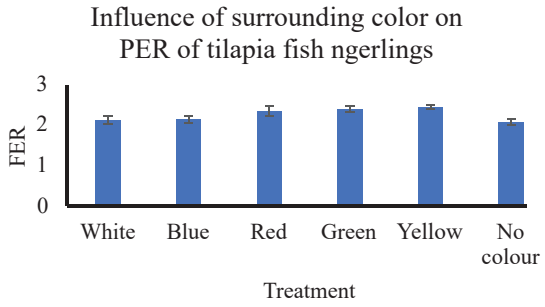


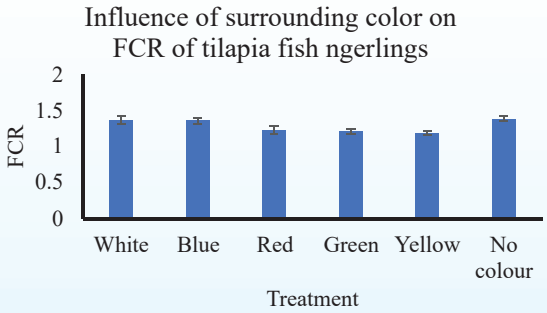


The behavioural response towards different colors of LED light (blue, red, green, & white) in *P. monodon*, was evaluated under controlled conditions in a Y-maze tank. The animal showed attraction response in a decreasing order from red> green> blue> white correspondingly.

Influence of surrounding colour on the growth performance of Tilapia fingerlings having an average weight of 1.18 ±0.2 g showed highest weight gain (%) with treatment group maintained in yellow backrow, followed by green and red colour.



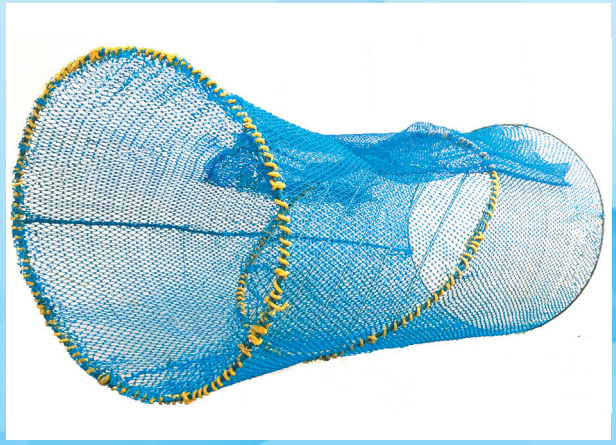




Studies on resource and energy conservation in trawl systems

Trials using the new V-form double slotted otter boards showed reduction in fuel consumption by approximately 2-3 liters/h of dragging compared to V-form otter boards.

Designed and fabricated prototypes of improved CIFT-TED for sea trials in association with NOAA, USA. Two grids 1100 x 900 mm & 1200 x 1000 mm with 132 mm bar space were prepared for shrimp trawls having head rope length up 35 m and above 35 m respectively.



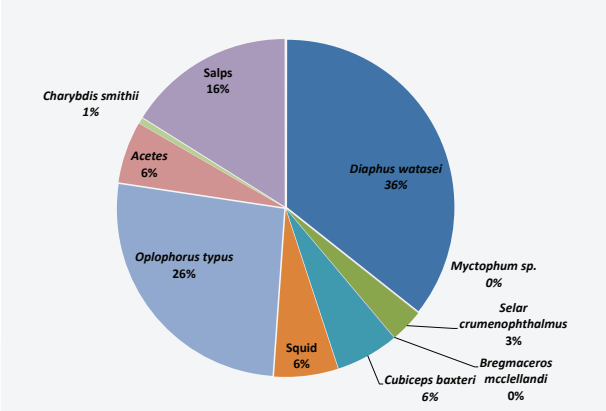
Jellyfish Excluder Device of 1000 mm x 800 mm with 50 mm deflector bar spacing was fabricated and initial trials revealed that about 72.0% jellyfish were excluded through the JED.

Decapterus russelli (Av. size 124 mm) and 30 kg of jellyfish. About 150 kg of juveniles of *D. russelli* (Av. size 109 mm, below MLS) could be excluded through the square mesh base panel.

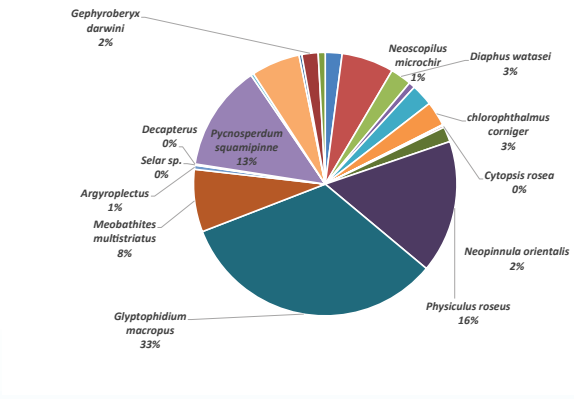
Single haul made with trawl fitted with square mesh trawl cod end with the innovative base panel (50 mm x 50 mm size, 20 mm bar size) retained approximately 300 kg, mainly

Optimization of harvest and post-harvest techniques for Mesopelagic in south western Arabian sea

Length–weight relationships were estimated for five bycatch fishes viz. *Astronesthes martensii, Glyptophidium macropus, Neobythites multistriatus, Physiculus roseus, Synagrops japonicus* from Kerala, south west coast of India. Fishes were collected from commercial trawlers operating at depth ranged from 270 m (Lat. 9°29.35'N, Long. 75°44.74' E) to 350 m (Lat. 9°26. 49' N, Long. 75°42.36' E) in the southwest Arabian Sea. Correlation coefficients (r^2) were found high for all species, with b value ranged from 2.923 to 3.404. The study gives first record LWRs for *A. martensii,* G. *macropus* and *N. multistriatus* from Indian waters.



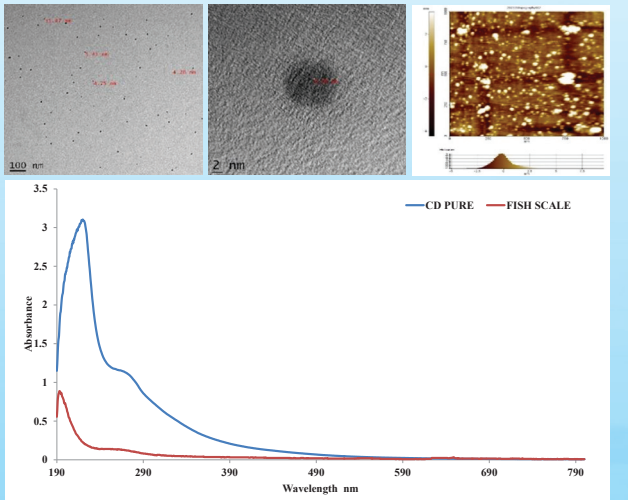
Catch composition in midwater trawl



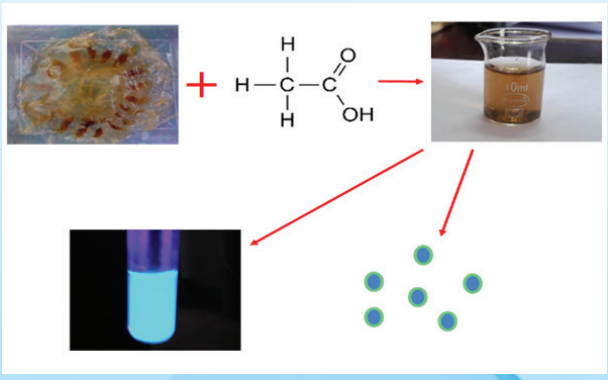
Catch composition in bottom trawl

Improved techniques for protection of materials in marine environment

Nano carbon dots having 5 nm size were synthesized from Rohu fish scale and characterized using UV-Vis, Fluorescence spectroscopy, FTIR, AFM and TEM. Which showed excellent fluorescence under UV light. Synthesized carbon nano dot: hydroxyapatite composite on FTIR analysis showed pi bonds of C=C and C=O of carbon dot interacted with PO_4 and -O-H of hydroxyapatite, probably through the hydrogen bonding (O-H-----O=C).



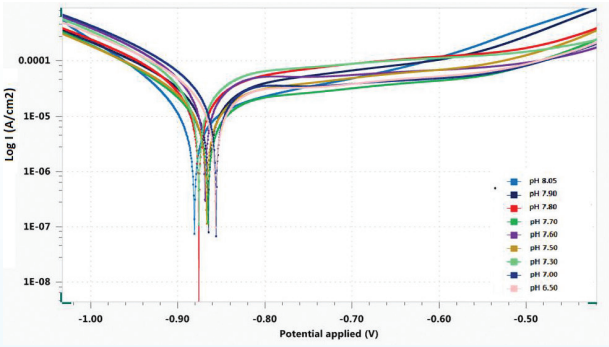
Jellyfish is a menace and its utilization to produce high value nano carbon dot was attempted. The morphological information was obtained by Atomic Force Microscopy (AFM), TEM and the results showed that CDs was in spherical shape with diameter of about 50 nm, multiple layers and the distance between the layers was about 10 nm. FTIR spectroscopic results showed that the CDs are rich with C=O and C-O groups.



Impact of ocean acidification on boat building steel (BIS 2062) were studied under laboratory environment. Severe degradation of steel occurred when the pH of seawater decreased from 8.05 to 7.90, thereby shifted the corrosion rate by 0.61 to 1.56 mm yr-1. Further decrease of pH aggravated the corrosion. Climate change is always attributed to the rise in temperature and emission of gases like CO_2, and the latter is largely responsible for

ocean acidification. This indicated the urgent need to evaluate the degradation pattern of marine materials.

Results of the electrochemical impedance spectroscopy corroborated the findings of linear polarization and also proved the formation of varied forms of FeOOH layers.



Tafel plots of steel at different pH

Atmospheric exposure studies of HDPE netting materials for 300 days exhibited significant reduction in strength, retaining only 46.93% and 31.28% of initial break load and extension at break respectively.

Aini wood was exposed under different saline environment. The percentage increase of MoR of wood in marine water was 24.5% where in case of fresh water the strength of the wood was gradually decreased for about 30%.

Molecular taxonomic studies of four species of biofoulers were done.

Nano copper oxide and titanium oxide treated aquaculture cage nets were prepared and exposed in the estuarine environment. Second month materials having better biofouling resistance.

Field evaluations of nano treated PE cage nets are under progress in coastal water bodies of Kerala (*Vizhinjam, Moothakunnam, Cherai*).

A survey was conducted to evaluate the intensity of disposal of FRP fishing boats from selected landing centres along the coast of Kerala. A sampling method was developed. During the study period most of the observed abandoned boats in the Kerala coast were plywood sheathed with FRP with a life span 7-10 years. From the selected study sites along Kerala, particular disposal sites for discarding fishing boats were identified. Microplastics from weathered FRP material was found from the soil collected from disposal sites.

Development of region and species specific pots/traps

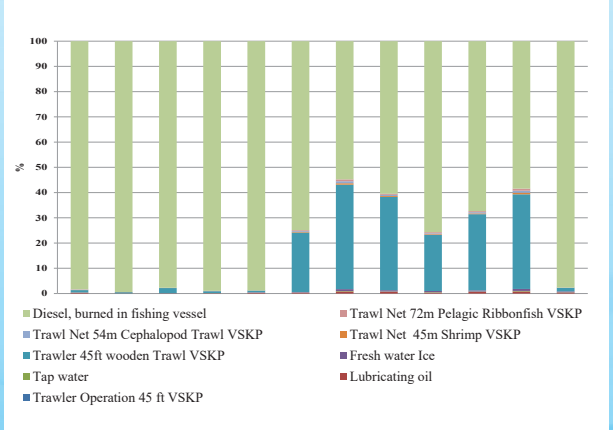
The results on the survey conducted on the trap designs of Kerala, Tamil Nadu, Goa, Maharashtra, Gujarat, Andhra Pradesh, West Bengal, Jharkhand, Odisha, North Eastern states were documented. Traps/pots are mainly operational in the inland sector of the country and well-organized marine traps fishery was observed from Tamil Nadu only. In estuaries traps are mainly operated for crabs. Traps are actively operated in the North Eastern states.

ICAR-CIFT collapsible fish trap, semi spherical trap, Minnow traps, fold and take trap, rectangular and conical crab trap, serially foldable horizontal and vertical traps were developed and tested.

To improve the efficiency of the traps, the collapsible traps were fabricated with modern materials like stainless steel, plastic webbings (funnel) and GI rods HDPE webbings.

Fishing technological interventions for sustainable marine ecosystem services along the East coast of India

LCA assessment of mechanized trawlers operating from Visakhapatnam fishing harbor was conducted. Total GWP of 45 ft trawler operation (for 10 days) was 12638.35. Total catch of 10 days operation was 4000. GWP/kg of Fish (Co_2 Equ.) was 3.16. 45ft Wooden Trawler emitted 3.16 kg of CO_2 equ. to produce 1 kg of fish (Catch). In subsystem 1, the environmental impact of material used for the construction procedure and the repair and maintenance of the vessel during its life time was assessed. Subsystem-2, in steel fishing vessel out of 10 environmental factors studied eight showed more than 74% contribution toward the construction material, steel and in wooden fishing vessel copper nails used for the hull construction contributed maximum to 98% of ADP elements. In the case of subsystem-2 fishing gear under materials used for construction, maintenance and repair were taken into consideration while assessing the contribution to environmental factors. In case of gear material HDPE material contributed maximum to all the environmental factors followed by Lead. In case of fishing operation coming under the subsystem-3, diesel contributed to about 75% to of all the environmental parameters.

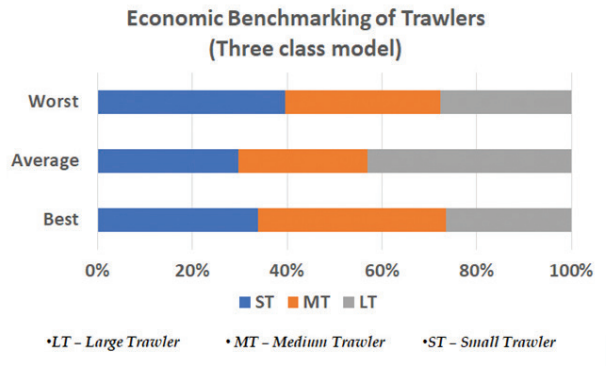


LCA analysis Method: CML 2001 (all impact categories) V2.05 / the Netherlands, 1997 / Characterization - Abiotic depletion, Acidification, Eutrophication, Global warming 100a, Ozone layer depletion steady state, Human toxicity infinite, Freshwater aquatic ecotox infinite, Marine aquatic ecotox. Infinite, Terrestial ecotoxicity infinite, Marine sediment ecotox infinite, Freshwater sediment ecotox. Infinite and Ionising radiation

Study on Structural changes in craft and Gears of Andhra Pradesh & Tamil Nadu - The study indicates drastic change in the structural and operational aspects of the fishing fleet in terms of size (LoA) and installed engine horsepower, depth of operation, duration of voyage etc among trawlers, long liners and gillnetters operating from Andhra Pradesh. The study also indicated a shift from single mode of fishing to combination systems with minor design modifications like Installation of gillnet winch, changes in fish hold design and capacity, to undertake trawling & gillnetting and trawling & long lining. The fleet size (LOA) of trawlers varied from 32– 42 feet and the depth of operation in trawling increased from 50 to 100 m. The engine horsepower in trawlers extended up to 280 hp. The over exploitation of both engine and fuel was observed among small trawlers. The medium trawlers utilized most of the inputs at most and reached the level of over exploitation.

Economic evaluation of fishing systems - Among the operational costs of trawlers, fuel contributed maximum (54%) followed by crew (23%). The optimum level of trawlers viz., technical optimum (TOL) and economic optimum (EOL) of the trawlers for the small, medium and large trawlers showed that medium trawlers gained comparatively high with 28% more revenue than other two vessel categories. Economic benchmarking of trawlers in Andhra Pradesh was calculated for

the small, medium and large trawlers categories using the three class model (Best-Average-Worst classes). The two variables viz., inputs use (IU) and cost effectiveness (CE) were selected for the benchmarking analysis. The trawlers were classified into Best (B), Average (A) and Worst (W) using the tertile values. Among the trawlers studied around 41%, 48% and 32% of vessels in the small, medium and large trawlers were found best. The economic bench marking was derived for both number of vessels and various vessel categories.

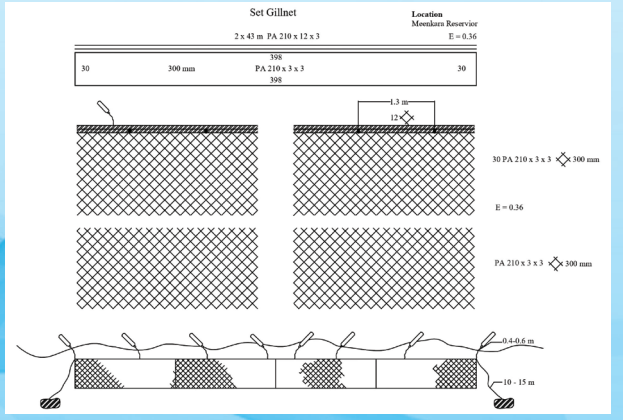


Technological interventions for improvement of fishing systems in selected inland water bodies of India

The existing designs and technical details of fishing systems from selected reservoirs in Kerala and Andhra Pradesh were documented.

In Meenkara reservoir (Kerala), FRP coracle (Parasal) and surface/column set monofilament gillnets (120 &150 mm) were used as common gear without foot rope and sinkers. Floats used were plastic bottles (0.5 litre-1 litre).

In Singuru and Nizamsagar reservoir (Andhra Pradesh), coracle (Veduru putti) made of bamboo and thermocol rafts and mainly gillnets having mesh sizes varying from 40 to 137 mm with a mesh depth of 50-100 mm, were mostly used. Thermocoal pieces were used as floats and lead material (5-10g) were used as sinkers.



Typical design of 300 mm PA multifilament gillnet (Catla vala) in Meenkara reservoir, Kerala

The structural & operational modifications in Chinese dipnets (*Cheena vala*) in Vembanad backwaters of Kerala were documented, after preliminary surveys in five centres namely Kuzhupilly, Kadamakudi, Ezhikkara, Cheranellur and Koonammavu.

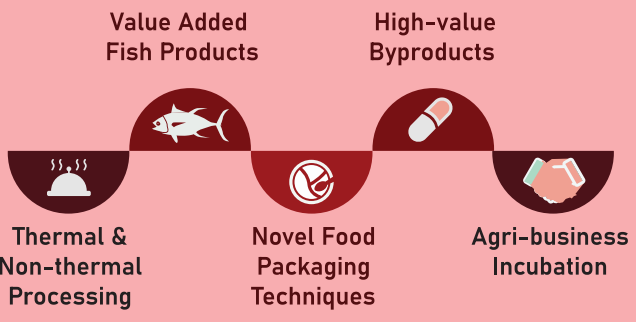
Wooden materials (coconut wood, teak wood, mast wood) were replaced with GI pipes for making various supporting structures for durability and to withstand strong winds and currents. Operational modifications were made by using refurbished bike engine with pulley system for lifting the nets, usage of white/ yellow coloured LED lights (9-90w) instead of kerosene lamps for fish attraction. Recent introduction is the capture-based cage culture nearer/below the cheenavala platform where small sized high values fishes captured in dipnets are transferred for culturing in cages (3.5m x 3.5m x 1.5m) and fed with trash fishes/shrimps.

An improved version of serially collapsible trap with 5 chambers was designed and fabricated to increase catching efficiency in inland fishery sectors. Serially foldable traps can be operated horizontally in shallow water bodies as well as

vertically in deeper water bodies. Each chamber is about 25 inches in length and 17 inches in height and covered with 25 mm nylon mesh netting. Frames are made from 12 mm PVC pipe joined with T shaped PVC. Mouth is funnel shaped having diameter of 7.8 inches and length of 8.6 inches. There are two mouths at each chamber alternately cut open and rigged into nylon webbing.

Serially collapsible trap with five chambers for operation in inland water bodies

Fish Processing



The scope of the Fish Processing division is to promote the utilisation of fishery resources keeping in mind the responsible utilisation of harvested resources in order to provide maximum protein to the population and to minimise the wastage. The major focus is on diversification of products for the export market, value addition and product development for economic utilization of low value fishes and discards, processed fishery products for the domestic consumers at economic prices, modifications in traditional fish processing methods to ensure better returns, identification of novel packaging materials and development of containers and methods for fishery products, utilization of fishery wastes as raw materials for the production of useful value added products, better methods for the utilization of deep sea and cultured fishes, improved methods for the transportation of fish and fishery products including live fish and development of suitable feeds for aquaculture.

Research Projects Handled

Institute Projects

- Interventions in processing and preservation of commercial and unconventional fishery resources
- Biodegradable packaging materials for fish and fishery products
- Technological interventions for enhancing utilization of secondary raw materials of aquatic origin
- Development of active and intelligent packaging system for fish & shellfishes
- Development of processing protocols for emerging farmed fishery resources
- Development and validation of biomedical and cosmetic products from secondary fishery raw materials
- Development of Soft Computing Systems in fisheries technology for technology dissemination and policy formulation.
- Enhancing the properties of paper-based packaging material by incorporating poly hydroxyalkanoates (PHA) from fish waste
- Process development and scaling up of production of different molecular weight chitosan with different degree of de-acetylation and evaluation of their applications
- Development of seaweed based edible and functional sachet for food packaging applications.
- Specific technological problems and mitigation measures in fish and fishery products of Maharashtra region.
- Assessment of fish harvest and post-harvest technological aspects and mitigation measures for problems with special reference to Maharashtra.
- Augmenting value and safety of wild and farmed fish of East Coast through technological approaches.
- Safety and quality aspects of fish and fishery product from Gujarat coast.

Most significant achievements

- A non-destructive and cost-effective web-based system (FISHQCheQ) was designed and developed to assess the quality of fresh fish.
- Polylactic acid (PLA) /chitosan biodegradable and antimicrobial film with ginger essential oil extract was effective in extending the shelf life of chilled stored seer fish steaks.
- A modified method with D optimal response surface design for optimizing the NaOH and HCl content, for chitin production was formulated. Quadratic model was fitted to the quality parameters viz: yield, ash and moisture content.

- An upscalable method for synthesis of gold nanorods (AuNRs) at room temperature was developed.
- A prototype of live fish transport container was developed with chilled salt water cooling system and aeration facility.
- Standardised a process for the co-synthesis of hydroxyapatite and nanocarbon dots from fish scale
- A customized database on fish import to India was developed in MS ACCESS and estimated trend and growth rate of fish import to India.
- Developed technology for production of Polyhydroxyalkanoates (PHA) using fish waste as substrate.
- A method was developed for the preparation of very low viscosity chitosan (< 2 cP).
- Edible film based on gelatin, chitosan, ZnO nanoparticle and essential oil exhibited good antimicrobial activity against Salmonella and *Staphylococcus aureus*.
- Identified presence of microplastics in edible and gastrointestinal tissues of Asiatic hard clam (*Meretrix meretrix*) and Bombay duck (*Harpadon nehereus*)
- Identified the presence of parasitic marine copepods in gills and eye of marine fishes in Mumbai region
- Developed a functional sachet from seaweed spp. and evaluated its functional and physicochemical properties.
- Developed a technology for low salt dried fish product. Brining with a combination of salt and sugar could reduce the salt content by 4-5% in the dried fish.
- Antibiotic resistance genes (ARGs) namely *tet*B and *tet*D genes for tetracycline resistance, CTX-MGp1 gene for beta-lactam resistance, aacA-aphd gene for aminoglycoside resistance and dfrA-Sul1 gene for sulfonamide resistance were detected in *E. coli* isolated from farmed freshwater fish.
- Standardised the technology for enzymatic enzyme assisted peeling of shrimp. A combination of endo and exo protease (1:1) resulted in the best peeling of shrimp after 30 min exposure to enzyme.

Chief findings

Interventions in processing and preservation of commercial and unconventional fishery resources

Optimized the process conditions for air fried fish balls as 200°C (temperature) and 8 minutes duration for the desired condition of the product. The air-fried fish balls showed 81% reduction in fat content and 17% increase in protein content compared to deep fried control sample with almost same overall acceptability score.

A non-destructive and cost-effective web-based system (FISHQCheQ) was designed and developed to assess the quality of fresh fish. The developed system was validated with real time data of Indian oil sardine.

Standardized the protocols for ready to eat tuna mushroom soup and pasta product in retortable pouches.

Process protocols were modified for the development of ready to fry products viz., shrimp

wafers & crackers and the quality characteristics of the developed products were evaluated.

The dried squilla protein concentrate produced in the laboratory showed very good solubility and can be used as a flavouring agent in food formulations such as soup, sauce or extruded products.

Squilla protein powder incorporated noodles

Retortable pouch processed pasta in prawn white sauce

Biodegradable Packaging Materials for Fish and Fishery Products

A coating of 15% PLA dissolved in dichloromethane was found optimum for increasing the moisture barrier properties of kraft paper.

Polylactic acid (PLA) coated bagasse trays with stretch film overwrap compared well with HDPE trays for storage of chilled fish.

Microencapsulated fish protein hydrolysate powder with combination of chitosan and clove oil extended shelf life of PD shrimps compared to control during chilled storage.

PLA/chitosan biodegradable and antimicrobial film with added ginger (*Zingiber officinale*) essential oil was effective in extending the shelf life of chilled stored seer fish steaks.

Antimicrobial films were developed by solvent casting polylactic acid with nutmeg essential oil.

Sodium alginate (1.5% aqueous solution) blended in starch (5% aqueous) was found to be the optimum concentration for casting films.

The overall acceptability scores for protein edible films indicated that spring rolls made up of fish protein wrappers at 2% protein level as optimum.

Sodium alginate films incorporated with dried Moringa (*Moringa oleifera*) leaf powder showed stronger ABTS (3.1 2,2'-Azino-bis (3-Ethylbenzothiazoline-6-Sulfonic Acid) activity and had significantly higher reducing power than the films incorporated with its extract.

The chito-oligosacharride incorporated chitosan-gelatin film exhibited higher antioxidant activity than COS incorporated chitosan gelatin HNT films.

Migration in PLA films were found below the generic overall migration limit of 60 mg/kg food (10 mg/dm^2) of Regulation EU 10/2011 in the case of 50% ethyl alcohol (worst stimulant).

Non-targeted screening of biodegradable paper cups, collected from domestic market, for migration of any added additives and fillers, was negligible.

Technological Interventions for Enhancing Utilization of Secondary Raw Materials of Aquatic Origin

The effect of using prawn waste derived plant growth booster incorporated coir pith matrix for the cultivation of microgreens viz. green gram, groundnut and mustard was assessed in terms of physical and anatomical features. The treated plants had low germination period, fast growth rate and high chlorophyll index as compared to conventionally grown plants.

Various feed formulations were developed for different fish species by incorporating fish waste and prawn shell extract as major source of protein.

Fractionation of cuttlefish skin protein hydrolysates using ultrafiltration membranes with three different molecular weight cut off membranes was tried. The hydrolysates fraction above 10 kDa had gelling properties while heat mediated enzyme inactivation process led to release of larger proteins through thermal denaturation of collagen to gelatin.

Shelf-life evaluation of optimized fish protein hydrolysate in selected food formulations revealed that health mix incorporated with yellowfin tuna red meat hydrolysate had storage stability up to six months.

Screening of natural antioxidant from plant and fruit sources indicated that fish oil emulsion prepared with pomegranate extract had better shelf life.

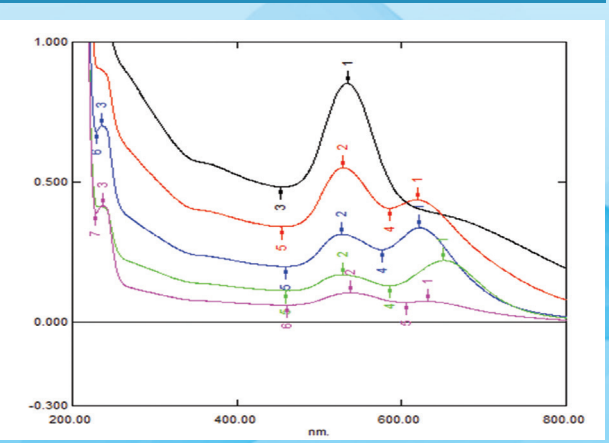
Fish oil emulsion loaded microbeads were prepared using chitosan (2-3%) / sodium alginates (2-3%) as wall material in two phase of homogenization viz., fish oil and water with Tween 20 and by ultrasonication. Studies on different quality parameters were conducted on weekly basis.

The oil extracted from Dolphinfish was encapsulated using maltodextrin & chitosan and the quality characteristics like encapsulation efficiency, optical microscopy, DSC, viscosity and FTIR profile were evaluated.

Efficacy evaluation of chitosan for waste water treatment had shown that chitosan with varying DA is able to reduce the heavy metal contents in water.

Development of Active and Intelligent Packaging System for Fish & Shellfishes

Gold nanorods (AuNRs) were synthesized using seed mediated method at room temperature and characterized. Position of plasmon resonance peak varied from 628 nm to 660 nm for different concentration of auric chloride used. The AuNRs synthesized showed a mean particle size of 30 – 35 nm with zeta potential of 81.6 to 85 mV. As the temperature is reduced, particle size decreased reaching a lowest value of 22.5 nm at 50°C. Whereas it was reverse as the temperature increased, and mean particle size of 38.6 nm was observed at 65°C.

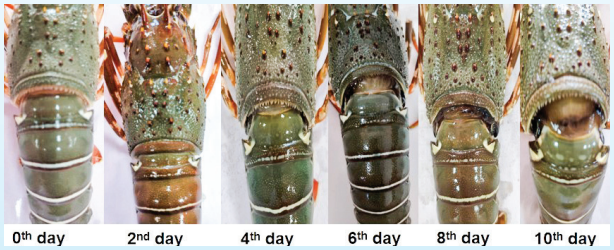


Gold nanoparticles prepared with 0.2% chitosan were frozen to -18°C and exposed to 5°C, 17°C, 21°C and 28°C to simulate the frozen temperature abuse. The frozen AuNPs were exposed to varying temperature for 0 to 102 hours. Monitoring of colour and physico-chemical properties showed distinguishable colour change at 28°C on exposure for 30hr which indicates the ability of the nanoparticle composite to show temperature fluctuation from frozen temperature.

Quality of Dolphin fish (*Coryphaena hippurus*) packed under air, vacuum packs were compared with the active packed samples at chilled conditions. Samples with active pack were acceptable up to 12 days compared to 10 and 6 days for vacuum packed and control air packed samples, respectively.

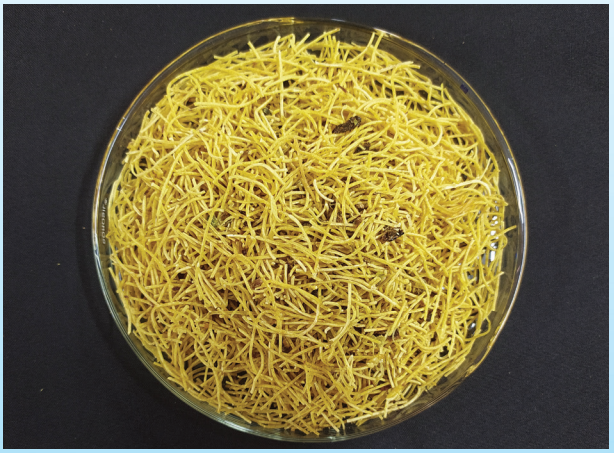
Development of processing protocols for emerging farmed fishery resources

Quality of chill stored cage reared lobster - Quality assessment of chill stored cage reared lobster (*Panulirus polyphagus*) demonstrated visible indices of spoilage in terms of melanosis, cephalothorax adhesion, shell loosening, meat colour and firmness. The study indicated a shelf life of 10-12 days for cage reared lobster under chilled storage.



Development of dried fish strips from Nile Tilapia - A process was standardized to develop dried fish strips from Nile Tilapia. Marination was done using salt-sugar mixture overnight and the strips were dried to a moisture content of 20-23%. Protein content of dried strips varied from 48-50%. The unpleasant unique dried fish flavor was not detected on sensory evaluation.

Quality enhancement of instant fish fortified noodles with bio additives - The ratio of the ingredients and the prawn pulp were optimized based on the characteristic properties of instant noodles. The flavour ingredients were also added before extrusion. After cold extrusion, noodles were steamed and dried. Six samples of noodles were prepared and analysed for bulk density, cooking properties, water absorption capacity, texture, colour etc. and the results were found to be comparable with those of commercial noodles (Maggi and Nissin).



Quality characteristics of nano chitosan / clove essential oil incorporated fish product from Nile Tilapia - Restructured products were prepared from Nile tilapia mince in four different formulations by incorporating corn starch, chitosan and clove essential oil. The ingredients were mixed and kept under refrigerated condition

(4°C) for 30 min for even setting. It was moulded into required shape and steam cooked for 30 min. Then, the product was immediately cooled and packed in polypropylene pouches and stored in chilled condition (4°C). The antioxidant activity of clove essential oil revealed good DPPH. Biochemical, microbiological and sensory analysis of restructured products indicated lower PV and TBARS value for samples containing both chitosan and essential oil. Similar trend was also observed for total plate count, psychrophiles and pseudomonas count during storage.

Performance evaluation of live fish in the designed transportation prototype - A live fish transportation prototype with chilled salt water cooling system and aeration facility was designed. The live fish storage chamber was cooled by jacketed cooling system filled with ice: salt water in pre-defined ratio depending upon the species being transported. Studies conducted in rohu indicated a post survival of 75% upon 24 hours of transportation period in the designed system. Optimization studies are underway to ensure enhanced survival for other cultured species. Works are also under progress for refining the existing model to a more economical, feasible design with more efficient aeration and filtration facility.

Development and validation of biomedical and cosmetic products from secondary fishery raw materials

Cytotoxicity and scratch assay of melanin isolated from cuttlefish ink - The cytotoxic activity assay of insoluble melanin was done using ISO 10993 protocol, and the cell viability was assessed using MTT assay. Cytotoxicity evaluation indicated statistically significant differences in the cell metabolic activity of L929 cells culture for 24 h in the presence of melanin extracts in comparison with the control. Some degradation products were released which decreased the proliferation activity of L929 cells. Further analysis showed promotion of fibroblast proliferation by melanin but not much as compared to the control. Melanin acted as an antioxidant and induced the wound closure within 24 hours.

Co-synthesis of hydroxyapatite (HAP) and nanocarbon dots from fish scale - Hydroxyapatite synthesis from the residue of fish scale after carbon nanodots synthesis yielded a pure white carbon free HAP. UV-Vis, FTIR and XRD revealed that the HAP was nano sized (5-8 nm), type B carbonate free HAP with traces of type A carbonate in the crystal lattice. MTT assay result indicated hydroxyapatite addition activated cell proliferation.

Assessment of antibacterial properties of spray dried squid ink powder - Antimicrobial property of squid ink powder was evaluated against 4 food pathogenic bacteria (*L. monocytogenes, S. aureus, S. enteritidis and E. coli*). Clear inhibition zone after 24 h incubation at 37°C demonstrated susceptibility of both Gram-positive and Gram-negative bacteria towards different extracts of squid ink powder, in the order *L. monocytogenes* > *S. aureus* > *S. enteritidis* >*E.coli* (11 mm).

Assessment of Bioactive properties of cuttlefish ink - Cuttle fish (*Sepia pharaonis*) ink was characterized for its nutritional, physical as well as bioactive properties. A comparison of the whole ink with melanin free ink was done. Analysis of the

amino acid profile of the ink as well as its fractions indicated high proportion of glutamic acid, aspartic acid and alanine. The antioxidant study revealed the possibility of using it as a natural additive in food.

Isolation and identification of Chlorella Spp for bio-fermentation - Water samples from fish farms were collected for the isolation of Chlorella species. Samples were serially diluted and streaked on to a modified BG 11 medium (Constituted medium). *Chlorella sp.* was identified by microscopic observation and morphology in BG 11 medium. The effect of pH on the growth of algae was studied at different pH (5, 6, 7, 8, 9, 10) Growth conditions were optimized by providing light and dark with little shaking at 30^{o}C in a shaking incubator.

Hazard profiling of liquid effluents generated in the pilot production lines of collagen peptide from Indian major carp scales - Liquid effluents generated during collagen peptide preparation was subjected to trace metal profiling. Aluminium, Calcium, Sodium, phosphorus, strontium, Zinc etc were present more in effluents generated after acid tenderisation. However, arsenic, berilium, bismuth, cadmium, cobalt, galium, mercury, lithium antimony and tin could not be detected in the effluents tested. Chemical Oxygen Demand and total dissolved solids were more which is cause of concern.

Development of Soft Computing Systems in fisheries technology for technology dissemination and policy formulation

A customized database on fish import to India has been developed in MS ACCESS - A customized database on fish import to India in terms of quantity and price under different harmonized system (HS) code has been designed and developed in Microsoft Office Access (MS Access) to provide a customized fish import data to the user. The database design comprises of creating various database objects such as tables, queries, forms and reports; these objects are intended to store data, write search queries for retrieving data, add, edit or delete data records from the table and to generate compiled and formatted data outputs from the database.

Estimated trend and growth rate of fish import to India - The total fish import to India increased linearly at a rate of 1656 tonnes in terms of quantity during the study period. India had imported 3231 tonnes of fish and fishery products worth US $ 4.6 Million in 2000, which increased to 39525 tonnes worth US $ 112 Million in 2019. Asian countries like Bangladesh, Thailand, Indonesia, Singapore, Malaysia, Vietnam, China, Oman and UAE were the major countries importing fish and fishery products to India under different HS codes. The countries like UK, USA, Norway, Japan and Canada also contributed significantly to the total fish import to India.

Enhancing the properties of paper-based packaging material by incorporating Poly hydroxyalkanoates (PHA) from fish waste

Isolation of PHA producing bacteria and optimisation of conditions for PHA production.

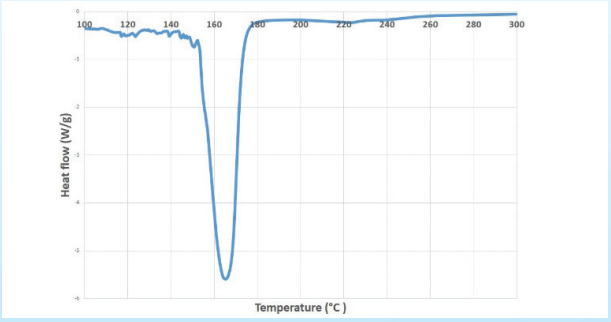
Selective plating methods were performed for pooled samples (paddy field, oil berth, fish markets) located in the Ernakulam, Kerala.

A total of 35 isolates including those showed positive result were subjected to PCR screening technique and nine strains were isolated as highest PHA producers.

The utilisation of fish waste in both dried and autoclaved form were studied. The mixed microbial culture using dried fish waste was found to be effective as substrate for microbial PHA production than other sterilised forms.

The PHA production using fish waste was optimised using box behnken design. The candidate species was *Bacillus sp.* and jaggery was used as supplementary carbon source. Temperature, time and quantity of jaggery were the parameters studied.

Temperature was found to be the significant factor affecting PHA production. The maximum PHA production was 0.686 g/l and the optimised parameters were obtained.



Differential scanning calorimetric image of extracted PHA

Precipitated PHA extracted using chloroform

Process development and scaling up of production of different molecular weight chitosan with different degree of de-acetylation and evaluation of their applications

Viscosities from different commercial suppliers with the claim of molecular weight categories of chitosan (low, medium, and high) widely differs.

Chitosan nitrogen to total nitrogen ratio of chitosan preparations doesn't have any pattern in relation to molecular weight classification

Thermal processing can be used to tailor the molecular weight of chitosan.

Different processes for the production of chitosan with different molecular weight and viscosity have been developed. Process developed could able to produce the chitosan with the DDA of 76, 81-83, and 92% having viscosities of 30, 132, 190 and 722 cP.

High degree of deacetylation resulted in low viscosities

Further research will be directed towards producing various viscosities chitosan without affecting the degree of deacetylation.

DDA-82%

DDA-83%

DDA-76%

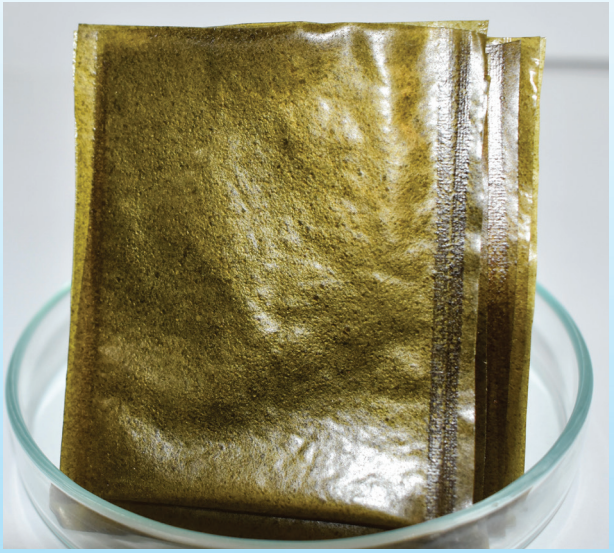
DDA-81%

DDA-91%

Development of seaweed based edible and functional sachet for food packaging applications

Seaweed based edible and functional sachet- Edible sachets were developed using *Ulva sp.* (0.5%, 0.75% and 1% w/v) and *Kappaphycus alvarezii* (1% w/v). The edible seaweed-based sachet was characterized with respect to antioxidant activities, physicochemical properties such as pH, water activity, thickness, solubility, colour, sealing property and sensory acceptance as well as storage stability.

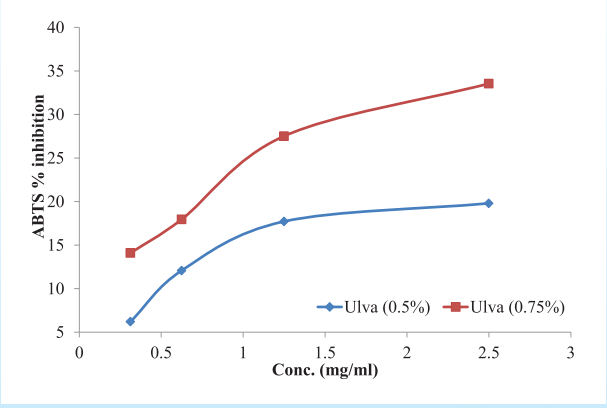
Edible seaweed sachet from Kappaphycus alvarezii

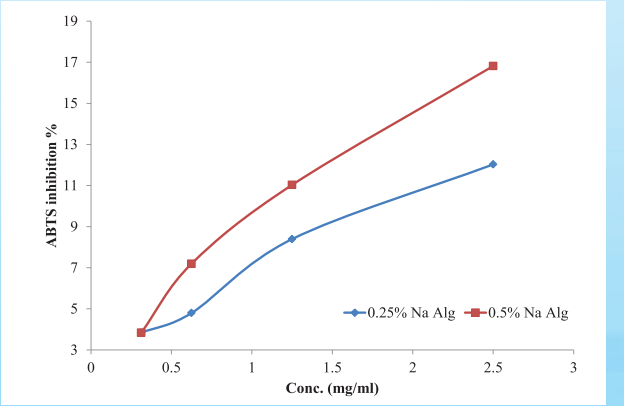


Edible seaweed sachet from Ulva sp.

Antioxidant properties of seaweed based edible sachet - Antioxidant activities of sachet prepared from different concentrations of *Ulva sp.* (0.5% and 0.75%) and *K. alvarezii* (1%) were evaluated. Total phenolic content of sachet was 138. 53 and 154.42 µg Eqvt. of gallic acid/mg, respectively for

sachet prepared from 0.5% and 0.75% of *Ulva sp.* Whereas, total phenolic content for the sachet prepared from *K. alvarezii* (1%) using 0.25% Na Alg and 0.5% Na Alg was 108. 26 and 116.57 µg Eqvt. of gallic acid/mg, respectively. ABTS free radical scavenging activity of sachet prepared from 0.75% *Ulva sp.* was higher than that of sachet prepared from 0.5% Ulva sp. Reducing power also followed the same trend. ABTS scavenging percentage and reducing power of the sachet increased with increasing concentration of Ulva sp. While, the sachet prepared from 1% *K. alvarezii* didn't show major difference in the ABTS scavenging and reducing activities. However, both the activities were low to that of the sachet prepared from *Ulva sp.*





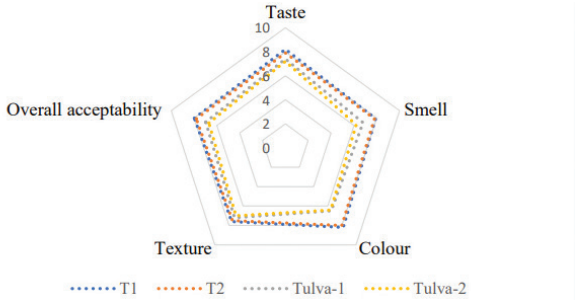
ABTS scavenging activity of sachet prepared from Ulva sp. and Kappaphycus alverazii

Physicochemical properties of seaweed sachet - The thickness of the seaweed sachet ranged from 610 to 720 gauge. The edible seaweed sachet had lower a_w in the range of 0.401 to 0.556 and lowest a_w was found in the edible sachet from 0.75% *Ulva sp.* (0.401). L*, a* and b* colour values differed significantly among the edible seaweed sachet prepared from *Ulva sp.* and *K. alvarezii*. Edible sachet with (0.5% and 0.75%) *Ulva sp*. had lower L* value (24.23 and 21.56, respectively) and a* (0.39 and 0.92, respectively) as compared with the Kappaphycus sachet. Sachet developed from *K. alvarezii* need high temperature to heat seal the sachet. The highest heat seal properties were exhibited by 0.75% Ulva film.

Solubility of seaweed based edible sachet - Solubility of seaweed based edible sachet were estimated at different temperature. The results showed that edible sachet prepared from *K. alvarezii* dissolved completely in distilled water and also need lesser time as compared to sachet prepared from *Ulva sp.* Edible seaweed sachet made from *K. alvarezii* completely dissolved within 50 to 60 sec at 90°C temperature, while edible seaweed sachet made from *Ulva sp.* required higher duration (1:20 to 4 min) to dissolve. In addition, edible sachet from *Ulva sp.* did not dissolve completely at 70°C, 90°C and 100°C.

Sensory evaluation of seaweed based edible sachet - The sensory analysis of edible seaweed based edible films was conducted by untrained sensory panel using 9 hedonic scales. The edible sachet prepared from 1% *K. alvarezii* scored higher sensory attributes in terms of taste, smell, colour and overall acceptability than the edible sachet developed from 0.5% and 0.75% *Ulva sp.* In case of sachet made from *Ulva sp.*, the sensory attribute of smell and colour scored the lowest values due to the presence of slightly seaweed smell and chlorophyll content which give green colour to the edible sachet. Colorimetric score of colour of edible sachet from *Ulva sp.* also showed similar results.

The buying intention was estimated using a 5-point scale as per Rodríguez et al. (2020), as follows, 5: I would certainly consume it; 4: I would probably consume it; 3: I have doubts if I would consume it; 2: I would probably not consume it; 1: I would certainly not consume it. Results showed that Kappaphycus sachet scored 5, while Sachet from 0.5% - 0.75% Ulva scored 4.



Sensory score of seaweed based edible sachet

Specific technological problems and mitigation measures in fish and fishery products of Maharashtra region

Fish oil fortified Bombay duck fish soup powder and its characterization - Fish oil fortified Bombay duck soup powder was prepared and characterized for various parameters. pH of Bombay duck soup powder ranged between 5.16±0.02 to 5.24±0.00 with and without fortification with fish oil. Fat absorption capacity ranged between 0.89 to 1.10 g of fat/g and values of water absorption capacity were found to be in the range of 0.93 to 1.17 g of water/g of sample. However, emulsifying properties showed significant reduction on fortification with fish oil. Bombay duck soup powder with 1% of fish oil exhibited better overall acceptability scores.

Development of gelatin, chitosan, ZnO nanoparticle and essential oil based edible films and their characterization - Edible films with thyme, sage and clove essential oils exhibited antimicrobial activity of film against Salmonella and *Staphylococcus aureus*. Edible films prepared with addition of thyme essential oil exhibited higher antimicrobial activity among the different essential oils which exhibited inhibition zone of 21 and 22 mm against Salmonella and *S. aureus* respectively. DPPH free radical scavenging activity of films ranged between 29.51 to 37.59% and reducing power was high for sage and thyme essential oil incorporated films.

Evaluation of quality and safety of freshwater fish marketed in Mumbai region - Six samples of fresh water fish were collected from local and hypermarkets at Vashi. The quality Index (QI) score fall between 2 to 17 out of 30. Tilapia was sold in fresh condition whereas QIM score for rohu indicated quality loss. Moisture content and pH ranged between 75.61%±0.09 to 81.44%±0.03 and 6.51 to 7.1 respectively. TBA values were within acceptable limit. Ammonia and formaldehyde content tests using kits indicated fish were safe for consumption. Microbiological scores for TPC count were 5 log values indicating safety of fish for consumption.

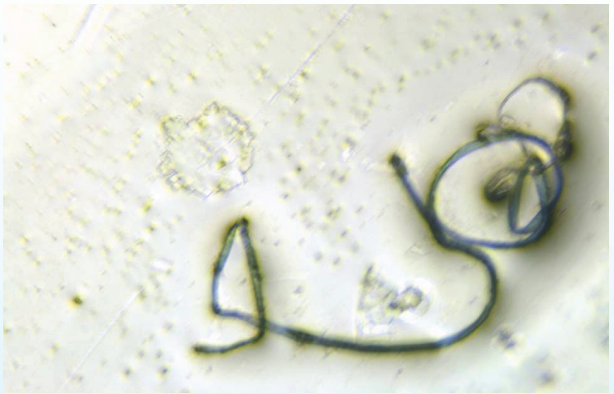
Quality and safety of shrimp marketed in Mumbai - Shrimp samples (26 Nos.) coming under 9 species marketed in domestic markets of Mumbai were analysed. In 12% of samples melanosis score was severe. As per QI score 19% of samples were very good, 54% are good and 12% was rejected. In 23 % of samples TVBN was found above 35 mg. TBA was within the acceptable limit in all the samples. Aerobic plate count reached 7 log CFU/g in 11.5% of samples and were spoiled. Coagulase positive staphylococcus was identified 7.7% of samples.

Screening of surimi based analogue products and RTE products for seafood authentication – Three fish products were collected from a mall at Navi Mumbai. DNA was extracted and amplified the mitochondrial gene Cytochrome c oxidase subunit I (COI) using the primers. Sequencing was carried out and compared with GenBank.

Name of fish product	Species identified
Tilapia fillet	*Oreochromis aureus*
Mackerel mashla	*Rastrelliger kanagurta*
Lobster bites	*Panulirus homarus*

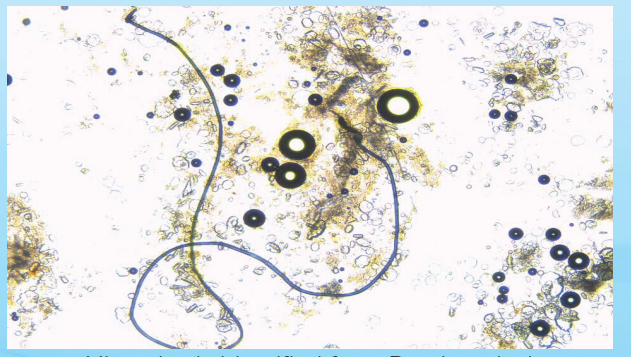
Assessment of fish harvest and post-harvest technological aspects and mitigation measures for problems with special reference to Maharashtra

Presence of microplastics in edible and gastrointestinal tissues of Asiatic hard clam (Meretrix meretrix) – Four samples of Asiatic hard clam were collected from domestic market of Navi Mumbai in fresh condition. Edible and gastrointestinal tissues were digested and examined using inverted microscope (Leica DMIL-LED with MC170 HD). Of the clams examined, 18 particles were observed in which 83.3% were found in gastrointestinal tissue and 16.7% in edible tissue. Particles with shapes of rod, fibre, irregular shape, curved and circular were identified.



Microplastic identified from Asiatic hard clam gastrointestinal tract

Presence of microplastics in edible and gastrointestinal tissues of Bombay duck (Harpadon nehereus): Nineteen samples of Bombay duck were collected from domestic market of Navi Mumbai. Edible and gastrointestinal tissues were digested and examined using inverted microscope. Out of the 46 number of microplastics observed in Bombay duck samples, 21.7% were present in the edible tissue and 78.3% in the gastrointestinal tissue. Particles include fibres, circular, coiled, curved rods, irregular shaped, other shaped, rod shaped and round.



Microplastic identified from Bombay duck gastrointestinal tract

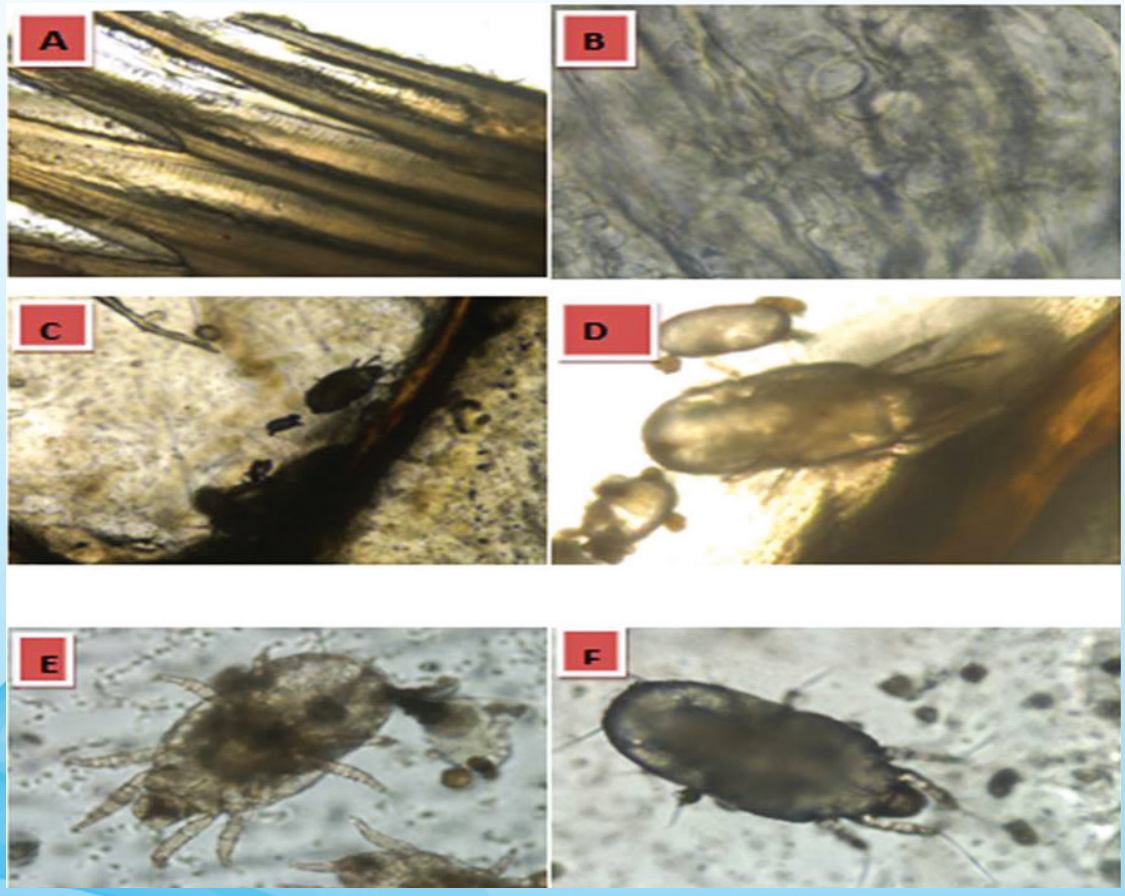
Heavy metal content in Bombay duck collected from retail market – Thirty four samples of fresh Bombay duck were collected from local market and evaluated for its heavy metal content. Arsenic content was detected in 5.9% of samples in the range of 0.56 to 1.2 ppm. Cadmium content was present in 94.1% of samples in the range of 0.07 to 0.21 ppm. Lead content was detected in 5.9% of samples (Avg. 0.36 ppm). Mercuric content was detected in one sample (2.9%) at an average value of 0.19 ppm.

Detection of formaldehyde in fish marketed in Mumbai – A total of 32 different species of fish and shellfish from freshwater, brackish water and marine habitat collected from various fish markets have been tested for formaldehyde using kits developed by ICAR-CIFT. Five species out of 32 showed the presence of formaldehyde.

Evaluation of industrial effluent water from seafood processing units for physicochemical, microbiological parameters and residual contaminants - Peeling shed waste from Sasoon dock, Mumbai was loaded in trucks for waste disposal. The drip water from vehicles is stagnating in the area and created foul smell. The drip water from trucks had a pH of 9.2. The dock yard water used for washing purpose showed a pH of 7.58.

Baseline survey for labour migration in seafood processing sector of Maharashtra - A tentative methodological framework and sampling plan for collecting data on labour migration was framed. Secondary data on details of seafood processing plants in Maharashtra was collected from MPEDA website to plan sampling framework. Also, information on pattern of workforce in a typical processing plant was collected from few key informants of the industries to decide sampling plan.

Identification and isolation of parasites in fish and fisheries product in Mumbai region - Fresh seafood samples of 20 numbers were collected including fishes and shrimp from retail markets and were screened for parasite. Liver, gills, kidney, gut, skin, eye were separated and observed under 10xobjective in microscope. Presence of marine copepod in gills and eyes of the marine fishes like mackerel was observed.

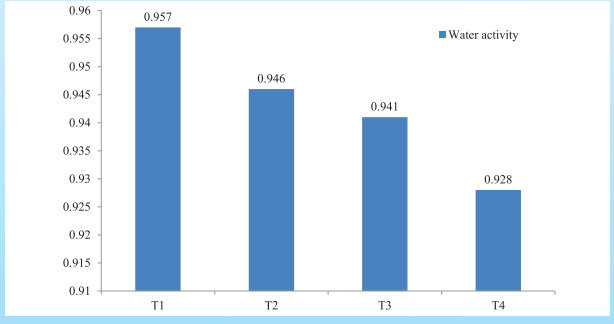


Presence of marine copepod in (A) Gill of mackerel (B) Shrimp muscle (C) Mackerel eye (D) mackerel gill rakers (E) Ventral view of marine copepod at 10X (F) Dorsal view of marine copepod.

Augmenting value and safety of wild and farmed fish of East Coast through technological approaches

Development of intermediate moisture fish products **-** Preliminary experiments were conducted to develop raw fish fillet with reduced moisture content and water activity. Skinless pompano fillets were treated with a mixture of sugar:salt in different combinations and marinated for 2 days under chilled conditions. Moisture content and a_w of fresh fish was 76.3% and 0.988, respectively. Moisture content of treated fillets varied from 64.45-72.68% and a_w varied from 0.903-0.963. A ratio of 2:1 sugar- salt in marinating mixture was found more acceptable after sensory evaluation. Synergistic effect of Sugar: salt treatment, glycerol and drying for 1 h on reducing a_w was also evaluated. Treatment with sugar salt mixture (20% w/w), glycerol treatment (3% w/w) followed by drying for 1 h after marination further reduced the water activity to 0.928.

Pompano fillet loins marinated with sugar:salt mixture and glycerol



T1- Fillet marinated with 20% (w/w) of Sugar-salt (2:1) mixture; T2- Fillet marinated with 20% (w/w) of Sugar-salt (2:1) mixture and dried for 1 h at 50°C; T3- Fillet marinated with 20% (w/w) of Sugar-salt (2:1) mixture and 3% glycerol; T4- Fillet marinated with 20% (w/w) of Sugar-salt (2:1) mixture and 3% glycerol and dried for 1 h at 50°C

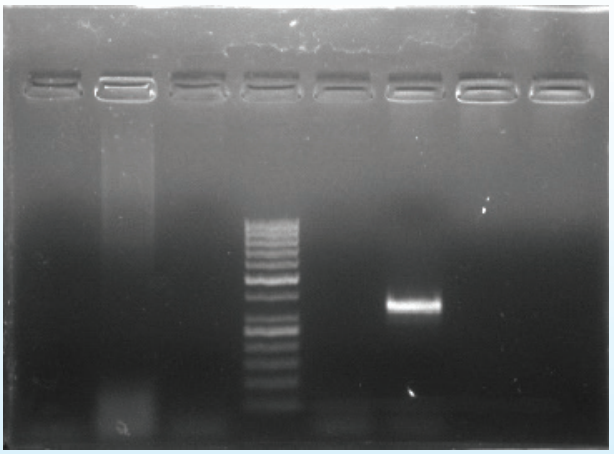
Development of low salt fish products **-** Low value fish, *Decapterus sp*. was dressed in butterfly style and brine salted with different concentration of salt and sugar and dried to nearly 30%. Moisture content and salt content of fresh fish were 75.83 and 1.45%, respectively. Moisture content of control sample (brined with 20% salt alone) was 61.78% after brine salting. Comparable moisture content was obtained in samples brined with 20% salt+5% salt (T1-59.05%), 20% salt+ 10% sugar (T2-57.7%) and 15% salt +10% sugar (T4-60.96%). Addition of sugar reduced salt content in dried products. Salt content of control fish was 17% and those of sugar added products varied from 10-14%. Water activity of the sugar salted fishes were (0.707 to 0.711) also comparable to those of control fish (0.713). This experiment indicated that salt content in dried fish can be reduced by adding sugar during brine salting process, which will not adversely affect the water activity of the dried fish. Storage study of the dried fishes to evaluate its quality and spoilage is under progress.

Treatments	Moisture after brine salting (%)	Moisture after drying (%)	Salt (% on wet weight basis)	Ash ((% on wet weight basis)
Control	61.78	28.56	17.38	20.84
T1	59.05	30.27	14.08	16.06
T2	57.7	31.58	13.18	16.37
T3	64.12	30.26	12.58	14.70

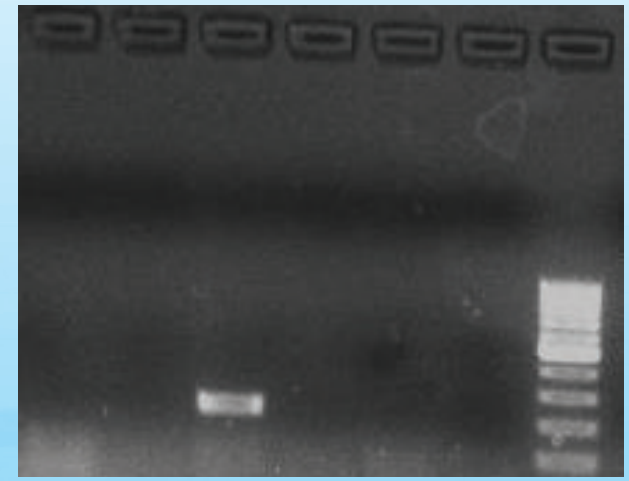
Moisture content of fresh fish : 75.83%; Salt content of fresh fish : 0.35%

Enzyme assisted peeling of white leg shrimp (Litopenaeus vannamei) - *Litopenaeus vannamei* shrimp (average length of 13.85±0.86 cm & weight of 21.7±1.25 g) were treated with proteolytic enzymes viz., endoprotease and exoprotease to felicitate the shell loosing prior to peeling. It was found that the proteolytic enzyme treatment effectively improved the peelability of the shrimp. A combination of endo and exo protease (1:1) resulted in the best peeling of shrimp followed by endo and exoprotease (1:2) after 30 min of enzyme maturation. However, shell became very soft after 45 min of enzyme maturation in all the treatments. It was also revealed that enzymatic maturation did not affect the texture, colour and organoleptic taste of the shrimp as compared to the control. Therefore, combination of endo and exo protease can be used to improve the shrimp peelability and assist in automated shrimp peeling.

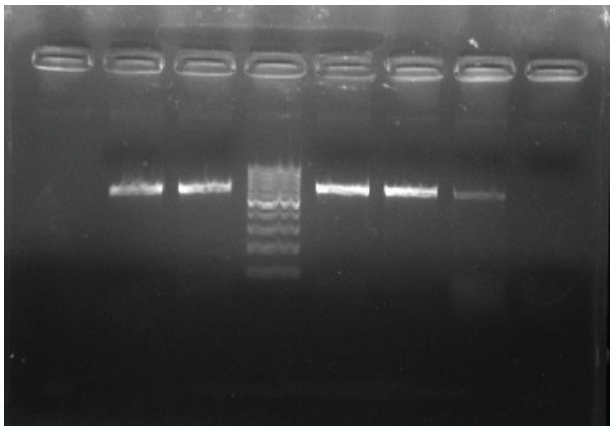
Screening of AMR genes in E. coli isolates from fish and shrimp from farms and markets of Andhra Pradesh - *E. coli* isolates (n=95) from freshwater fish (*Catla catla* and *Labeo rohita*) were identified using multiplex PCR targeting *lac*Y (289 bp), *cyd*(398 bp), *pho*A (468 bp), *lac*Z (517 bp) and *uid*A (603 bp) genes. All the 95 isolates showed amplification at specific region for 4 or more genes. Fifty four out of 95 E. *coli* isolates showing phenotypic resistance to one or more drugs were investigated using single PCR for the presence of antimicrobial resistance genes (tetracyclines, aminoglycosides, sulfonamides, fluroquinolones, phenicols and beta-lactams). Nine tetracycline resistant *E. coli* isolates were screened for the presence of eight tetracycline resistance genes namely *tet*B, *tet*C, *tet*D, *tet*G, *tet*K, *tet*L, *tet*M, *tet*S. One of the nine (11%) tetracycline resistant *E. coli* isolates carried *tet*B and *tet*D genes. However, all the isolates tested were negative for the presence of *tet*G, *tet*K, *tet*L, *tet*M, *tet*S genes. Among the beta-lactam resistant isolates, CTX-MGp1 gene was found in 5 of 24 tested (21%) isolates. The aminoglycoside resistance gene, *aac*A-*aph*D was found in 1 of 13 (7.7%) isolates; sulfonamide resistance gene, *dfr*A-Sul was detected in 1 of 11 (9%) isolates. None of the isolates carried antibiotic resistance genes coding for phenicols (*cat*A1, *cat*A2, *cat*A3, *cat*B3 gene) fluroquinolones (qnr gene), ESBL (CTX-MGp9, CTX-MGp9, CTX-Mg8/25, *bla*TEM, *bla*OXA and *bla*SHV), plasmid mediated ampC genes (ACC, FOX, MOX, DHA, CIT) and carbapenems (New Delhi metallo-β-lactamase 1; NDM-1 gene).



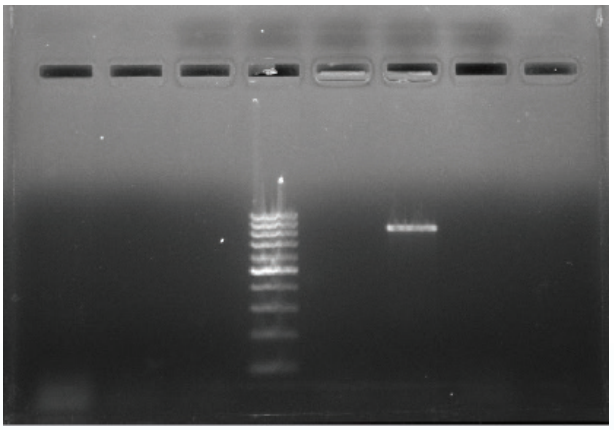
PCR amplification of tetDgene (356 bp) Lane 1: negative control, lane 2, 3, 5, 6: test isolates, lane 4:50 bp ladder



PCR amplification of aacA-aphdgene (227 bp) Lane 1: negative control, lane 2, 3, 4, 5, 6: test isolates, lane 7:100 bp ladder



PCR amplification of CTX-MGp1 gene (688 bp) Lane 1: negative control, lane 2, 3, 5, 6, 7: test isolates, lane 4:100 bp ladder



PCR amplification of sul1 gene (822 bp) Lane 1: negative control, lane 3, 4, 5: test isolates, lane 2:100 bp ladder

Safety and quality aspects of fish and fishery product from Gujarat coast

Biochemical and microbial quality assessment of ice used for fish preservation in Gujarat - A total of 100 samples including 52 ice samples, 13 water samples and 35 fish samples were collected from ice plant, landing centre and fish hold of Veraval fishing boats. Biochemical parameters such as pH, total hardness, Total alkalinity, total dissolved solids, iron and chloride of water and ice samples were carried out. The result showed that average values of total hardness, total alkalinity, and total dissolved solids and chloride was above the acceptable limit as per IS 10500:2012. Average microbial counts of water from ice plant (3.46 log cfu/g) and ice in ice plant (2.8 log cfu/g) and ice before crushing (4.27 log cfu/g), ice after cruising (4.67 log cfu/g) and ice from fish hold (5.9 log cfu/g). Total coliforms, faecal coliforms and *E. coli* was increasing significantly at various sampling points (water used for ice manufacturing, ice from ice plant, ice from local seafood carrier, ice after crushing, and ice from fish hold of boat after fishing.). Result also showed 97.29, 83.78 and 56.79% of samples total coliforms, faecal coliforms and *E. coli* was above the acceptable limit as per IS 10500:2012. *Listeria monocytogenes* was not found in water and ice samples.

Thirty-five samples including seven varieties of fishes were collected from the fish hold of boat and APC of fish was in the range of 3.5 to 5.74 log cfu/g. All the samples APC was within the limit. *E. coli* was detected in 11 samples out of 35 fishes. *Listeria* spp. was detected in 5% out of 100 samples collected (including ice and fish). Incidence of *Listeria* spp. was found in ice from fish hold, ribbon fish and threadfin bream and squid. *Listeria monocytogenes* (3%) was detected only in fish (ribbon fish, threadfin bream and squid) stored in fish hold.

Study on the marketing channels of ribbon fish preservation methods in Gujarat -Ribbon fish is generally processed as whole frozen, surimi, dried, and fish meal products. 90% of the catch is directly used for whole frozen processing. The wholesaler or commission agents are the middle men for ribbon fish marketing to the processor. Ribbon fish is the major finfish commodity in Veraval, Gujarat. In India, ribbon fish alone contributed 6% of total

marine fish catch and in Gujarat it was 52% of the total marine landing. The first stage of ribbon fish marketing is bulk landing in landing centres. The catch is handled by the wholesalers/suppliers in the landing centres. There are 150 commission agent / wholesalers / suppliers exclusively doing the ribbon fish marketing. The wholesaler who secures fairly large quantities of ribbon fish fix the price based on the size and quality of ribbon fish for seafood processing. The auction is carried out with the purchase person incharge of seafood factory via SMS. The ribbon fish weighed in landing centres are transported through chakkada to the seafood factory for further whole frozen or surimi processing. The wholesalers who secure fewer quantities auction the fishes for dry fish processing and fish meal processing.

Study on impact of COVID-19 on the export of ribbon fish to China - Survey was conducted to assess the impact of COVID-19 on the export of ribbon fish to China, the main market. During COVID-19, the export market of frozen fish was 62,685 MT for the period from April to September 2019, it has been increased to 84,224 MT in April to September 2020. Currently, ribbon fish catch has reduced drastically due to the COVID-19 and hence limited quantities were exported to china market. The local price of ribbon fish reduced 30% after COVID-19. The local export of ribbon fish increased for both dried ribbon fish and fish meal. The dried ribbon fish was mainly transported to West Bengal. The fish meal is transported to AP and TN.

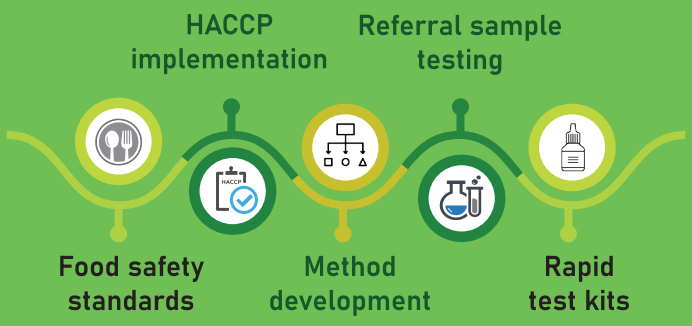
Prevalence of virulence genes in Salmonella spp. isolated from seafood - The prevalence of virulence genes associated with Salmonella Pathogenicity Islands (SPIs) in Salmonella isolated from seafood were *hil*A (SPI-1) (98.93%), *mar*T-SPI-3 (94.68%), *mgt*C (92.55%), *orf*L-SPI-4 (97.87%), *spi*C-SPI-2 (95.74), *ttr*C-SPI-2 (90.42%), *mis*L-SPI-3 (73.40%), *pip*D- SPI-5 (58.51%), Bacteriophage [*sod*C (30.85%) and *gog*B (27.65%)] and *sop*B (15.95%) indicating the high virulence potential of the strains.

Antibiotic susceptibility assay of Salmonella spp. from seafood - Antibiotic susceptibility of 94 Salmonella isolates determined by disc diffusion test against 14 antibiotics revealed 38 (40.42%) were resistant to at least one antibiotic. A total of 7.4% of the isolates were multidrug resistant.

Serotyping of Salmonella spp. isolated from seafood - Only 17 isolates out of 34 Salmonella isolates from seafood could be serotyped and belonged to *Salmonella typhimurium* (3), *Salmonella tennessee* (7), *Salmonella kentucky* (5) and *Salmonella weltevreden* (2) and rest of the isolates were untypable.

Quality Assurance and Management

Quality Assurance and Management division was the nucleus for starting the statutory pre-shipment inspection for the first time in the country. The Division has expertise in areas such as seafood quality assurance, evaluation of process water and ice, factory sanitation and hygiene, pest/insect control in seafood processing plants, modern quality management programmes such as EU regulations, HACCP, TQM, QMP, Codex/IS standards etc.



The division focuses on conducting research to evolve new and quick methods for evaluating microbial, chemical and organoleptic quality, to evolve new techniques of quality assurance for ensuring food safety and eating quality, to develop package of practices for good manufacturing practice, good sanitation and hygiene practice, good laboratory practice and good personnel policy for different types of food industries, to develop effective methods for disposal of liquid and solid wastes from food processing industries and to develop appropriate waste minimization technologies for seafood industries. (The division address the activities under the ISO 17025:2017 besides taking care of the activities of the National referral laboratory approved by the Food Safety Standards Authority of India.)

Research Projects Handled

Institute Projects

- Food safety hazards of fish and fishery products: Assessment and mitigation measures
- Enhancing utilization of rest raw materials of aquatic origin for feed, agricultural and industrial product development
- Ensuring safety of fish and fishery products: Framework for validating regulatory specifications

Most significant achievements

- Method was developed for estimation of FSSR approved artificial food colour additives (Indigotine, Ponceau 4R, Allura Red and Sunset Yellow) in fish and fishery products.
- Feeding experiments conducted in BV 280 breed of poultry with shrimp processing waste-based feed showed that the HU value of feed treated egg was 73.46 against the control value 71.09. Significant difference in Egg Weight was observed in the treatment lot.
- Commercially available brands of fish oil, both imported and domestically manufactured were evaluated for compliance as per Codex Standard (329-2017). More than 30% of samples did not comply with the quality and safety parameters stipulated in the standard.
- Natural level of formaldehyde in 124 species of commercially important finfish and shellfish were analyzed.
- Metal profile comprising of 18 elements of 240 species of commercially important finfish and shellfish varieties were conducted and the compiled data was submitted to FSSAI for formulation of standards.
- Gap analysis for method availability for all test parameters stipulated under FSSR for various categories of food products were compiled.
- Method developed for the determination of multiclass pesticide residues in fish and fish products.
- A method was developed for measuring total florfenicol residues in fish (as sum of florfenicol and its metabolites measured as florfenicol-amine) by AB Sciex QTRAP Mass Spectrometry.

Chief findings

Food safety hazards of fish and fishery products: Assessment and mitigation measures

Quality evaluation of Mahi Mahi (Coryphaena hippurus) Burger patties - The product had a shelf life of 24 days when stored at 2°C in different packaging materials. Polyester/polythene laminate films were superior compared to PLA/LDPE and PLA trays.

Storage stability of fish ham during chilled storage - The aerobic plate count of the samples

showed that the samples were of prime quality up to 20 days of storage but reached the permissible limit after 34 days storage.

Microbiological quality of fresh fish in domestic markets - Aerobic plate count of horse mackerel, shrimp and pomfret was found in the range of 4.11 to 5.94, 5.32 to 6.23 and 5.23 to 5.98 log cfu/g, respectively. *E. coli* was found in 11 out of total 15 samples collected. *S. aureus* was found in 9 samples. Other pathogens were absent.

Monitoring of marine biotoxins - Ciguatoxin was monitored in 14 frozen barracuda and red snapper and no samples were found to be positive.

Effect of pressure cooking on shrimp allergen, tropomyosin - Considerable reduction in immunoglobulin (IgE) activity in the shrimp extracts was observed in samples subjected to pressure cooking for 20 minutes. The tropomyosin band was observed to be absent in both SDS PAGE analysis and immunoblotting while in pressure cooking of peeled shrimps, the tropomyosin band was retained indicating the treatment dependent nature of antigenicity and also the stability in tissues.

Effect of non-thermal treatment along with pressure cooking on shrimp allergen, tropomyosin - The absence of tropomyosin band in the shrimp sample subjected to acetic acid treatment and pressure cooking is a clear indication of thorough reduction in allergenicity. Lack of immunoreactivity after acid treatment can be due to shift in the isoelectric point of allergic protein.

Evaluation of hygiene status in fisheries environments - The Mesophilic microbial concentration was found to be ranging from 3-5 log cfu/cm^2 in the fish contact surfaces of fishing vessel (boat), 1-4 log cfu/cm^2 in harbour and 3.01- 3.03 log cfu/cm^2 on contact surfaces of domestic head load fish venders. None of the contact surfaces showed the presence of enterotoxigenic Staphylococcus.

Prevalence of emerging microbial flora - Emerging pathogen of nosocomial origin *Enterococcus faecium* was detected in 6.6 % of samples of finfish sampled from Cochin region.

Methyl Mercury in predatory fishes - Content of methyl mercury was estimated in the major predatory marine fishes such as Sword Fish, *Xiphias gladius* (0.23-0.88 mg/Kg), Yellowfin Tuna, *Thunnus albacares* (0.12-0.54 mg/Kg), Skipjack Tuna, *Katsuwonus pelamis* (<0.1 ppm), Bullet Tuna, *Auxis rochei* (<0.05 mg/Kg) and Barracuda, *Sphyraena jello* (<0.05 ppm).

Isolation of novel histamine formers - Novel histamine formers such as *Granulicatella elegans, Kocuria rhizophila, Kocuria varians, Staphylococcus epidermidis, Klebsiella aerogenes* and *Acinetobacter baumannii* complex were isolated from fresh Indian Mackerel and Yellowfin Tuna.

Method development for antibiotic residues in fishery products as per FSSR Requirements - A multi-class, multi-residue method for determination of 24 antibiotic residues in fish and fishery products was developed in LC-MS/MS, validated and accredited as per ISO 17025.

Enhancing utilization of rest raw materials of aquatic origin for feed, agricultural and industrial application

Optimized the production of extruded floating fish feed from fresh fish market waste incorporated with other ingredients.

Optimized the extraction of peptides from anchovy head waste collected from processing industry by response surface methodology.

A machine was designed and fabricated for the production of shrimp shell extract and the performance is being evaluated.

Biochemical changes during ensilation of prawn shell protein extract for foliar spray was studied for a period of 30 days and changes in pH, TVBN, NPN and TBA were monitored.

The Cephalopod paste was prepared from byproducts and stabilized by using acids. The protein rich paste prepared was characterized for the proximate composition

Biogenic amine content of fish feed developed from fish waste was monitored by high performance liquid chromatography (HPLC) as per ISO 19343: 2017

Ensuring safety of fish and fishery products: Framework for validating regulatory specifications

Development of predictive model for acidified fishery products - Bacteria inactivation model was fitted to the prawn pickle data using SAS 9.3. The functional form of statistical model was: Yt =N0 - (0.434*((hours/a) **(1/b))) + et, where Yt is Salmonella, LM and EC counts respectively in prawn pickle, et is the error term, the parameters N0, a and b were estimated by Levenberg-Marquardt algorithm.

Quality and safety assessment of fish oil - Acid value of 20 different brands of fish oil available in online platforms in India varied from 0.31 to 1.6 and acidity/free fatty acid content varied between 0.16 to 0.80 (% oleic acid), when tested by ISO methods. Peroxide value, Anisidine Value, Vitamin A & D and antioxidant contents were also estimated.

Method development for authentication of cephalopods - New primers were designed for COX3 cytochrome c oxidase subunit III of *Uroteuthis duvaucelii* with amplicon Length: 419, *Sepia pharaonis* with amplicon Length: 262 and *Octopus vulgaris* (common octopus) with Amplicon Length: 198 using IDT primer tools. The endpoint PCR have been optimized with amplification temperature for squid and cuttlefish of 56°C and 50°C, respectively.

RT-PCR based Method development for Vibrio cholerae - Real time PCR assay was used for the qualitative and quantitative analysis of *Vibrio cholerae* using sybr green. The test determines the amplification rate of ompw gene (191 bp) used in the detection of *V. cholerae.* A new primer set was designed for identification of *Vibrio cholerae* with amplicon of 241 bp using digital PCR. The Accession: CP016324.1; GI: 1043202374 was used for designing. The length of primers was 18 bases with GC content of 50%.

Multi-residue method development for selected antibiotics in fish using LC-MS/MS - A multiresidue method was developed for the analysis of 12 antibiotics in fish as per FSSR listed tolerance limit. The compounds are Tetracycline, Oxytetracycline, Chlortetracycline, Sulfanilamide, Sulfadiazine, Flumequine, Albendazole, Albendazole-2-aminosulfone, Albendazole sulfoxide, Albendazole sulfone, Ampicillin, and Cloxacillin. Chromatographic separation was achieved using a gradient programme of 0.1% formic acid in water and 0.1% formic acid in methanol.

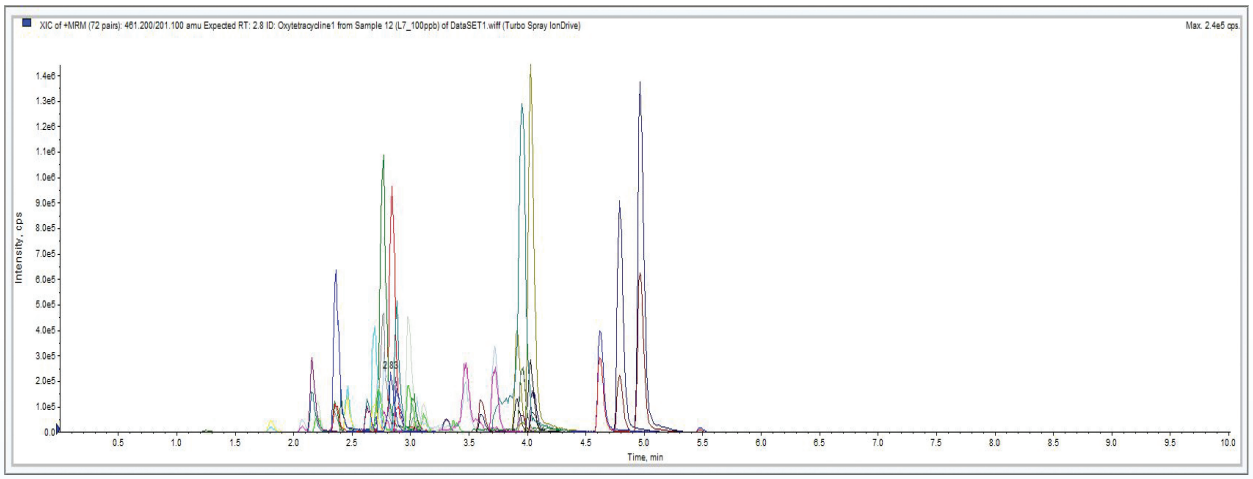


Fig. Extracted ion chromatogram of the selected antibiotics showing chromatographic separation and mass parameter optimization performance

The LOQ values ranged from 0.21 ppb to 2.59 ppb. Matrix based linearity with r^2 value of 0.999 was achieved for all the compounds. Decision limits (CCα), calculated for fish muscle and MRLs (Maximum Residual Levels) are presented in the following table:

Sl. No.	Antibiotics	MRL µg/kg	CC alpha (µg/kg)
1.	Flumequine	500	502.26
2.	TC	100	102.35
3.	CTC	100	102.44
4.	OTC	100	102.49
5.	Sulfanilamide	10	11.02
6.	Sulfadiazine	10	11.97
7.	ABZ	10	10.80
8.	ABZ Sulfoxide	10	11.43
9	ABZ Sulfone	10	11.50
10.	ABZ 2 Aminosulfone	10	11.01
11.	Cloxacillin	10	11.06
12.	Ampcillin	10	11.28

Quality and safety assessment of dried/salted & dried fishery products - Salt content above FSSR limit of 12% was found in Indian mackerel (16%) and in all the other samples it was below 12%. Acid insoluble Ash content of above FSSR limit of 1% was found in 37.5% of samples. Total plate count exceeded 5 log CFU/g in 56% of samples. Presence of yeast and mold was noticed in 25% of samples in the range of absent to 3.8 log CFU/g. Mold count above 4 log CFU/g was present in 75% of samples.

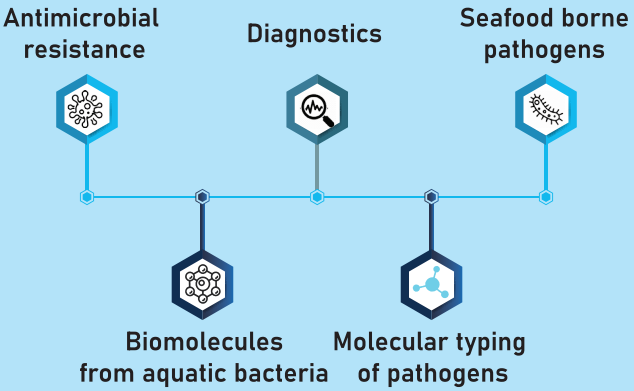
Screening of allergic proteins in Solenocera crassicornis (Coastal mud shrimp) and Meretrix meretrix (Asiatic hard clam) - Crude allergic protein extracts of coastal mud shrimp and Asiatic hard clam in raw and cooked form were prepared and subjected to SDS PAGE profiling. In case of raw extract of coastal mud shrimp, 7 protein bands of 100, 37, 45, 22, 18 KDa were visible. In case of cooked extract, number of protein bands were lesser than raw extract and which includes bands of 37, 25, 20 KDa. In case of raw extract of Asiatic hard clam, 11 protein bands in the range of 100 to 15 KDa were visible and mainly include 100, 55, 38 and 20 KDa. In case of cooked extract, number of protein bands was lesser than raw extract and which includes bands of 37 and 20 KDa.

Parameter	Ribbon Fish	Threadfin Bream	Lizard Fish
APC	3.51-5.3 log cfu/g Mean: 4.72±0.41 log cfu/g	3.86 - 5.74 log cfu/g Mean: 4.65±0.41 log cfu/g	4.2- 4.3 log cfu/g Mean: 4.26±0.03 log cfu/g
E. coli	2.81±0.03 log cfu/g	Nil	1.76±0.42 log cfu/g
Coagulase positive *Staphylococci*	Not detected/g	Not detected/g	1±0.5 log cfu/g
Salmonella	Not detected in 25g	Not detected in 25g	Not detected in 25g
Listeria monocytogenes	Not detected in 25g	Not detected in 25g	Not detected in 25g
Vibrio parahaemolyticus	Not detected in 25g	Not detected in 25g	Not detected in 25g
Vibrio cholerae	Not detected in 25g	Not detected in 25g	Not detected in 25g
Compliance as per FSSR	68%	100%	100%

Microbiological safety of chilled/frozen fish used for surimi processing in Veraval:

Method development for BHA and BHT determination in fish oil - HPLC based method was developed for determination of BHA/BHT in oils. For calibration and recovery studies, virgin coconut oil was used as matrix. The matrix-based calibration was found to have good linearity with r^2 value 0.997 for both BHA and BHT. The recovery for accuracy studies was found in the range of 83.69-112.88% and 80.31- 116.03% for BHA and BHT, respectively.

Microbiology, Fermentation and Biotechnology



Microbiology, fermentation and biotechnology division focuses its activities on monitoring the aquatic environment for human pathogen and for development of remedial measures. The division is entrusted to explore the marine microbial biota for isolation and identification of novel bioactive molecules and genes for industrial applications. Development of ideal preservative methods for enhanced shelf life of products of seafood origin is also an area of interest of the division.

The major interest areas of the division include, seafood-borne pathogens, ecology and their genomics, Development of antimicrobial resistance in aquatic bacteria, data mining on microbial changes during fish handling and processing, monitoring microbial pollution in aquaculture systems, Probiotic preperations for bio remediation prospects on marine biotechnology with reference to production of bioactive and antimicrobial substances, development of nucleic acid based methods for bacterial identification, toxin detection and taxonomy genomics and transcriptiomics of aquatic bacteria, phages of control of pathogenic bacteria in aquatic systems and seafood. Conduct of training courses on microbiological examination of seafood

Research Projects Handled

Institute Projects

- Occurrence, distribution and molecular characteristics of emerging and re-emerging pathogens in seafood and its environment
- Molecular diversity of pathogens associated with aquatic systems and harnessing aquatic niche for beneficial bacteria or products
- Development of colorimetric nano-biosensor strips for detection of food borne pathogens

Most significant achievements

- The most prevalent antibiotic resistance observed for *E. coli* from Vembanad Lake was for cefotaxime
- Heterotrophic bacterial isolates (N=2304) from shrimp aquaculture farms were resistant to oxytetracycline (22.1%), erythromycin (12.3%), co-trimoxazole (9.50%), ciprofloxacin (9.1%) and chloramphenicol (5.69%); alarmingly 6.9% isolates were multi-drug resistant
- The sensitivity of gold nanoparticle paper based calorimetric assay for detection of Salmonella from shrimp samples was 10^1 cfu/g
- *Listeria monocytogenes* was detected in fish collected from fish hold and the prevalence was 3%
- Documentation of different ribbon fish processing protocols in Gujarat was carried out.
- The prevalence of extended-spectrum beta-Lactamases producing *E. coli* and *Klebsiella pneumoniae* from aquaculture farms of Kerala was 24.3%.
- Predominance of CTX-M15 gene were found among the ESBL- producing *E. coli* in seafood from Assam
- Tilapia Lake Virus was detected in Tilapia fingerlings.
- A two-step microtiter plate method was developed to simultaneously check wide values of multiplicity of infection (MOIs) to determine the most suitable MOI of bacteriophage for inhibiting growth of target bacteria.

Chief findings

Occurrence, distribution and molecular characteristics of emerging and re-emerging pathogens in seafood and its environment

***Plesiomonas shigelloides* in aquaculture environments** – *P. shigelloides* was not detected in fish, water and mud samples from 15 aquaculture farms using biochemical reactions and PCR targeting *hug*A gene. Bioprofiling of 21 *Plesiomonas shigelloides* isolates with 19 sugar utilization tests revealed common pattern for 95% of isolates. The isolates did not produce protease, lipase, gelatinase, amylase, cellulase and DNAase.

Vibrio mimicus from fish and aquatic environment - *V. mimicus* was present in 4 out of 74 (5.5%) of seafood samples from fish farms and fish markets. All the isolates possessed *vmh* gene encoding *V. mimicus* hemolysin and showed β-hemolysis on sheep blood agar. Clove oil and ginger oil were found effective in inhibiting the growth of *V. mimicus*.

V. alginolyticus from seafood - A total of two out of 15 seafood samples were positive for *V. alginolyticus*. The isolates were negative for hemolysis, lecithinase, lipase and caseinase.

Pulsed Field Gel Electrophoresis typing of V. alginolyticus - PFGE was employed to determine its efficacy for characterizing *V. alginolyticus* strains. Twelve isolates of *V. alginolyticus* isolated from different seafood samples were grouped into two clusters based on the presence or absence of tlh gene following *NotI* restriction enzyme with high degree of genetic similarity (92%). PFGE typing successfully differentiated *tlh* positive *V. alginolyticus* from tlh negative *V. alginolyticus*.

Occurrence of Vibrio vulnificus in fish and aquatic environment - *V. vulnificus* was present in 3.7% of the 108 samples from aquaculture farms of Ernakulam, Kerala and all the isolates carried the hemolysin (*vvh*A) gene.

Isolation of Arcobacter spp. from fish and fishery environment - None of the 15 samples consisting of aquaculture farm sediment, water and animals harbored Arcobacter.

Antibiotic resistant bacteria from shrimp aquaculture farms - A total of 2304 heteroptrophic bacteria isolated from sixty shrimp (*P. vannamei*) farms from 192 samples of soil, water and shrimps located in four districts of Andhra Pradesh were screened for antibiotic sensitivity against five antibiotics. Maximum resistance was observed for Oxyteracycline (22.13%) followed by Erythromycin (12.28%), Co-trimoxazole (9.50%), Ciprofloxacin (9.07%) and Chloramphenicol (5.69%). A total of 160 bacterial isolates from shrimp samples were found to be multidrug resistant against the five antibiotics. Conventional biochemical tests and 16S rRNA sequences analysis revealed prevalence of *Bacillus* sp., *Microbacterium* sp., *Bhargavaea* sp., *Exiguobacterium* sp., *Vibrio* sp., *Halomonas* sp., *Tenacibaculum* sp., *Pseudoalteromonas* sp., *Escherichia coli, Pseudomonas* sp., *Burkholderia* sp., *Kocuria* sp., *Staphylococcus aureus, Salinicoccus* sp., *Brachybacterium* sp. and *Acinetobacter* sp. in shrimp culture environment.

Extended Spectrum Beta-Lactamase producing E. coli from seafood and aquatic environment - Out of the 250 seafood samples from aquatic environment tested, 52 samples were positive for ESBL producing *E. coli.* Three of the ESBL strains harbored CTX-M1, TEM and OX, while 18% had a combination of CTX-M1 with either TEM and or OX. The presence ESBL producing *E. coli* strains in the samples revealed the possibility of potential contamination either from the domestic sewage or hospital settings and / or animal.

Faecal indicator bacteria in Vembanad Lake of Kerala - The level of faecal indicator bacteria, faecal coliform and faecal streptococci, in Vembanad Lake (n=34) was highest in the Ernakulam region (425.6±155.05 MPN, 239.28±89.76 MPN) and lowest in Alappuzha (105.59±16.65 MPN; 60.25±11.85 MPN).

GUD and Indole negative E. coli isolates from Vembanad Lake - Out of 102 *E. coli* strains isolated from the Vembanad lake an confirmed by polymerase chain reaction (PCR) targeting the *uid*A gene, 6 isolates (5.88%) were indole negative (biotype II *E. coli*) with an IMViC test result of - + - - and 7 isolates (6.87%) were glucuronidase (GUD) negative. Hence PCR test should be used as a confirmatory test for detection of *E. coli* along with IMViC test or glucuronidase (GUD) production.

Congo red binding ability of E. coli - Sixty-seven isolates (65.7%) of a total of 102 *E. coli* were able bind to congo red indicating the possibility of higher level of pathogenic *E. coli* in the Vembanad Lake.

Molecular diversity of pathogens associated with aquatic system and harnessing aquatic niche for beneficial bacteria or products

V. cholerae in seafood - Out of the 42 seafood samples from brackish water farms, landing centres and fish markets of Cochin tested, 18 samples showed incidence of *V. cholerae*. Two of the *V. cholerae* isolates grouped into *V. cholerae* O1 possessed both El Tor and classical attributes but did not carry *ctx*B gene of either Classical or Eltor biotypes.

Diversity of Salmonella serotypes from seafood and aquatic environment - Antimicrobial susceptibility testing of *Salmonella paratyphi* B isolated from seafood revealed 12.8% of the isolates were resistant to cefotaxime and carried the *bla*TEM gene but were negative for *bla*SHV, *bla*CTXM-1 and *bla*CTXM-9 genes. Antimicrobial susceptibility testing of *Salmonella Typhimurium* isolates from seafood by disc diffusion assay revealed 58.7%, 50%, 47%, 4.3% and 4.3% resistance to azithromicin, gentamycin, ampicillin, ceftazidime and tetracycline respectively.

Pathogenicity of V. parahaemolyticus in animal model - The pathogenicity of *V. parahaemolyticus* isolated from retail markets of Cochin studied using ileal-loop method and by orogastric administration in the mouse model revealed fluid accumulation for the clinical isolate and 2 among the 4 retail market isolates tested by ileal loop method. Whereas, by the orogastric method there was no visible fluid accumulation. The histopathoglogical examination of intestinal tissues revealed inflammation and haemorrhage in mice administered with environmental isolates.

Vancomycin Resistant Enterococci (VRE) from seafood - None of the 84 isolates of Enterococcus from 50 seafood samples were Vancomycin Resistant.

AMR in E. coli from Vembanad Lake - Surveillance of Vembanad Lake for AMR *E. coli* revealed that all the 34 stations of the lake harboured *E. coli* and 37.2% of the *E. coli* were multidrug resistant. The highest resistance was recorded for Cefotaxime (53%) and 100% susceptibility was observed for Gentamicin.

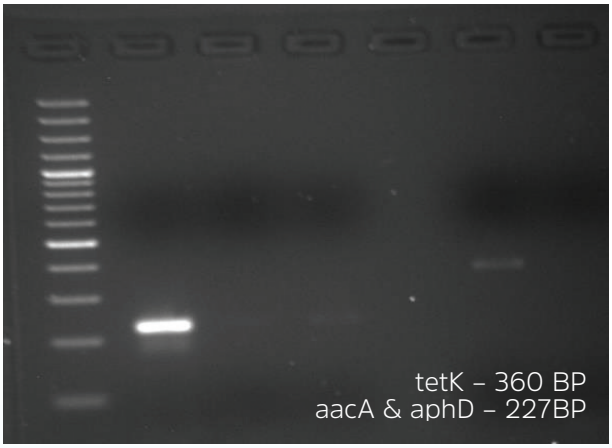
Molecular epidemiology of ESBL producing E. coli - Sequencing analysis of ESBL genes of *E. coli* isolated from Vembanad Lake identified *bla*TEM-116, *bla*CTX-M-27, *bla*CTX-M -55, *bla*CTX-M -152, *bla*CTX-M-205 and *bla*SHV-27 genes. Multi Locus Sequence Typing analysis of the selected ESBL *E. coli* identified ST11439 and new STs as a single or double locus variant of existing STs. Plasmid Based Replicon Typing revealed that Vembanad Lake *E. coli* carried Inc Plasmids viz., B/O, F, W, I1, FIIA, HI1, P-1α, K/B, and N.

Characterization of sulphur oxidising bacteria - Autotrophic sulphur oxidizing bacterial strains (*Halothiobacillus* sp. and *Thiomaonas* sp.) isolated from mangrove and freshwater fish farm were found to harbour *sox*B genes; component of the periplasmic thiosulfate-oxidizing Sox enzyme complex.

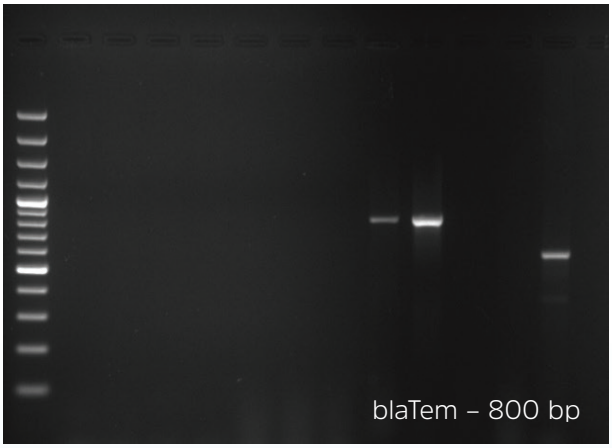
Antibacterial activity of chitosan hydrogel - Chitosan hydrogel was found to have antibacterial activity against *Bacillus* sp., MRSA, *Pseudomonas* sp., *Klebsiella pneumonia* and *Salmonella* sp.

Antibacterial activity of Zinc oxide nanoparticles against biofilm and non- biofilm producing E. coli - Zinc oxide nanoparticles (ZnO-NPs) and its bulk particles (ZnO-BP) when tested against biofilm and non-biofilm-producing *E. coli* revealed lower MIC and MBC values for ZnO-NP compared to ZnO-BP. No significant difference in activity was observed between the biofilm and non-biofilm producers.

PUFA and tyrosinase producing bacteria - A total of 27 PUFA producing isolates were isolated from sardine fish. Tyrosinase producing bacteria isolated from sediment and shrimp samples belonged to *Bacillus* sp. and *Pseudomonas* sp.



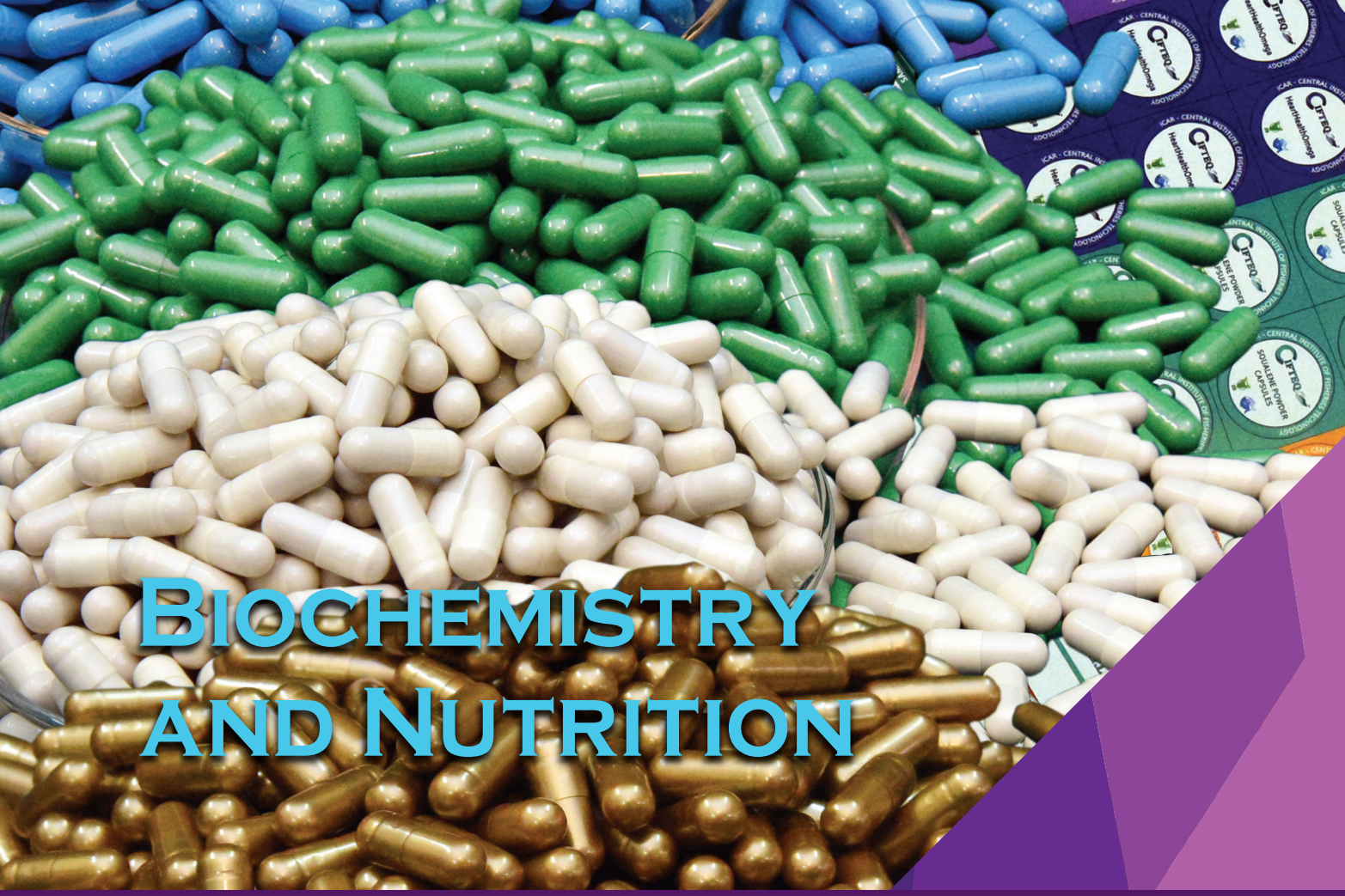
Detection of tetracycline and aminoglycoside resistance genes in Staphylococcus sp. from aquaculture farm



Detection of blaTem and blaCtxm resistance genes in E. coli from Vembanad

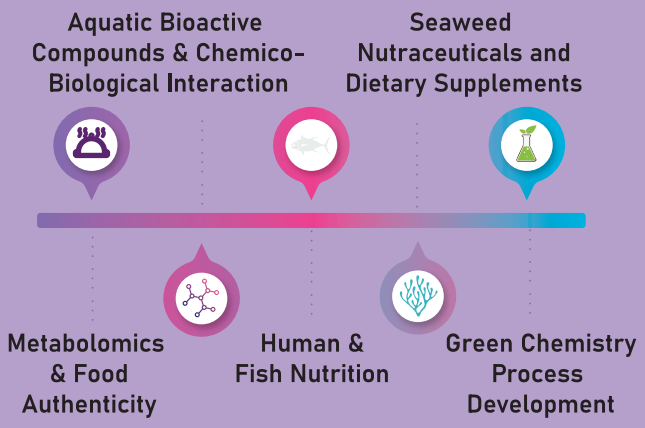
Development of colorimetric nano-biosensor strips for detection of food borne pathogens

Sensitivity and specificity of paper based colorimetric assay for detection of Salmonella - The detection limit of gold nanoparticle incorporated paper based calorimetric assay, based on C8-esterase for detection of Salmonella from shrimp samples was found to be 10^1 cfu/g after enrichment for 6 h. The paper strip method for detection of Salmonella was found to be highly specific by both colorimetric and paper strip method when tested with nine bacterial pathogens; E. coli O157:H7 (ATCC 43888), *E. coli* (ATCC 35218), *Edwardsiella tarda* (ATCC 15947), *Aeromonas hydrophila* (ATCC 35654), *Enterobacter cloacae* (ATCC 13047), *Pseudomonas aeruginosa* (ATCC 10145), *Staphylococcus aureus* (ATCC 43300), *Vibrio cholerae* (MTCC 3906), *Salmonella* paratyphii (ATCC 15305), *Salmonella* typhimurium (ATCC 14028), *Listeria monocytogenes* (ATCC 19115).



Biochemistry and Nutrition

The Biochemistry and Nutrition Division is aimed at solving various biochemical and nutritional problems associated with fish processing and preservation and providing basic information in this area to develop new technologies/products. Information on the biochemical constituents of fish is a primary input for the processing technologists the Division has been generating an exhaustive database on proteins, lipids, fatty acids, minerals etc. in fish and other commercially important aquatic organisms. These investigations have led to the development of technologies for the production of several products of biomedical applications. It is also imperative to ensure that our fisheries products do not contain toxic substances. The Division is keeping a constant watch on the levels of organochlorine pesticide residues, heavy metals, polyaromatic hydrocarbons, antibiotic residues, aflatoxins etc. in fish and fishery product.



The major areas of research from the division include nutrient profiling of fish and fishery products. extraction, characterization and establishing bioactivity of biomolecules from fish and fishery wastes, Seaweed- as a source of nutraceuticals, Contaminant profiling of fish and fishery products, Development of nutraceutical and functional foods of marine origin, Nutrient profiling of deep sea fishes including myctophids, Heavy metal profiling of marine fishes, Characterization and bioactivity studies on biomolecules viz collagen, collagen peptide, squid peptide, proteoglycans, n-3 PUFA, fish oil, liver oil, fish proteins and peptides, chitosan derivatives, vitamins from marine sources.

Research Projects Handled

Institute Projects

- Seaweeds of Indian coast as source of bioactive compounds for developing nutraceuticals/ functional foods
- Novel Bio-molecules for Food and Nutraceutical Applications from Marine Resources

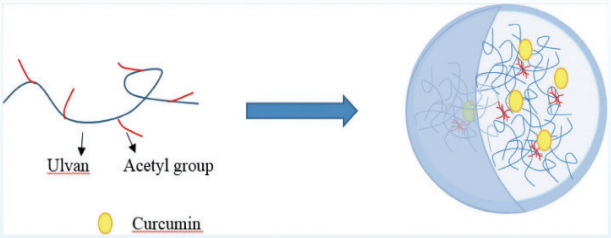
Most significant achievements

- Deep eutectic solvents are novel green chemistry solvents. Eleven new deep eutectic solvents were synthesized for extraction of bioactive compounds from seaweeds for nutraceutical applications.
- A reconstitutable formulation of seaweed fucoidan and green tea extract was developed as dietary supplement, which demonstrated excellent cardioprotective activity in preclinical studies.
- A unified method was developed for the quantification of more than 300 pesticides, organochlorines, poly aromatic hydrocarbons, polychlorinated biphenyls, and other endocrine disruptors in fish using GC-MS/MS and LC-MS/MS.
- 2-phenyl phenol and metalaxyl were the major contaminants found in the various fish species in Cochin estuary. A hazard index-based risk assessment indicated moderate risk to the coastal population.
- Standardized the process for the formulation and yield optimization of seaweed-based biochar for its application as an agent of bioremediation in water filtration unit.
- Characterized and the biochemical parameters of Nile tilapia skin mucus.
- Cuttlefish protein hydrolysate can be used as potential dietary supplement in aqua feed sector. Supplementation of cuttlefish protein hydrolysate at 10 to 15 % in the diet has proven to enhance the growth performance and thermal tolerance of *Oreochromis niloticus* fingerlings.
- Seaweed based feed supplement aimed for the aquaculture sector was developed in combination of chitosan and vanillic acid.
- Established the concept on influence of background colour on the growth performance of fish
- Methodology developed for the extraction of sodium alginate from brown seaweeds *Turbinaria conoides, Sargassum whitti* and *Sargassum cristaefolium*.
- Alginate polyvinyl alcohol-based hydrogels are prepared using sodium alginate extracted from brown seaweeds Turbinaria conoides, *Sargassum wightii* and *Sargassum cristaefolium*.
- Methodology developed for the extraction of oil from sardine by using supercritical fluid extraction
- Complete valorisation of tuna fish bone powder was carried out.
- Sustainable extraction protocol was developed for extracting squalene rich oil from bramble shark liver.
- Cellulose derivatives for diverse applications have been developed.

Chief findings

Seaweeds of Indian coast as source of bioactive compounds for developing nutraceuticals/ functional foods

Curcumin-loaded Acetylated Ulvan - Curcumin-incorporated Acetylated Ulvan (Cur-AcU) was prepared by dissolving curcumin in anhydrous dimethyl sulphoxide (DMSO) followed by addition of triethylamine (TEA) and acetylated ulvan at room temperature and dialysed thereafter against deionised water.



Schematic showing the formation Curcumin-incorporated Acetylated Ulvan

Structural Characterization of Ulvan, acetylated ulvan and curcumin-loaded acetylated ulvan- Particle size, polydispersity index, and zeta potential of Ulvan (U), acetylated ulvan (AcU) and curcumin-loaded acetylated ulvan (Cur-AcU) were determined by dynamic light scaterring analyses (DLS) using a Zeta Sizer Nano Series. The zeta potential of the suspension was measured with an angle of 15° at 25°C. Ulvan sample had smallest particle size followed by Cur-AcU and AcU had the largest size. A PDI between 0.00 – 0.08 indicates nearly monodispersive sample and PDI of Cur-is in this range and is monodispesive nature. Similarly, the PDI between 0.08 – 0.7 show midrange value and PDI of both U and AcU fall in this range and exhibit medium range dispersibility. The zeta potential values obtained for U, AcU and Cur-AcU in our study are 17.8, 36.7 and 39.05 respectively reflecting the anion charge repulsion among ionic carboxyl and sulphonic acid of acetylated ulvan gel particles.

Determination of Cur loaded in Cur-AcU nanogel- Stock solution and working standard of curcumin were prepared in ethyl acetate and analysed using. Comparison of amount of Cur encapsulated in 1% acetylated ulvan nanogel and known solubility of curcumin in water which is 11 ng/ml, it was determined that solubility of Cur in water enhanced by more than 16000 times.

Green chemistry solvents, process and nutraceutical formulation from seaweed - A novel formulation of seaweed fucoidan extract and green tea extract was developed by microencapsulation technique. The formulation has been commercialized as "CIFTEQ FucoTeaEx" to Kerala Nutraceuticals Pvt. Ltd, Cochin. The company is marketing the product under the trade name "Zafora". The formulation showed better antioxidant activity than green tea extract or fucoidan extract alone and is rich in micronutrients such as riboflavin, nicotinamide, pyridoxine, Fe, Ca, and Zn. Novel deep eutectic solvents and supercritical carbon dioxide were evaluated for extraction of fucoxanthin from brown seaweed.

Fucoxanthin Dietary Supplement - A dietary supplement of fucoxanthin in oil was developed. Another novel nano-formulation of seaweed fucoxanthin was prepared by nano-encapsulation of fucoxanthin in vanillic acid-grafted chitosan. The hydrodynamic Z-average particle size of the particles were ~320 nm with an encapsulation efficiency of 82%. In cell line studies, the nano-particles showed no cytotoxicity even at higher

doses proving that nano-encapsulated fucoxanthin is safe for food and nutraceutical applications.

CIFTEQ FucoTeaEx

Fucoxanthin in oil

Process optimization of biochar preparation - Seaweed *Ulva lactuca* and *Sargassum wightii* were selected for the process optimization of biochar preparation. The formulation of biochar was done with muffle furnace at various temperature settings (300, 350, 400, 450, 500, 550, 600°C). It was observed that a better yield and availability of functional group was better for the biochar prepared at 450°C.

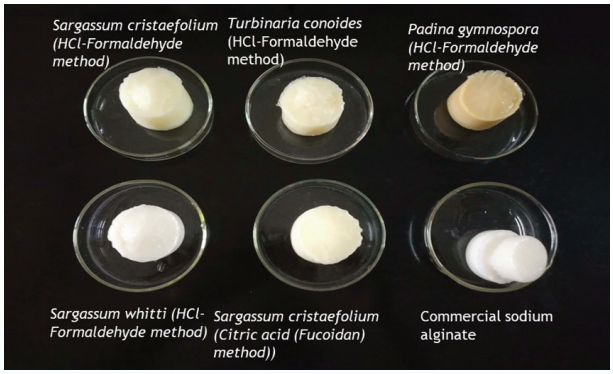
Assessment of the role of seaweed extract as fish-feed supplement – In the Experiment conducted to assess the role of seaweed extract as fish-feed supplement, *Labeo rohita* fingerlings (average weight of 2.0 to 2.5 g) were fed with seaweed extract, vanilic acid, chitosan, and graded level of combined mixture of seaweed extract, vanilic acid, chitosan for a period of 45 days. The role of different dietary supplements was assessed in terms of growth performance. Supplementation of different dietary inputs in the purified diet showed significant ($P<0.05$) difference among the control and treatment group on weight gain%, specific growth rate (SGR), feed efficiency ratio (FER), and protein efficiency ratio (PER). Whereas, feed conversion ratio (FCR) did not show a significant difference. However, better FCR was recorded in the animals fed with 1% chitosan and mixture of Vanillic acid, chitosan and crude seaweed extract @1% in the purified diet when compared to crude seaweed extract alone. It is inferred, that animals fed with combination of chitosan, vanillic acid and crude seaweed extract showed its influence on the growth performance *Labeo rohita* fingerlings.

Extraction of sodium alginate from brown seaweeds - Alginate was extracted from brown seaweeds (*Turbinaria conoides*, *Sargassum cristaefolium* and *Padina gymnospora*) by three methods which include HCl-formaldehyde method, citric acid (fucoidan) method and combined extraction process of alginate using formaldehyde-citric acid method. The free radical scavenging efficiency (78.01±0.2%) and maximum reducing power (8.79±0.5 mg BHT/g) was found to be greater for the sodium alginate extract obtained from *Turbinaria conides* by HCl-formaldehyde method. In terms of zeta potential, sodium alginate extracted from *Padina gymnospora* shows highest stability and it was found to be -73.6 mV.

Sodium alginate extracted from different seaweeds

Development of seaweed-based alginate hydrogels - Alginate polyvinyl alcohol-based hydrogels were prepared using sodium alginate extracted from brown seaweeds - *Turbinaria conoides*, *Sargassum wightii*, *Sargassum cristaefolium* and *Padina gymnospora*. The feasibility of seaweed-based hydrogel as delivery system for fat soluble vitamins was explored as delivery system for vitamin D. Preliminary results

show that sodium alginate can function as effective delivery system for vit D.



Sodium alginate/PVA hydrogels prepared from different seaweeds

Utilization of seaweed biomass for production of cellulose derivatives - The seaweed biomass left after extraction of antioxidants by supercritical fluid extraction were utilized for production of cellulose derivatives. The effect of NaOH concentration and monochloroacetic acid on the water solubility of the prepared carboxy methyl cellulose derivatives are analyzed. It was observed that with increase in concentration of mono chloroacetic acid, water solubility seems to be improved.

Novel bio-molecules for food and nutraceutical applications from marine resources

Nile tilapia mucus - Nile tilapia mucus obtained was aseptically mixed with physiological saline, centrifuged and the supernatant was lyophilised, stored at -80°C. The supernatant was subjected to biochemical constituent analysis including protein, carbohydrate and lipids.

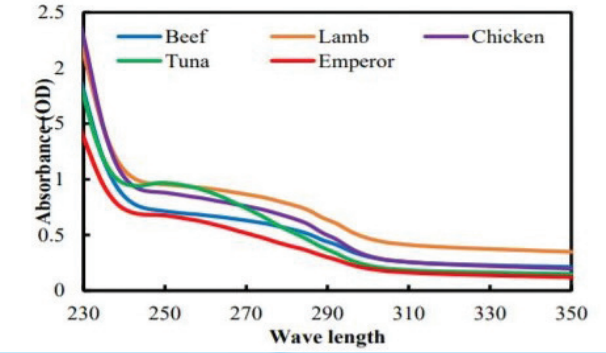
Cuttlefish protein hydrolysate - Feeding trial was conducted to study the effects of cuttlefish protein hydrolysate on growth performance of Tilapia (*Oreochromis niloticus*) fingerlings of average weight 3.8 to 4.6 ± 0.02g. Fishes were fed with graded levels of cuttlefish protein hydrolysate such as 5, 10, 15, 20% in diet for period of 65 days. The fishes fed with 10 to 15 % cuttlefish protein hydrolysate in the diet showed to have enhanced growth performance and thermal tolerance capacity in fish.

High-quality edible fish protein powder - *Nemipterus japonicas* protein was extracted from raw fish, dried fish and supercritical fluid extracted fish and compared the functional properties like water holding capacity, oil holding capacity, solubility, emulsifying stability, foaming capacity, viscosity etc. Protein extracted from post SFE shows superior quality than the raw and dried fish. Isoelectric solubilisation and isoelectric precipitation methods are used for protein isolation.

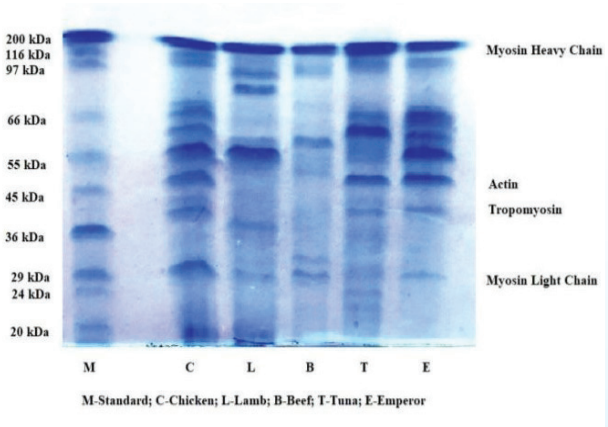
Complete utilization of shark liver - An attempt has carried out for the complete utilization of shark liver. As an initial step, the potential of supercritical CO_2 in extracting squalene rich oil from Bramble shark (*Echinorhinus brucus*) liver was investigated. Influence of factors such as extraction pressure, temperature and time on yield, squalene content, major fatty acid content such as Docosahexaenoic acid (DHA), Eicosapentaenoic acid (EPA), Arachidonic acid (AA) and fat-soluble vitamins (A and E) were investigated. In addition, the fatty acid composition of the extracted shark liver oil was also studied. The extraction of shark liver was carried out at conditions of 275 bar pressure, 40°C temperature for a duration of 2 h. The flow rate of carbon dioxide and ethanol was kept constant at the rate of 50 g/min and 1 g/min respectively. The extraction yield of shark liver oil was 68.64%. and a squalene content of 665.53 mg/g of shark liver oil, total fatty acid content of 63.54 mg/g of shark liver oil, DHA content of 15.26 mg/g of oil, EPA 3.88 mg/g oil and Arachidonic acid 3.22mg/g oil. In addition, it was also found to have 45.33 µg vitamin A and 24.96 µg vitamin D per gram of extracted oil.

Utilization of tuna fish bone powder - A preliminary study was carried out for comprehensive utilization of tuna fish bone powder. The bone powder was subjected to fat extraction using supercritical carbon dioxide as the main solvent at 250 bar pressure, 50 g/min CO_2 flow rate and 1 g/min of co-solvent flow rate. About 15.68% of oil was recovered from fish bone which was deep yellowish in colour. Further studies revealed a high content of vitamin A and D in the oil. Fish bone powder left after supercritical fluid extraction was found to be rich in minerals like calcium and potassium.

Myofibrillar proteins extracted from tuna, emperor, beef, lamb and chicken - Myofibrillar proteins was extracted from the meat proteins of tuna, emperor, beef, lamb and chicken using non-denaturation method and, their physico-chemical properties assessed. The UV–Vis absorption spectra of myofibrillar protein samples showed higher absorption in the wavelength region of 240-300 nm.

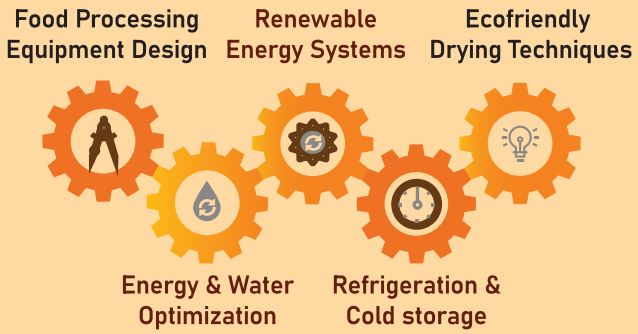


The molecular weight distribution of myofibrillar proteins was characterized by SDSPAGE analysis, which showed major bands myosin heavy chain, α-actinin, desimin, actin, troponin, tropomyosin and myosin light chain with wider molecular weight distribution in the range of 200-20 kDa.



The myofibrillar proteins of beef, emperor and lamb samples have higher solubility than other two samples. Among fish samples, tuna has significantly lower than emperor ($P < 0.05$). The myofibrillar protein of chicken sample found to have more ionic and hydrogen bonds than other myofibrillar samples. The ionic bonds in fish myofibrillar proteins were significantly lower than beef, lamb and chicken samples ($P < 0.05$).

ENGINEERING



The activities of the Engineering division research and development are intended to carry out technological interventions in the field of harvest and post-harvest sector of fisheries, which include fish process engineering, design and development of energy efficient equipment/machinery, electronics & instrumentation in fisheries and fishing vessel design and inspection. Focussed areas of research are on development of cost-effective solar dryers with LPG, electrical and biomass back-up heating systems, fish descaling machine, ergonomic and gender friendly designs of fish vending equipment, non-destructive methods of fish freshness inspection, energy and water optimization techniques for fish processing industry, tools for quality improvement of Indian fishing fleet, etc.

Research Projects Handled

Institute Projects

- Design and development of tools and technologies for energy and water use optimization in fish processing industries
  - **Component A:** Design and development of tools and technologies for energy and water use optimization in fish processing industries
  - **Component B:** Engineering interventions in post-harvest sector

Most significant achievements

- Collected and analysed real time data of energy and water use pattern of all three selected seafood industries at Kochi.
- Industry specific energy and water usage guidelines document is being prepared.
- Developed an Arduino-GSM module based real time energy data acquisition and SMS alert system for Industry.
- 3D printing of portable fish freshness sensor was developed to make the device more compact and user friendly. Front-end development of mobile application for fish freshness sensor was completed.
- ICAR-CIFT, Cochin, in collaboration with research partner M/s Lanasol Energy Solutions, Pvt Ltd, Bangalore, jointly designed and developed a low-cost energy efficient solar powered refrigerated mobile fish vending kiosk (30 kg) to sell fishery products at consumer's door step under hygienic conditions.
- Designed and developed a solar energy-based feed dispensing system (capacity - 6 kg) and preliminary field evaluation was carried out.
- Performance of a mini fish descaling machine was evaluated using threadfin bream and observed the descaling efficiency of 67.9% and 60.15% for the fish loading of 0.5 kg and 1 kg, respectively.
- Developed prototype of hot air assisted continuous infrared drying system for high value fish and fishery products. Performance evaluation of prototype dryer was carried out using shrimp, anchovy and squid rings
- Developed a hybrid photovoltaic thermal system (PVT) for co-generation of electricity and hot water. Performance of PVT system was tested using water and nanofluid as cooling medium.

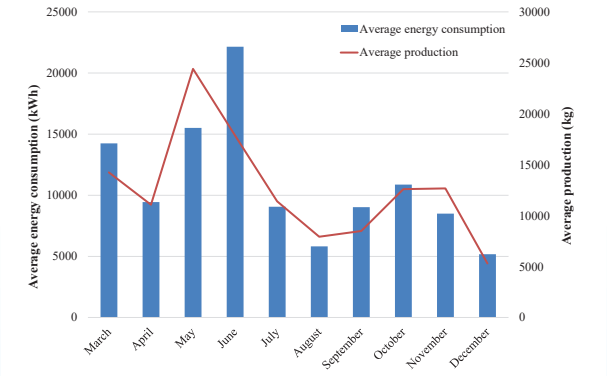
Chief findings

Design and development of tools and technologies for energy and water use optimization in fish processing industries

Component A: Design and development of tools and technologies for energy and water use optimization in fish processing industries

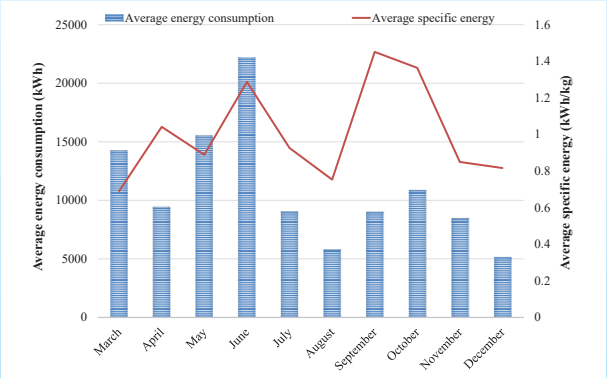
Energy usage: Real time data collection and analysis - Energy Optimization & Sustainability Services (REOSS) developed by the research partner, Datamatrix Pvt Ltd., Pune was used for the collection of data from all the selected seafood processing industries (I, II, III) located at Kochi cluster based on seafood handling capacity (large, medium & small). Based upon the energy usage data obtained from

March 2020 to December 2020, an analysis has been carried out using different variables and the results obtained were plotted.



Average energy consumption against average production (Industry I)

The average energy consumption and production is maximum from March to June, after that production is decreased correspondingly average energy consumption also decreased. This trend confirms that energy consumption and production have positive correlation for the large-scale Industry I.

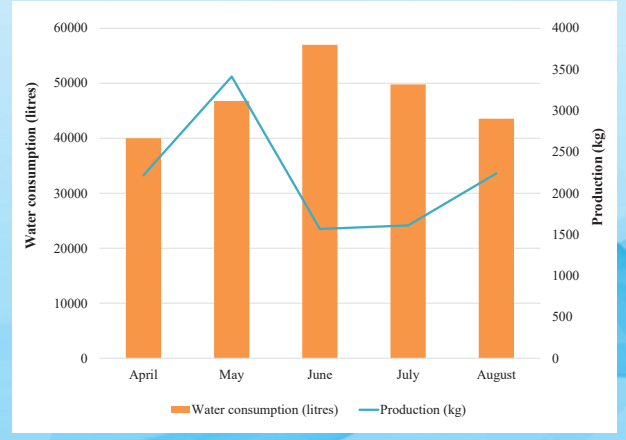


Variation of Average Energy Consumption with Average Specific Energy (Industry I)

The figure shows that average energy consumption is maximum and specific energy is minimum from March to June 2020. This could be due to maximum production during these months implying effective utilization of equipment and machines. Whereas, from July to Dec 2020, specific energy is high but energy consumption is low which suggests that equipment in the connected process line were not utilized to its full handling capacity.

Water usage – Data collection and analysis - The water usage data pertaining to April - August 2020 is collected and analysed after installing water flow meter and solenoid valves in the Industry. In order to reduce the surplus wastage of water, an automatic system to control the flow rate based on the loading capacity of the material is being prepared. The Figure shows that production is less during June and July, however water usage is maximum, implying that water leakage in the line.

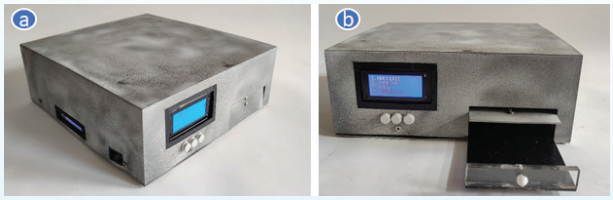
Installed water flow meters in the process line of seafood industry



Monthly total water consumption of Industry

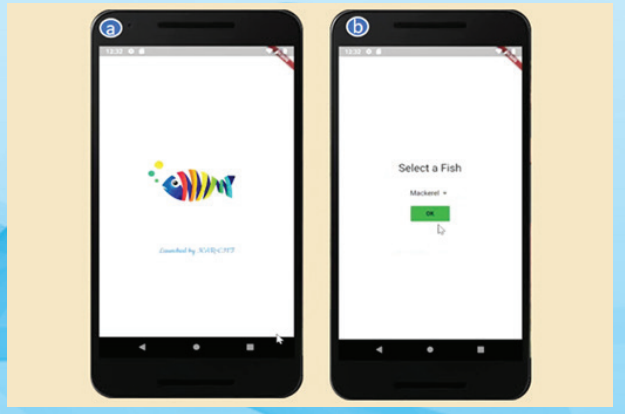
Component B: Engineering Interventions In Post-Harvest Sector

3D printing of fish freshness sensor device and Mobile App development - Different parts of the fish freshness sensor device were prepared using Multi Jet Fusion 3D printer with the polyamide 12(HP PA 12) material. The electronic circuits including the processor board, LCD display, battery, functionality switches and the camera module were assembled inside the 3D printed device. Fish loading tray was made using acrylic sheet for placing fish and capturing the eye image for evaluation of fish quality and freshness. The 3D printed device is durable, intact, and ready for evaluation and demonstration purposes.



3D printed fish freshness sensor (a) Isometric view (b) Front view with open tray

An attempt has been made to develop android/ iOS mobile application for on-spot evaluation of fish quality and freshness. The front-end development of mobile application was carried out using "Android Studio" software and programming was done on flutter platform using dart computer language. The mobile app front-end has following aspects including App Icon, Splash-screen, Camera capturing & accessing, Buttons and Front page consisting of menu dropdown-list. For the back-end development, Multiclass Classification-Machine Learning algorithms was used. In the preliminary stage, in order to train the system, images of fish eye were duplicated and 15 days dataset were created. Mobile application back-end development work is under progress.



Mobile app for fish freshness sensor (a) Splash screen (b) Selection of fish

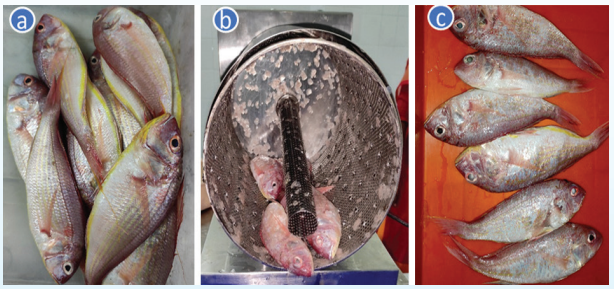
Solar powered refrigerated mobile fish vending kiosk - ICAR-CIFT, Cochin, in collaboration with research partner M/s Lanasol Energy Solutions, Pvt Ltd, Bangalore, jointly designed and developed a low-cost energy efficient solar powered refrigerated mobile fish vending kiosk to sell fishery products at consumer's door step. This is an improved form of refrigerated fish vending kiosk already developed by ICAR-CIFT. The kiosk volume is about 135 L and carry about 30 kg of fish at the temperature of 2-3°C. The unit is powered by 450 W polycrystalline photovoltaic panel, supported by 150 Ah lead-acid battery. It is provided with an AC adapter to charge the battery during off-sunshine hours. The fish can be stored safely for 2-3 days without spoilage.

Solar powered refrigerated mobile fish vending kiosk under field evaluation

Design of solar based feed dispensing system- Automatic feeders are most advanced feeding device used during intensive aquaculture. It was aimed to develop solar based fish feed dispensing system for aquaculture ponds. The feed dispensing unit (3000 rpm) is powered by a small PV panel (30 W) and Lead -acid battery (7Ah, 12 V), and the unit was mounted on a HDPE surface float mechanism. It can carry about 6 kg of feed and provided with two servo motor to avoid clogging during opening and closing of hopper, and it can dispense feed (3 mm) at a distance of about 5 to 6 m. The performance evaluation of solar based fish feed dispensing system was conducted in aquaculture pond, KVK Narakkal

Field evaluation of solar based feed dispensing system

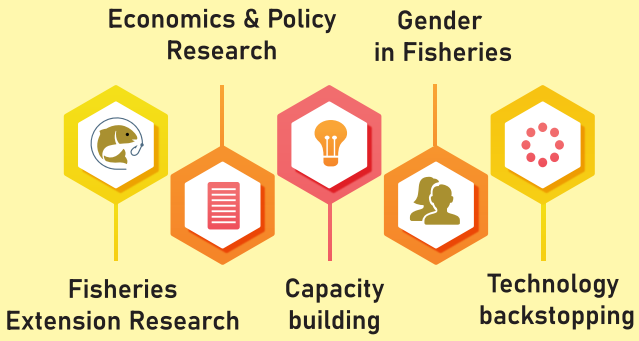
Performance evaluation of commercially viable model of mini fish descaling machine - A knob operated table-top mini fish descaling machine of 1 kg capacity was developed to cater household needs related to fish descaling. It consists of a rotating drum, a motor and frame to support the assembly. The machine was ergonomically designed in such a way that even women can work on it without any drudgery. Performance of a mini fish descaling machine was evaluated using threadfin bream and observed the descaling efficiency of 67.9% and 60.15% for the fish loading of 0.5 kg and 1 kg, respectively.



Performance of mini fish descaling machine
(a) fresh threadfin bream (b) descaling drum (c) descaled threadfin bream

Extension, Information and Statistics

The Extension Information and Statistics Division plays a pivotal role in technological nudging for the overall development of the harvest and post-harvest sector in fisheries. It undertakes quality research on various socio-economic issues and policy matters based on region specific problems across the fisheries value chain. The Division attempts to conduct research studies in the areas of entrepreneurship development, resource optimization, consumer behaviour, consumption pattern, service and delivery system, gender mainstreaming, trade and markets, structural and migration pattern of labours, impact assessment of technologies, assessment of extension systems etc. using improved statistical and econometric analysis. The division also pursues Knowledge management in fisheries through documentation and validation of ITKs, creation of database, preparation of affordable technology menu for field applications, technology showcasing and creating an information exchange network to reach the unreached. In addition to its role as an interface between the institute and society, the division is keen to strengthen the linkage with various actors in the research and extension system to upscale and out-scale the extension activities of the institute in *interdisciplinary* mode through technology backstopping, novel extension approaches and policy support that give an impetus for the promotion of innovations in the sector.



Research Projects Handled

Institute Projects

- Evolving SMART EDP module for livelihood security of small scale fisherfolk through fish-preneurship
- Occupational structure, labour productivity and labour migration in the fisheries sector
- Economic evaluation of resource use efficiency and management of reservoir ecosystem
- A study on the entrepreneurship ecosystem in fisheries and the cybernetics of Women Initiated Enterprises in Fisheries (WIEF) in selected coastal states of India
- Assessing the input and service delivery system for marine fisheries in Kerala
- A study of dynamics of fish consumption in Kerala with reference to emerging health, safety and quality issue
- An Assessment of Extension System in Marine Fisheries Sector of Kerala
- Development and validation of a scale to measure fisher's attitude towards responsible fishing

Most significant achievements

- Factor analysis indicated that the consumers' behaviour towards fish and fish-based products was highly influenced by product preference and feasibility; moderately affected by product convenience, quality packaging and service delivery system.
- The labour productivity by conventional production and man-hour methods, was estimated as Rs.9375 per labour per trip and Rs.110.29 per hour of work per trawler.
- Surplus production models fit to 10-year catch effort data collected from Aliyar fishery and economic evaluation predicts that increasing effort by 34% will result in enhancement of the profit per fishing unit to Rs.2.15 lakhs per annum.
- Review studies indicate that the entrepreneurship ecosystem of each country or region is different owing to the interplay of many factors relevant to the regions.
- An analysis on fish growth indicated that during the past decades the culture fishery has grown at the rate of 6.64% per year, while the capture fishery growth is limited to only 2.8% per year.
- A study on constraints faced in fish vending revealed that escalating cost of fresh fish (35.5%), difficulty in getting species having good customer demand (17.3%), insufficient quantity of fish available (14.2 %), lack of relaxed credit availability (12.2%) and improper market facility considered as major constraints.
- A study indicated existence of gender difference with respect to access to fish and management of unsold fish, skewed against women.
- Study on agricultural extension indicated disparities in funding, inadequacy of human resources, regional variations, subdued attention to livestock and fisheries, and lack of convergence. Study

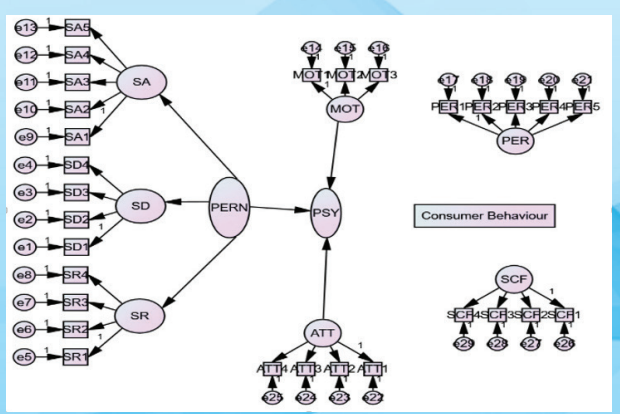
argues for renewed focus on extension system in the context of multiple challenges posed by climate change, entrepreneurship development, and service delivery.

- The monthly per capita fish consumption in Kerala was estimated as 2.94 kg for the state with 3.21, 3.05, 1.85 and 3.65 kg/month respectively in the districts of Ernakulam, Kozhikkode, Palakkad and Kottayam.
- 'Transreg' procedure revealed that for Keralites; 'safety of fish' was the most important driver or barrier for consumption while 'price of fish' and 'availability of favourite fish' were the second and third most important drivers. '24x7 market accessibility' was the most important driver for online fish consumers while 'convenience perception' was the second most important driver.
- An analysis of pattern of expenditure on fisheries extension in Kerala during 2009 to 2017 showed an increasing trend. The expenditure increased from Rs.238.48 lakh to Rs.469.40 lakh during the study period at the rate of Rs.39.30 lakhs per year.
- Developed a scale to measure the fishers' attitude towards responsible fishing using Likert methodology.

Chief findings

Evolving SMART EDP module for livelihood security of small scale fisherfolk through fish-preneurship

Study on consumer behaviour towards fish and fish-based products: The consumers' behaviour towards fish and fish-based products available in markets was assessed on the basis of data collected on dependent variables like *Psychological, Personal factors* and *Socio-cultural* factors from 92 fish consumers randomly selected from Kadamakuddy, Kerala (45), Mangmaripeta, Andhra Pradesh (24) and Veraval, Gujarat (23) using Factor Analysis (FA). The consumers' behaviour under the psychological variable was measured in terms of extent of *selective attention, selective distortion* and *selective retention* for a particular commodity. In case of selective attention (SA), product convenience (SA3), attractive packaging (SA4), and service delivery system (SA5) showed significant influence with the factor loading of 0.915, 0.913 and 0.941, respectively. In the same vein, selective distortion (SD) was affected with *non-availability of product* (SD1) and *non-maintenance of quality* (SD4) with factor loading value of 0.818 and 0.744, respectively. Selective retention (SR) of product was influenced by one of the most important factor i.e. *opinion of reference group* (SR4) with a factor loading score of 0.881. On the other hand, consumers' motivation (MOT) was highly influenced by two factors namely MOT1-*information drive* (0.847) and MOT3-*product familiarity* (0.960) with factor coefficient close to 1. Likewise, consumers' perception with respect to attitude and beliefs (ATT) indicated that product preference (ATT1) and product feasibility (ATT4) had higher influence with factor loading score of 0.913 and 0.868, respectively. It was also observed that the consumers' behaviour was highly influenced by demographic factors, personal/group characteristics, economic condition and lifestyle.



Consumer behaviour model

Occupational structure, labour productivity and labour migration in the fisheries sector

To measure the labour productivity Nearest Neighbor Algorithm (NAA) was identified. The labour productivity using conventional production and man-hour methods, was estimated as Rs.9375 per labour a trip and Rs.110.29 per hour of work per trawler respectively.

Using the micro-individual approach to migration, it was observed that the major reason for migrant fishers working in the sector is the lack of other employment opportunities and the opportunity for better wages. All crew on-board a single trawler belonged to a particular state. There were no mixed crew. Labour on-board trawlers in Kerala belonged to Tamil Nadu, Kerala, West Bengal, Andhra Pradesh and Assam. The local workforce from Kerala is older than the migrant labour who are in the peak productivity age of 30-40 years.

The impact of fuel price rise on the gillnet and long line fishing sector, assessed using data from 200 fishing trips, showed that a rupee increase in diesel price increased the total expenditure by about Rs.4093 per trip.

Economic evaluation of resource use efficiency and management of reservoir ecosystem

Data on fishing effort and its corresponding yield from Aliyar reservoir recorded from 2007-08 to 2017-18 was used to fit the surplus production models due to Fox (1970), Schaefer (1954), and Clarke, Yoshimoto & Peeley (1992). Maximum Sustainable Yield (MSY) and optimum effort required to achieve MSY were estimated. Maximum Economic Yield (MEY) estimates giving the economic optimum yield, effort and profit were computed using the procedure given by Clarke et al. (1992) under three scenarios - zero interest rate, nominal interest rate (5%) and competitive market rate (10%).

The MEY estimates obtained through CY &P fit predicts that increasing effort by 34% will result in enhancement of the profit per fishing unit to Rs.2.15 lakhs per annum. The present effort level put into the fishery is not optimum and most of the days only 75% of the units operate. The fishermen do not have the motivation to maximize the income from fisheries as their basic minimum needs are taken care at subsidy rates. The Maximum Economic Yield (MEY), based management can be implemented in association with Fisheries Department which will result in socio-economic upliftment of the fishermen and ensure more freshwater fish supply to the local community.

The average annual production from the reservoir is around 30 MT with average effort being 4970 nets and the results of the analysis indicates scope for increase in production with better management and calculated increase in the effort. The present level of effort can be further increased to obtain a 20% increase in the present production level which will sustain the fishery.

	Clark Yoshimoto Pooley (CY&P) model optimization		
	I=0	I=5	I=10
Y (MT)	44.88	50.08	52.82
E (No. of nets)	5789	6198	6345
Profit (Rs. Lakhs)	42.64	47.58	50.17

Model fit parameters

A study on the entrepreneurship ecosystem in fisheries and the cybernetics of Women Initiated Enterprises in Fisheries (WIEF) in selected coastal states of India

On analysis of review studies, it was observed that the entrepreneurship ecosystem of each country or region is different owing to the interplay of many factors relevant to the regions. A research tool was developed on the basis of secondary data and review studies for collecting information on the basic entrepreneurship ecosystem existing in each of the study regions in a narrative style and on two major facets, i.e. on the Structural (formal institutions -Government as well as Non-Government) as well as Functional (linkages, skills, leaderships, communications and other logistics support) elements of the ecosystem.

Assessing the input and service delivery system for marine fisheries in Kerala

Study on trends and progress in agricultural extension in India - Agricultural extension is critical to improve the productivity in Indian agricultural sector and translate the productivity gain into higher farm income. The agricultural extension system in India is facing a multitude of challenges. Given the vast diversity of agro-ecologies and farming system in India, public agricultural extension system has been given supports in terms of policies and promotion even before green revolution, which is gradually weakening. This is reflected most glaringly in funding, human resource in extension, regional variations, subdued attention to livestock and fisheries, and lack of convergence. This is also coupled with depressed farm income growth and distress in rural areas. Restructuring of Indian agricultural extension system is vital to evolve agricultural sector into major source of growth in Indian economy in emerging times.

Fisheries development and its relation with poverty - An analysis was carried out on development of fisheries sector, and its economic impacts, particularly on poverty, using secondary data. As on 2018, with about 5.34 million tonnes, the capture fishery, from both inland and marine, together accounts for about 43% of total fish production. The marine capture fishery accounts for about 68.2% of total capture fishery, and the rest is by inland sector (brackish water and fresh water together). While the culture fishery has grown at the rate of 6.64% per year during the past decade, the capture fishery has been growing at the rate of only 2.8% per year. Compared to the year 2008, the share of marine fisheries in total capture fisheries has come down, mainly on account of a 5% per year growth in inland capture fishery compared to a much-subdued annual growth of marine capture fishery at about 2.0%. As on 2018, the fresh water accounts for about 88.5% of total culture compared to 11.2% by brackish water culture. The brackish water culture has grown at the rate of 16.5% per year compared to 5.9% by fresh water culture during the past decade, which has resulted in an increase in the share of brackish water in total culture fisheries. The fisheries development was linked with the poverty and nutritional security.

Fish vending experience and access to fish and ice - A study was conducted among fish vendors in Kerala to assess their access to input and services. A total of 197 fish vendors were surveyed from Thiruvananthapuram (80), Ernakulam (87) and Kozhikode (30) districts of Kerala. The respondents varied with respect to their experience in fish vending from one year to 63 years and the

mean experience in fish vending was 21.63 years (SD=13.39). The sample constituted shop vendors (45.2%), mobile fish vendors (20.8%), Head load vendors (19.3%) and Petty traders in markets and other places (14.7%).

Gender disparity in access to fish - Women constituted 26.9 per cent of the sample size and had more experience in fish vending than men. A difference with respect to gender was observed with respect to reason for opting fish vending as a profession. Large majority of women (71.7%) expressed the reason for fish vending as "traditional practice of livelihood", but only 48 percent of men were of same opinion. While 18.1 per cent of men had come to this profession due to high profit gain, only 5.7 per cent of women had come to this profession due to similar reason, which shows they have more orientation towards the profession.

Management of unsold fish - Significant gender difference was observed in terms of management of unsold fish also. Women had less access to icing at selling point compared to that of men. Due to this woman generally could not store and sell the balance fish next day. To support fish vendors especially women on scientific fish handling and processing methods is necessary to address this problem. It will open up a cost-effective preservation means as well as new avenue to enhance their profit from fish vending through value addition.

Type of fish storage and processing	N	Gender		Chi-square	Fisher's exact
		Male	Female		
Icing at home	40	25	15	19.14	0.000
Icing at selling point	58	54	4		
Process into dry fish	50	32	18		
Distress sale	45	31	14		

Genderwise storage practices of fish vendors

Among the seven constraints rated significant among the fish vendors, irrespective of the gender difference, the escalating purchasing cost of fresh fish was rated as major constraint by majority (35.5%). This was followed by difficulty to get fish having good customer demand (17.3%), insufficient fish availability (14.2 %), lack of relaxed credit availability (12.2%) and improper market facility also followed as constraints. It can be observed that the major constraints were regarding the poor availability of fish.

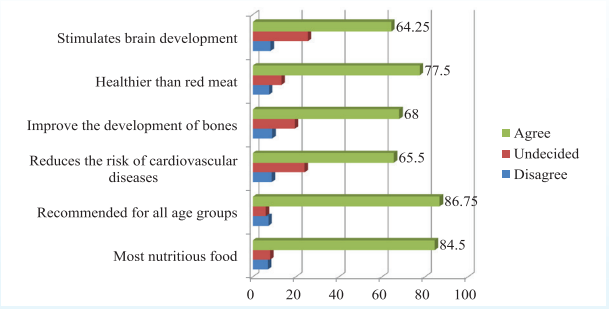
A study of dynamics of fish consumption in Kerala with reference to emerging health, safety and quality issue

Fish consumption patterns- Majority in Kozhikode (64%) reported daily consumption of fish while majority in Ernakulam (46%), Kottayam (67%) and Palakkad (38%) reported consumption at 2-3 times per week. Dry fish consumption has been observed to be in declining trend because of the concern for health issues due to non-hygienic practices and fear of chemicals used in drying. The per capita fish consumption was found to be 3.21, 3.05, 1.85 and 3.65 kg per month respectively in the districts with average of 2.94 kg per month in the state. Majority in Kozhikode (64%) reported daily consumption of fish while majority in Ernakulam (46%), Kottayam (67%) and Palakkad (38%) reported consumption at 2-3 times per week

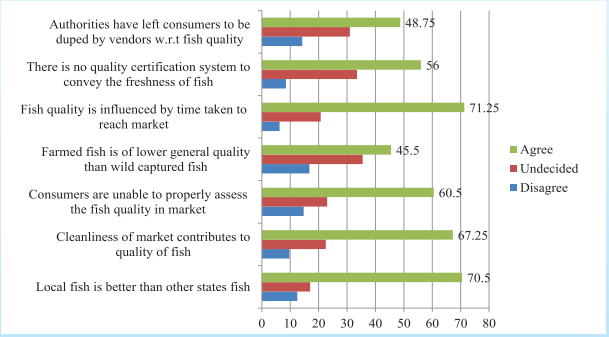
Market choice of consumers- 'Door to door fish vendors' are still the most preferred choice of fish consumers in all the districts except Kottayam where 'nearby fish stall' was found to be most preferred one. Perceived freshness of fish was the major reason attributed to choice of particular market in three districts, while accessibility was the major reason attributed to choose the market in Kozhikode.

Knowledge, Attitude and Perception of fish consumers - With respect to knowledge on health benefits of fish and fish quality, majority of consumers belonged to high knowledge category, while majority belonged to medium category in knowledge of fish quality aspects. Assessment of customers on five dimensions namely semantic; sensory; health; economic, quality and safety, showed that most of the consumers were found to have medium level of favourableness towards all the dimensions and sub dimensions of the attitude.

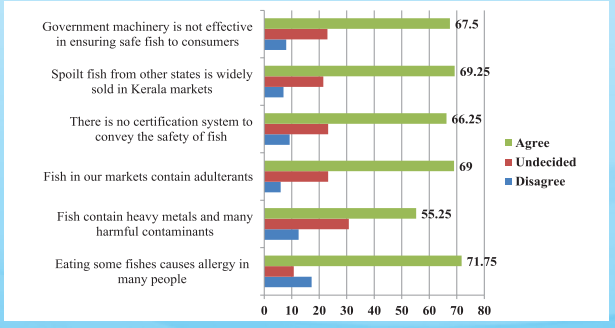
Distribution of fish consumers of Kerala (N=400) based on their perception about health benefit of fish



Distribution of fish consumers of Kerala (N=400) based on their perception about quality of fish



Distribution of fish consumers of Kerala (N=400) based on their perception about safety of fish



Medium level of perception about nutritional-health benefits of fish was observed among majority while comparatively less awareness was observed about specific health benefits of fish consumption. Non-parametric Friedman test revealed that there existed significant difference in perception of consumers about various quality aspects of fish ($\chi^2 = 131.799$, p=0.00). Consumers in the state expressed their concern about quality of fish brought from other coastal states and about maintenance of fish quality during transport.

Drivers and barriers to fish purchase and consumption- 'Transreg' procedure revealed that for Keralites, 'safety of fish' was the most important driver or barrier for consumers and 'price of fish' and 'availability of favourite fish' were the second and third most important drivers respectively. When the coastal and non-coastal districts were compared, 'Source of fish is the most important driver in coastal districts while 'safety of fish' emerged as the most important driver for consumers of non-coastal districts. For online fish consumers, '24x7 market accessibility' and 'convenience perception' were the important two drivers and 'price of fish' acted as a barrier.

Trends in online fish sale - A survey of 100 online fish customers in Ernakulam revealed that prawns are the most frequently purchased fish online (61% households) at 1.47 kg/family/month. Sardines (43% households at 1.79kg) and seer fish (41% households at 1.85kg) were the second and third most purchased fishes both in frequency and quantity. On an average, consumers purchased 1.5 kg of fish per online purchase with a monthly average of 6.40 kg of fish.

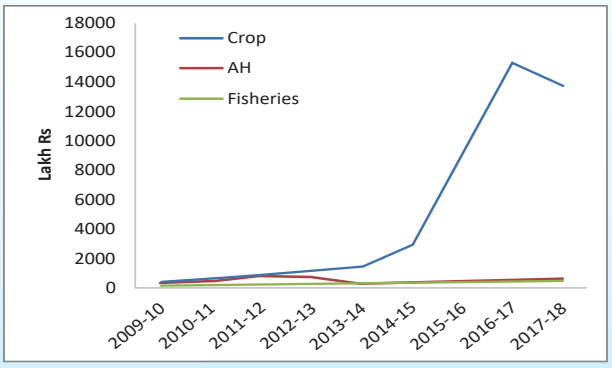
Study of online fish vendors- An analysis of 15 online fish vendors operating in Ernakulam district, Kerala with respect to their products menu, price range, quality and safety guarantees, delivery systems and consumer accessibility over online, mobile and social media platforms revealed that wide range of options provided by online portals was the major attraction for consumers with 3 to

40 fish varieties made available on online platform. The online portals focused on convenience and easy availability of variety of products/dressing options (2-8). As regard to hybrid media marketing done by all the online vendors, it was observed that 'e-mail+website' was the most popular mode adopted closely followed by 'facebook+mobile' mode.

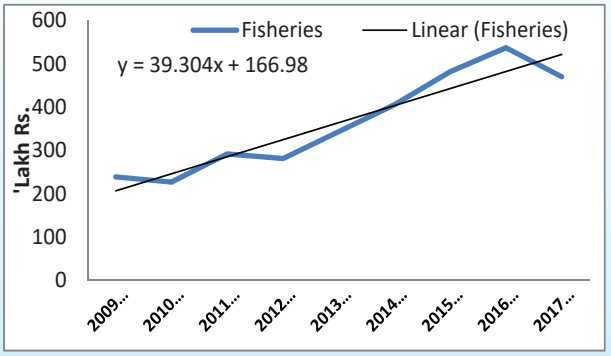
An Assessment of Extension System in Marine Fisheries Sector of Kerala

A preliminary assessment of extension system in marine fisher sector of Kerala revealed that the system is pluralistic in nature with multiple agencies involved in the provision of extension and advisory services. State Department of fisheries and various agencies under the department play the major role, not withstanding the activities of various agencies in public, private and civil society segments.

An analysis of pattern of expenditure on fisheries extension in Kerala for last one decade shows an increasing trend. Expenditure has increased from Rs.238.48 lakh in 2009-10 to Rs.469.40 lakh in 2017-18 at the rate of 39.3 lakhs.



Trend in Expenditure on Extension in Kerala



Trend in Expenditure on Fisheries Extension in Kerala

Development and validation of a scale to measure fisher's attitude towards responsible fishing

Analysis of Relevancy Percentage, Relevancy Weightage and Mean Relevancy Scores of attitude statements

The relevancy score of each item was established by Relevancy Percentage, Relevancy Weightage and Mean Relevancy Scores.

Statements having mean relevancy score (MRS) > 3.89, relevancy weightage (RW) > 0.78 and relevancy per cent (RP) >88.57, were considered for final selection of statements. Finally, 43 statements were selected out of the 90 statements given for judges rating.

To analyse the relevance of attitude statements selected through expert judgemen, modifications were made in the attitude statements to avoid regional differences in the statement formation based on the survey results.

Majority of the fishermen interviewed at Sassoon Dock and Versova were unaware about importance of technologies for responsible fishing.

Externally funded projects

International

1. Diagnostics for one health and user driven solutions for AMR (DOSA)
2. Does antimicrobial resistance (AMR) in livestock contribute to AMR in people in NE India? An interdisciplinary study investigating antibiotic use, drivers of AMR, and transmission dynamics
3. Establishing Value Chain for Coastal and Small Indigenous Freshwater Fish Species: Towards Nutritional Security for Rural Population.
4. Dialogues In Gender And Coastal Aquaculture: Gender And The Seaweed Farming Value Chain
5. Enhancing awareness among stakeholders of trawl systems in Andhra Pradesh and Odisha through capacity building, on use of CIFT-TED for Sea Turtle conservation
6. Support mitigation of Antimicrobial Resistance (AMR) risk associated with aquaculture in Asia

National

Indian Council of Agricultural Research

7. Global Warming Potential (GWP) of mechanized fishing methods of India and mitigation strategies: Analysis using Life Cycle Assessment (LCA)- Data Envelopment Analysis (DEA) approach (NICRA)
8. Zonal Technology Management (ZTM) – Agri Business Incubation (ABI) Centre
9. All India Network Project on Fish Health

10. Investigations on Ghost Fishing by derelict traps and gillnets in selected areas of Indian waters and mitigation measures
11. ICAR-National Fellow Project- Biomodulation of Marine Biopolymers for the Preparation of Biomaterials of Healthcare Importance.
12. Indian Network for Fisheries and Animal Antimicrobial Resistance (INFAAR)

Department of Science & Technology

13. Determining Seasonal and Spatial Occurrence of Multiclass Endocrine Disrupting Chemicals in Fishes, Crustaceans and Molluscs of the Vembanad Urban Estuary: Risk Assessment by an Untargeted Metabolomics Approach (SERB- ECRA- ED)
14. Green, Clean and Affordable Energy for Fishermen Community: Development of a Multipurpose Solar Thermal Conversion System with Gasifier/Biomass Heater Backup
15. Development of a foldable smart live fish transportation system for distant trade of table fish

Department of Biotechnology

16. Screening lytic phages from diverse marine and aquatic niche for controlling bacterial pathogens associated with aquaculture and post-harvest fish quality

Ministry of Food Processing Industries (MoFPI)

17. Design and development of hot air assisted continuous Infrared drying system for high value fish and fishery products

Indian National Centre for Ocean Information (INCOIS)

18. Validation and dissemination of ocean state forecast advisories along Gujarat coast

Marine Products Export Development Authority (MPEDA)

19. Assessing Seafood Exporting Units' needs for exporting Value added products and capacity building requirements

National Fisheries Development Board (NFDB)

20. National surveillance programme for aquatic animal diseases

Food Safety and Standards Authority of India

21. Natural Levels of Formaldehyde In Freshly Harvested Finfish And Shellfish Species
22. Monitoring of Heavy Metal Content in Finfish and Shellfish Along the Coast of India and Possible Mitigation Measures
23. NETSCOFAN-Food Testing Group (FTG)
24. FSSAI-National Reference Laboratory

Coconut Development Board, Govt. of India

25. Improved coconut wood canoes for small scale fishing sector of southeast coast of India

International Projects

1. Diagnostics for One health and user Driven Solutions for AMR (DOSA)

Funding Agency: Department of Biotechnology [DBT] – Indo -UK Collaborative project
Grant amount: Rs. 98.304 Lakhs
Operating Division: Microbiology, Fermentation & Biotechnology Division

Salient achievements:

User mapping studies and baseline assessment of resistance pathogens profile in aquaculture environment setting

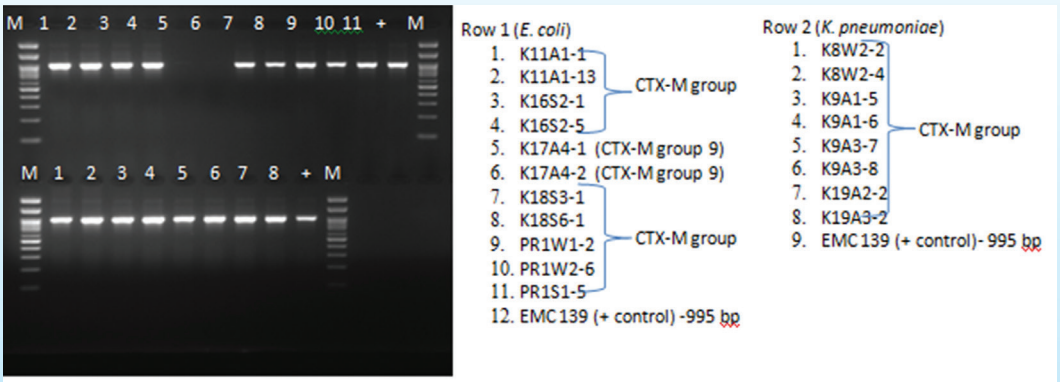
Samples from 37 aquaculture farms (n=261) were screened for ESBL-producing *E. coli* and *K. pneumoniae* yielded 32 isolates of ESBL-positive *E. coli* and 16 isolates of ESBL-positive *K. pneumoniae*.

About 24.3% of the farms were positive for ESBL-producing *E. coli* or *K. pneumoniae*.

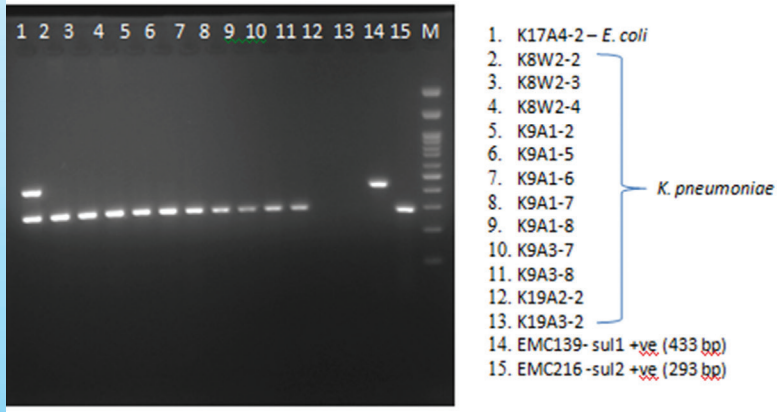
Multidrug resistance was observed in 11 (34.4%) ESBL-*E. coli* and 13 (81.3%) ESBL-*K. pneumoniae* isolates, with resistance mainly towards cephalosporins, tetracycline and trimethoprim-sulfamethoxazole.

Fluoroquinolone resistance was observed in 9 (28.1%) of ESBL-*E. coli* isolates.

The ESBL strains were found to harbour genes for tetracyclines (40%), fenicol (25%) and quinolones (22%).



Multiplex PCR for typing of ESBL genes in E.coli and K. pneumoniae



Multiplex PCR for sul1 & sul2 genes

2. Does antimicrobial resistance (AMR) in livestock contribute to AMR in people in NE India? An interdisciplinary study investigating antibiotic use, drivers of AMR and transmission dynamics

Funding Agency: Department of Biotechnology [DBT] – Indo -UK Collaborative project
Grant amount: Rs. 74.312 Lakhs
Operating Division: Microbiology, Fermentation & Biotechnology Division

Salient achievements:

About 67% of the *E. coli* and *K. pneumoniae* strains isolated from seafood from local markets of Guwahati, Assam were resistant to at least 4 different antimicrobial categories and significant proportions of these isolates were found to carry CTX-M-15 type gene.

Co-existence of CTX-M, TEM, SHV and plasmid mediated resistance gene determinants especially the quinolone resistance along with tetracycline and sulfonamide resistance genes were found.

Six out of the seven phylogroups (A, B1, C, D, E and F) of *E. coli* sensus tricto were identified.

Persistence of ESBL-producing *E. coli* and *K. pneumoniae* underlined the possibility of environmental contamination through sewage, industrial effluent and clinical waste disposal to the natural bodies in the selected study sites.

3. Establishing Value Chain for Coastal and Small Indigenous Freshwater Fish Species: Towards Nutritional Security for Rural Population.

Funding Agency: World fish Centre
Grant amount: Rs.18.5 Lakhs
Operating Division: Biochemistry & Nutrition Division

Salient achievements:

Survey on fish consumption pattern among tribal population of Wayanad district was completed. It was found that 45.5% of the respondents consumed fish weekly and 38 percent consumed fish 2-3 times a week. Only 6% of the respondents consumed fish once in 2 days, 5.5% consumed 1-2 times a month and 1.0% of the population once in a month.

Average monthly per capita consumption of fish among respondents was found to be 1.04 kg.

Sardine was the most consumed fish followed by anchovy, mackerel, tuna, sharks, squids.

Product intervention studies -Development of Fish incorporated protein rich functional foodmix for 1000 days for nutritional studies on children

Animal study on Wister albino male rats for the evaluation of growth parameters of novel products developed.

Technology for protein enriched functional food was transferred to M/S Aracia Pvt. Ltd., A private entrepreneur

The technology developed for iron fortified soup was transferred to Kerala nutraceuticals Pvt. Ltd., Cochin.

Solar dryers were installed at Odisha as part of MoU signed with Borlaug Institute of South Asia and Worldfish.

4. Dialogues In Gender And Coastal Aquaculture: Gender And The Seaweed Farming Value Chain

Funding Agency: SwedBio-AFS
Grant amount: Rs. 43.09 Lakhs
Operating Division: Extension Information & Statistics Division

Salient achievements:

ICAR-CIFT was the coordinating agency for the project that was operational in Tamil Nadu, India and Kenya. This project aimed to bring gender and other researchers into dialogue with coastal groups, industry, government policy makers and NGOs to expand the policy boundaries for environmentally sustainable, socially and economically just coastal aquaculture, focusing on seaweed farming in Tamil Nadu and Kenya. The location-specific dialogues will create platforms on which women and other local actors in aquaculture and communities, policy makers from aquaculture agencies and other state agencies.

Methodology for conducting small and big stakeholder dialogues under COVID-19 was evolved which included virtual dialogues.

Capacity building of women seaweed farmers in use of ICT tools (mobile phones and using social media) was facilitated through the project as part of conducting the virtual dialogue process.

5. Enhancing awareness among stake-holders of trawl systems in Andhra Pradesh and Odisha through capacity building, on use of CIFT-TED for Sea Turtle conservation.

Funding Agency: World Wide Fund for Nature- India
Grant amount: Rs. 8.93 Lakhs
Operating Division: Research Centre of CIFT, Visakhapatnam

Salient achievements:

Awareness on "Fabrication of CIFT-TED (CIFT- Turtle excluder device)": Under this project, awareness cum training programmes on "Fabrication of CIFT-TED (CIFT- Turtle excluder device)" were conducted at Visakhapatnam fishing harbor and Balasore and Dhamra in Odisha.

CIFT-TED on board demonstration of ICAR-CIFT developed Turtle Excluder Device (TED) was conducted onboard private marine fishing vessels from two states fishing harbors in Visakhapatnam, Andhra Pradesh and in Dhamra and Balasore Districts of Odisha.

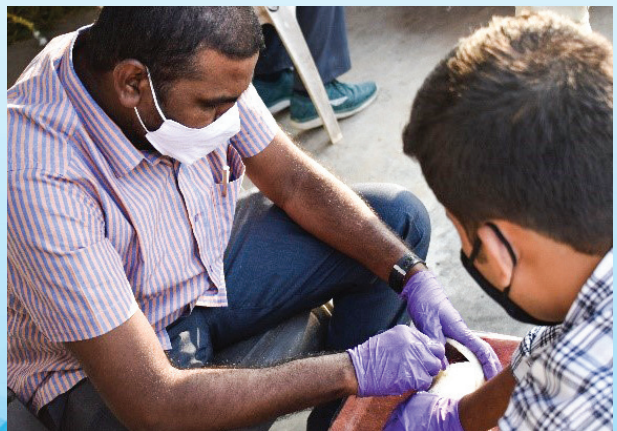
6. Support mitigation of Antimicrobial Resistance (AMR) risk associated with aquaculture in Asia

Funding Agency: Food and agricultural Organization [FAO]
Grand amount: Rs. 25.86 lakhs (CIFT share)
Operating Division: Research Centre of CIFT, Visakhapatnam

Salient achievements:

Baseline information on use of antimicrobials in culture of freshwater fish namely *Labeo rohita* (rohu) and *Pangasionodon hypophthalmus* (Pangasius) is being collected from Krishna and West Godavari districts of Andhra Pradesh. Pilot surveillance and monitoring of antimicrobial resistance (AMR) in two target bacteria viz., Aeromonas in fish gills and *E.coli* in fish intestine samples of rohu and pangasius fish is being conducted.

Information pertaining to culture practices, use of antimicrobials and knowledge on antimicrobial practices were collected from farms where rohu and Pangasius are cultured from Kaikaluru, Mandavalli and Kalidini mandals of Krishna District, Andhra Pradesh. Four isolates of *Aeromonas* spp were isolated from the fish gills (2 isolates from rohu, 2 isolates from pangasius fish) and seven isolates of *E. coli* were isolated from the fish intestines (4 isolates from rohu, 3 isolates from pangasius fish). The identity of the bacteria was confirmed biochemically and through molecular techniques. The confirmed *Aeromonas* spp. and *E. coli* isolates were tested for antibiotic resistance profile by conducting antibiotic susceptibility test.



National Projects

7. Global warming potential (GWP) of mechanized fishing methods of India and mitigation strategies: Analysis using Life Cycle Assessment (LCA) – Data Envelopment Analysis (DEA) approach

Funding Agency: National Innovations in Climate Resilient Agriculture (NICRA), ICAR
Grant amount: Rs.33.55 Lakhs
Operating Division: Fishing Technology Division

Salient achievements:

Fiberglass Reinforced Plastic (FRP) is widely accepted for the marine construction purpose due to its durability, flexibility, easiness to manufacture, corrosion resistance and high strength to weight ratio.

Discarded/ abandoned FRP boats are a type of marine debris which fall under the category 'plastic'. The number of abandoned FRP boats are increasing which leads to the burning of boats in the beach itself causing the release of high levels of harmful gas in the atmosphere thereby leading to atmospheric pollution.

Surveys were initiated in the major landing centers in Kerala to study the impact of disposed and burned FRP and samples were collected for conducting the in-situ burning test of boat building FRP.

Intensity of disposal (quantity in terms of number) of FRP boats/1000 m^2 was calculated.

The extend and quantity of disposal were assessed from the data collected from each sampling sites and the Global Warming Potential due to burning of FRP material is also being studied.

8. Zonal Technology Management (ZTM) – Agri Business Incubation (ABI) Centre

Funding Agency: ICAR
Grant amount: Rs. 28 Lakhs
Operating Division: Fish Processing Division

Salient achievements: *Brief outline of activity is given in pages 133 to 138*

9. All India Network Project on Fish Health

Funding Agency: Indian Council of Agricultural Research (ICAR)
Grant amount: Rs. 11 Lakhs
Operating Division: Quality Assurance and Management Division

Salient achievements:

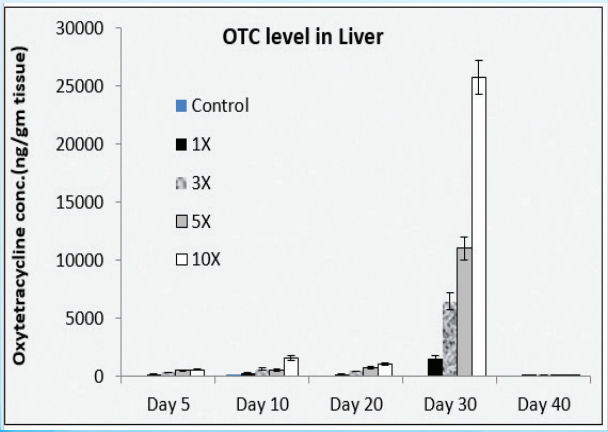
Residue analysis of oxytetracycline (OTC) in fish exposed to the therapeutic dose

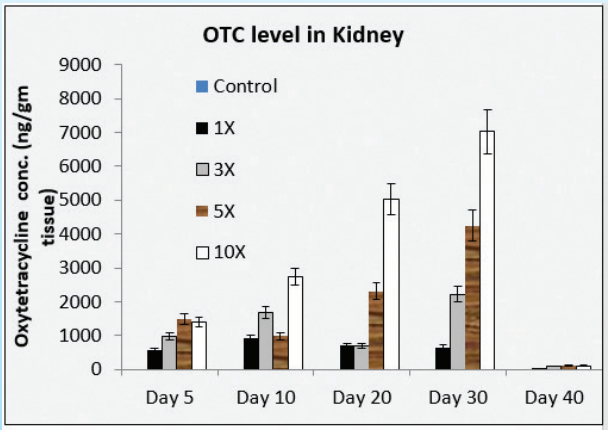
Fish (*Pangasianodon hypophthalmus*) were daily fed OTC at 80mg (1x, 3x, 5x, 10x) for 30 days, followed by 10-day post-drug observation.

Drug concentrations were measured in flesh, serum and other internal organs on 5, 10, 20, 30 and 40th day and correlated with fish health parameters and examined the body clearance of the drug.

The concentrations of oxytetracycline in plasma and different tissues/organs were measured using LC-MS/MS (AB Sciex 400 Qtrap) following approved methods.

Results showed that the drug is cleared from body very rapidly within 40 days.





Determination of withdrawal period of Emamectin benzoate in *P. hypophthalmus*

To determine withdrawal period of the drug, for safety of consumer, fish were daily fed with 1x dose of Emamectin Benzoate (EB) for 7 days, followed by 42 days post-drug observation and quantification of EB residue on predefined days.

Quantification of EB residue using LC/MS/MS showed that the drug is cleared from flesh in two weeks of withdrawal.

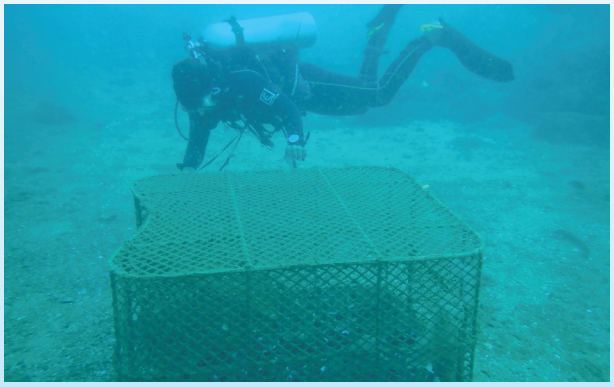
10. Investigations on Ghost Fishing by Derelict Traps and Gill Nets in Selected Areas of Indian Waters and Mitigation Measures

Funding Agency: Indian Council of Agricultural Research (ICAR) - Extramural
Grant amount: Rs. 27.00 Lakhs
Operating Division: Fishing Technology Division

Salient achievements:

For mitigating ghost fishing by lost traps, timed release mechanism (TRM) through incorporation of biodegradable / easily corrodible material was attempted. Through lab experiments and field exposure study, deterioration of different natural materials and loss in their mechanical strength properties over periods of exposure were assessed. Jute, cotton, aluminum, copper and iron were adjudged as the best materials for use in TRM in traps. Field trials were conducted using fish traps incorporated with timed release mechanism (TRM) using jute, cotton, iron, aluminium and copper in the trap fishing ground at Enayam, Tamil Nadu. Traps deployed at the sea floor along with control traps were monitored periodically using scuba divers. The TRM based on jute became effective after 45 days exposure in sea while that based on aluminium after 53 days.

The preliminary results showed that when a trap is lost, the trap door opens on its own after 45 to 53 days if the trap door is tied with jute or aluminum (instead of polypropylene rope) giving a chance for the trapped live fish to escape.



Monitoring deployed traps by scuba diving

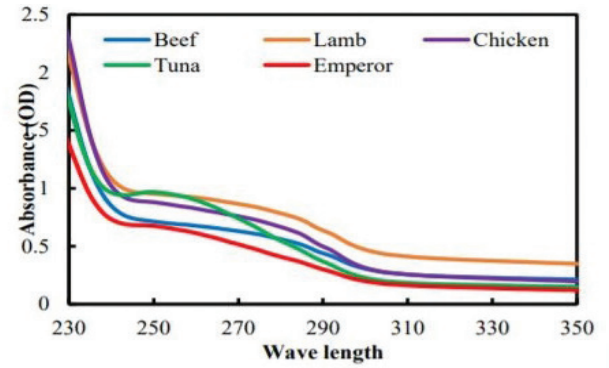
Fish traps deployed on sea floor

11. Biomodulation of Marine Biopolymers for the Preparation of Biomaterials of Healthcare Importance.

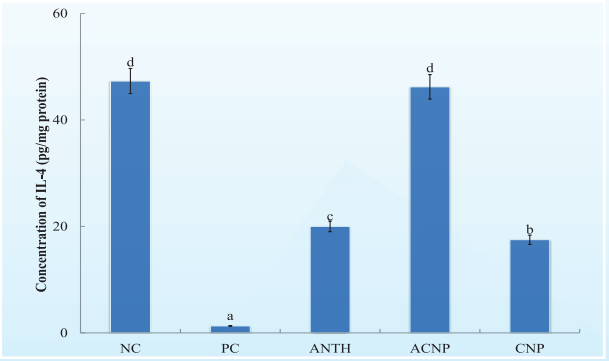
Funding Agency: Indian Council of Agricultural Research (ICAR) - National Fellow Project
Grant amount: Rs. 57.00 Lakhs
Operating Division: Biochemistry & Nutrition Division

Salient achievements:

The myofibrillar proteins of tuna and emperor have been extracted and compared with muscle proteins of beef, lamb and chicken. Physico-chemical, functional and rheological properties revealed that the myofibrillar proteins will make more useful way to develop the formulations of functional foods and nutraceutical products.



Encapsulated anthocyanin- loaded chitosan nanoparticles (ACNPs) indicated gastro protective action to alleviate inflammation of induced-gastric ulcer and confirm the cytoprotective effect against HCl-Ethanol induced necrotic damage to mucosal membrane.



The Physico-chemical characterization revealed that the chitosan nanoparticles-grafted fish gelatin-based bio-nanocomposite membranes have better cross-linking capability as well as higher porosity and swelling index properties.

Biochemical characterization of myofibrillar protein from fish muscle and its comparison with other muscle proteins have been assessed. The molecular interaction and surface hydrophobicity of myofibrillar proteins were found to have a linear direct relationship with functional and biochemical properties.

Methodologies developed

Method for the development of synthesis of Poly (vinyl alcohol)/Starch Based Composite Hybridized Films has been standardised

Method has been standardized for the conjugation of Rutin hydrate to sodium alginate

Technology transfer

Technology on production of seaweed sanitisers was transferred to M/s Kerala Nutraceuticals pvt. Ltd., Kerala.

Products developed

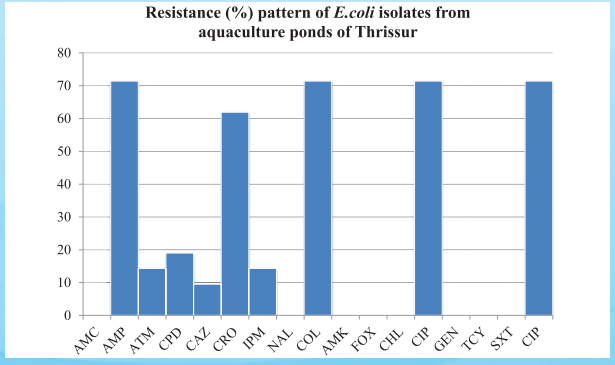
Rutin conjugated alginate with improved antioxidant property

12. Indian Network for Fisheries and Animal Antimicrobial Resistance (INFAAR)

Funding Agency: ICAR- CIFT as Network project
Grant amount: Rs. 30 Lakhs
Operating Division: Microbiology, Fermentation & Biotechnology Division and Research Centre of CIFT, Visakhapatnam

Salient achievements:

Antimicrobial Resistance was analysed in the farm samples. Out of 10 shrimp farms analysed, 6 farms revealed presence of *E. coli* (n=21), 8 farms harboured *Vibrio* sp (n=30) while all farms harboured Staphylococcus sp (n=59). *bla*TEM and *bla*CTX-M genes were detected in 8 out of 25 *E. coli* strains, while tetk gene was detected in 1 strain of *Staphylococcus* sp. isolated from the farms.



13. Determining Seasonal and Spatial Occurrence of Multiclass Endocrine Disrupting Chemicals in Fishes, Crustaceans and Molluscs of the Vembanad Urban Estuary: Risk Assessment by an Untargeted Metabolomics Approach

Funding Agency: Department of Science & Technology (SERB-ECRA-ED)
Grant amount: Rs. 34.78 Lakhs
Operating Division: Biochemistry & Nutrition Division

Salient achievements:

Multiresidue analytical method and risk assessment:

A large-scale screening and quantification method have been developed for more than 300 endocrine disruptors and pesticides by LC-MS/MS and GC-MS/MS. A single sample preparation method was developed for extraction of the contaminants and analysis was done by LC-MS/MS and GC-MS/MS.

Around 150 samples of various fish species from the Kochi estuary have been screened using the developed multiresidue method.

Metalaxyl and 2-phenyl phenol were the major contaminants detected.

A hazard index (HI) based analysis indicated low to moderate risk to the coastal population.

14. Green, Clean and Affordable Energy for Fishermen Community: Development of a Multipurpose Solar Thermal Conversion System with Gasifier/Biomass Heater Backup

Funding Agency: Department of Science & Technology [DST]
Grant amount: Rs. 24.71 Lakhs
Operating Division: Engineering Division

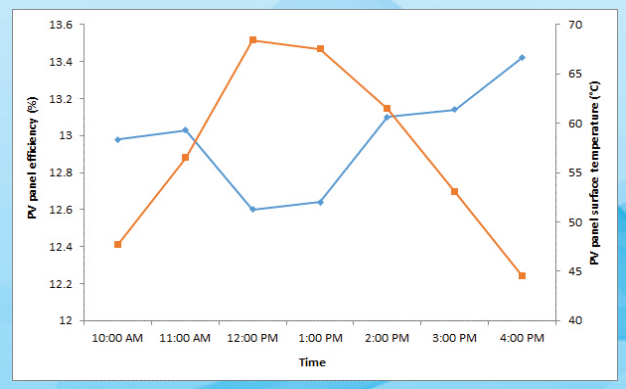
Salient achievements:

Preliminary experiments in the hybrid PVT system- A technique to decrease PV panel surface temperature and increase the panel efficiency has been developed using water as active cooling system.

Hybrid PVT system developed consists of 100W PV panel, 120 Ah battery and 6A charge controller, copper tubes, black painted aluminium sheets, temperature sensors and PUF insulation.

Photograph of developed hybrid photovoltaic panel (PVT) with charge controller.

The results of experiments revealed that PV panel efficiency is indirectly proportional to the panel surface temperature. High panel temperature due to high solar radiation lead to decreased PV panel efficiency. The water cooling of panel decreased PV surface temperature, thus resulted in increased panel efficiency.



Average PV panel efficiency against panel surface temperature in a typical sunny day.

15. Development of a foldable smart live fish transportation system for distant trade of table fish

Funding Agency: Department of Science & Technology [DST]
Grant amount: Rs. 48.79 Lakhs
Operating Division: Fish Processing Division

Salient achievements:

Preliminary survey on aquaculture systems carried out in selected aquaculture farms suggested that 60% was pond-type aquaculture, the remaining is comprised of cage culture, aquaponics, biofloc culture and crab fattening.

Tilapia was the commonly cultured species followed by pearl spot, seabass, milkfish, carps, etc. Shrimp farming and crab fattening were practiced only in the brackish water areas having an average salinity of 15 ppt.

Majority of farmers (60%) prefer live fish harvest on account of the high customer demand. However, lack of technical know-how was the major reason behind unadoption of live fish transportation. A few farmers were practicing open type methods of live fish transportation using plastic barrel/ tank with aerators to transport fishes like tilapia, seabass, *Caranx* sp. and *Lutjanus* sp.

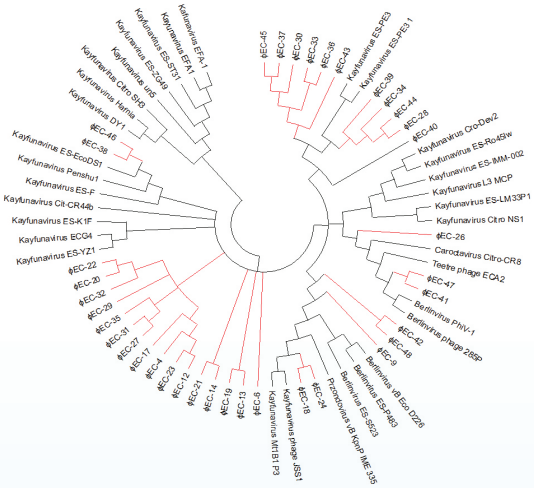
16. Screening lytic phages from diverse marine and aquatic niche for controlling bacterial pathogens associated with aquaculture and post-harvest fish quality

Funding Agency: Department of Biotechnology [DBT]
Grant amount: Rs. 60.12 Lakhs
Operating Division: Microbiology, Fermentation & Biotechnology Division and Research Centre of CIFT, Visakhapatnam

Salient achievements:

Polymerase chain reaction and sequencing: Fifty-four isolated bacteriophages were characterized by Polymerase chain reaction using the primers specific for the major capsid protein. A product of approx. 500 bp obtained specific for *Podoviridae* was sequenced.

The bioinformatic analysis indicated that the bacteriophage samples belonged to the lineage of *Caudovirales; Autographiviridae; Studiervirinae;* Kayfunavirus except two phage samples that were similar to Berlinvirus.

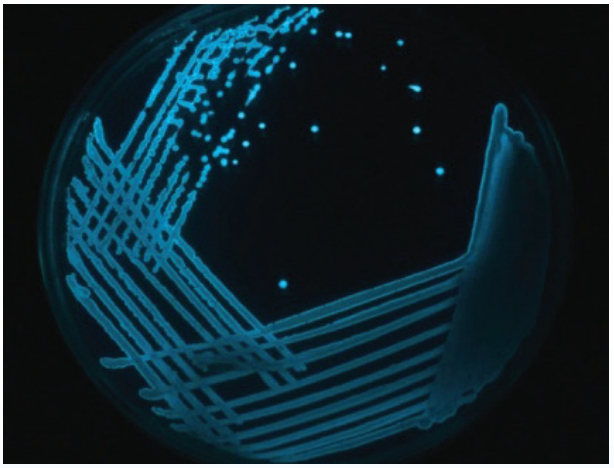


Phylogenetic analysis of the selected sequences using MegaX software using default parameters. Kay: Kayfunavirus, Un: Unclassified, Prz: Przondovirus, Ber: Berlinvirus, Car: Caroctavirus, Teet: Teetrevirus, Sipho: Siphoviridae

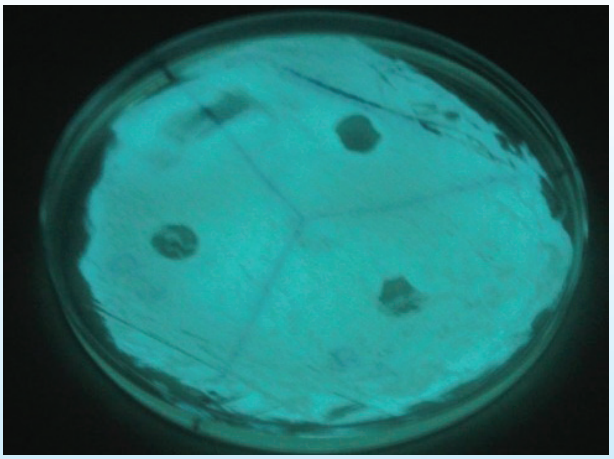
Whole genome sequencing revealed that the virus with 22 host range of AMR *E. coli* belonged to Autographiviridae. Total data generated from the WGS is 4.9Gb.

Restriction analysis of the phage DNA and the restriction patterns indicate that the phages could be different from each other.

A 2-step microtiter plate method was developed to simultaneously check wide values of MOIs, ranging between MOI-0.0001 to MOI-10,000, so as to optimize the most suitable MOI for inhibiting the growth of target bacteria.



Luminescent Vibrio harveyi isolated from shrimp hatchery



Lytic activity of vibriophage on luminescent Vibrio harveyi (Spotting method). Clear lytic spots seen on luminescent bacterial lawn

17. Design and development of hot air assisted continuous Infrared drying system for high value fish and fishery products

Funding Agency: Ministry of Food Processing Industries [MoFPI]
Grant amount: Rs.27.02 Lakhs
Operating Division: Engineering Division

Salient achievements:

A hot air assisted continuous infrared dryer was fabricated with multiple application in food processing. Performance evaluation of prototype dryer was carried out using shrimp, anchovy and squid rings.

Drying studies of shrimp, anchovy and squid were conducted under infrared-hot air combination mode at infrared radiation of 4500 W, air temperature of 70°C, air velocity of 1.5 m/s and IR source to sample distance of 10 cm.

Optimization of drying process parameters in IR-hot air mode of operation was done based on the observed values and the pilot scale design is in progress

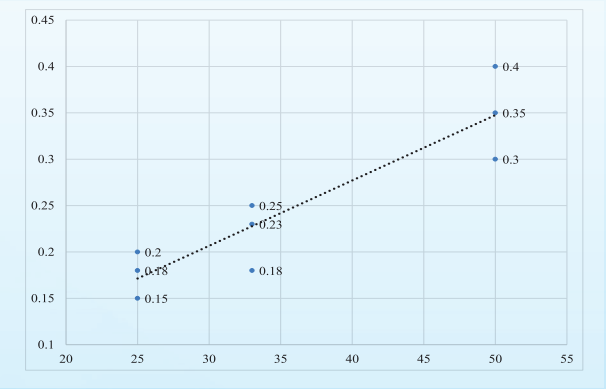
18. Validation and dissemination of Ocean State Forecast advisories along Gujarat

Funding Agency: ESSO - Indian National Centre for Ocean Information Services (INCOIS), Hyderabad
Grant amount: Rs. 26.07 Lakhs
Operating Division: Research Centre of CIFT, Veraval

Salient achievements:

ITKs on the abundance of jellyfishes along the Gujarat coast, were collected from the fishermen through structured surveys and observers were ranked were based on Garrett's ranking technique. Wind was the most important factor that determines the abundance of jellyfishes with abundance positively correlated with clearer waters also.

A preliminary study to understand the swimming speed of common jellyfish *Rhopilema* sp. was carried out in lab conditions with specimens collected during trawling operations. The displacement (speed) for smaller individuals (25-33 cm bell size) ranged from 0.15 to 0.25 m/s; whereas for the large individual 50 cm bell size, the average speed was 0.35 m/s.



Relationship between length (bell size – cm) and displacement (speed = m) for Rhopilema sp.

19. Assessing seafood exporting units needs for exporting value added products and capacity building requirements

Funding Agency: Marine Products Export Development Authority [MPEDA]
Grant amount: Rs. 32.51 Lakhs
Operating Division: Fish Processing Division

Salient achievements:

Face-to-face survey was conducted with the Firm owner/Firm Manager of 290 fish processing establishments covering 9 states – West Bengal (24), Orissa (26), Andhra Pradesh (40), Tamil Nadu (23), Kerala (53), Karnataka (24), Goa (9), Maharashtra (33), Gujarat (58), along the east and

west coast of India and collected the background information about the processing units including, its export performance, innovation orientation, pro-activeness, customer orientation, export channel, external working conditions and owners' opinion/expectations.

Of the total units surveyed, 60% of the units are involved in exporting cephalopods, 80% shrimp exports, 62% fish export. Raw freezing and Blast freezing in particular is the major activity of the units surveyed and frozen shrimp is the major commodity.

Majority of the processing units across all the maritime states are interested in initiating value-added products. Lack of quality raw material, skilled man powers, high throughput machineries and requirement for imported ingredients and machineries and difficulties in meeting the regulatory requirement of exporting and importing countries are found to be the major constrains for value addition.

Various recommendations related to infrastructure building, research and technology development, implementation of existing schemes, trainings required and gaps in communicating the various regulations have been proposed to boost the value addition activities in seafood processing and exporting sectors of India.

States	Fresh Chill	Blast Freezing	Raw freezing	IQF	Cooked & Frozen	Coated	Canned	Surimi
Gujarat	3.45	86.21	53.45	48.27	15.52	1.73	0	5.17
Maharashtra	78.78	90.91	87.88	51.51	36.36	6.06	0	6.07
Goa	0	77.78	55.56	33.33	11.11	0	11.11	0
Karnataka	20.83	75.00	75.00	12.50	4.17	4.17	0	16.67
Kerala	20.75	86.79	67.93	41.51	22.64	5.67	1.89	0
Tamil nadu	4.35	73.91	78.26	47.83	8.69	0	21.74	0
Andhra pradesh	0	42.5	87.50	82.50	45.00	2.50	2.50	0
Orissa	0	80.77	53.85	42.31	11.54	3.85	0	0
West bengal	0	45.83	91.67	62.50	16.67	37.50	0	0
India	15.52	74.83	71.72	49.32	21.38	6.21	2.76	3.11

Percentage of units involved in various activities in different maritime states

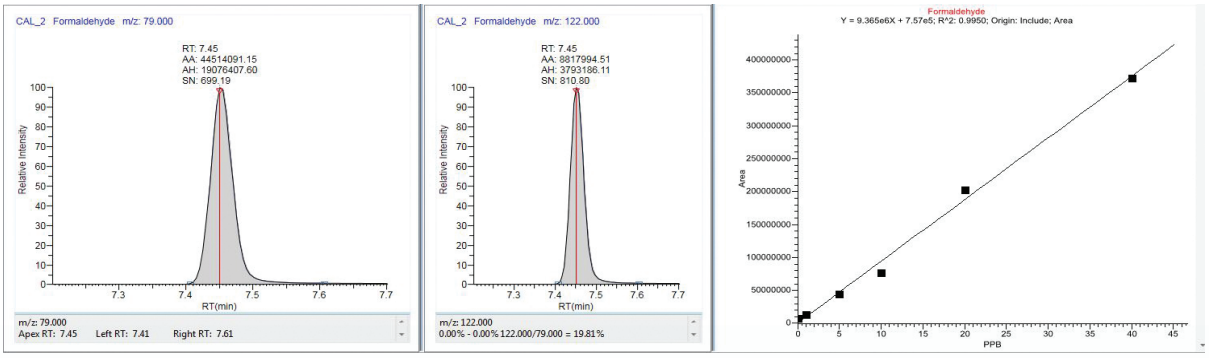
20. Natural Levels of Formaldehyde in Freshly Harvested Finfish and Shellfish Species

Funding Agency: Food Safety Standards Authority of India (FSSAI)
Grant amount: Rs. 54 Lakhs
Operating Division: Quality Assurance & Management Division

Salient achievements:

Commercially important finfish and shell fish species (2098 samples) were collected from different locations across India for estimation of formaldehyde in the flesh.

Maximum level of natural formaldehyde was observed to be 8 ppm in marine fish and 4 ppm in freshwater fish.



21. National surveillance programme for aquatic animal diseases

Funding Agency: National Fisheries Development Board (NFDB) - Network project
Grant amount: Rs. 204.00 Lakhs
Operating Division: Microbiology, Fermentation & Biotechnology Division

Salient achievements:

OIE listed pathogens were not detected in active surveillance of seven brackish water shrimp farms. Passive surveillance of six farms revealed EUS in Tilapia.

One imported frozen shrimp sample carried WSSV.

Tilapia Lake Virus, TiIV, was detected in Tilapia seed sample submitted by a farmer.

More than 100 farmers were benefited by testing of the seeds during the period.

22. Monitoring of heavy metal content in finfish and shellfish along the coast of India and possible mitigation measures

Funding Agency: Food Safety Standards Authority of India (FSSAI)
Grant amount: Rs. 50.00 Lakhs
Operating Division: Quality Assurance & Management Division

Salient achievements:

Heavy metal content was estimated in about 200 species of finfish and 40 shellfish along the coast of India.

Methyl mercury content of yellow fin tuna and sword fish in the coast of India were 80-92% of total mercury content.

Cadmium content in 1620 samples of finfish and shellfish samples were submitted as country data to Codex Committee on Contaminants in Foods (CCCF).

23. NETSCOFAN- Food Testing Group

Funding Agency: Food Safety Standards Authority of India (FSSAI)
Grand amount: Rs. 5.00 Lakhs *(Replenishible basis)*
Operating Division: Quality Assurance & Management Division

Salient achievements:

A ready reckoner of rapid food testing kits was developed.

Risk assessment on presence of chlorate in imported fish products was conducted.

Two research projects submitted to FSSAI for funding and one completed project was evaluated in collaborative mode with partner institutes.

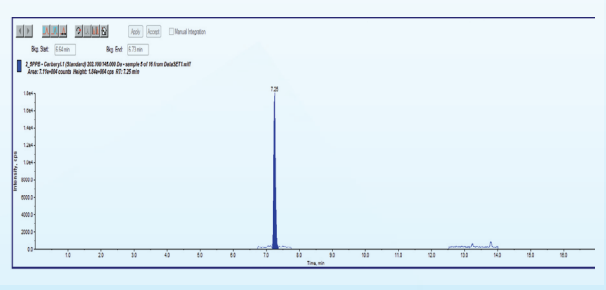
24. FSSAI-National Reference Laboratory

Funding Agency: Food Safety Standards Authority of India (FSSAI)
Grant amount: Rs. 25.00 Lakhs
Operating Division: Quality Assurance & Management Division

Salient achievements:

Trial study for multiclass pesticide residue was successfully conducted. All performance characteristics as per SANTE/12682/2019 were determined and validated.

Accreditation for proficiency test provider as per ISO 17043:2010 was initiated for Salmonella, Pesticide residue, Histamine, Heavy Metal and WSSV.



25. Improved coconut wood canoes for small scale fishing sector of southeast coast of India

Funding Agency: Coconut Development Board (CDB)
Grand amount: Rs. 34.72 Lakhs
Operating Division: Fishing Technology Division

Salient achievements:

Coconut wood was treated with biocides including 8% Chromated Copper Boron (CCB), three concentrations of nano copper oxide and nano copper oxide with a polymerising agent (polyaniline). Coconut wood treated with CCB showed the highest bending strength with a modulus of rupture (MoR) value of 73.359 N/mm^2. With the increasing concentration of nano copper oxide, MoR was found to be decreasing. SEM micrographs of treated wooden samples indicated strong interaction of copper compounds formed over the samples. The samples treated with 0.02% nano copper oxide over polyaniline showed the least leaching rates than CCB treated ones.

Treated and untreated coconut wood is exposed to aquatic environment for one year. The physical and mechanical changes of each treatment on wood before and after the marine exposure are being studied.

Control | 8% CCB | 0.02% Nano CuO | 0.02% Nano CuO+PANI

Coconut wood, before exposure

Control | 8% CCB | 0.02% Nano CuO | 0.02% Nano CuO+PANI

Coconut wood, after exposure (80 days)

Preliminary surveys were conducted along Tamil Nadu coast for the selection of most popular design of Catamaram/canoe. Colachel area of Kanyakumari district was identified for the implementation of project in the southeast coast of India. Coconut wood canoe of dimensions 8 m LOA, 1.1 m breadth and 0.7 m depth with FRP sheathing was quoted for Rs.1,70,000/- by a local supplier at Chellanam, Ernakulam District. Construction is under progress.

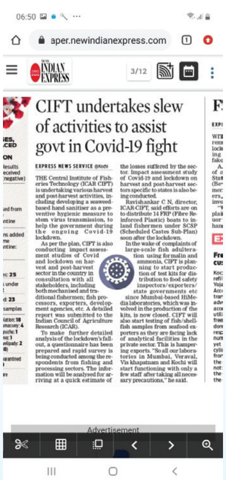
Boat under construction

Covid-19 Initiatives

The Covid-19 pandemic that spread all across the globe leading to lockdown, has significantly affected the fisheries sectors in a multitude of ways in the country. The fishers, processors and their communities have been facing the threat of the pandemic, which is affecting the entire value chain and the livelihoods depending on it. During this crisis, ICAR-CIFT has undertaken several initiatives to ensure the safety and wellbeing of all stake holders associated with fisheries sector of the country.

In fisheries sector, including capture fisheries and other associated activities, ICAR-CIFT took lead in developing and issuing a series of advisories through the Fishery Institutions, for ensuring safety of the workers and for preventing the spread of the disease. In this endeavour, ICAR-CIFT prepared advisories for the benefit of the fishermen, fishing boat owners, fishing harbours, fish market and seafood processing plants in 10 different regional languages such as Gujarati, Marathi, Kannada, Malayalam, Tamil, Telugu, Konkani, Manipuri, Assamese, Bangla, Odiya, English and Hindi. These advisories were popularized through print & electronic media, circulated to State Fisheries Departments, developmental agencies, NGOs and SHGs, and also through social media. Such efforts have been received very well by the sector across the country.

Recognizing the importance of these timely advisories, the Food and Agricultural Organization (FAO), Rome has recommended the advisories prepared by ICAR-CIFT to include them as Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries under the Asia-Regional initiatives for the benefit of fisheries sector across the globe (Webpage: http://www.fao.org/3/ca8959en/ca8959en.pdf). This is a huge acknowledgement of the efforts by the Institute.



CIFT undertakes slew of activities to assist govt in Covid-19 fight

EXPRESS NEWS SERVICE @Kochi

THE Central Institute of Fisheries Technology (ICAR CIFT) is undertaking various harvest and post-harvest activities, including developing a seaweed-based hand sanitiser as a preventive hygienic measure to stem virus transmission, to help the government during the ongoing Covid-19 lockdown.

As per the plan, CIFT is also conducting impact assessment studies of Covid and lockdown on harvest and post-harvest sector in the country in consultation with all stakeholders, including both mechanised and traditional fishermen; fish processors, exporters, development agencies, etc. A detailed report was submitted to the Indian Council of Agriculture Research (ICAR).

To make further detailed analysis of the lockdown's fallout, a questionnaire has been prepared and rapid survey is being conducted among the respondents from fishing and processing sectors. The information will be analysed for arriving at a quick estimate of the losses suffered by the sector. Impact assessment study of Covid-19 and lockdown on harvest and post-harvest sectors specific to states is also being conducted.

Ravishankar C N, director, ICAR-CIFT, said efforts are on to distribute 14 FRP (Fibre Reinforced Plastic) boats to inland fishermen under SCSP (Scheduled Castes Sub-Plan) soon after the lockdown.

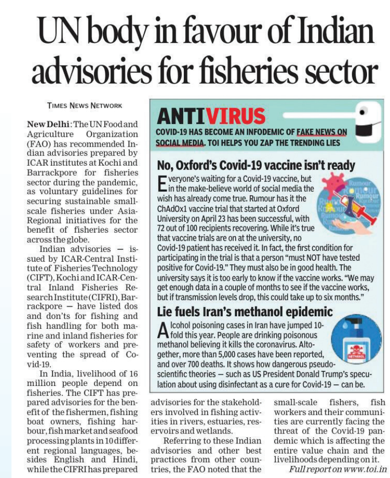
In the wake of complaints of large-scale fish adulteration using formalin and ammonia, CIFT is planning to start production of test kits for distribution to food safety inspectors/exporters/state governments etc since Mumbai-based HiMedia laboratories, which was involved in the production of the kits, is now closed. CIFT will also start testing of fish/shellfish samples from seafood exporters as they are facing lack of analytical facilities in the private sector. This is hampering exports. "So all our laboratories in Mumbai, Veraval, Vishakhapatnam and Kochi will start functioning with only a few staff after taking all necessary precautions," he said.

CIFT issues advisory for fishing community

SPECIAL CORRESPONDENT
VISAKHAPATNAM

The ICAR-CIFT has issued mitigation advisories for the fishing industry in view of the COVID-10 pandemic. The advisories are meant for fishing harbours and fish landing centres, seafood processing units, fish markets and the fishermen.

Scientist in-charge of Visakhapatnam centre of ICAR-CIFT R. Raghu Prakash said the advisories include screening, restricted entry, social distancing, disinfecting workspaces.



UN body in favour of Indian advisories for fisheries sector

TIMES NEWS NETWORK

New Delhi: The UN Food and Agriculture Organization (FAO) has recommended Indian advisories prepared by ICAR institutes at Kochi and Barrackpore for fisheries sector during the pandemic, as voluntary guidelines for securing sustainable small-scale fisheries under Asia-Regional initiatives for the benefit of fisheries sector across the globe.

Indian advisories — issued by ICAR-Central Institute of Fisheries Technology (CIFT), Kochi and ICAR-Central Inland Fisheries Research Institute (CIFRI), Barrackpore — have listed dos and don'ts for fishing and fish handling for both marine and inland fisheries for safety of workers and preventing the spread of Covid-19.

In India, livelihood of 16 million people depend on fisheries. The CIFT has prepared advisories for the benefit of the fishermen, fishing boat owners, fishing harbour, fish market and seafood processing plants in 10 different regional languages, besides English and Hindi, while the CIFRI has prepared advisories for the stakeholders involved in fishing activities in rivers, estuaries, reservoirs and wetlands.

Referring to these Indian advisories and other best practices from other countries, the FAO noted that the small-scale fishers, fish workers and their communities are currently facing the threat of the Covid-19 pandemic which is affecting the entire value chain and the livelihoods depending on it.

Full report on www.toi.in

ANTIVIRUS
COVID-19 HAS BECOME AN INFODEMIC OF FAKE NEWS ON SOCIAL MEDIA. TOI HELPS YOU ZAP THE TRENDING LIES

No, Oxford's Covid-19 vaccine isn't ready

Everyone's waiting for a Covid-19 vaccine, but in the make-believe world of social media the wish has already come true. Rumour has it the ChAdOx1 vaccine trial that started at Oxford University on April 23 has been successful, with 72 out of 100 recipients recovering. While it's true that vaccine trials are on at the university, no Covid-19 patient has received it. In fact, the first condition for participating in the trial is that a person "must NOT have tested positive for Covid-19." They must also be in good health. The university says it is too early to know if the vaccine works. "We may get enough data in a couple of months to see if the vaccine works, but if transmission levels drop, this could take up to six months."

Lie fuels Iran's methanol epidemic

Alcohol poisoning cases in Iran have jumped 10-fold this year. People are drinking poisonous methanol believing it kills the coronavirus. Altogether, more than 5,000 cases have been reported, and over 700 deaths. It shows how dangerous pseudo-scientific theories — such as US President Donald Trump's speculation about using disinfectant as a cure for Covid-19 — can be.

COVID-19 Advisory Series developed by ICAR-CIFT

CIFT-COVID-19 General Advisory

Languages: English, Hindi, Gujarati, Marathi, Konkani, Kannada, Malayalam, Tamil, Telugu, Odiya, Bangla, Assamese, Manipuri.

CIFT-COVID-19 Fishing Boat Advisory

Languages: English, Hindi, Gujarati, Konkani, Kannada, Malayalam, Tamil, Telugu, Odiya, Bangla, Assamese, Manipuri.

CIFT-COVID-19 Fish Transport Advisory

Languages: English, Hindi, Gujarati, Marathi, Konkani, Kannada, Malayalam, Tamil, Telugu, Odiya, Bangla, Assamese, Manipuri.

CIFT-COVID-19 Fish Market Advisory

Languages: Hindi, Gujarati, Marathi, Konkani, Kannada, Malayalam, Tamil, Telugu, Odiya, Bangla, Assamese, Manipuri.

CIFT-COVID-19 Fishermen Advisory

Languages: Hindi, Gujarati, Marathi, Konkani, Kannada, Malayalam, Tamil, Telugu, Odiya, Bangla, Manipuri.

CIFT-COVID-19 Seafood Processing Plant Advisory

Languages: Hindi, Marathi, Konkani, Kannada, Malayalam, Tamil, Telugu, Odiya, Bangla, Assamese, Manipuri.

CIFT-COVID-19 Fishing Harbour and Landing Centre Advisory

Languages: Hindi, Gujarati, Marathi, Konkani, Kannada, Malayalam, Tamil, Telugu, Odiya, Assamese, Manipuri.

Seaweed based CIFT-Nutraceuticals and sanitizers

ZAFORA-360 Enriched Fucoidan Capsules: Fucoidan is a high value polysaccharide with known health benefits including anti-inflammatory, anti-viral, and anti-cancer activities and applications in nutraceuticals and cosmetic products. Fucoidan was extracted from brown seaweed *Sargassum*

ZAFORA GARGLE: Zafora Gargle is a unique homogenous phyto-nutraceutical blend combining antiviral herbs based ready-to-use antiviral gargle without adding any preservatives or additives with a shelf life between 1 to 2 years.

ZAFORA Seaweed Hand Sanitizer: In the present context of pandemic Covid-19, a seaweed-based hand sanitizer was developed as an immediate hygienic control to contain the spread of corona infection. The major ingredients involved in the developed product are isopropyl alcohol, seaweed extract carrageenan and aloe vera extract.

ICAR-CIFT, Kochi Develops Pedal operated and Touch-free sanitizer dispenser units

ICAR-CIFT has developed a touch-free sanitizer dispenser for ideal use in offices, markets, malls and railway stations in view of COVID-19 pandemic and facilitated the personal sanitisation process.

Touch-free sanitizer dispenser displayed at the School Bhavan's Vidya Mandir, Eroor

The ICAR-CIFT Recreation Club distributed cloth masks and alcohol-based sanitizer to all staff members, free of cost, when COVID19 struck the State. The club also facilitated the supply of five-layered cloth masks, sanitizers and pedal operated sanitizer dispenser units prepared in CIFT lab during the COVID 19 pandemic.

Awareness programme on "COVID-19: do and don't"

Veraval Research Centre of ICAR-CIFT organized the awareness programme on "COVID-19: do and don't" to the staff of Veraval RC of ICAR-CIFT on 18 March 2020 A Practical demonstration on "Hand wash to prevent the spread of novel corona Virus" was also given.

Institute Building Activities

COLLABORATION WITH OTHER INSTITUTES

International Institutions

- Bay of Bengal Programme (BOBP-IGO)
- Food and Agricultural Organisation (FAO), Rome, Italy
- GESAMP of United Nations, London, UK
- National Oceanic and Atmospheric Administration (NOAA), USA
- World Wide Fund (India)
- University of Cambridge, England
- Chulalongkorn University, Bangkok
- University of Bradford, England
- University of Edinburgh, Scotland
- University of Liverpool, England
- University of London, England
- University of Southampton, England

National Institutes

- ICAR-Central Institute of Fisheries Education (CIFE), Mumbai
- ICAR-Central Marine Fisheries Research Institute (CMFRI), Kochi
- ESSO - Indian National Centre for Ocean Information Services, Hyderabad
- Agriculture Skill Council of India, Haryana
- Board of Radiation and Isotope Technology, BRIT-BARC, Mumbai
- Central Institute of Fisheries Nautical and Engineering Training (CIFNET), Cochin
- Entrepreneurship Development Institute (EDII) of India, Ahmedabad
- Export Inspection Agency (EIA), Kochi
- Fishery Survey of India (FSI), Kochi
- Food Safety and Standards Authority of India (FSSAI), New Delhi
- Marine Products Export Development Authority (MPEDA), Kochi
- National Fisheries Development Board (NFDB), Hyderabad
- National Institute of Fisheries Post Harvest Technology and Training (NIFPHATT), Kochi
- Export Inspection Agency (EIA), Veraval and Porbandar
- Export Inspection Agency EIA-Maharashtra, Goa and Gujarat
- Food Safety and Standards Authority of India (FSSAI), Kochi

State Departments

- Agency for Development of Aquaculture Kerala (ADAK), Kerala
- Department of Fisheries, Diu
- Department of Forestry, Tamil Nadu
- Department of Women and Child Development Centre, Kerala
- The Kerala State Co-operative Federation for Fisheries Development Ltd. (Matsyafed)
- Pollution Control Board, Kerala
- Rajiv Gandhi Centre for Aquaculture, Tamil Nadu
- State Fisheries Departments
- State Institute of Fisheries Technology, Kakinada
- Tamil Nadu Fisheries Development Corporation, Tamil Nadu

State / Universities/Colleges

- Indian Institute of Management, Bangalore
- Dr. V. S. Krishna Govt. PG college, Visakhapatnam
- GITAM Deemed to be University, Visakhapatnam
- Kerala Veterinary and Animal Sciences University, Wayanad
- Kerala Agricultural University
- Kerala University of Fisheries and Ocean Studies (KUFOS), Panangad
- Junagadh Agricultural University, Junagadh, Gujarat
- Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Tuticorin
- West Bengal University of Animal & Fisheries Sciences, Kolkata
- Andhra University, Visakhapatnam
- Cochin University of Science and Technology, Kochi
- Kamadhenu University, Gandhi Nagar, Gujarat
- Sri Venkateswara Veterinary University, Tirupati
- Christ College, Rajkot, Gujarat
- College of Fisheries Chhattisgarh, Kawardha
- College of Fisheries Technology, Ratnagiri
- College of fisheries, NAU, Navsari, Gujarat
- College of Veterinary and Animal Sciences, Mannuthy, Trissure
- SCMS Institute of Bioscience and Biotechnology, Kerala.

Other agencies

- Society of Fisheries Technologists (India) (SOFTI), Kochi
- Seafood Exporters Association of India (SEAI), Kochi
- Marine Biological Association of India (MBAI), Kochi
- NETFISH-MPEDA, Veraval
- District Youth Fishers Welfare Association, Kochi
- Udyabhansinhji Regional Institute of Cooperative Management, Gandhinagar

Private Sector

- Boat owner's association, Veraval
- Garware Wall Ropes Ltd., Pune
- Himedia Laboratories, Mumbai
- Jhindal Steels and Powers Ltd., New Delhi
- M/s. Nishiindo foods Pvt. Ltd., Veraval
- MS Swaminathan Research Foundation, Chennai
- Naturalle Herbal Remedies Pvt. Ltd., Bangalore, Karnataka
- The Sahara Matsyudhyog Adivasi Sahakari Mandli, Chopadvav, Sagbara, Narmada
- The Vadgam Vibhag Matsyudhyog Sahakari Mandli, Pantalavadi, Nadod, Narmada

Extension and Development Agencies

- Food and Agricultural Organisation (FAO)
- Bay of Bengal Programme (BOBP)
- ATMA Foundation, Thrissur
- Colleges in locality and Fisheries colleges in different states
- Kerala Development & Innovation Strategic Council
- Marine Products Export Development Agency
- National Fisheries Development Board Chulalongkorn University, Bangkok
- Petronet LNG

COMMERCIALISATION OF ICAR-CIFT TECHNOLOGIES

Sl. No:	Technology	Date of Agreement signing	Name of the Client
FISH COLLAGEN PEPTIDE			
1.	Production of fish collagen peptide and fish calcium	20.02.2020	M/s. ANDR, Mr. Sherwin James Karnataka
2.	Production of collagen peptide from fresh water fish scale	28.02.2020	Mr. Pratik Kantilal Kothari, Gujarat
NUTRACEUTICAL PRODUCTS & HAND SANITIZER			
1.	Production of seaweed nutri-powder, calcium-Iron fortified fish soup powder and hand sanitizer	20.03.2020	Bodina Naturals Pvt. Ltd. (BNPL), Kochi
FISH PROTEIN			
2.	Production of fish protein "Fish Pro"	08.06.2020	Arecia Life Sciences Pvt. Ltd., Ernakulam
SOLAR DRYER			
1.	Establishment of hybrid solar dryer and production of dry fish	12.06.2020	The Ocean Harbour India, Mr. Suneer V. A., Ernakulam
2.	Establishment of hybrid solar dryer and production of dry fish	16.06.2020	M/s. Fauna Foods, Maradu, Ernakulam
3.	Design and technical know-how of Solar-LPG Hybrid Dryer (100 kg capacity) for dehydration of gooseberry products	28.08.2020	Vcan Agro Foods, Maharashtra
4.	Technical know-how of Solar-tunnel dryer (50 kg capacity) for dry fish processing	25.09.2020	Galilee Fish, Kollam
5.	Technical know-how of solar-electric dryer (20 kg capacity) and training for dry fish processing	25.09.2020	Mr. Lijo K.V., Thrissur
6.	Design and technical know-how of solar fish dryer with LPG backup (300 kg) for hygienic drying of fish	09.12.2020	Elba Exports, Thrissur
7.	Technical know-how of solar-electric dryer (100 kg capacity) and training for dry fish processing	29.12.2020	Ranjini E., Kochi

VALUE-ADDED FISH PRODUCTS			
1.	Production of fish pickle and handling of fresh fish	16.06.2020	M/s. Fauna Foods, Maradu, Ernakulam
2.	Technical guidance and handing over of small scale processing aids of fish processing and engineering technologies developed / recommended by ICAR-CIFT, Kochi to the scheduled caste society for establishing small-scale unit for developing value added fishery products	24.07.2020	Shree Bhimrav Matshy Udhayog Seva Sahkari Mandali, Gujarat
3.	Technical know-how of dry fish, shrimp processing and other value-added products	02.11.2020	Sri Teja Solar Dy Fish, Andhra Pradesh
4.	Technical know-how and hands-on training for the production of value-added products (Fish/shrimp pickle, Fish cheese ball, Fish cutlet)	10.12.2020	Swadeep Shikshan Vikas Sanstha (NGO), Gujarat
5.	Technical guidance and support for production of fish pickle	18.12.2020	M/s Malsyaking Shree Viken Babu Bhai
FISH VENDING KIOSK			
1.	Setting up of chilled storage facility at retail fish vending hub in Aroor and technology for refrigerated mobile fish vending kiosk (CIFTEQ ChillFish-RKVK) through the empanelled manufacturing firm	02.07.2020	D'S Family Mart, Aroor

Agreement signing with Mr. Sherwin James of M/s. ANDR, Karnataka

Agreement signing with Mr. Boby Kizhakkethara of M/s. Bodina Naturals Pvt. Ltd., Kochi

Agreement signing with Mr. Steive Johaan & Mr. Kiran T. of Arecia Life Sciences

Agreement signing with Mr. Suneer V. A. of The Ocean Harbour India

Agreement signing with Mr. Prasobh & Mr. Sumesh of M/s. Fauna Foods

Agreement signing with Mr. Joseph Deleesh, Ms. Nisha Dani & Ms. Jency Denny of M/s. D'S Family Mart

Agreement signing with Mr. Shaji & Mr. Unnikrishnan of M/s. Galilee Fish

Agreement signing with Mr. Lijo K.V. & Mr. Sijo Paul, Thrissur

Director, CIFT launched the refrigerated fish vending kiosk at Kumbalangi, Kochi.

Touch-free sanitizer dispenser placed at Bhavan's Vidhya Mandir School, Eroor

Exchanging of MoU for production of collagen peptide from freshwater fish scale

Exchanging of MoU for technical guidance for production of value added products

S. No:	Technology	Date of Agreement signing	Name of the Client
	COLLABORATIVE RESEARCH		
1.	Antifouling strategies for aquaculture cage nets	16.01.2020	Inter Institute Research Collaboration with ICAR- CMFRI, Kochi
2.	Study on the "Development of Solar based renewable energy systems" in the following areas : 1. Concentrated solar thermal energy applications including drying 2. Development of energy efficient chilling system including solar based system	22.01.2020	Lanasol Energy Solutions Private Limited, Bangalore
3.	Conservation and management of trawl fishery of five species (*Parapenaeopsis stylifera, Metapenaeus dobsoni, Uroteuthis duvauceli, Sepia pharaonis, Amphioctopus neglectus*) from Kerala coast as per the FIP action plan	27.04.2020	SEAI-KFCCS Seafood Exporters Association of India – Kerala Forum for Crustacean and Cephalopod Sustainability, Kochi
4.	Conservation and management of deep-sea shrimp trawl fishery of three species (*Aristeus alcocki, Heterocarpus chani and H. woodmasoni*) in Kerala coast as per the FIP action plan	27.04.2020	SEAI-FDSSK Seafood Exporters Association of India – Forum for Deep-Sea Shrimp Sustainability, Kochi
5.	Setting up of two mobile fish display and vending units	02.07.2020	Torry Harris Seafoods Private Ltd., Alappuzha
6.	Collaborate in research and development of "Live fish transportation system"	18.09.2020	Cochin Food Tech Pvt. Ltd., Kochi
7.	Technical guidance and support for the establishment of "Modern hygienic fish market" at Karikkode, Kollam	29.10.2020	Kerala State Coastal Area Development Corporation Ltd. (KSCADC), Trivandrum
8.	Collaborate in research and development towards "Decarbonizing the fishing industry through the introduction of renewable energy systems and green technologies"	19.11.2020	YeSeN Sustain Private Limited (YSPL), Ernakulam

CONTRACT RESEARCH (GRANT-IN-AID / SPONSORED)			
1.	Solar-Electrical-LPG (3-in-one) Hybrid Fish Dryer (60-70 kg capacity) at ICAR-CIFT Campus, Kochi	09.01.2020	Dept. of Fisheries, Govt. of Kerala, Thiruvananthapuram
2.	Capacity building on use of CIFT-TED for Sea Turtle conservation - Enhancing awareness among stakeholders of trawl systems in Andhra Pradesh and Odisha	27.01.2020	WWF-INDIA, New Delhi
3.	Project on "Reducing bycatch of Elasmobranchs in trawl fisheries of Gujarat"	27.01.2020	WWF-INDIA, New Delhi
4.	"Supply, installation and technical consultancy for polyhouse tunnel solar dryer and affordable & safe fish products for ensuring the nutritional and food security of tribal and underprivileged children of Odisha"	15.02.2020	Borlaug Institute for South Asia (BISA), New Delhi

CONTRACT SERVICE			
1.	Testing of enzyme formulation of de-bittering of fish protein hydrolysate	01.05.2020	DuPont India, Performance Specialty Products (India) Pvt. Ltd., Haryana
2.	Microbiological analysis of herbal products	01.12.2020	Naturalle Herbal Remedies Pvt Ltd.
3.	Technical guidance and support for value added products from seafoods	20.12.2020	Shree Mahemudsya K Saiyad

INCUBATION FACILITY			
1.	Project to popularize e-commerce technology among fish retailers through the website : www.onlinefishsales.com and mobile app	20.05.2020	Foundation for Environmental Research and Innovation, FERI-TRUST ("Resinnov Blue Project"), Kannur
2.	Incubation facility	21.12.2020	Atma Farm Tech, Ernakulam

CONSULTANCY			
1.	Guidance on building of electrical marine craft	04.01.2020	Ramji Sankara Krishnan The UAV Company Pvt. Ltd., Trivandrum
2.	Technical guidance and support for the design and development of a chilled room and ice plant at Koorikuzhi, Thrissur	13.01.2020	Kaipamangalam Fishermen Development And Cooperative Society, Thrissur
3.	Technical guidance on "Value addition of fish & fishery products"	28.01.2020	M/s. The Karjan Jalasay Vistar Aadivasi Matsyodyog Sahkari Mandali Limited, Movi Borida Gujarat
4.	Technical guidance on "Value addition of fish & fishery products"	30.1.2020	M/s. The Sahara Matsyoudhyog Aadivasi Sahkari Mandali Limited, Chopadvav Gujarat
5.	Technical guidance on "Hygienic handing & maintenance in fish"	31.01.2020	M/s. The sagbara Taluka Matsyoudhyog Sahakari Mandali Limited, Motidevrupan Gujarat
6.	Preparation of general arrangement drawing of commercial fishing vessel under 24.0 m LOA	17.02.2020	Antony P.T., Ernakulam
7.	Inclining test and approval of trim and stability booklets	20.02.2020	Sicagen India Ltd, Puducherry
8.	Approval of design of long liner cum gillnetter, witnessing the inclining test and approval of trim and stability booklets	21.03.2020	Lockheed Engineering Works, Tamil Nadu
9.	Technical support for the construction of 3 marine ambulances.	27 08. 2020	Department of Fisheries & Cochin Shipyard Ltd
10.	Design approval of 18.0 m LOA FRP fishing vessel for long liner cum gillnetter etc.	15.10.2020	United Kireeti Marines Ltd., Andhra Pradesh
11.	Setting up of mini processing plant at Nandurbar	28.10.2020	Dept. of Fisheries, Nandurbar, Maharashtra
12.	Witnessing the inclining experiment and approval of Trim and Stability booklets	28.12.2020	Master Shipyard Pvt Ltd, Ernakulam
13.	NABL accreditation to CALG, KLDB, Trivandrum.	28.12.2020	Kerala Live Stock Development Board, Trivandrum.

Agreement signing with Mr. D. S. Bharath of Lanasol Energy Solutions Pvt. Ltd.

Agreement signing with Mr. Ramji Sankara Krishnan of The UAV Company Pvt. Ltd.

Agreement signing with Mr. Nidhin K.B of Kaipamangalam Fishermen Development & Cooperative Society

Agreement signing with M/s. Sicagen India Ltd., Puducherry

Agreement signing with WWF-India, New Delhi

Agreement signing with SEAI-KFCSS

Agreement signing with SEAI-FDSSK

Agreement signing with Dr. Rojith Girindran & Dr. Dhanya Joseph of FERI-TRUST

Agreement signing with Mr. Rajesh Babu of Torry Harris Seafoods Pvt. Ltd.

Agreement signing with Mr. Praveen Gopalan & Mr. K. Sathish Kumar of Cochin Food Tech

Agreement signing with Mr. George Mathew and Mr. Govind S. Menon of YeSeN Sustain Pvt. Ltd.

Agreement signing with Mr. Sanuraj of Atma Farm Tech Pvt Ltd

Installation of Cold storage facility at Vandanmedu Idukki for Kerala State Warehousing Corporation

Refrigerated fish vending kiosk (SAF) inaugurated at Kumbalangi fish market, Kochi

Work carried out through empaneled agencies

Pappi dry fish store started by Mr. Ananthakrishnan at Edakochi. The Solar Hybrid Dryer was manufactured by ICAR-CIFT empanelled agency, Kraftwork

Solar Dried Products Retail Outlet opened by Isra Foods at Peringala, Aluva

Solar Dryer established at ICAR-CIWA, Bhubaneswar, Odisha

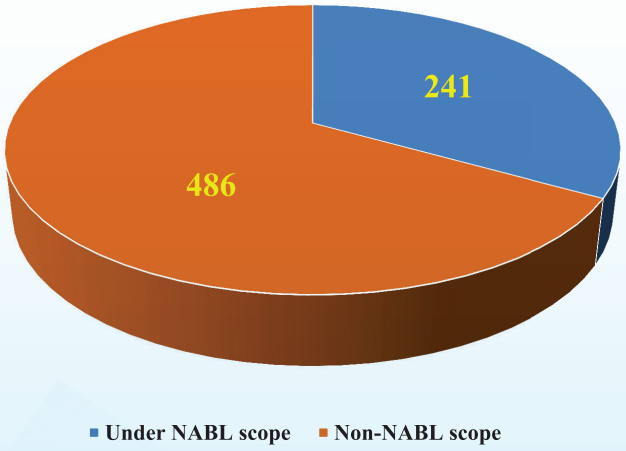
Consultancy on Marine Ambulance for Department of Fisheries, Kerala as part of Social Commitment of the Institute

For search and rescue operations in rough weather, Govt. of Kerala decided to construct three marine ambulance at Cochin Shipyard Ltd. (CSL) The supervision of design and construction of three marine ambulance at Cochin shipyard was entrusted to ICAR-CIFT Naval Architect Shri. M. V. Baiju. The design and construction were certified by IRS and the first Ambulance was launched on 27.8.2020 by Hon'ble Chief Minister of Kerala at CSL. This vessel having a LOA of 22.8 m and a mortuary, three bed for rescued fishermen, first aid facilities and facilities for the crew. It attained a speed of 14 knots during trials. No consultancy fee was collected for this programme.

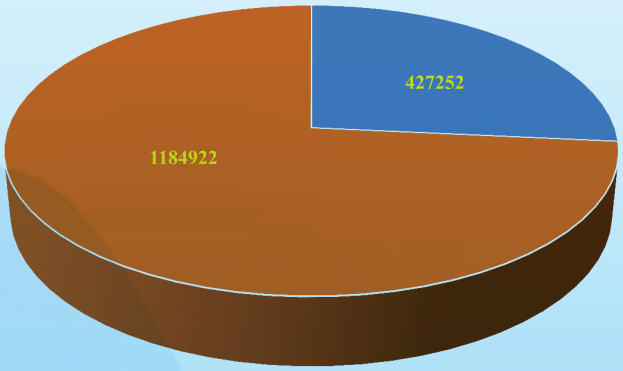
ANALYTICAL SERVICES

ICAR-CIFT is accredited laboratory under the ISO 17025:2017 and is a Referral Laboratory approved by the Food Safety Standards Authority of India, New Delhi. Besides analysing the Fish and fishery product samples (biochemical and bacteriological quality, quality of packaging materials, gear materials etc.) from seafood processing industries and various institutes. The ICAR-CIFT laboratory also addresses the legal samples received. The details of samples and the revenue generated are given below:

Details of Samples Received



Revenue Generated in Rupees



Workshops / Short Courses / Seminars / Conferences etc. conducted

Sl. No.	Title of the programme	No. of participants	Date and duration
1.	Agriculture skill council of india sponsored training program for the qualification pack aquatic animal health lab assistant.	15	22 .02.2020 to 17 .03. 2020
2.	ISO 17043: 2010 Training at ICAR-CIFT Kochi.	15	09.03.2020 to 10.03.2020
3.	ISO 17025: 2017 Transition Training at ICAR-CIFT Cochin.	56	11.03.2020 to 12.03.2020
4.	Sustainable water conservation practices in context of Kerala; In Webinar on Ensuring Water Security for Future organized by KSCSTE, GoK, NIT Suratkal and ICAR-CIFT Kochi.	100	08.05.2020
5.	Environmental Impact Assessment; In Webinar on EIA organized by Malayala Manorama.	120	04.06.2020
6.	WEBINAR organised by ZTMC ICAR-CIFT on Entrepreneurship Opportunities in Indian Fisheries Sector a crisis management support to overcome the impact of COVID-19 pandemic.	400	12.06.2020
7.	Innovations and entrepreneurial opportunities in Post-harvest Fisheries Engineering; In Webinar on Entrepreneurship opportunities in Indian fisheries sector organized by ZTMU, ICAR-CIFT, Kochi.	250	12.06.2020
8.	IPR Regime for Agri Innovations; In Webinar on Intellectual Property rights organized by RAFTAR ABI, KAU, Trissur.	50	17.06.2020
9.	Innovations and entrepreneurial opportunities in Post-harvest Fisheries Engineering; In Webinar on Innovations for boosting sustainable agriculture and Agri entrepreneurship: With special reference to North East region of India organized by KIIT-TBI, Bhubaneshwar.	56	14.07.2020

10.	Climate change and river management; In Webinar on Bharathapuzha river management organized by Friends of Bharathapuzha & VIMA.	75	14.07.2020
11.	National digital discourse on "Gender and pandemic".	40	10.08.2020 to 12.08.2020
12.	CIFT engineering technologies with special emphasis on refrigeration and drying; In Webinar oraganised by Farm Learner.	40	13.08.2020
13.	Online practical counselling and evaluation of course on "Coated products (BPVI-043)" for the registered candidates of IGNOU programme study Centre 2019-20 batch.	60	22.10.2020
14.	IGNOU Delhi Online Practical Counselling and Evaluation of Course on "Fish By-products and Waste Utilization (BPVI-044)" for the registered candidates of 2019-20 batch on“Diploma in Fish Products Technology” (DFPT).	75	23.10.2020
15.	Engineering technologies for "Aquaculture and Inland Fisheries"; In National Workshop on Water Quality management for Aquaculture organized by NIT, Puducherry, Tamil Nadu.	40	16.11.2020
16.	Scope and Application of sensor technologies in Post-Harvest Fisheries; In FDP on Sensor technology organized by KUFOS, Kochi.	150	23.11.2020 to 26.11.2020
17.	e-Symposium on "Challenges and Solutions for Seafood Safety- Analytical Techniques" ICAR-CIFT and Perkin Elmer.	156	16.12.2020 to 18.12.2020

Training/Awareness Imparted

Sl. No.	Subject	No. of beneficiaries	Venue and date
1.	Hygiene handling and value addition in fisheries.	56	07.01.2020 to 08.01.2020 Shiroda, Vengurla Taluka, Sindhudurg, Maharashtra
2.	ITEC training programme on "Sustainable management and entrepreneurship development" in fisheries for nutritional and livelihood security.	20	09.01.2020 to 20.01.2020 ICAR-CIFT, Kochi
3.	ITEC on "Sustainable management entrepreneurship development in fisheries for nutritional and livelihood security".	20	09.01.2020 to 20.01.2020 ICAR-CIFT, Kochi
4.	ITEC course on “Sustainable management and Entrepreneurship Development in Fisheries for Nutritional and Livelihood Security”.	20	09.01.2020 to 20.01.2020 ICAR-CIFT, Kochi
5.	Hygiene handling and value addition in fisheries.	52	09.01.2020 to 10.01.2020 ParuleVengurla Taluka, Sindhudurg, Maharashtra
6.	Implementation of HACCP in food industry.	25	13.01.2020 ICAR-CIFT, Kochi
7.	Microbiological quality analysis of fish and Fishery products.	25	13.01.2020 to 18.01.2020 Veraval RC of ICAR-CIFT
8.	HACCP Concepts.	25	13.01.2020 to 18.01.2020 ICAR-CIFT, Kochi
9.	Model Training Course on ‘Pluralistic Extension for upscaling secondaryfisheries’.	30	17.01.2020 to 24.01.2020 ICAR-CIFT, Koch

10.	Good customer and hygienic fish handling practices.	50	20.01.2020 Trivandrum
11.	In-plant training program for B.Tech (Food Engineering) students from KCAET, Tavanur on "Engineering Technologies".	20	20.01.2020 to 31.01.2020 ICAR-CIFT, Kochi
12.	Improved packaging and labelling methods for producing better quality dried fish	1	21.01.2020 Veraval RC of ICAR-CIFT
13.	Training programme on "Value added products from seafoods".	20	22.01.2020 to 24.01.2020 KVK, Wayanad
14.	Trainers training programme, technical staff of Loyola college on fish silage and foliar spray	2	22.01.2020 ICAR-CIFT, Cochin
15.	Value addition of fish and fishery products and recent advances in fishing technology.	54	27.01.2020 to 29.01.2020 Nandurbar, Maharashtra
16.	Hygienic handing & maintenance in fish.	20	28.01.2020 Sagbara, Gujarat
17.	Value addition of fish and fishery products.	20	29.01.2020 Sagbara, Gujarat
18.	Hygienic handing & maintenance in fish.	20	30.01.2020 Rajpipla, Gujarat
19.	Value addition of fish and fishery products.	20	31.01.2020 Rajpipla, Gujarat
20.	A training programme on 'Fish value added products and drying technology' under NEH programme of ICAR-CIFT	57	01.02.2020 KVK Sonitpur, Assam
21.	HACCP Concepts.	35	10.02.2020 to 15.02.2020 ICAR-CIFT, Kochi
22.	Value addition of fish and fishery products and recent advances in fishing technology (Under SCSP).	21	11.02.2020 to 13.02.2020 KardaTah, Maharashtra

23.	Preparation of feed from secondary raw materials from fish market.	43	12.02.2020 ICAR-CIFT, Cochin
24.	Practical session on “Improved fish drying and packaging” in the Indian Technical and Economic Cooperation training programme on “Improving fishery-based livelihood: Policies, technologies and extension strategies” under Indian Technical and Economic Cooperation.	20	13.02.2020 to 26.02.2020 ICAR-CIFT, Cochin
25.	ITEC training on ‘Improving fishery based livelihood: Policies, Technologies and Extension strategies’.	20	13.02.2020 to 26.02.2020 ICAR-CIFT, Cochin
26.	Under scheduled tribe component (STC) Programme-Awareness on “Hygienic handling and maintenance in fish”.	25	14.02.2020 Shimiliguda mini reservoir Araku valley (M), Visakhapatnam
27.	Under scheduled tribe component (STC) Programme- Awareness on “Value addition of fish and fishery products”.	25	14.02.2020 Shimiliguda mini reservoir Araku valley (M), Visakhapatnam
28.	Under scheduled tribe component (STC) Programme- Awareness on “Fabrication of improved gear materials for sustainable fishery”	25	14.02.2020 Shimiliguda mini reservoir Araku valley (M), Visakhapatnam
29.	Trainings for the commercial trawl fishermen at three locations along the Palk bay on "Rigging of the BRDs on to the trawl nets".	50	17.02.2020 to 21.02.2020 Mandapam, Kottaipattanam and Rameswaram fishing harbours
30.	Responsible fishing and fabrication of improved gillnets.	50	19.02.2020 Chopadvav, Sagbara, Narmada
31.	Awareness cum a training programme on “Fabrication of CIFT-TED (CIFT- Turtle excluder device)”.	25	20.02.2020 Visakhapatnam Research Centre of ICAR-CIFT
32.	Responsible fishing and fabrication of improved gillnets.	50	20.02.2020 Pantalavadi, Nadod, Narmada
33.	Agriculture skill Council of India sponsored training program "Aquatic Animal Health Lab Assistant".	15	22.02.2020 to 17.03.2020

34.	Training programme on "Good customer and hygenic fish handling practices" to Self-help members & employees in fish mart.	20	24.02.2020 to 01.03.2020 Kollam & Kottayam
35.	Process for the production of collagen peptide from fresh water fish scale.	1	26.02.2020 to 28.02.2020 Veraval RC of ICAR-CIFT
36.	Training cum demonstration programme on "Fabrication and benefits of square mesh cod ends".	50	02.03.2020 Veraval RC of ICAR-CIFT
37.	Under STC training cum demonstration programme on “Fabrication of improved gear materials for sustainable fishery”.	25	02.03.2020 to 04.03.2020 Shimiliguda mini reservoir Araku valley (M), Visakhapatnam
38.	Under STC training cum demonstration programme on “Hygienic handling and maintenance in fish”.	25	02.03.2020 to 04.03.2020 Shimiliguda mini reservoir Araku valley (M),
39.	Under STC training cum demonstration programme on “Value addition of fish and fishery products”.	25	02.03.2020 to 04.03.2020 Shimiliguda mini reservoir Araku valley (M),
40.	Hygienic handling of fresh water fish and its importance in quality maintenance.	20	05.03.2020 Pauri, Uttarakhand
41.	Value addition of fish and fishery products.	20	06.03.2020 Pauri, Uttarakhand,
42.	Training cum demonstration program on “ICAR-CIFT Turtle Excluder Device”.	25	08.03.2020 Dhamra, Odisha
43.	Training cum demonstration program on “ICAR-CIFT Turtle Excluder Device”.	25	11.03.2020 Balasore, Odisha
44.	One day demonstration on “Pre-processing and drying fish” for the ABI incubatees.	10	28.05.2020 ICAR-CIFT, Kochi
45.	One day demonstration on “Refrigerated fish vending kiosk” for the ABI incubatees.	10	20.06.2020 ICAR-CIFT, Kochi
46.	Hygienic handing & maintenance in fish.	5	18.07.2020 Veraval RC of CIFT

47.	Value addition of fish and fishery products.	5	21.07.2020 Veraval RC of CIFT
48.	Virtual training programme on "Processing and quality assurance in fisheries" for the Bachelor of Fisheries Science (BFSc) students from College of Fisheries, RPCAU, Dholi, Bihar.	20	01.09.2020 to 01.08.2020 ICAR-CIFT, Kochi
49.	Virtual In-plant training programme for B.F.Sc. students of College of Fisheries, Dholi, Bihar ICAR-CIFT, Kochi.	19	01.09.2020 to 01.10.2020 ICAR-CIFT, Cochin
50.	Effective health management for enhancing work efficiency of ICAR Employees' conducted by HRD cell of ICAR-CIFT.	250	23.09.2020 24.09.2020 ICAR-CIFT, Kochi
51.	Training programme on Fish drying technology.	17	25.09.2020
52.	Training on Hygienic handling and packing of fish for fisherwomen of Karikkode modern fish market, under 'Parivarthanam' project organized by Kerala State Coastal Area Development Corporation Ltd.	35	28.09.2020 Karikkode, Kollam
53.	Training programme on 'Refrigerated fish vending kiosk'.	11	28.09.2020 Karikkode, Kollam
54.	Hygienic handling and packing of fish" under 'Parivarthanam' project organized by ICAR-CIFT, Kochi & KSCADC, Thiruvananthapuram.	35	28.09.2020 Karikkode, Kollam
55.	Virtual Training programme to B.Tech food technology students (KUFOS) on "Post-harvest fisheries Engineering".	38	13.10.2020 to 16.10.2020
56.	Frontline demonstrations of Collapsible fish trap to the farmers of Goa and Honorable Chief Minister.	25	17.10.2020 ICAR-CIFT, KVK, South Goa
57.	Hygienic handling & value addition of fish and fishery products".	5	15.12.2020 to 16.12.2020 Veraval RC of ICAR-CIFT
58.	Production of value-added seafood products.	5	17.12.2020 to 18.12.2020 Veraval RC of ICAR-CIFT

One day training programme on "Pre-processing and drying of fish"

Awareness programme on post-harvest technologies at Shimiliguda mini reservoir, Araku Valley, Andhra Pradesh

Participants of the training programme at Rajpipla, Gujarat

Distribution of fish processing aids to the trainees at Shimiliguda mini reservoir, Araku Valley, Andhra Pradesh

Distribution of fishing gear materisls to the trainees at Chopadvav, Sagbara, Narmada, Gujarat

Demonstration of ICAR-CIFT collapsible traps at Krishi Vigyan Kendra (KVK), South Goa

નર્મદા જિલ્લાના સાગબારા અને નાંદોદ તાલુકામાં

આદિજાતિ માછીમારો માટે માછલીઓના આરોગ્યપ્રદ સંભાળ અને મૂલ્યવર્ધન વિશે અંગેની તાલીમ અપાઈ

મીઠું ચઢાવેલી સુકી માછલી, માછલી નું અથાણું માછલીના દડા અને માછલા કટલેટ સહિતની માછલીઓના મૂલ્યવર્ધન ઉત્પાદનો ની તૈયારી માટે પણ પહેલીવાર તાલીમ દ્વારા સજ્જ કરાયા

ગુજરાત કાઈમ બ્યુરોદીન જ્યોતિ જગતાપ, રાજપીપળા

નર્મદા જિલ્લાના સાગબારા અને નાંદોદ તાલુકામાં આદિજાતિ માંથી મારો માટે માછલીઓના આરોગ્યપ્રદ સંભાળ અને મૂલ્યવર્ધન વિશે અંગેની તાલીમ અપાઈ હતી. મીઠું ચઢાવેલી સુકી માછલી, માછલી,નું અથાણું માછલીના દડા અને માછલા કટલેટ સહિતની માછલીઓના મૂલ્યવર્ધન ઉત્પાદનોની તૈયારી માટે પહેલીવાર તાલીમ દ્વારા સજ્જ કરાયા હતા. આઈ. સી.એ.આર સેન્ટ્રલ ઈન્સ્ટીટ્યુટ ઓફ ટેકનોલોજીના વેરાવળ સંશોધન કેન્દ્ર દ્વારા નર્મદા જિલ્લાની અનુસૂચિત જનજાતિના માછીમારો માટે નિદર્શન પ્રશિક્ષણ તથા કૌશલ્ય વિકાસ કાર્યક્રમોનું આયોજન કરવામાં આવ્યું છે.

ગુજરાતના નર્મદા જિલ્લાના સાગબારા અને નાંદોદ તાલુકામાં આદિજાતિ માછીમારો સહકારી મંડળીઓની આદિજાતિ મહિલાઓ અને પુરુષોને માછલીઓના આરોગ્યપ્રદ નિયંત્રણના વિવિધ પાસાઓની તાલીમ આપવામાં આવી હતી. તેઓને મીઠું ચડાવેલી સુકી માછલી, માછલી નું અથાણું, માછલીના દડા અને માછલા કટલેટ સહિતની માછલીઓના મૂલ્યવર્ધન ઉત્પાદકો ઉત્પાદનોની તૈયારી માટે પણ સજ્જ કર્યા હતા. આદિજાતિના માછીમારો સામાન્ય રીતે માછલીઓને કેળવે છે, અને જળાશયોમાંથી પકડેલી માછલી વેપારીઓને રૂપિયા ૮૦ થી ૧૨૦ કિલો માં વેચે છે. જો વેલ્યુએડેડ પ્રોડક્ટ માછલી ની તૈયારી કરવામાં આવે તો તે ઓછામાં ઓછા ૩-૪ ગણા વધારે કમાણી કરી શકે છે.

આઈ.સી.એ.આર. સી. આઈ એફ ના વેરાવળ સંશોધન કેન્દ્રના વડા અને પ્રભારી વૈજ્ઞાનિક અને તાલીમ કાર્યક્રમો ના સંયોજન ડો. ટોમ્સ. સી. જોસેફે જણાવ્યું હતું કે આ તાલીમ કાર્યક્રમ નો મુળ હેતુ આદિજાતિ યુવાનોમાં ઉદ્યોગ સાહસિકતાનો વિકાસ કરવાનો છે. તાલીમ કાર્યક્રમો ગુજરાત સરકારના મત્સ્યઉદ્યોગ વિભાગ ના સહયોગથી લેવામાં આવે છે, પ્રોગ્રામ નું સંકલન કરનાર મત્સ્યઉદ્યોગ વિભાગ ના મત્સ્યઉદ્યોગ અધિક્ષક એચ.વી.મહેતાએ જણાવ્યું હતું કે નર્મદા ડીસ્ટ્રીક્ટની અનુસૂચિત જનજાતિની માછલીઓને પકડ્યા/કાપણી પછીની પ્રક્રિયામાં તાલીમ આપવામાં આવતી પહેલી ઘટના છે.રેણુકા વી. વૈજ્ઞાનિક આઈ. સી. એ. સી. આઈ.એફ. ટી. અને તાલીમાર્થીઓને માર્ગદર્શન આપ્યું હતું.

Local media coverage about the STC training programme organized by VRC of ICAR-CIFT

महिलाओं ने सीखे व्यंजन बनाने के गुर

जयन्त प्रतिनिधि।

पौड़ी। जिलाधिकारी धीराज सिंह गर्ब्याल के पहल से विकासखंड पौड़ी एवं कोट के स्वयं सहायता समूह की 40 अनुसूचित जाति महिलाओं को गुजरात की वैज्ञानिकों से मछली से बनने वाली तरह-तरह की व्यंजन बनाने के गुर सीखा है। प्रशिक्षण कार्यक्रम का उद्देश्य स्वयं सहायता समूह की महिलाओं को प्रशिक्षित कर आत्म निर्भर बनाना है।

प्रशिक्षण कार्यशाला में महिलाओं ने मछली के कटलेट, अचार, मोमो, फिश वॉल, चाउमीन, बिरयानी आदि व्यंजन बनाना सीखा।

बीएसआर फॉम खोलाचैरी पौड़ी में भारत सरकार के उपक्रम केन्द्रीय मात्स्यिकी प्रौद्योगिक संस्थान वेरावल गुजरात के वैज्ञानिकों ने विकासखंड पौड़ी एवं कोट के स्वयं सहायत समूह की 20-20 अनुसूचित जाति महिलाओं को भारत सरकार की एससीएसपी योजना के तहत दो दिवसीय मछली से बनने वाली व्यंजनों का प्रशिक्षण दिया। प्रशिक्षण के दूसरे दिन शुक्रवार को महिलाओं ने व्यंजन बनाकर प्रशिक्षक को परोसते हुए अपनी प्रतिभा का परिचय दिया। जिस पर उपस्थित सभी वैज्ञानिक दल ने महिलाओं की सीखने की प्रतिभा की तारीफ की। प्रशिक्षक दल में सीआईएफटी प्रधान वैज्ञानिक डा0 टाम्स सी. जोसफ, वैज्ञानिक डा0 रेनुका, रंजन सिंह, तकनीकी अधिकारी मुखवाना, एजाज परमार सहित संबंधित अधिकारी मौजूद थे।

Local media coverage about the SCSP programme organized by VRC of ICAR-CIFT

STC training programme organized by VRC of ICAR-CIFT

Exhibitions organized

Sl. No.	Name of the Exhibitions	Organizers	Date (Duration)
1.	7th Indian Science Congress (ISC) – Pride of India expo.	The Indian Science Congress Association (ISCA)	03.01.2020 to 07.01.2020
2.	MECOS-3 at ICAR-CMFRI.	Marine Biological Association of India, Kochi	07.01.2020 to 10.01.2020
3.	CLIMFISHCON -2020.	CUSAT, Kochi	15.02.2020 to 17.02.2020

4.	32nd Kerala Science Congress.	Kerala Science Congress	24.01.2020 to 27.01.2020
5.	Food Tech Kerala -2020.	Food Tech Kerala	30.01.2020 to 01.20.2020
6.	International Seafood show-2020.	MPEDA, Kochi	07.01.2020 to 09.02.2020
7.	Exhibition held in connection with International Conference ClimFishCon 2020.	CUSAT, School of Industrial Fisheries, Cochin, Kerala and Department of Fisheries, Govt. of Kerala	11.02.2020 to 14.02.2020
8.	Aqua Goa Mega fish festival in Aqua Goa – Mega Fish Festival 2020 Explore the wonders of the underwater world.	Directorate of Fisheries, Government of Goa	14.02.2020
9.	Eco system, Health and Fisheries of Indian Inland at Pantnagar, Uttarakhand.	ICAR-CIFRI, Guwahati, Assam	17.02.2020 to 19.02.2020
10.	National Organic Festival of women Entrepreneurs at New Delhi.	Ministry of Food Processing, Govt. of India	21.02.2020 to 23.02.2020
11.	Karshika Mela at CPCRI, Kasaragod.	ICAR-CPCRI, Kasaragod, Kerala	27.02.2020 to 02.03.2020
12.	Rural India Business Conclave & Horti fair and SITI Expo.	ICAR-CPCRI, Kasaragod, Kerala	01.03.2020 to 02.03.2020
13.	Agri-Business show-2020 (Virtual Exhibition).	Food Hospitality Media	15.10.2020 to 18.10.2020

Replies to Technical Queries

Technical queries received from the various categories of clients such as fish processors, technologists, entrepreneurs, self-help groups, Government organizations and fisherfolk were attended. The queries were related to the topics such as harvest and post-harvest technology of fish, participation in training programme and payment of fees, technical guidance, analytical testing services, assistance under technology transfer programme etc. Some of the items are given below:

- Reply to FSSAI Codex Contact point on CCCF13
- Reply to BIS on affirmation of standards for standards adopted by BIS in FAD 12 and FAD 15

- Queries and visits by entrepreneurs and students on testing of samples and utilization of fish waste for development of fish feed and poultry feed were attended.
- Attended press conference on the discussion of Swatchtha action plan activities of ICAR-CIFT.

Radio Talks

Sl. No.	Name	Topic	Broadcasted by	Date
1.	Dr. Manoj P. Samuel	Fish drying technologies	All India Radio program: Valayum Veedum	07.07.2020.
2.	Dr. Manoj P. Samuel	Rainwater harvesting	Red FM	22.09.2020
3.	Dr. Saly N. Thomas Dr. Madhu V. R.	Plastics associated with fishing operations	All India Radio	30.09.2020

Invited Talks

Dr. Ravishankar C.N.

- Webinar on 'Business Opportunities in Fish Post-Harvest' organized by ICAR- Central Institute of Post Harvest Engineering & Technology, Ludhiana on 01 June 2020
- 3rd Tuna Webinar Series: Certification and Technology on 02 September 2020
- 7th Dr. B P. Ghidyal Memorial Lecture on 03 September 2020
- Sectional Committee meetings 2020 – Section IV: Fisheries Sciences on 03 September 2020
- Webinar on "Hydrohraphy & Fisheries and their intrinsic linkages with Blue Economy on 05 September 2020
- SaGHAA Webinar 2020, Managing the Polar oceans on 06 September 2020
- Vaishvik Bhartiya Vaigyanik (Vaibhav) Summit 2020, Food safety and Nutritional Security with sub-horizontal Smart and biodegradable packaging on 01 October 2020

Dr. Ashok Kumar K

- An introduction to seafood processing and quality assurance, Training programme on " Hygenic handling and packing of fish under Parivarthanam", Karikode modern Fish Market, Kollam, 28 September 2020

Dr. M M Prasad

- Major food borne pathogens in fish and fish products: Challenges in India, Food Web Series 2, 01 June 2020
- Factors facilitating emergence and spread of resistance in livestock and fishery sectors. Possible containment measures, Orientation on Understanding basics of antibiotics in context of antimicrobial resistance for INFAAR members, 22-23 June 2020

- Dynamics aiding rise and spread of AMR in aquaculture: Probable mitigation measures, National Webinar on Aquatic Animal Health Management for Sustainability of Aquaculture Production on the Occasion of Release of Standard Operating Procedures for Aquatic Animal Health Management, 25 August 2020
- Microbial hazards associated with Fish and Fish products: Measures of Mitigation, VIRTUAL training programme on "Processing and Quality Assurance in Fisheries' for the Bachelor of Fisheries Science (BFSc) students from College of Fisheries, RPCAU, Dholi Bihar, 01 September 2020 to 01 October 2020

Dr. Leela Edwin

- "Energy Consumption in Indian Marine Capture Fisheries and Need for optimization". International Conference on 'Impact of Climate Change on Hydrological Cycle Ecosystem, Fisheries and Food Security (CLIMFISHCON)'.14 February 2020 at Cochin.
- "Sustainability issues in Marine Fishing". International Centre for Environment Audit and Sustainable Development (iCED) hostedNational Training Programme on"Audit of Water Pollution and Marine Biodiversity" Video Conferenceon 18 December 2020.
- Career guidance for M.Sc. (Industrial Fisheries) students. Industrial Fisheries students, Virtual Presentation on 14 November 2020

Dr. A.K. Mohanty

- Promoting EDP in fisheries: A way forward for Covid-19 crisis management, Webinar on "Entrepreneurship Opportunities in Indian Fisheries Sector" Organised by CIFT, Kochi, CMFRI, Kochi, CIBA, Chennai, CIFRI, Barrkpore, CIFE, Mumbai,CIFA, BBSR, DCFR, Bhimtal, NAARM, Hyderabad, ICAR, New Delhi, IIIT, Kottayam, MSME, Kerala, Online; 12 June 2020

Dr. Manoj P. Samuel

- Keynote address in the National Conference on 'Sustainable Natural Resources Management: An Engineering Perspective, College of Forestry, Ponnampet under University of Agricultural and Horticultural Sciences, Shivamoga, Karnataka, 28 -29 January 2020
- Keynote address in the Pamba River Environment, Seminar held at Maramon, Pathanamthitta District, 20 January 2020.
- Technical talk in the 27th ICFoST-2019 (Indian Convention of Food Scientists and Technologists), by AFSTI at Tezpur University, Tezpuron, 31 January 2020.
- 'Climate smart Agriculture for Livelihood and Food Security', Swadeshi Science Congress at ICAR-CPCRI Kasaragod, 27 February 2020
- On-line session on Engineering interventions in post-harvest fisheries', WBUAFS, Kolkata, 06 May 2020
- Different aspects of sustainable water conservation in context of the status of Kerala, webinar on "Ensuring Water Security for Future" by KSCSTE organized by Kerala State Council for Science, Technology and Environment, Govt of Kerala in collaboration with ICAR-CIFT, Kochi and National Institute of Technology, Surathkal, 08 May 2020
- On-line session on Engineering interventions in post-harvest fisheries', SKUAST - K, Srinagar, 16 May 2020.

- Webinar on Environmental Impact Assessment, Malayala Manorama Media group, 04 June 2020.
- Webinar on IPR Regime for Agri Innovations, RAFTAR-ABI, KAU, Thrissur, 17 June 2020
- Webinar on Innovations for boosting Sustainable Agriculture and Agri entrepreneurship: With Special Reference to North East region of India, KIIT-TBI, Bhubaneshwar, 29 June 2020
- Climate change and River management, Friends of Bharathapuzha and VIMA, 14 July 2020
- Kerala's climate and Water management, Kottayam Nature Society and Alappuzha Natural history Society, 19 July 2020
- Building up IP portfolios for start ups', 'R-ABI, Kerala Agricultural University, 09 October 2020
- Webinar series on 'Agricultural engineering and food processing: Brighter career opportunities' ICAR-CPCRI

Dr. Suseela Mathew

- "Marine Nutraceuticals in sports medicine" for the National seminar "Relevance of fish nutrients in sportsmen nourishment", St. Alberts College, Ernakulam.

Dr. Zynudheen A. A.

- Overview: Safety and quality of fish, Virtual training programme on 'Processing and Quality Assurance in Fisheries' conducted by ICAR-CIFT, Kochi for B.F.Sc students of College of Fisheries, Dholi (RPCAU), Bihar, 07 September 2020
- Fish waste utilization, Virtual training programme on 'Processing and Quality Assurance in Fisheries' conducted by ICAR-CIFT, Kochi for B.F.Sc students of College of Fisheries, Dholi (RPCAU), Bihar 22 September 2020

Dr. Saly N. Thomas

- "Plastic pollution in the ocean and its effects on fishing industry", Occasion of the World Fisheries Day celebrations by Department of Aquaculture, S H College, Thevara. 21 November 2020

Dr. Remesan M.P.

- "Current issues in the harvest sector of Inland Open Waters of India". Global webinar on Small Scale Fisheries in Inland Open waters: Status & Opportunities, 09-10 September 2020

Dr. Nikita Gopal

- Women in Post-Harvest Fisheries: Undervalued and Unrecognised, Virtual Consultation on "Science for Resilient Food, Nutrition and Livelihoods: Contemporary Challenges" in the session "Post-harvest markets and supply chains" organized by M. S. Swaminathan Research Foundation, Chennai, Online; 10 August 2020
- Introduction to Fisheries Economics (B.FSc students, College of Fisheries, RPCAU, Dholi, Bihar), As part of the 'Virtual Training Program on Processing and Quality Assurance in Fisheries', 30 September, 2020
- Women empowerment in fisheries in the Gandhian Perspective, Organised by ICAR-CIFRI, 01 October 2020
- Marketing innovations in fisheries in COVID times of India, organized by Dr. MGR FCRI, Thalainayeru (Dr. J. Jayalalithaa Fisheries University), 13 October, 2020

- Gender in fisheries- present status and future road map, National Webinar on "Evolving livelihoods for women in post-harvest fisheries: approaches, policies and institutional support" organised by ICAR-Central Institute for Women in Agriculture (ICAR-CIWA), Bhubaneswar, 14 December 2020

Dr. V. Geethalakshmi

- 'Conjoint analysis in Fisheries data sets', Online training programme on "Data Analytics in Fisheries" organized by Fisheries College and Research Institute, TNFU, Nagapatnam. Online programme 20-28 August 2020
- Fisheries sector and data needs: Connecting the world with trustworthy data, World Statistics Day. Event organised by MPEDA, Cochin, Online; 20 October 2020
- Timeseries analysis – Tools and applications in fisheries research, Online training programme on "Statistical Tools for Applied Research (STAR)"organised by Department of Agricultural Statistics, College of Agriculture, KAU, Trivandram, Online; 10 October 2020
- 'Studying consumer preference of fisheries products', Training on "Data Analytics in Fisheries" by Fisheries College and Research institute, Nagapatinam, Tamil Nadu, 20 August 2020

Dr. R.Anandan

- "Nutritional, Pharmacological and Biomedical Applications of Marine Biomolecules"for the National seminar "Relevance of fish nutrients in sportsmen nourishment", St. Alberts College, Ernakulam

Dr. Bindu J.

- Advances in Fish Processing Technology, ITEC programme on "Sustainable Management and Entrepreneurship Development in Fisheries for Nutritional and Livelihood Security", ICAR-CIFT, Cochin, 09-20 January 2020
- Biodegradable packaging, National Seminar on "Food for Future", Voc Food Processing Technology Department, St. Teresa's College, Ernakulam , 04 February 2020

Dr. George Ninan

- Entrepreneurship Opportunities in Indian Fisheries Sector A crisis management support to overcome the impact of COVID-19 pandemic, ZTMC (Fy) ICAR CIFT, Webinar Programme, 12 June 2020.
- Entrepreneurship Development in Fish Processing Sector 2nd July 2020, CoF CAU Tripura, Webinar Programme, 02 July 2020
- Agri Business Incubator- Translating Ideas in to reality, RABI, KAU, Online Webinar Programme, 26 August 2020
- "Business Opportunities in Value added products using Fish", Agro Business – Food Processing Incubation Program – ARISE – Online Awareness Program KIED, Ernakulam, Webinar Programme, 18 September 2020
- Incubation in Fisheries Post-Harvest Sector, Kalpa Green Video Chat series on 26 September 2020 organised by ABI Unit, ICAR -CPCRI, Webinar Programme, 26 September 2020.
- Entrepreneurship Development in fish and shellfish products, Webinar organised by NAHEP CAAST, ICAR CIFE, 06 October 2020.
- മത്സ്യ സംസ്കരണ മേഖലയിലെ നൂതന ആശയങ്ങളും സംരംഭക സാധ്യതകളും, Webinar organized by Taluk industry Centre Kochi, 08 October 2020.
- Facilities and Opportunities provided at Agri Business Incubator of ICAR-CIFT, Kochi, Agripreneurship Orientation & Startup Incubation Training Programme KAU RAISE 2020, 09 October 2020.

- Value addition and cold chain in Fisheries, MSc Food Science students, KUFOS, Online training 15 October 2020
- Chilling and freezing technology and introduction to entrepreneurship in fisheries sector, Virtual In-plant training programme for B.F.Sc. students of College of Fisheries, Dholi, Bihar, 17 September 2020
- Entrepreneurship opportunities in Fisheries Post-Harvest Sector, Agri Seminar organized by State Agriculture Management & Extension Training Institute, 13 October 2020.
- Technological Interventions in Harvest and Post-harvest Sector for improved utilization and promote entrepreneurship in fish value chain, Expert consultation meeting on Promoting Innovations in Fisheries Value Chain for Improving Human Nutrition in South Asia Organized by SAARC Agriculture Centre (SAC), Dhaka, Bangladesh. Special Paper presentation, 25 November 2020.

Dr. Ashaletha. S

- "Women entrepreneurship development in fish processing sector", Webinar organized by College of Fisheries, Central Agricultural University-I, Tripura on 'Entrepreneurship Development in Fish Processing Sector 15 June 03 July, 2020.
- "Fisherwomen in the Pandemic era- the Struggle for Survival", A two days International Webinar on "Vulnerabilities through the gendered lens: Lessons from Covid-19 organized by Women's Studies Centre Cochin University of Science and Technology, Kerala, 06-07 August 2020
- Fisherwomen in the pandemic era- the struggle for survival, Global Webinar on the topic "Vulnerabilities through the Gendered Lens: Lessons from Covid-19", organised by Women Studies Centre of CUSAT, 07 August 2020

Dr. R. Raghu Prakash

- "Recent advances in harvest technologies for sustainable fisheries", In a five day faculty development programme in Zoology on New knowledge in Animal Science and Emerging Technologies in Molecular Biology organized by Commissionerate of Collegiate Education, Govt. of Andhra Pradesh, 07 July 2020

Dr. Toms C. Joseph

- "Future of Biotechnology" , SCMS Institute of Bioscience and Biotechnology, Kerala, 09 July 2020

Dr. L. N. Murthy

- Freshwater fish utilization, value addition and marketing opportunities in fisheries Five Days Online Vocational Training Programme on "Augmenting sustainable production, processing and safety of food of aquatic origin" Organized by Department of Fish Processing Technology and IDP cell, College of Fisheries Science (JAU), Veraval, India, 12-16 October 2020
- Seafood: processing, safety, residual contaminants", Online training program on "Innovative Approaches in seafood processing and Quality Control" (Organized by ICAR-Central Institute of Fisheries Education and NAHEP), 01-08 May 2020
- Seafood: Processing, quality, safety and marketing opportunities, A national webinar on "Value Chain Development In Fish Processing: Way forward", Organized by College of Fisheries, Tripura and College of Fisheries, Ludhiana, 18 June 2020
- Post-Harvest Losses and Utilization of freshwater fishes as nutrients, Fish Farmers Day Celebration (Organized by KrishiVigyan Kendra, Taralabalu, Davangere, Karnataka, 10 July 2020

- Employment Opportunities in Fisheries Sector, National Webinar on “Importance of post-harvest management in fishery sector” Organized by College of Fishery Science, Dr. NanajiDeshmukh Veterinary University, Jabalpur, 17-18 July 2020
- Seafood: Processing, quality, safety and marketing opportunities, National Webinar on “Prospects and possibilities of Fish Processing in Chattisgarh" Organized by College of Fisheries, Chattisgarh, 27 August 2020
- Recent technologies in Fish processing, Webinar on "Recent techniques in Aquaculture", Organized by Fisheries Research and Information Centre, Bangalore, 29 August 2020
- Food Safety Measures in Marine Products, Khadya Sangam – 2020 at Mother Teresa Park of St. Aloysius College, organized by Department of Post Graduate Studies and Research in Food Science 14 January 2020

Dr. A. Suresh

- Reforming Agricultural Extension System in India: Public Policy Perspectives, Organised by Kerala Agricultural University, 23 October 2020
- Cost of cultivation- principles and practical utility, Organised by College of Agriculture, KAU, Vellayani, 09 November 2020
- Agricultural Extension System in India: Challenges and Way forward In the webinar series entitled "Transforming Indian Agriculture: Role of Policies and Reforms organized by College of Agriculture, Vellayani, 01 October 2020.
- Cost of cultivation- principles and practical utility, For the final year B.Sc (Agri.) students as part of their Rural Agricultural Work Experience (RAWE) programme organized by College of Agriculture, Vellayani, 09 November 2020

Dr. G.K. Sivaraman

- Monitoring and manipulation of microbial communities in aquaculture setting to combat antimicrobial resistance, 3rd International Symposium on Genomics in Aquaculture (ISGA- III), Bhubaneswar, Odisha; 21-23 January 2020

Dr. Madhu V R

- “Bycatch reduction in trawl fisheries”, training program organized by MSSRF for fishermen from Palk bay , 23 October 2020

Dr. B. Madhusudana Rao

- Post-harvest Fisheries: An overview of business opportunities and challenges for food safety. National Conference on New Horizons in Nutrition, health and Environment 2020 organised by GITAM deemed to be University, Visakhapatnam, 10 January 2020
- ‘Fisheries Sector: Post harvest business opportunities and challenges ‘ In the Regional webinar organized by Fisherfolk Foundation, East Godavari District, Andhra Pradesh, 08 August 2020

Dr. Asha K K

- DBT sponsored International Seminar on “Innovative and Sustainable Aquaculture”, Mar Athanasius College, Kothamangalam, 03-04 February 2020

Dr. Satyen Kumar Panda

- Safety and Quality of Fish and Fish Products, Panelist in the Session on Agro-economy & Food Security and session on Food Safety and Quality in the Vaishvik Bhartiya Vaigyanik (Vaibhav) Summit organized by Prime Minister’s Office (PMO), Govt of India, 14 October 2020

- Regulatory Scenario for Food of Animal Origin as per FSSAI, eSymposium on 'Challenges and Solutions for Seafood Safety- Analytical Techniques', ICAR-CIFT and Perkin Elmer from 16-18 December 2020
- Tips and Tricks for Heavy Metal Analysis, eSymposium on 'Challenges and Solutions for Seafood Safety- Analytical Techniques' ICAR-CIFT and Perkin Elmer from 16-18 December 2020
- Rapid food testing: Microbiological Testing and Accreditation Challenges, Training programme organized by NABL, Quality Council of India, Online, 14 July 2020
- Want to be an Aquaculture Researchpreneur?, Mun Bhi Samartha Foundation, Online, 28 November 2020

Shri. M.V. Baiju

- "Factory vessels", Master Mariners online, Synergetic Engineering Solutions Pvt. Ltd. 14 November 2020
- Lecture on "Deep Sea Fishing in India: Initiatives by ICAR-CIFT" in Boost-up Blue Economy in Tamil Nadu Through Coastal Cage Farming and Deep-Sea Fishing (BBCD'2020)". Institute of Fisheries Post Graduate Studies, TNJFU, Chennai, 21 February 2020

Dr. C.O. Mohan

- 'Ensuring Food Safety using Nanotechnology, Webinar Role of Nanotechnology in Food and Agriculture Organized by Centre for Nanotechnology, College of Agricultural Engineering, UAS, Raichur, Karnataka, 26 August 2020
- Basics of Thermal Processing Technology, One month Virtual Training programme for BFScstudents from College of Fisheries,RPCAU, Bihar, 04 September 2020
- 'Hurdle Technology for fish', 3 days training to MFSc students of West Bengal University of Animal & Fishery Sciences, Online Programme, 23-25June 2020
- Smart packaging, solutions for fish, National Webinar on Value Chain Development in Fish Processing: Way Forward, 18 June 2020
- Techno economic packaging of fish and fish products for entrepreneurship Development, National webinar on Entrepreneurship Development in Fish Processing Sector, 03 July 2020
- Fish processing and preservation technologies, B.Sc Food Tech of St Theresas college , EKM, Vimala college, Trichur and MES college, Perinthalmanna organized by Farm to Fork, Centre for Safe Food, Edapally, Kochi, 02 October 2020
- Fish processing and preservation technologies, Voc Food Tech Department of St. Theresas college, EKM and St. Thomas, Pala organized by Farm to Fork, Centre for Safe Food, Edapally, Kochi, 06 November 2020

Dr. Pe. Jeyya Jeyanthi

- Preparation of ICAR Examinations; A step for the Agricultural Graduates, Organized by Department of Agriculture, Karunya Institute of Technology and Sciences, Coimbatore, Tamil Nadu, Online; 24 July 2020.

Dr. Binsi P.K.

- Marine biomolecules: Research directions and future dimensions', Webinar on "Tools and Techniques in Biological Research", Vimala College, Thrissur, 06-07 October 2020
- Value added fishery products, on 'Value addition in Seafood Sector' organized in connection with World Food Day, 2020, VHSE, Njarakkal 16 October 2020

Dr. Remya S.

- HACCP in Fish Processing Sector, Agri-Business Virtual Expo 2020 coordinated by Cruzexpos, Cochin, Digital platform, 15-18 October 2020
- Conventional and modern techniques for quality assessment of seafood, Online vocational training program organized by Department of Fish Processing Technology and IDP Cell of College of Fisheries Science, Junagadh Agricultural University, Veraval on "Augmenting sustainable production, processing and safety of food of aquatic origin" during 12/10/2020 to 16/10/2020, Online through Google meet, 16 October 2020
- Fish Processing & Value-added products, Krishi Pada Sala – Facebook Live Training Programme for famers by RATTC (Regional Agricultural Technology Training Centre), Vyttila under Subhiksha Keralam Project of Kerala Government, Facebook Live, 23 October 2020
- Fish Processing & Quality Control, Krishi Pada Sala – Facebook Live Training Programme for famers by SAMETI, Kerala under Subhiksha Keralam Project of Kerala Government, Facebook Live 11 December 2020

Dr. Parvathy U.

- Nutritional significance of seafoods, Online training course on 'Food Chemistry and Fish in Nutrition' to B.F.Sc students of Dr. MGR Fisheries College & Research, Institute, Ponneri, 20 May 2020
- Handling and transportation of fish and shell fish, Virtual training on "Processing and Quality Assurance in Fisheries" for the BFSC students of College of Fisheries, Dholi, 01 September 2020 to 01 October 2020.
- Quality evaluation of dried fish, Trainingprogram on "Post-harvest fisheries engineering" for the KUFOS students, 13-16 October 2020.

Dr. Pankaj Kishore

- Regulatory requirement for fish and fishery trade, Online vocational training programme on "Emerging technological interventions for fisheries and aquaculture development, College of Fisheries, Veraval, Gujarat, 21-25 September, 2020
- Online Practical Counselling and Evaluation of Course - Quality Assurance (BPVI-045), Diploma in Fish Products Technology" (DFPT) with the financial support of Ministry of Food Processing Industries (MOFPI), Govt. of India, 24 October 2020

Shri. Sreejith S.

- Extrusion Processing of fish, Model Training Course on Pluralistic extension for upscaling secondary fisheries, 22 January 2020.
- Extrusion Processing and Preparation of extruded products, Training programme organized for B. Tech. (Food Engg.) students of KCAET, Tavanur, 12 February 2020.
- Extrusion Processing, Training programme organized for MVSc students of KVASU, Mannuthy, Thrissur, 04 March 2020.
- Packaging of fish and fishery products, Online training for 2nd year BFSc students of College of Fisheries, CAU, Lembucherra, Tripura, 02 May 2020.

- Packaging of fish and fishery products, Online training for 6th Semester BFSc students of Dr. M.G.R. Fisheries College and Research Institute, Tamil Nadu Dr. J. Jayalalithaa Fisheries University Ponneri, 08 May 2020.
- Packaging of fish and fishery products, Online training to BFSc and MFSc students of KUFOS, Kerala, 27 May 2020.

Smt. Sreelakshmi K. R.

- Pre-processing of fish, Online Training program on "Post-harvest fisheries engineering" for the KUFOS students, 13-16 October 2020
- Opportunities in value addition for the fish processing sector, Agri business virtual expo 2020, October 15-18 October 2020

Smt. Lekshmi R. G. Kumar

- "GC Instrumentation and its Applications", Webinar conducted by School of Ocean Science and Technology, KUFOS, 12 November 2020.
- 'Analytical Techniques in Nutrient and Contaminant Profiling of Fishes, Department of Zoology, St. Joseph's College for Women, Alappuzha, 04 December 2020.

Dr. Sarika K.

- Packaging of dried fish, Online Training program on "Post-harvest fisheries engineering" for the KUFOS students, 13-16 October 2020
- Preparation of breaded and battered value added product, Virtual training on "Processing and Quality Assurance in Fisheries" for the BFSC students of College of Fisheries, Dholi , 01 September 2020 to 01 October 2020

Shri. P. N. Jha

- Lectures on "Fishing technologies". BFSc Students under Institutional Development Plan- National Agriculture higher Education Project, Pantnagar GBPUAT, 01 December 2020

Dr. K. Elavarasan

- Proteins and its derivatives from aquatic food processing waste, Augmenting sustainable production, processing and safety of food of aquatic origin, College of Fisheries Science, Junagadh Agricultural University, Veraval; 12-16 October 2020

Dr. Anuj Kumar

- Biscuit baking technology (theory) and preparation of cookies and biscuits (practical) ,Training program for BTech Food Engg. students of KAU-KCAET Tavanur, at ICAR-CIFT, Kochi, 04-15 February 2020

Shri. Tejpal C. S.

- "Introduction to HPLC and its application", webinar organised by the School of Ocean Science and Technology, KUFOS, Cochin, 12 November 2020

Human Resources Development (HRD) Cell

Activities of the Institute HRD Cell

During the period under report, the Human Resource Development Cell of ICAR-CIFT met several times for deliberations and decision-making with regard to training requirements of staff. Individual requests of staff members of all categories for their capacity building needs were processed for approvals. In addition, necessary approvals were obtained from the competent authority to enable staff who were specifically nominated by Secretary DARE and DG, ICAR and HRM Division of ICAR to undergo specialised training. As recommended by HRD Cell, staff of CIFT (Total staff-243, Scientific-84, Technical-75, Administrative & Finance-83) participated in 26 training programmes during the year.

The HRD Cell ensures that every employee records the training information in the ICAR-ERP system following completion of the training. Training needs assessment and Annual Training Plan (ATP) for Scientific, Technical, Administrative and Skilled Support Staff were made for the year 2020 and the ATP 2020-21 has been uploaded on the Institute website. Upon a request from the HRM Division of ICAR, category-wise and employee-wise skill deficient areas were furnished to the Council based on which the ATP 2020-21 was revised to include staff who hadn't undergone training during the past 6 years.

The Cell organized a day long online training program on "Effective Health Management for Enhancing Work Efficiency of ICAR Employees" in English on 23rd September and in regional languages Malayalam viz., Marathi, Guajarati and Telugu on 24th September 2020. The training facilitated all categories of permanent staff including those at Research Centers in Mumbai, Veraval and Visakhapatnam, to equip them with information to manage their health such that they are able to discharge their duties effectively during the pandemic times.

The online program that was streamed used Microsoft Teams and attended by over 250 of ICAR-CIFT employees, based on the directives from HRM Division of the Council. Dr. Manjunath Sukumaran, Holistic Health Coach and Founder of Harmony Wellness Concepts, Thiruvananthapuram, spoke on 'Eating right for a healthy life', Dr. Edward Edezhath, Youth Trainer and former Associate Professor, St. Albert's College, Ernakulam, spoke on 'Fighting the virus of negativity', Dr. D. Purushothaman, Director, Centre for Human Perfection and Dr. G. Zaileshia, Clinical Psychologist, both spoke on 'Stress management in COVID Times'. The Program Coordinator and Director, ICAR-CIFT, Dr. C. N. Ravishankar oversaw the smooth conduct of the event, while Dr. Asha K. K., Nodal Officer, HRD-Cell and Training Coordinator welcomed the eminent speakers and all participants spread across 4 States. Dr. Remya S., Convenor of the training program proposed the vote of thanks.

Participation of staff in Training Programmes 2020 (Category wise)

Scientific Staff

Sl. No	Name(s) of Participant(s)	Training Attended	Venue & date
1	Mr. Chandrasekhar V.	"Animal Diseases Economics"	ICAR-IVRI 08.01.2020 to 10.01.2020
2	Dr. Manju Lekshmi N.	Mechanical properties and quality testing of reinforced plastic (FRP) used in the fishing boat construction	CIPET-Cochin 04.02.2020 to 05.02.2020
3	Dr. Pe. Jeyya Jeyanthi	FDP on Basics of structural equation modelling	IIM, Kozhikode 17.02.2020 to 21.02.2020
4	Dr. Ashok Kumar K. Dr. Bindu J. Dr. Muhamed Ashraf P. Dr. George Ninan Dr. Femeena Hassan Dr. Asha K. K. Dr. Toms C. Joseph Dr. Mohan C. O. Dr. Binsi P. K. Dr. Joshy C. G. Dr. Murugadas V. Dr. Visnuvinayagam S. Dr. Niladri S. Chatterjee Dr. Sandhya K. M. Dr. S. Monalisha Devi Dr. Remya S. Dr. Manju Lekshmi N. Dr. Parvathy U. Dr. Pankaj Kishore Dr. Ranjit Kumar Nadella Mr. Sreejith S. Dr. H. Mandakini Devi Dr. Anuj Kumar Mr. Tejpal C. S. Dr. Elavarasan K.	Laboratory Quality Management System & Internal Audit as per the revised standard ISO/IEC 17025:2017	ICAR-CIFT, Cochin 11.03.2020 to 12.03.2020

	Ms. Greeshma S. S. Mr. Chinnadurai S. Mr. Paras Nath Jha Ms. Muthulakshmi T. Dr. Renjith R. K. Dr. Sarika K. Ms. Sreelakshmi K. R. Ms. Priya E. R. Dr. Lekshmi R. G. Kumar Dr. Minimol V. A. Mr. Anas K. K. Mr. Sathish Kumar K. Mr. Ezhil Nilavan Dr. Rehana Raj		
5	Ms. Laly S. J. Ms. Renuka V. Dr. Anupama T. K.	"Laboratory system and internal audit programme as per ISO/ IEC/17025: 2017"	Quality Council of India (QCI) 04.07.2020 to 05.07.2020.
6	Smt. Laly S. J.	Online training programme on "Uncertainty of Measurement and Decision Rules as per ISO/ IEC 17025: 2017	Quality Council of India (QCI) 18.07.2020
7	Dr. A. Jeyakumari	Online training programme on Laboratory Management-Competence of Testing ISO/IEC 17025:2017	and Food analysis and Research Institute (NAFARI), Pune
8	Dr. Murugadas V.	Proficiency testing programme "Antimicrobial susceptibility testing (AST) of Salmonella and *E. coli* test strains"	Chulalongkorn University Veterinary AMR Cluster, Thailand, 01.09.2020.
9	Dr. Jesmi Debbarma	Online training programme on Interactive dashboard using MS excel	Xanthus Institute, Goa ICAR-CIFT, Cochin and SOFTI 08.09.2020 to 09.09.2020
10	Dr. George Ninan	Training programme on "Virtual workshop-cum-training on & quot; Intellectual Property Rights in Agricultural Research & Education in India &quot"	IPTM & NAHEP ICAR, New Delhi 12.09.2020 to 28.09.2020

11	Dr. A. Jeyakumari	Online training on Internal Auditor to FSMS Based on BRC version 8	ITCFSAN, Mumbai 14.09.2020 to 15.09.2020
12	Dr. Renjith R. K.	Online training on "Remote Sensing of Coastal Ecosystems"	ARSET-NASA 22.09.2020.
13	Dr. Madhusudana Rao	Online training programme on 'Quality Management System in AMR Laboratories for the Indian Network for Fisheries and Animals Antimicrobial Resistance (INFAAR)'	FAO, India 24.09.2020
14	All Scientists of ICAR-CIFT	Online Training Programme on "Effective Health Management for Enhancing Work Efficiency of ICAR- Employees"	ICAR-CIFT, Cochin 23.09.2020 to 24.09.2020
15	Dr. Manju Lekshmi N.	Online Training Programme on 'Climate Change: Challenges and Response'	DST Centre for Disaster Management, Mussoorie 05.10.2020 to 09.10.2020
16	Dr. George Ninan	Agripreneurship Orientation & Startup Incubation Training Programme KAU RAISE 2020 AND KAU PACE 2020	KAU 09.10.2020
17	Dr. Madhu V. R.	Online Training Course on "Understanding sea level: data analysis and applications"	INCOIS. 12.10.2020 to 14.10.2020.
18	Dr. Parvathy U.	ICAR-NAHEP sponsored workshop on "Emotional Intelligence for success	ICAR-CIFE 15.10.2020.
19	Dr. Sandhya K. M.	DST sponsored online training programme for "Women Scientists on Emotional intelligence at Workplace"	Centre for Organization Development, Hyderabad, 23.10.2020 to 27.10.2020
20	Dr. G.K. Sivaraman Dr. Toms C. Joseph	Virtual training programme "Management Development Programme on Leadership Development"	NAARM, Hyderabad during 08.12.2020 to 19.12.2020

Technical Staff

Sl. No.	Name(s) of Participant(s)	Training Attended	Venue & ate
1	Mr. Mohanan K. V.	Automobile Maintenance, Road Safety and Behavioural Skills for Regular Drivers- Batch-VII	ICAR-CIAE, Bhopal 16.01.2020 to 22.01.2020
2	Dr. Baiju M. Mr. Jos K. D. Mr. Sunil N. Mr. Suresh C. K. Ms. Sruthi P. Mr. Rakesh Raghavan	Model training course on "Pluralistic Extension for upscaling Secondary Fisheries	ICAR-CIFT, Cochin 17.01.2020 to 21.01.2020
3	Mr. Nobi P. S.	Capacity building programme for IJSC members	ICAR-NAARM, Hyderabad 27.01.2020 to 31.01.2020
4	Mr. Anish Kumar K. C.	Mechanical properties and quality testing of reinforced plastic (FRP) used in the fishing boat construction	CIPET, Cochin 04.02.2020 to 05.02.2020
5	Ms. Shyma P. K. Mr. Babu P. S. Ms. Kala K. K. Ms. Lekha N. Ms. Bindu Joseph Ms. Shyla N. C. Mr. Aneesh P. A. Mr. Noby Varghese K. A. Ms. Vineetha Das Ms. Prinetha Mr. Jojoy T. Ms. Susmitha V. Mr. Rahul Raveendran Mr. Anish Kumar K. C. Mr. Vinod G. Mr. Ajith V. Chellappan Mr. Ajeesh K. Ms. Anu Mary Jose Ms. Archana G. Ms. Mary P. J. Mr. Suresh P. Ms. Reshmi K. Mr. Sreejith V. N.	Laboratory Quality Management and Internal Audit as per revised quality standard IS/ISO/IEC 17025:2017	ICAR-CIFT, Cochin 11.03.2020 to 12.03.2020
6	All Technical Staff of ICAR-CIFT	Online Training Programme on "Effective Health Management for Enhancing Work Efficiency of ICAR- Employees"	ICAR-CIFT, Cochin 23.09.2020 to 24.09.2020

Administrative Staff

Sl. No.	Name(s) of Participant(s)	Training Attended	Venue & Date
1	Mr. Krishna Kumar P. Ms. Aleyamma V. S. Ms. Shyma T. K. Ms. Renuka V. Mr. A. N. Agawane Ms. Surya G. Ms. Jyothilekshmy E. Ms. Raji V. R. Ms. Nilina Elais Ms. Akhila N. R. Mr. Syam Prasad T. R. Ms. Mini P. R. Mr. Santhosh Mohan Ms. Shiji John	Administration and financial management for section officers/ AAOs/ AFAOs/ JAOs/ Assistants of ICAR HQ/ Institutes	ICAR-CIFT In association with ICAR-NAARM, Hyderabad 05.02.2020 to 11.02.2020
2	Mr. Rizwan P. M.	Basic training on the use of Hindi on computer	Dept. of Official Language, ICAR-CIFT, Kochi 27.01.2020 to 31.01.2020
3	All Administrative Staff of ICAR-CIFT	Online Training Programme on “Effective Health Management for Enhancing Work Efficiency of ICAR- Employees”	ICAR-CIFT, Cochin 23.09.2020 to 24.09.2020
4	Mr. W. Sreenivas Bhat Mr. K. S. Sreekumaran Ms. Febeena P. A. Mr. R. N. Subramanian Mr. P. Krishnakumar Mr. K. B. Sabukuttan Mr. M. N. Vinodh Kumar Ms. T. K. Shyma Mr. K. Das Mr. Riswan P. M. Ms. Deepa T. Ms. Suni Surendran Mr. Subeesh S. S. Ms. K. Renuka Ms. Akhila N. R. Mr. Syam Prasad Ms. Nilina Elais Ms. Mini P. R. Ms. Shiji John Ms. Subin George Ms. Archana N. Ms. Surya G. Ms. Jaya Das Mr. Shaji T. N. Ms. V. S. Aleyamma Mr. C. K. Sukumaran Mr. P. G. David	Training on Government e-Marketing	ICAR-CIFT, Cochin 20.10.2020

Skilled Support Staff

1	All SSS of ICAR-CIFT	Online Training Programme on "Effective Health Management for Enhancing Work Efficiency of ICAR- Employees"	ICAR-CIFT, Cochin 23.09.2020 to 24.09.2020

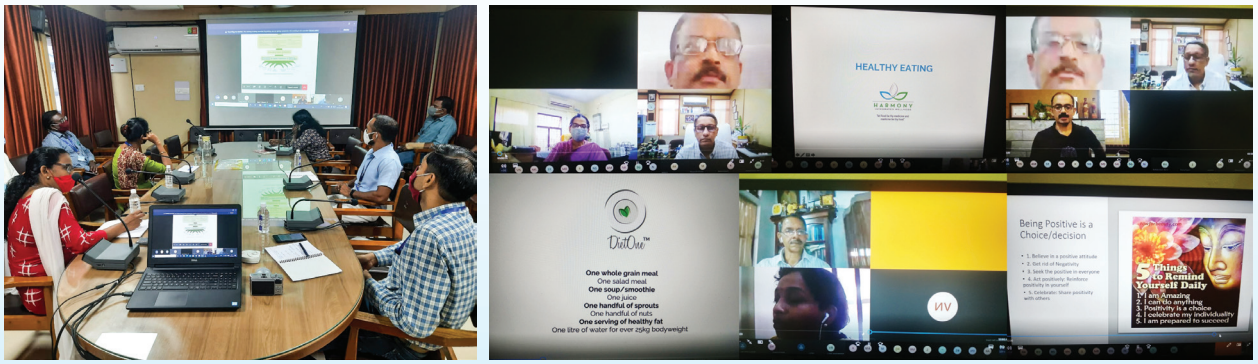
Other subject matter capacity building programme attended by Scientific/ Technical personal of the different divisions/ Centers are given below:

Sl. No	Name(s) of Participant(s)	Training Attended	Venue & Date
Scientific Staff			
1.	Dr. Manju Lekshmi N.	Participated in a three-day training program for e-office.	ICAR-CIFT, Kochi 05, 06 and 09.01.2020
2.	Mr. Ranjit Kumar Nadella	In house training on eOffice implementation in ICAR institutes	ICAR-CIFT, Kochi 16.01.2020 to 18.01.2020
3.	Dr. Femeena Hassan Dr. Satyen Kumar Panda Dr. Pankaj Kishore Dr. Anuj Kumar Mrs. E. R. Priya Dr. Devananda Uchoi	Quality system as per requirements of ISO/IEC 17043: 2010 for proficiency testing providers and PT statistics as per 13528:2015	ICAR-CIFT, Kochi 09.01.2020 to 10.01.2020
4.	Dr. A. K. Mohanty Dr. S. Ashaletha Dr. Pe. Jeyya Jeyanthi Dr. V. K. Sajesh	Webinar series on 'Quantitative Analysis in Social Sciences' (online)	ICAR- NIAP, New Delhi 01.06.2020 to 20.06.2020
5.	All the scientific and staff of ICAR-CIFT, Visakhapatnam Research Centre	e-office training organized by	ICAR-CIFT, Kochi 08.06.2020 08.07.2020 to 09.07.2020
6.	Mr. Sathish Kumar K.	Online certificate course on "Marine Nanobiotechnology" organized by centre for ocean research, Sathyabhama Institute of Science & Technology, Chennai.	Online training 22.06.2020 to 30.08.2020

7.	Dr. G. K. Sivaraman	Training cum workshop on Next generation sequencing & Bioinformatics, Organized by the Bengaluru Genomics Center	Online training 26.06.2020 to 27.06.2020
8.	Ms. Laly S. J.	'Laboratory System and Internal Audit as per ISO/IEC 17025: 2017' (Organized by Quality Council of India (QCI).	Online training 24.07.2020 to 25.07.2020
9.	Dr. Renjith R. K. Mr. P. N. Jha	21 days online training on "GIS training programme using QGIS" organized by Central University of Karnataka	Central University of Karnataka 13.07.2020 to 02.08.2020
10.	Mr. P. N. Jha	One week training programme on "QGIS training programme"	Geotech QIS training Institute, Aurangabad, Maharashtra 12.08.2020 to 18.08.2020
11.	Dr. A. Jeyakumari	Laboratory Management-Competence of Testing ISO/IEC 17025:2017 (Organized by National Agriculture and Food analysis and Research Institute (NAFARI), Pune)	Online training 26.08.2020 to 27.08.2020
12.	Ms. Laly S. J.	'Uncertainty of Measurement and Decision Rule as per ISO/IEC 17025:2017' (Organized by Quality Council of India (QCI)	Online training 05.09.2020
13.	Dr. Abhay Kumar Dr. Renjith R. K.	Demystifying Interactive Dashboard using Microsoft" (Organized by ICAR-CIFT and SOFTI, India.	Online training 08.09.2020 to 09.09.2020
14.	Dr. A. Jeyakumari	Internal Auditor to FSMS Based on BRC version 8 (Organized by International Training Center Food Safety & Applied Nutrition (ITCFSAN), Mumbai.	Online training 14.09.2020 to 15.09.2020

15.	Dr. V. Geethalakshmi	Online training course on 'Organization of Fishery Statistical System'	International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) , IAMZ, Spain and FAO, Rome; 09.11.2020 to 19.11.2020
16.	Dr. V. Geethalakshmi	Training session on FishStatJ-Software for Fishery and Aquaculture Statistical Timeseries	FAO and CIHEAM 17.12.2020
17.	Mr. Ranjit Kumar Nadella	Aquatic epidemiology by WorldFish, Malaysia, and the Norwegian Veterinary Institute	Online training 09.12.2020 to 10.12.2020
Category - Technical			
18.	Ms. Priyanka A. Nakhawa	21 days online training programme on 'Data Analytics in Fisheries" (conducted by Department of Fisheries Extension,Economics and Statistics, Dr. M.G.R. Fisheries College and Research Institute, Thalainayeru, Nagapattinam)	Online training 10.08.2020 to 03.09.2020
19.	Mrs. K. K. Kala Mr. P. S. Babu Mrs. Bindu Joseph Mr. P. D. Padmaraj Mrs. Mary P. J. Mr. T. Jijoy Mr. Aneesh P. A.	Quality system as per requirements of ISO/IEC 17043: 2010 for proficiency testing providers and PT statistics as per 13528:2015	ICAR-CIFT, Kochi 09.01.2020 to 10.01.2020
Category - Adminisitrative			
20.	Mr. Avinash N. Agawane	Administrative & Financial Management for Section Office/ AAOs/ AFAOs/ JAOs/ Assistants of ICAR H.Q./Institute (Organized & Funded by ICAR-NAARM, Hyderabad)	05.02.2020 to 11.02.2020

Online training programme brochure in English & Malayalam



Glimpses of the online training programme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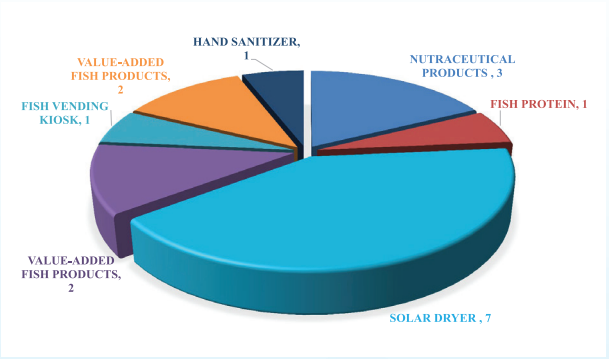
Cift

ZONAL TECHNOLOGY MANAGEMENT & AGRIBUSINESS INCUBATION CENTRE

ICAR-CIFT started the ZTM-ABI Centre in 2010, as a platform to create new technology-based industries particularly in the fisheries sector. This entrepreneurial support system caters to its clients through strong technical and advisory support, and assist them to orient their resources in most optimized manner thereby yielding high productivity and economic value. This Centre promotes technology adoption and enable the entrepreneur to explore new ways of doing business through wide spectrum of activities. Pro-active and value-added business services are provided to registered incubatees in the form of technology transfer, contract research, consultancy, contract service, office space, certified state-of-the-art pilot level production facility, on-site guidance and specialized trainings to establish technology-based business enterprises. ZTM-ABI Centre operates an important networking mechanism between R&D institutes, private industry, government agencies, academia and funding agencies. The Incubator allows start-ups as well as established business enterprises access to new innovations, cutting edge technologies and scientific know-how. Through virtual incubation, the ZTM-ABI Centre is able to provide services to clients across the nation.

Achievements during January – December 2020

Signed 16 technology transfer agreements and 20 professional service functions: Commercially viable technologies related to value added products from fish/seaweed, fish collagen peptide, nutraceuticals, sanitizers, chilled / frozen fish products, retort pouched products, solar dryers, refrigerated fish vending kiosks were transferred to the private sector and government agencies.



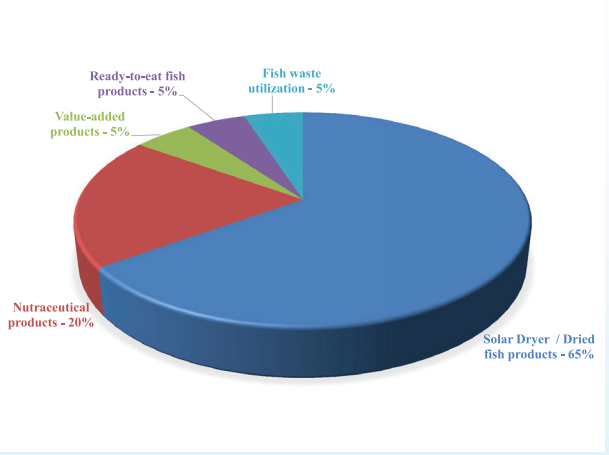
Number of technology transfer agreements signed in various areas

Category of professional service function	No:
Consultancy Projects	8
Collaborative Research	7
Contract Service	1
Contract Research (Grant-in-Aid / sponsored)	4

The professional service functions facilitated by the ZTM-ABI Centre

A total of 19 entrepreneurs registered at ZTM-ABI Centre for business incubation:

The ZTM-ABI Centre targets entrepreneurs, from fledgling start-ups in need of basic small-scale processing capacity to sophisticated businesses in need of R&D back up, office infrastructure and pilot/test market processing facility for the development of new products. The clients who approached the centre during the year 2020, for various services are classified based on the area of their expertise and represented below:



The Incubation Centre possesses good infrastructure facilities suitable for providing direct incubation of about 9 entrepreneurs in a corporate environment within the premises of ICAR-CIFT, at a time. This year two new clients started their business using the Incubation Office Facility.

1. Foundation for Environmental Research and Innovation, FERI-TRUST ("Resinnov Blue Project"), Kannur
2. Atma Farm Tech, Ernakulam

Manufacture and supply of ICAR-CIFT designed machineries to Clients through empanelled agencies

The Centre has facilitated the manufacture and supply of 9 ICAR-CIFT dryers and 12 refrigerated vending kiosks through the empanelled agencies to various clients .

Facilitation of Incubatees

Sl. No.	Client	Details of technology	Status of the Work
INCUBATEES			
1	CHELLANAM SEAFISH Malikaparambil, Chellanam, Kochi - 680008	Solar-electrical hybrid dryer - 100 kg	Completed
2	PAPPI DRY FISH, Peediyekkal Parambil, Opp. Govt. Homoeo Dispensary, Edakochi, Kochi - 10	Solar Hybrid Dryer – 40 kg	Completed
3	GOD"N FOODS Mr. Gorden Norbert, Kochi	Solar-LPG hybrid dryer- 300 kg	Ongoing
4	Sri Teja Food Products Shri. S. Narasing Rao	Solar Hybrid Dryer, 100 kg 1 unit	Ongoing
ICAR INSTITUTES / UNIVERSITIES / KVKs / GOVT. DEPARTMENTS			
5	College of Fisheries, Assam Agricultural University, Raha, Nagaon - 782103	Solar Dryer with LPG backup, 4 units - (40-50 kg capacity)	Completed
FISHERMEN COMMUNITIES / SOCIETY			
6	SAGARIKA MATSYA SAMSKARANA UNIT Alappad, Kakkathuruthu, Cheriyazhikkal P.O., Karunagappilly, Kollam – 690573	Solar-electrical dryer-20 kg	Completed
7	Savitha Raghu, Nayarambalam CDS	Solar-electrical dryer-20 kg	Completed

Commercialisation of Technologies

Sl. No.	Client	Details of technology	Status of the Work
ACTIVITY GROUPS			
1	Torry Harris Seafoods Private Ltd., Mr. Rajesh Babu M. S., Alappuzha	Refrigeration enabled mobile fish display and vending units (2 units)	Ongoing
2	Refrigerated fish vending kiosk	Mr. Shamir, Karivellur, Thrissur	Completed
3	Karunya Activity Group, Kumbalanghi, Ernakulam	Refrigerated Mobile Fish Vending Kiosk	Completed
4	Muthu Fish Stall Activity Group, Chellanam, Kochi	Refrigerated Mobile Fish Vending Kiosk	Completed
5	Dhanasree Activity Group, Kumarakom, Kottayam	Refrigerated Mobile Fish Vending Kiosk	Completed
6	Munna Activity Group, Kumarakom, Kottayam	Refrigerated Mobile Fish Vending Kiosk	Completed
7	Fresh and Pure Daily Mart Activity Group, Vadookkara	Refrigerated Mobile Fish Vending Kiosk	Completed
8	Oruma Activity Group, Puthenvelikkara, Ernakulam	Refrigeration enabled mobile fish vending kiosk	Completed
9	Fish Vending Table Unit, Cherthala, Alappuzha	Refrigeration enabled mobile fish vending kiosk	Completed
10	Thejus Activity Group, Kollam	Refrigeration enabled mobile fish vending kiosk	Completed
11	St. George Activity Group, Kollam	Refrigeration enabled mobile fish vending kiosk	Completed
12	Dhanya Activity Group, Kollam	Refrigeration enabled mobile fish vending kiosk	Completed
13	D'S Family Mart, Mr. Joseph Delish, Alappuzha	Refrigeration enabled mobile fish vending kiosk	Completed

Intellectual Property Rights

The ZTM-ABI Centre facilitated the filing of following IPRs for ICAR-CIFT.

IPR CATEGORY	TITLE	INNOVATORS / AUTHORS/ CONTRIBUTORS	STATUS
PATENT	Title: HYBRID SOLAR DRYER FOR DRYING OF AGRICULTURAL COMMODITIES Patent Application No.202041042996 Filing date: 03.10.2020 Class :	1. Dr. Ravishankar C.N. 2. Dr. Manoj P. Samuel 3. Dr. Murali S. 4. Dr. Aniesrani Delfiya D.S. 5. Smt. Alfiya P.V.	Application filed
COPYRIGHT	MOBILE ALERT SYSTEM FOR DRYER USERS Diary No: 20175/2019-CO/SW Registration No: SW-13307/2020 Date of Application: 16/12/2019 Granted Date: 24/02/2020 Type of work: Computer software	1. Dr. Manoj P. Samuel 2. Dr. S. Murali 3. Dr. Aniesrani Delfiya 4. Smt. Alfiya P.V. 5. Shri Harikrishnan S. 6. Ms. S. Kunjulakshmi	Registered
	FISHQChEQ – A System to Assess the Quality of Fish" – 7 Dec 2019 Diary No. 19629/2019-CO/SW	1. Dr. Joshy C.G. 2. Dr. George Ninan 3. Dr. Zynudheen A. A 4. Dr. Satyen Kumar Panda 5. Smt. Shyla N.C. 6. Dr. Ashok Kumar K. 7. Dr. Ravishankar C.N.	Application filed
	CUSTOMIZED DATABASE ON FISH IMPORT TO INDIA (Regn No. SW-13919/2020, Dt : 11.11.2020)	1. Dr. Joshy C. G. 2. Dr. George Ninan 3. Smt. Shyla N. C. 4. Smt. Lizbeth Roshin 5. Dr. Ashok Kumar K. 6. Dr. Ravishankar C. N.	Registered
	CIFTRAINING (Regn no. SW-13924/2020, Dt : 18.11.2020)	1. Shri V. Chandrasekar 2. Dr. Ashok Kumar K 3. Dr. Zynudheen A. A 4. Dr. Leela Edwin 5. Dr. M.M. Prasad 6. Dr. Suseela Mathew 7. Dr.A.K. Mohanty 8. Dr. Ravishankar C.N.	Registered
	CIFT LAB TEST (An Android based Information System on Sample testing and Analysis in ICAR-CIFT Laboratory) (Reg. No. SW-13923/2020, Dt : 13.11.2020)	1. Shri V. Chandrasekar 2. Dr. Ashok Kumar K 3. Dr. Zynudheen A. A 4. Dr. Leela Edwin 5. Dr. M.M. Prasad 6. Dr. Suseela Mathew 7. Dr.A.K. Mohanty 8. Dr. Ravishankar C.N.	Registered

INDUSTRIAL DESIGN	REFRIGERATED MOBILE FISH VENDING KIOSK Design No: 319819-001 Application Date: 20-07-2019 Date of publication: 28-02-2020 Journal No: 09/2020 Validity: 20/07/2029 Class: 15-07	ICAR – Central Institute of Fisheries Technology (ICAR-CIFT)	Registered
	FISH FRESHNESS SENSOR (Application No. 329196-001 in Class 10-05, Filing Date : 6th May 2020)	1. Dr. Manoj P. Samuel 2. Dr. Murali S. 3. Shri Harikrishnan S. 4. Ms. Kunjulakshmi S.	Application filed
	CLAM MEAT-SHELL SEPARTOR MACHINE (Application No. 332452-001 in Class 31-00 on 28th August 2020)	1. Dr. Sreejith S. 2. Shri James J. P. 3. Shri Vipin K. V. 4. Dr. Bindu J. 5. Dr. Nikita Gopal	Application filed
	LIVE FISH TRANSPORATATION SYSTEM (Application No. 333109-001, Class : 09-03 on 11.09.2020)	1. Dr. Parvathy U. 2. Dr. Binsi P. K. 3. Shri Sathish Kumar K. 4. Dr. Murali S.	Application filed
TRADEMARKS	FIFERS – (Application Renewal) Application No: 1946892 Application Date: 06/04/2010 Date of publication: 06/12/2010 Validity: 06/04/2030 (Renewed 07-01-2020) Class: 29		Registered
	Maricream – (Application Renewal) Application No: 1946893 Application Date: 06/04/2010 Date of publication: 07/11/2014 Validity: 06/04/2030 (Renewed 07-01-2020) Class: 29, 30		Registered
	CIFTEQ Application No: 4400400 Application Date: 07/01/2020 Date of publication: 03/02/2020 Validity: 01/07/2030 Class: 29, 42		Registered

Institute Technology Management Committee meetings

Two **ITMC Meetings were held** on 27th July and 23rd October 2020, under the Chairmanship of the Director ICAR-CIFT. Presentations of proposals for IPR protection viz., CIFT FISHTRAP, Solar LPG Hybrid dryer, Solar tunnel dryer, Hot air assisted continuous infrared dryer, Customized Database on Fish Import to India in MS Access, Customized Feed Unit, Synergistic effect of high pressure with microbial transglutaminase and live fish transportation system were discussed and finalised.

ACADEMIC EXCELLENCE

Ph.D

Ms. Parvathy U., Scientist, Fish Processing Division of ICAR-CIFT, Kochi was awarded Ph.D Degree for the thesis entitled "Optimization of process parameters for enzymatic hydrolysis of tuna red meat protein with emphasis on specific applications" from the Faculty of Marine Sciences, Cochin University of Science and Technology (CUSAT), Kochi, under the guidance of Dr. George Ninan, Principal Scientist, Fish Processing Division. Dr. A. A. Zynudheen, Principal Scientist and HOD (i/c), Quality Assurance and Management Division, ICAR-CIFT was the Co-Guide.

Mr. K. Ahamed Basha, Scientist, Visakhapatnam Research Centre was awarded Ph.D Degree for the thesis entitled "Diversity and Characterization of Ammonia Oxidizing Bacteria from Freshwater Finfish Farms of Kerala" in Aquatic Animal Health Management from the ICAR-Central Institute of Fisheries Education, Mumbai. Dr. Toms C Joseph, Principal Scientist, ICAR-Central Institute of Fisheries Technology, Kochi was the Guide.

Ms. Sarika K., Scientist, Fish Processing Division of ICAR-CIFT, Kochi was awarded Ph.D Degree for her thesis entitled, "Quality enhancement of Fish mince based products using high pressure processing" in Post-Harvest Technology from CIFE Mumbai, under the guidance of Dr. G Venkateshwarlu, ADG (EQR), ICAR, New Delhi and Dr. Bindu J., Principal Scientist, Fish Processing Division of ICAR-CIFT as Co-chair.

Ms. Divya K. Vijayan, Senior Reserch Fellow, Biochemistry and Nutrition Division of ICAR-CIFT, Cochin was awarded Ph.D Degree for the thesis entitled "Biomodulation of fish collagen for the preparation of bioactive peptides (FCP) : in vitro and in vivo bioactivities against experimentally induced ulcer and hyperlipedemia" from the Faculty of Marine Sciences, Cochin University of Science and Technology (CUSAT), Kochi, under the guidance of Dr. R. Anandan, Principal Scientist, Biochemistry and Nutrition Division. Dr. Suseela Mathew Principal Scientist and HOD Biochemistry and Nutrition Division ICAR-CIFT was the Co-Guide.

Recognitions

Dr. Remesan, M.P, Principal Scientist, ICAR-CIFT received the Dr. M. Devaraj Memorial Award 2019 award in International Symposium "Marine Ecosystems Challenges and Oppertunities-3" held at Kochi from 7-10, January 2020 for the presentation entitled Development of jellyfish excluder device for trawls: Performance of Grid-1 authored by Remesan, M.P, V.R, Madhu, Paras `Nath Jha, R.K. Renjith, S. Chinnadurai and Leela Edwin.

Dr. G. K Sivaraman was selected for the Visiting Scientist Programme sponsored by Indian National Science Congress, New Delhi.

G. K. Sivaraman, Principal Scientist, ICAR-CIFT received the best E-poster award for the research paper on Virulence and antimicrobial resistance gene profiles of multi-drug resistance methicillin resistant *S. aureus* from food fish based on WGS authored by Visnuvinayagam. S and Prasad, M.M., In: International Webinar on One-Health Perspectives of Antimicrobial Resistance & E-Poster competition, organized jointly by Karnataka Veterinary, Animal & Fisheries Sciences University, Bidar and Indian Association of Veterinary Public Health Specialists on 04 September, 2020.

Dr. Ashish Kumar Jha, Scientist, ICAR-CIFT received best oral presentation award "Proximate composition and metal pollution index of eggs of commercially available fish in Veraval, Gujarat" in 12th National Science Symposium on recent trends in science and Technology organized by Christ College, Rajkot on 19th January 2020.

Dr. Prajith, Scientist, ICAR-CIFT received best oral presentation award for the research work "Development of Region and species specific pots/ traps: performance of four fish trap designs in the vicinity of the sea cage farming site off" authored by Prajith,K.K and Divu.D. in 12th National Science Symposium on recent trends in science and Technology organized by Christ College, Rajkot on 19th January 2020.

Dr. Anupama T. K, Scientist, ICAR-CIFT received best oral presentation award for the presentation entitled Incidence of enterotoxin producing Staphylococcus aureus isolated from various fishery environments authored by T.K Anupama, S.K Panda and A. Zynudheen in 12th National Science Symposium on recent trends in science and Technology organized by Christ College, Rajkot on 19th January 2020.

Dr. Anupama T. K, Scientist, ICAR-CIFT received best poster presentation award for the research work on "Shelf life assessment of cage reared silver pompano (*Trachinotusblochii*) stored in modified chilling condition" by T.K. Anupama, S.J. Laly and P.K. Binsi. in 12th National Science Symposium on recent trends in science and Technology organized by Christ College, Rajkot on 19th January 2020.

Smt. Razia Mohammed A., Research Associate, , ICAR-CIFT received best poster award in ICFoST for the paper *Use of technology and readiness assessment matrix in Agri-business Incubation programme to boost Start up Ecosystem* by Razia Mohammed A, George Ninan, Manoj P Samuel, Ligin Nambiar, Ajeesh Kumar K. K, and Ravishankar C. N (2020) in ICFoST 2019 - 27th Indian Convention of Food Scientists and Technologists, Tezpur University during 30 th January -1 st February 2020.

Miss. Kunjulekshmi and **Mr. Akhil Xavier,** Apprentice trainees attached with Engineering Division adjudged as one among the 102 best innovative ideas for Young Innovation Programme (YIP) for year 2019-22 for the idea of Fish Freshness Sensor by Kerala Development and Innovation Strategic Council (K-DISC), Government of Kerala.

Priority setting, Monitoring and Evaluation Cell

The **Priority setting, Monitoring and Evaluation (PME) Cell** of ICAR-CIFT functioned primarily with the following objectives, during the year 2020,

Priority setting, Monitoring and Evaluation of Institute Research Projects

PME Cell monitored and evaluated the research projects in the identified research priority areas of the Institute and evaluated the projects on half yearly basis through the meetings of PME cell. The projects initiated during April 2020 and those completed by March 2020 were evaluated and graded. RPP I, RPP II and RPP III of all the 31 ongoing Institute projects including short term projects on innovative areas from young scientists on a competitive mode and 12 concluded projects were processed.

Externally Funded Projects

A total of nine proposals for external funding were routed through the cell after ascertaining that they fall under the mandate and priority research areas of the Institute.

Submission of Monthly, Quarterly and Half Yearly Reports

Monthly reports on the important activities of the Institute and significant research findings were compiled and sent to ICAR regularly for inclusion in the ICAR monthly report to the Cabinet Secretariat//PMOs Office. Quarterly and six-monthly reports on the targets and achievements of the Institute comprising both research and financial, were regularly furnished to the Council. Inputs requested from the council on various points were collected, processed as per prescribed formats and submitted to the council from time to time. Other kind of weekly, monthly reports are also furnished as per instructions provided. Reports to DARE / ICAR such as DARE Report, ICAR Reporter, ICAR News etc. were also furnished.

Institute Research Council (IRC)

The Institute Research Council meeting was convened during 11-14th May 2020 in online platform, due to the prevailing pandemic situation,

to review the progress achieved in the ongoing research projects during 2019-20 and to discuss the research project proposals for the year 2020-21. The Institute Research Project Document for the year 2020-21 was compiled and brought out for discussion at the meeting. The house discussed in detail the 20 ongoing research projects, 12 completed projects and 11 new projects apart from various ad-hoc projects.

Verification of CAS Reports of Scientists

The PME Cell verified and scrutinized Career Advance Scheme Reports submitted by five scientists for their promotion.

Participation of Staff/ Research Fellows in Conference/Seminar/Symposia

The PME Cell monitored & ensured the participation of staff members and other research scholars in various conferences/seminars/symposia as per the mandate of the Institute and theme of the programmes. During the year virtual mode of participation was promoted in such events. A total of 120 personal were permitted to attend the programmes.

Publication of the Scientific Papers and Maintenance Of Database

PME cell facilitated processing and approval for 206 publications of/from the Institute viz., research papers, popular articles, books, brochures, leaflets, pamphlets, seminar/conference abstracts etc. The research papers and popular/technical articles meant for publication in journals and for presentation in symposia/seminars were arranged for review, plagiarism check and recommended for decision/approval by Director.

Parliament/Lok Sabha questions/Requests

The cell arranged to give replies to the Parliament/ Lok Sabha questions/Requests from MP/MLA/ Minster etc. on priority basis.

Database on all ICAR Funded and Externally Funded Projects (Completed and On-Going), Publications, Technologies Developed, Patents, Consultancies

The PME cell maintained the database of projects and publications of the Institute viz., research papers, popular articles, books, brochures, leaflets, pamphlets, seminar/conference abstracts and papers, Annual Report Newsletter etc.

Knowledge Management activities of the Institute

The Cell facilitated the Knowledge Management activities of the Institute and uploaded the publications, technologies, data etc. in the KRISHI portal of ICAR and updated regularly.

Other Technical Matters

The PME Cell regularly addressed the queries on various technical matters received from other organizations and individuals. The queries received by the PME Cell as well as from the feedback option in the Institute Website were attended to. Further, materials for various publications like ICAR News/ ICAR Reporter, Agrinews, Fishing Chimes, MPEDA Newsletter, Seafood News, Aqua International, Sea Queen, ICAR Web page etc. were forwarded regularly for publication.

The publicity related and extension-oriented activities of the Institute are being regularly presented in the monthly meetings of the Inter Media Publicity Co-ordination Committee of Ministry of Information and Broadcasting, Govt. of India.

Agricultural Knowledge Management Unit (AKMU)

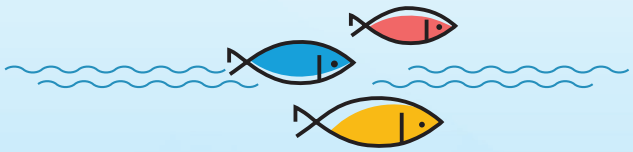
Agricultural Knowledge Management Unit (AKMU) caters to meet the ITC needs of the institute by providing and maintaining the internet, email, video conferencing and other computer related facilities. AKMU provides internet connectivity to nearly 250 systems through LAN and wifi connectivity. ICAR-CIFT is presently connected with 1000 mbps lease line under National Knowledge Network (NKN) provided by Govt. of India and 20 mbps ILL from BSNL to provide all the ICT services around the clock for the employees of the Institute. AKMU provides K7 Enterprise Security through the server for protecting from malware threats and other external sources of threats, thus improving the ICT efficiency. It also acts as a gateway to protect from intrusion attacks to prevent the leakage of

confidential data by adding 250 clients in the system.

AKMU manages ICAR-CIFT website and it is available in the url https://cift.res.in/. It highlights overall research activities and achievements of the institute and act as an interface between institute and end users. AKMU also periodically updates Institute website. The information on training programmes, recruitments of temporary staff, tender notices and other circulars of the institute are periodically uploading in the Institute website to the transparency of the working condition. The IP based video conferencing facility of the institute is being operated and maintained effectively by AKMU. This facility is being used for monitoring and evaluating research programmes in the research centers of the institute and also other organizations. AKMU manages institute's official social media accounts like Facebook, Twitter and WhatsApp for disseminating institute's technologies and activities to the public.

AKMU is maintaining and updating of Personnel Management Information System Network (PERMIS net-II) of ICAR at CIFT. It contains personal, professional and referential attributes of personnel along with information on plan wise cadre strength and institutional parameters for different categories of CIFT. As per the provision given, CIFT provided user name and password to the Regional Centers to update the information periodically in the PERMISnet.

AKMU facilitates to provide real time reply to queries received from farmers, students, entrepreneurs, researchers and others in the agricultural and allied sectors to e-Krishi Munch, a public interface platform developed by ICAR for stakeholders. AKMU also provides input to KM Portal developed by ICAR by updating details of institute higher authorities contact information, sophisticated analytical instrumentation facility and financial transaction details of the institute. AKMU also assisted in successfully implementing ICAR MIS & FMS and e-office in the institute by providing technical and training support.



Accreditation activities

ICAR-CIFT laboratories are accredited to ISO/IEC 17025: 2005 by National Accreditation Board for Laboratories (NABL) in the field of Chemical, Mechanical and Biological testing since the year 2005. Transition Audit of the testing laboratories of ICAR-CIFT as per ISO/IEC 17025: 2017 was conducted by NABL during 21st December 2019. The validity of accreditation of laboratories were renewed up to 14/12/2021. Total recommended scope of accreditation for testing consists of 266 parameters, which includes testing of 205 Chemical parameters, 52 Biological parameters and 09 Mechanical parameters. The National Referral Laboratory facility in ICAR-CIFT, Kochi is also accredited as per ISO/IEC 17025: 2017. The Laboratories participated in three Proficiency Test programmes during the year. Inter Laboratory Comparison was also conducted for metals in water and vitamins. The laboratory conducted

internal audits at planned intervals to conform the requirements of the management system and documents. Management Review Meeting was conducted as per schedule.

A training programme on "Laboratory Quality management system & Internal Audit as per revised standard, ISO/IEC 17025: 2017, was organized during 11-12 March 2020 for the scientists and technical staff of CIFT, involved in accreditation activities. The programme was conducted by Shri. S. Subramanian, Trainer from NABL and 56 participants from the institute attended the training programme.

Official Language Implementation

The Official Language cell of ICAR-CIFT is contributing towards the compliance of Official Language policy implementation in the Headquarters' and its regional research centre's as per the guidelines of Official Language Department, Ministry of Home Affairs, Government of India. The key concepts of the official language implementation like bilingual maintenance of section 3(3) documents, noting and drafting in Hindi in e-office, maintenance of the official language roster of the organization and thus enabling hindi training and granting incentive awards to the employees for doing their original work in Hindi, establishing check points etc. are being implemented from time to time. Apart from this, the Official Language section is putting all practical and creative efforts for Official Language Implementation in the Institute. The ICAR-CIFT has achieved the distinction of getting the award from ICAR on eight occasions including the one received during 2020. Other achievements are summarized below:

Best Hindi Journal Rolling Trophy for ICAR-CIFT

'Jaladhi 2018', the Scientific Journal of the Central Institute of Fisheries Technology, published during the year 2018-19, has won ***Best Hindi Journal Rolling Trophy*** and same was bestowed for the first position by Kochi Town Official Language Implementation Committee. The Award distribution ceremony was not held due to Coronavirus Pandemic.

Kochi Tolic Cash Prizes

Mrs. Archana G. and Kumari Archana N. have been awarded cash prizes for Precise Writing and Poetry Recitation respectively for Joint week Hindi Competitions at Kochi TOLIC.

Official Language Workshops

An Official Language Workshop for the Scientists and Technical Officers of Engineering Division was held on 24 June 2020. It was attended by four Scientists and three Technical Officers of the Engineering Division. This workshop was conducted on Usage of Unicode in OL implementation while working on computer by Dr. J. Renuka, Deputy Director (OL).

Another Official Language Workshop on ***'Responsibility of Assistant Administrative Officers in Official Language Compliance'*** was held on 17 September 2020. It was attended by four Assistant Administrative Officers of the Institute. Workshop on Unicode was conducted and bilingual implementation in official work using computer through Unicode was organised by Dr. J. Renuka, Deputy Director (OL).

Hindi week celebration 2020

Hindi Week celebration was organized at ICAR-Central Institute of Fisheries Technology from 07-14 September 2020. During the Hindi week celebrations, two competitions like news reading and extempore speech were organized. This year as a practical implementation special practical programs of official language implementation such as noting in hindi through unicode in e-office, sending internal e-mails in Hindi, signing attendance register in Hindi and sending all e-mails from the Institute to other Institutions in Hindi were conducted as a unique innovative style of Implementation by individual employees of organization.

News Reading and Extempore Speech competitions

Hindi Day Message

Director Dr. C. N. Ravishankar had delivered Hindi day message to all employees of the Institute through google meet on September 14, 2020, at 10.30 AM. On this occasion, the Director underlined the achievements made by the Institute in the field of Official Language and also announced

the winners of both the competitions held in the Institute. On this occasion, the e-Hindi booklet related to Extension, Information and Statistics Division was released through virtual medium.

Director Dr.C.N. Ravishankar delivering Hindi Day message

Incentive Scheme

Under the Incentive Scheme of the Department of Official Language, Ministry of Home Affairs, Government of India, three employees were given cash prizes as incentives for original work done in Hindi during the year. In order to motivate the employees working under him to do original work in Hindi, an officer was also given cash prize as an incentive. The cash awards along with the certificates of appreciation to three winners and one motivating officer were presented during the Hindi Week Celebration on 14 September 2020.

Director distributing cash awards along with the Certificates of Appreciation to the winner, motivative officer of Incentive Scheme

Participation in Meetings/Seminars

Dr. J. Renuka, Deputy Director (Official Language), Dr. Santosh Alex, Assistant Chief Technical Officer and Dr. P. Shankar, Assistant Chief Technical Officer have attended State Level Official Language seminar on the topic "*Badalte Parivesh mein Rajbhasha ki Bahuayami Bhoomika*" conducted by Kochi TOLIC on 09-10 January 2020 at CIFNET, Kochi.

LIBRARY

Library is playing a vital role in providing services to support the information needs of the scientific community of the Institute. The CIFT library is well equipped with modern facilities and resources in the form of online databases, CD-ROMs, DVDs, books, e-journals, e-standards, theses, reports etc. During the period under report, library acquired 28 books and 142 issues of journals. Online databases viz., ASFA (Aquatic Science and Fisheries Abstracts) and Indian Standards have also been acquired.

Library Portal

The library home page provides a single window access to bibliographic databases developed in the library. Bibliographic databases have been developed using WINISIS and search interfaces have been developed using ***GenISISweb.***

Koha Library Management System

The Library is using KOHA Library Management Software. The Online Public Access Catalogue (OPAC) enables users to search the library collection and guides them to precise locations.

Digital Repository of ICAR-CIFT

Digitization of CIFT publications and putting them in open digital repository is an important activity of the library. During the period 293 documents have been digitized and added to the repository. At present CIFT Digital Repository holds 4251 digital documents.

Remote Access to e-Resources

Remote access to subscribed e-resources has been provided to the users. Users are getting access to IP protected resources outside the campus also via the library's list of online resources. The facility is also available to members of the research centres.

CeRA (Consortium of e-Resources on Agriculture)

More than 2000 online journals are available online through CeRA (Consortium of e-Resources on Agriculture). Library has supplied copies of 31 articles under DDR (Document Delivery Request) facility of CeRA (Consortium of e-Resources on Aquaculture) to the member libraries.

Institutional Membership

CIFT library is member of IAMSLIC (The International Association of Aquatic and Marine Science Libraries and Information Centers) and is part of the Interlibrary Loan program, with more than 90 member libraries from more than 25 countries offering materials to other member libraries via interlibrary loan and document delivery.

The Library is also an institutional member of DELNET-Developing Library Network, which coordinates with other regional, national and international networks and libraries for exchange of information and documents.

CIFT Library had become an Institutional member of Current Science Association from September 2016 onwards.

ASFA Input Centre

The library in association with NIO, Goa continued to act as a National Input Centre of ASFA (Aquatic science and Fisheries Abstracts) database.

National Digital Library of India (NDLI) Partner

Content of CIFT Digital Repository is available through National Digital Library of India (NDLI)

IMPORTANT EVENTS

ITEC International Programme customized for Oman officials

ICAR-Central Institute of Fisheries Technology (CIFT), Kochi, the leading research institute in the country in the realm of harvest and post-harvest technologies in fisheries, has organized an international ITEC Course on **"Sustainable management and entrepreneurship development in fisheries for nutritional and livelihood security"** specially designed for officials from Govt. of Oman from 9-20 January, 2020 at its main campus in Kochi. This training is being organized as a part of *Indian Technical and Economic Cooperation (ITEC)* programme sponsored by Ministry of External Affairs, Govt. of India to share India's knowledge in the field of science and technology with ITEC partner countries. Twenty executives from Govt. of Oman participated in the programme.

International ITEC Course sponsored by MEA, Govt. of India

ICAR-CIFT, Kochi organized an International Training Programme under Indian Technical & Economic Cooperation Programme (ITEC), on "Improving fishery-based livelihood: Policies, Technologies and Extension Strategies" from 13-26 February, 2020 at its main campus in Kochi. This training was sponsored by ITEC Ministry of External Affairs, Govt. of India to share India's knowledge in the field of science and technology with ITEC partner countries. Eleven executives representing 9 ITEC partner countries including Serbia, Ethiopia, Eritrea, Somalia, Tanzania, Tunisia, Cambodia, Kenya and Palestine participated in the programme. Most of the participants were officials representing the fisheries departments and Universities in the respective countries. Shri Alex Ninan, President, Seafood Export Association of India (Kerala Chapter) was the Chief Guest on the inaugural day

Awareness programme under Scheduled Tribe Component (STC) at Shimiliguda, Araku valley (M), Visakhapatnam

A one-day programme on Harvest and Post-Harvest Fishery Technologies under "Scheduled tribe component" (STC) was conducted by Visakhapatnam Research Centre of ICAR-CIFT at Shimiliguda mini reservoir, Shimiliguda, Araku valley (M), Visakhapatnam of Andhra Pradesh on 14.02.2020. A total of 75 tribal fishers from Shimliguda, Kothabhalluguda, Gadyaguda tribal villages participated in the STC programme.

***Training cum demonstration programmes* under Scheduled tribe component (STC) at Shimiliguda, Araku valley (M), Visakhapatnam:** Training programmes on harvest and post-harvest fishery technologies under "Scheduled tribe component" (STC) was conducted by Visakhapatnam Research Centre of ICAR-CIFT at Shimiliguda mini reservoir, Shimiliguda, Araku valley (M), Visakhapatnam of Andhra Pradesh during 02.03.2020 to 04.03.2020. A total of 75 tribal fishers from Shimliguda, Kothabhalluguda, Gadyaguda tribal villages participated in the STC programme.

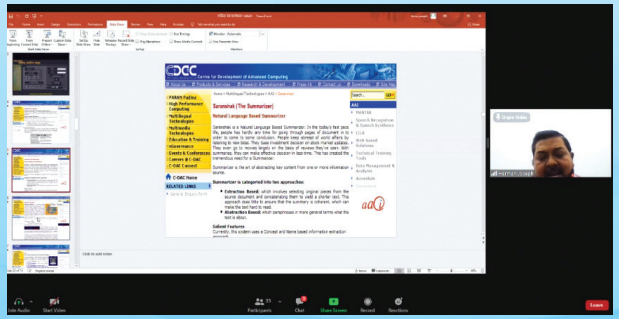
Awareness cum CIFT-TED fabrication training programme in Andhra Pradesh: Awareness cum a training programme on ***"Fabrication of CIFT-TED (CIFT- Turtle excluder device)"*** was conducted at Visakhapatnam on 20th February 2020 jointly by ICAR-Central Institute of Fisheries Technology (ICAR-CIFT) and World-Wide Fund for Nature-India (WWF-India).

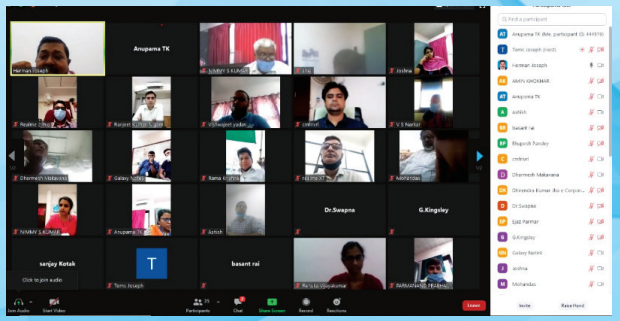
TED fabrication in progress

TED operation

Hindi web workshop on "Usage of electronic media for Official Language Implementation in Covid-19 scenario" at Veraval RC of ICAR – CIFT

Veraval RC of ICAR-CIFT conducted a Web workshop on 'Usage of electronic media for Official Language Implementation in Covid-19 scenario' on 16th June 2020. Dr. Herman P. J., Associate Professor, Department of Hindi, Kerala University, Thiruvananthapuram was the Chief Guest for the programme.





Training programme on "Effective stress management to improve the productivity of employee" in Local Language at Veraval RC of ICAR-CIFT.

Veraval RC of ICAR-CIFT organized a training programme on "Effective stress management to improve the productivity of employee" in local language on 24th September 2020. The motivational mentor Dr. Ketan tank, was the chief guest and he discussed on the different aspects of life and way to achieve holistic success along with mental peace

Stakeholders Meet – 2020

Mumbai Research Centre of ICAR-CIFT has organized stakeholders meet on 16th January 2020 to discuss the draft national policy on "Post-Harvest Processing and Marketing of Fish and Fishery Products". Officials from different organizations such as EIA, MPEDA, FSI, CMFRI, CIFE, State fisheries department and representatives from seafood industries, fishermen society, national fishermen association, aquaculture farmer and boat owner attended the stake holder meet

Training programme under Scheduled Tribe Component (STC)

Training programme under Scheduled Tribe Component (STC) was conducted on "Value addition of fish and fishery products and recent advances in fishing technology" from 27-29th January 2020 in collaboration with Assistant Commissioner of Fisheries, Nandurbar, Maharashtra

Training programme under SCSP was conducted on "Value addition of fish and fishery products and recent advances in fishing technology" programme at KardaTah, Risod Dist. Washim, Maharashtra from 11-13th February 2020.

Training programme in association with Mangrove foundation, Maharashtra

Mumbai Research Centre of ICAR-CIFT has conducted two 2 days training cum demonstration programme in association with Mangrove and Marine Biodiversity Conservation Foundation of Maharashtra (Mangrove Foundation), Maharashtra. The first programme on "Hygiene handling and value addition in fisheries" was organized from 7th to 8 January 2020 at Shiroda, Vengurla Taluka, Sindhudurg district. The second programme on "Hygiene handling and value addition in fisheries" was conducted from 09-10 January 2020 at Parule, Vengurla Taluka, Sindhudurg district, Maharashtra.

Participants along with MRC CIFT team

Stakeholder's consultation meeting for national policy

ICAR-CIFT conducted the stakeholder's consultation meeting for National Policy on Post-Harvest Processing and Marketing of Fish and Fishery Products funded by National Fisheries Development Board (NFDB) on 25th January 2020 at Hotel Fern Residency, Veraval, Gujarat. The meeting was attended by 53 participants including President of seafood Export Association of India & Gujarat Chapter, leading Seafood Exporters and representatives from EIA, Veraval Research Centre of ICAR-CMFRI and College of Fisheries, Veraval, boat owners associations and NGOs and actively participated in the deliberations.

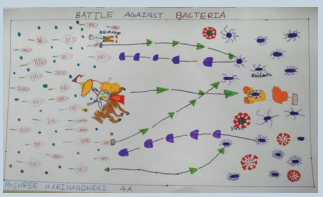
Stakeholder Consultation Meeting

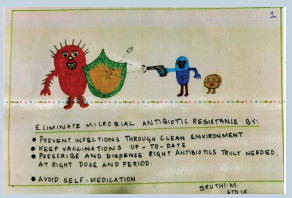
Visakhapatnam Research Centre of ICAR-CIFT has conducted a stake holder meeting on 18.02.2020 at ICAR-CIFT, Visakhapatnam to get the opinion and invite inputs from fisheries stakeholders for the preparation of a national policy on "Post-harvest processing and marketing of fish and fishery products" by Govt. of India. Stake holders from Central and State Govt. including the officials from ICAR-CMFRI, MPEDA, EIA, FSI, CIFNET, NIFPHATT, Network for Fish Quality Management and Sustainable Fishing (NETFISH), Department of Fisheries, Government of Andhra Pradesh and representatives from seafood exporting industry, boat operators' associations, market association, NGO's, fishermen and fisherwomen participated in the meeting.

Functions & Celebrations

World Antimicrobial Awareness Week (WAAW)

The simplest and easiest way of containing AMR is creating awareness among various stakeholders across the sector. ICAR-CIFT observed WAAW (World Antimicrobial Awareness Week) 2020 from 18 to 24 November 2020 with this year's theme "Antimicrobial: handle with care". This year ICAR-CIFT has taken five initiatives for AMR posture and brochure competitions were conducted for children of staff members.





Visakhapatnam Research Centre of ICAR- CIFT observed the World Antimicrobial Awareness Week (WAAW) from 18-24 November 2020 to increase awareness on antimicrobial resistance (AMR). Dr. B. Madhusudana Rao, Principal Scientist gave a talk on 'Enlarging the AMR ambit from Antibiotics to Antimicrobials: Implications for Fisheries' on 21 Nov 2020. A leaflet on 'Antimicrobial Resistance in Fisheries' was also released.

Gandhi Jayanti

Gandhi Jayanti was celebrated at ICAR-CIFT, Headquarters and Research Centres during 26 September to 02 October 2020. As a part of this, various activities such as talks related to Gandhiji's philosophy and Swachhta hi Seva were conducted for staff of the institute. All the staff of Headquarters attended a talk on "Democratic Decentralisation and Rural Development - one of the ideals of Gandhiji, having far reaching implications on society" delivered by Dr. Joy Elamon, Director General of Kerala Institute of Local Administration (KILA) conducted by ICAR-CIFT, Kochi on 29 September 2020 through an online platform.

Mumbai Research Centre of ICAR-CIFT, Mumbai organized various events at the centre to celebrate '150th Birth anniversary of Mahatma Gandhi'. included cleaning of labs and office premises, Display of posters in 'Gandhi and women empowerment', Display of Gandhi slogans and Talk on 'Gandhian Principles'

Observance of Vigilance Awareness Week

ICAR-CIFT, Kochi observed the **Vigilance Awareness Week (VAW)- 2020** on digital platform by organizing the different events starting from 27 October to 2 November, 2020 focusing on the theme of this year **'Satark Bharat, Samriddh Bharat'(*Vigilant India, Prosperous India*)'**. The Integrity pledge on vigilance was administered by Director 27 October 2020.

A quiz, poster and painting competitions were organized for the staff members of ICAR – CIFT including Headquarters and Centers on the occasion on 28, 29 and 30 October, 2020 respectively.

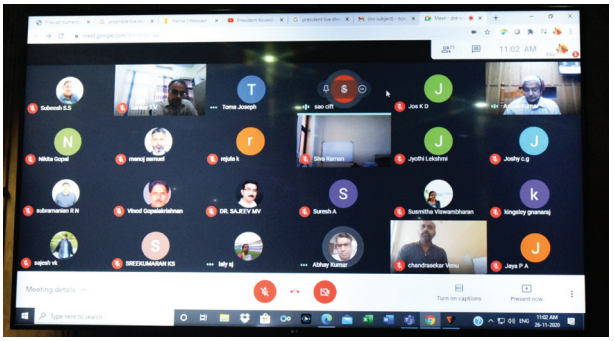
Posters made by students and staff

A special online lecture on '*Preventive vigilance measures and free governance*' by Dr. Aneesh V Pillai, Asst. Professor, School of Legal Studies, Cochin University of Science and Technology, CUSAT, Cochin, was organized on 2 Nov., 2020 on the concluding day of Vigilance Awareness Week-2020 and was attended by more than 50 participants

Constitution Day Celebration

ICAR-CIFT, Kochi observed the Constitution Day by organizing preamble reading on digital platform on 26 November, 2020 at Headquarters and Research Centres. The preamble reading was administered by Dr. K. Ashok Kumar, Director (i/c), ICAR-CIFT, Cochin. At research centres the preamble reading was administered by the respective Scientist-In-Charges.

A special online talk on '*Constitutional values and fundamental principles of the Indian Constitution*' was organized on 26 November, 2020. Adv. Sivan Madathil, practicing lawyer at High Court, Cochin delivered an informative and illuminating talk on the above topic which is highly useful to the staff members.



As part of the Constitution Day celebration for the month of January a quiz competition was organised for the High school students at St. Thomas Girls' High School, Perumanoor, Cochin, Kerala on 29 January, 2020 for the class VIII and IX students and prizes were distributed to the winners. Similarly, extempore competition was organized for the High school students at Kendriya Vidyalaya, Ernakulam, Cochin, Kerala on 10 February, 2020. and prizes were distributed to the winners.

International Women's Day Celebration

International Women's Day (IWD) was celebrated at ICAR-CIFT to uphold this year's IWD theme of **'I am Generation equality: Realizing women's rights'** i.e., **'Each for Equal'**. The celebration started with a series of women centric programmes at the institute Headquarters. A workshop on 'Cake making' was organized on 02 March, 2020. More than 50 women staff attended the programme. The programme ended with the cake cutting ceremony with the Director, Dr. Ravishankar C. N. A special photo shoot of ICAR-CIFT, Cochin staff was arranged on 3 March, 2020 to uphold the IWD's theme.

In the meeting followed, Dr. Ravishankar. C. N, Director, ICAR – Central Institute of Fisheries Technology, presided over the function and Smt. Muthumani Somasundaran, Cine actor was the Chief Guest. Two women staff viz., Smt. Leena. N and Smt. Sasikala. K.G. who are getting retired in the year 2020-21 were felicitated during the function.

Cake making workshop

Honoring women staff of ICAR-CIFT

Women's day celebration at ICAR-CIFT Research Centres

Swachhata Pakhwada

Swachhata Pakhwada was formally inaugurated at the Institute with the administering of pledge by Director, ICAR-CIFT, Cochin on 16 December 2020. Subsequently division wise cleaning, distribution of hand sanitors, awareness programme were organized during the fortnight long period from 16-31 December, 2020.

Replacement with energy efficient bulbs and lighting system in progress

Cleanliness drive at Veraval Centre

Kisan Diwas

To commemorate Kisan Diwas, fifteen fish farmers from Ernakulam and its suburbs were invited to the Institute for a demonstration-cum-training on 'Conversion of fish waste to feed'. Hands on training was provided on mixing of ingredients, handling of fish discards for including in feed, operation of floating and sinking feed machines and drying and packing of the prepared feed.

Awareness on water harvesting

A digital campaign on importance of water harvesting was organized at seminar hall of ICAR CIFT on 16-31 December 2020. The staff of the institute watched slide show and were made aware about importance of water harvesting, method of water harvesting at house hold and agriculture field level.

International Yoga Day

The Headquaters and the Research centres of ICAR-CIFT observed International day of Yoga on 21.06.2020. All Scientists and Staff actively practiced yoga as per the common yoga protocol through online resources provided by Ministry of Ayush for practicing yoga from home.

Republic Day Celebration

The Republic Day Celebrations were carried out at the ICAR-CIFT Headquarters and Research Centres on 26th January 2020.

The Independence Day Celebration

The Independence Day celebrations were carried out at the ICAR-CIFT Headquarters and Research Centres on 15 August 2020 under COVID Protocol. Dr. C .N. Ravishankar hoisted the National Flag and addressed the gathering. At the Research Centre, the respective Scientist In-charges did the honour.

Celebration of Independence Day by staff of MRC-CIFT

Institute Joint Staff Council (IJSC)

During the period under report, the Institute Joint Staff Council (IJSC) of the Institute conducted four meeting. IJSC has celebrated its 100th meeting in the month of 2nd January 2020. The Secretary IJSC and member CJSC Shri. P.S. Nobi has attended 39th Central Joint Staff Council (CJSC) meeting held at ICAR-New Delhi. He has been nominated to Follow up action committee (FAC) of CJSC and to Annual General Meeting (AGM) of ICAR.

Director, ICAR-CIFT Honouring Shri M.K. Kuttikrishnan Nair, Former Secretary, CJSC-ICAR.

Shri P. S. Nobi, Secretary IJSC presenting report at 100th IJSC meeting Celebration

Shri P. S. Nobi, Member FAC, ICAR- IJSC at Annual General Meeting of ICAR

ICAR - CIFT Recreation Club

The recreation club of the institute plays a role to bring together the CIFT staff and maintains a lively relationship between then the various sections. The club conducts different programmes among the staff and facilitates a stress-free working environment.

The New year 2020 was celebrated by welcoming the staff with a piece of cake and Recreation club designed wall calendar 2020. As a New Year gift ecofriendly reusable cloth bag were distributed to all the staff members of CIFT.

Director, ICAR-CIFT inaugrating the Ecofriendly Bag Distribution

As way of reducing stress, club members of Recreation Club with their family undertook a one-day tour to Vagamon during February 2020. The outing brought together the staff members who enthusiastically participated in the trekking and recreation activities.

Staff member and family at Vagamon

The Club distributed single-layered cloth masks and alcohol-based sanitizer to all staff members, free of cost, when COVID19 struck the State. The club also facilitated the supply of five-layered cloth mask and sanitizers prepared in CIFT lab, the staff at a nominal rate, during the COVID 19 pandemic.

When the CIFT Quarters located at Thevara was declared containment zone during the mid-phase of COVID and the movement of public was restricted, the Club arranged provision to staff at Residential Complex.

In view of the COVID restrictions, the Onam 2020 celebration, was held as low-key affair on 27.08.2020, limiting to a pookalam and lighting of traditional lamp by Director and senior most colleagues who were due for superannuation. The Staff of CIFT joined the celebration following the COVID protocol.

From the month of September, 2020 onwards, as a safeguard measure for the prevailing pandemic condition, CIFT Recreation Club distributed homeopathic immunity booster, Arsebicum album 30, (as recommended by Ministry of AYUSH), procured from Ernakulam District Homeo Hospital, to all club members at free of cost.

Recreation Club arranged the distribution of awards for academic excellence to wards of staff. Cash awards were given to the wards of members for academic excellence. The awards were given for the following categories, based on the performance of wards in the final examinations held during 2018-19: (1) 10th or Equivalent (2) Plus two or Equivalent (3) Diploma (3 years) (4) Bachelor's degree.

Representation in Committees

Officials represented the Institute in various Committees/Board panels etc. in different capacities

Dr. Ravishankar C. N.
Director, ICAR-CIFT

As Chairman

- Scientific panel on Fish and Fish Products, Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Govt of India, New Delhi.
- Committee for drafting National Policy on Post Harvest Processing and Marketing of Fish and Fishery Products, NFDB, Department of Fisheries, Ministry of Agriculture and Farmers Welfare, Govt. of India, New Delhi.

As Member

- Governing Body of ICAR Society, ICAR, Ministry of Agriculture & Farmers Welfare, New Delhi
- Scientific Committee, Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Govt of India, New Delhi
- Committee for drafting National Fisheries Policy, Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India
- MPEDA Authority, Ministry of Commerce & Industry, Govt. of India, Cochin
- The Sub-Committee (Finance & Accounts) of the Governing Body of ICAR, Ministry of Agriculture & Farmers Welfare, New Delhi
- Sub-Committee on Administration of the Governing Body of ICAR, Ministry of Agriculture & Farmers Welfare, New Delhi
- Academic Council, ICAR-Central Institute of Fisheries Education, Mumbai
- Executive Committee, Kerala Agricultural University, Thrissur
- Board of Directors, Lakshadweep Development Corporation Limited, Cochin
- National Reference & Referral Laboratory on Fish and Fishery Products, Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Govt of India
- National Steering Committee, NetSCoFAN (Network for Scientific Co-operation for Food Safety and Applied Nutrition), Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Govt of India, New Delhi
- Food & Agriculture Division Council, Bureau of Indian Standards, New Delhi
- Transport Engineering Division Council, Bureau of Indian Standards, New Delhi
- Textile Division Council, Bureau of Indian Standards, New Delhi
- Executive Committee, NETFISH (Network for Fish Quality Management & Sustainable Fishing), MPEDA, Ministry of Commerce & Industry, Govt. of India
- Expert Committee of the Ministry of Food Processing Industries (MoFPI) for considering the R&D proposal to be received under the scheme of Research and Development in processed food sector

- Committee to Assess the Requirement of Common Incubation Facilities for Incubation Centres to be Set up Under PMFME Scheme, MoFPI, Govt. of India
- Technical Advisory Committee for Promotion and Development of Seaweed Farming and Value Chain, Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India
- NABL Accreditation Committee, ICAR, New Delhi
- Agri-Business Incubation programme Implementation committee, ICAR, New Delhi
- Sectional Committee of Fisheries, National Academy of Agricultural Sciences, New Delhi
- Industrial Advisory Board, Department of Food Science and Technology, Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi
- Expert Committee, Sacred Heart College, Kochi
- Technical Assessor, National Accreditation Board for Testing and Calibration of Laboratories, New Delhi

Dr. K. Ashok Kumar
Principal Scientist and Head, Fish Processing Division

As Member

- Export Inspection Council- APE Panel member Root Cause Assessment of rejection of Antibiotics
- FSSAI Scientific panel on Antibiotics
- Sectional Committee of Bureau of Indian Standards (BIS), New Delhi.
- Board of studies, Cochin University of Science and Technology (CUSAT), Kochi
- Board of studies, Kerala University of Fisheries and Ocean Studies (KUFOS), Panangad, Kochi
- Board of studies, Mahatma Gandhi Unversity, Kottayam
- Board of studies, Calicut University, Thenhipalam, Kerala
- Board of studies, Sacred Heart College, Kochi
- Board of studies, St Albert's College, Kochi
- APC meeting for considering promotion of Scientists under Career Advancement Scheme (CAS), ICAR CMFRI, Cochin.
- External expert for the implementation of E-procurement online portal system in Export Inspection Agency (EIA), Kochi

Dr. M. M. Prasad
Principal Scientist and Head Microbiology, Fermentation and Biotechnology Division

As Chairman

- Institute Biosafety Committee (DBT, Govt., India)

As Member

- Rajiv Gandhi Centre for Aquaculture (RGCA) (MPEDA, Ministry of Commerce & Industry, Government of India)

Dr. Leela Edwin
Principal Scientist and Head, Fishing Technology Division

As Member

- Board of studies in Industrial Fisheries, Faculty of Marine Sciences & Board of UG studies in Marine Sciences, CUSAT, Kochi
- 18th meeting of the Transport Engg. Division – Fishing Vessel Sectional Committee
- Technical committee meeting on diversification of trawlers to purse-seiners
- Technical Committee setup by the Government of India for "Reviewing the duration of the fishing ban period and to suggest measures to strengthen the conservation and management measures"
- In the Round Table Interaction with Ambassador for Ocean, France
- Selection Committee meeting for the Recruitment to the post of Assistant Professor - School of Industrial Fisheries at CUSAT Administrative Office
- Kerala State Fisheries Management Council Meeting
- Expert Committee to Curb on unsustainable marine fish capture practices and sustainable fisheries in Maharashtra

Dr. A. K. Mohanty
Principal Scientist and Head, Extension, Information and Statistics Division

As Member

- Career Assessment Committee of Scientists (Agril. Extension) in ICAR-VPKAS, Almora, Uttarakhand
- Member of the Assessment Committee for the cadre regularization of NETFISH staff of MPEDA, Cochin under Ministry of Commerce, Govt. of India
- Nodal officer for ODOP (Fish and Marine product) under Uttar Pradesh (UP)-PMFME

Dr. Manoj P. Samuel
Principal Scientist and Head, Engineering Division

As Member

- Transport Engineering Division Council (TEDC) of BIS
- Certified Assessor, NABL
- Ph.D advisory board, NIT Pondicherry
- External examiner of PG and PhD students of Faculty of Agricultural Engineering, Kerala Agricultural University
- Expert Reviewer for the BIG and GYTI Schemes launched by Department of Biotechnology (DBT) and Biotechnology Industrial Research and Assistance Council (BIRAC) facilitated by ICAR-NAARM, Hyderabad and IIT Kanpur.
- District Technical Support Group, Kerala State Biodiversity Board

Dr. Suseela Mathew
Principal Scientist and Head, Biochemistry & Nutrition Division

As Member

- NABL lead assessor.
- Subject expert for review of projects DBT, KSCSTE
- Academic Council, Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi

Dr. Zynudheen A. A.
Principal Scientist, Head In-Charge, Quality Assurance and Management Division

As Member

- Technical Committee for Risk Assessment for Import of Fish & Fishery Products into India, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India
- Assessment Panel of Experts, Export Inspection Council
- Technical committee for setting up of fish meal plant at Arattupuzha by MATSYAFED, Govt. Kerala.

Dr. T. V. Sankar

As Principal Member

- Fish and fisheries products sectional committee - FAD 12, Food & Agriculture Division, Bureau of Indian Standards (BIS), Govt. of India, New Delhi

As Member

- Scientific Panel for Fish & Fishery Products, FSSAI, Govt. of India, New Delhi
- Board of Studies in Biotechnology, Cochin University of Science & Technology, Cochin

Dr. Saly N. Thomas
Principal Scientist

As Chairperson

- Textile Materials for Marine/Fishing Purposes Sectional Committee, TXD 18 of Bureau of Indian Standards, New Delhi.

As Member

- GESAMP (Interagency body of UN) working Group 43: Sea based sources of Marine litter including fishing gear and other shipping related litter; jointly sponsored by FAO and IMO
- Technical Committee constituted by Matsyafed, Government of Kerala for the implementation of Twine factory at Alappuzha District, Kerala.
- Technical Committee constituted by Matsyafed, Government of Kerala for the implementation of RKVY-FAFTAR assisted modernization of net factories at Ernakulam, Kannur
- Technical Committee constituted by Matsyafed, Government of Kerala for evaluating technical bids received for the supply of raw materials and finished goods to Matsyafed Net Factories and Matsyafed OBM Division.
- Institute Management Committee, ICAR-CMFRI, Cochin.

Dr. Femeena Hassan
Principal Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. R. Raghu Prakash
Principal Scientist and SIC, VRC of CIFT

As Member

- Board of Studies, Dept. of Marine Living Resource, Andhra University
- Scientific Advisory Committee (SAC) meeting of BCT-Krishi Vigyan Kendra, Visakhapatnam District
- Selection committee, Walk-in-interview for SMS (Agrometeorology)Krishi Vigyan Kendra KVK, Rastakuntubai,

Dr. L. N. Murthy
Principal Scientist and SIC, MRC of CIFT

As Member

- Scientific assessment Panel for Technologists, Gujarat and Maharashtra.
- Selection Committee of various ICAR-CIFE endowment awards

Dr. U. Sreedhar
Principal Scientist

As Chairman

- Assessment committee of promotion of technical staff of CMFRI, Kochi

Dr. George Ninan
Principal Scientist

As Member

- National policy on Post Harvest processing and marketing of fish and fishery products
- Committee on Assessment of Requirements of Common Incubation Facilities for Incubation Centers to be setup under PM-FME scheme
- MPEDA Subsidy committee on large cold storage and Technology Development for Specific Value Addition

Dr. B. Madhusudana Rao
Principal Scientist

As Member

- Task force committee on Preparation of Andhra Pradesh Fish Feed Act constituted by Dept. of Fisheries, Govt. of Andhra Pradesh.
- Scientific Panel on Antibiotic Residues, Food Safety and Standards Authority of India, (FSSAI), New Delhi

- FAD, 15, Food and Agriculture Department, Bureau of Indian Standards (BIS), New Delhi.
- Academic Council , Dr.V.S.Krishna Govt. Degree College (A), Visakhapatnam
- Institute Bio safety Committee, ICAR- CIFT, Cochin
- Assessment Panel of Experts, Export Inspection Council, Visakhapatnam

Dr. G. K. Sivaraman
Principal Scientist

As Member

- APE panel for approval of seafood processing plants
- Institute Bioethics Committee ICAR- CMFRI, Cochin, Kerala.
- Institute Bioethics Committee Veterinary College, Thrissur, Kerala.

Dr. Satyen Kumar Panda
Principal Scientist

As Member

- FSSAI evaluation committee for classification of large states based on "Food Safety Index" to measure the performance of States and UTs on various parameters of Food Safety
- FSSAI Scientific Panel on Fish and Fisheries Products
- Method Review Group, FSSAI
- RAFT Committee, FSSAI on approval of rapid food testing kits
- Fish, Fisheries and Aquaculture Sectional Committee, FAD 12, Bureau of Indian Standards
- Food Hygiene, Safety Management and other systems sectional committee, FAD 15, Bureau of Indian Standards
- FSSAI Committee for setting up of Microbiology Laboratory under Central Sector Scheme
- FSSAI Expert Committee to evaluate a guidance document for Standard Food Testing Laboratory
- FSSAI Working Group on Microbiology
- Technical Committee for Risk Assessment for Import of Fish & Fishery Products into India, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India
- Assessment Panel of Experts, Export Inspection Council
- Committee constituted by MPEDA for certification of farms for the production of antibiotic free shrimps for export

Dr. Madhu V. R.
Prinipal Scientist

As Member

- Represent India on Issues related to BRD and bycatch by Department of Fisheries, Govt. of India.

Shri. M. V. Baiju
Senior Scientist

As Member

- Technical committee of NPOL for finalizing the Design specification of Submersible platform
- KSINC for finalizing the design of tourist boats for operation in Kerala
- Department of Science and Technology, U.T of Lakshadweep for the construction of 16.0 m FRP boat.
- Fishing Vessel Sectional Committee of Bureau of Indian Standards
- Dept. of Fisheries Govt. of Tamil Nadu for the construction of long liner cum gill netters.

Dr. Viji P.
Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Jesmi Debbarma
Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Remya S.
Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. A. Jeyakumari
Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Sandhya K. M.
Scientist

As Member

- Twenty second meeting of Textiles Division Council (TXDC)

Dr. Murali S.
Scientist

As Member

- Expert member for the Physical Verification Committee of MPEDA equipment subsidy scheme.

Dr. Devananda Uchoi
Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Parvathy U.
Scientist

As Member

- Technical Committee for NIFAM-Implementation of integrated Aquapark project
- Assessment Panel of Experts, Export Inspection Council

Shri. S. Sreejith
Scientist

As Member

- Technical Committee for NIFAM-Implementation of integrated Aquapark project
- Assessment Panel of Experts, Export Inspection Council

Smt. Laly S. J.
Scientist

As Member

- Working group on formaldehyde in fish and shellfish by FSSAI
- Assessment Panel of Experts for evaluation of seafood exporting companies

Dr. Anuj Kumar
Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Sarika K.
Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Pankaj Kishore
Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council
- External examiner for B.F.Sc. End Term Examination 2020 Bihar Animal Sciences University, Patna
- MPEDA Certification scheme for Hatcheries for the production of antibiotic free seeds

Ms. Priya E. R.
Scientist

As Member

- Assessment Panel of Experts, Export Inspection Council

Dr. Aniesrani Delfiya
Scientist

As Member

- External expert in the examination passing board committee of KUFOS, Panangad.

Important Institute Committees

Quinqennial Review Team (QRT)

Chairman: Dr. K. S. M. S. Raghava Rao, Director, CSIR-CFTRI.

Members:

1. Dr. B. Sundaramoorthy, Dean (I/c), Prof. & Head, Dr. MGR Fisheries College & Research Centre, TNJFU, Nagapattinam
2. Dr. K. C. Dora, Former Dean, Dpt. of Fish Processing Technology, KBAFS, Kolkatha (WB)
3. Dr. Udey S. Annapure, Prof. & Head, Institute of Chemical Technology, Mumbai
4. Dr. V. R. Joshi, Former Prof . & Head, College of Fisheries, Ratnagiri
5. Dr. N. Bhaskar, Advisor, FSSAI

Member Secretary: Dr. Satyen Kumar Panda, Principal Scientist, QAM Division, ICAR-CIFT, Kochi

Research Advisory Committee (RAC)

Chairman: Dr. S. D. Tripathi, Former Director, ICAR-CIFE, Mumbai

Members:

1. Dr. A. K. Upadhyay, Prof. & HOD, College of Fisheries, Pantnagar
2. Dr. K. Rathnakumar, Dean, College of Fisheries Engineering, TNJFU, Nagapattinam
3. Dr. K. N. Gurudutt, Former Head, CFTRI, Mysore
4. Dr. M. N. Venugopal, Former Prof., College of Fisheries, Mangalore
5. Prof. Biswanth Sadangi, Former Head, ICAR-CIWA & Emeritus Scientist, ICAR-NRRI
6. Asst. Director General(M.Fy), ICAR, New Delhi
7. Director, ICAR-CIFT, Kochi

Member Secretary: Dr. V. R. Madhu, Principal Scientist, ICAR-CIFT, Kochi

Institute Management Committee (IMC)

Chairman: Dr. Ravishankar C. N., Director, ICAR-CIFT

Members:

1. Shri P. Sahadevan, Additional Director of Fisheries, Directorate of Fisheries, Kerala
2. Mr. H. S Veerappa Gowda, Director, Directorate of Fisheries, Bangalore - 56001
3. Dr. G. Sugumar, Director(I/c), DIVF, TNJFU, Tamilnadu
4. Shri K. S. Shaiju, R/o Kalathil House, Edavanakkad, Ernakulam
5. Ms. Samyuktharani K., R/o Kayakkalath Sivasthuthi Bhavan, Puthiyappa, Kozhikode
6. Dr. Rani Palaniswami, Officer-in-charge, Research Centre of CIFRI, Cochin.
7. Dr. Alavandi S. V., HOD, CIBA, Chennai.
8. Dr. S. Kalavathi, Principal Scientist, CPCRI, Kayamkulam.
9. Dr. K. V. Rajendran, HOD, CIFE, Mumbai.
10. Assistant Director General (M. Fy.), ICAR, New Delhi - 12.
11. FAO, ICAR-CTCRI, Trivandrum.

Member Secretary: Sr. Administrative Officer, ICAR-CIFT, Kochi

Grievance Cell

Chairman: Dr. Ravishankar C. N., ICAR-CIFT, Kochi

Members:

1. Dr. K. Asok Kumar, Principal Scientist & HOD, FP Dvn., ICAR-CIFT.
2. Shri W. Sreenivasa Bhat, Sr. Admn. Officer, ICAR-CIFT
3. Shri K. S. Sreekumaran, Fin. & Accts. Officer, ICAR-CIFT
4. Dr. Pankaj Kishore, Scientist, ICAR-CIFT
5. Shri P. V. Sajeevan, Tech. Officer., ICAR-CIFT
6. Shri M. Arokya Shaji, Asst., ICAR-CIFT, Veraval
7. Smt. P. T. Mary Vinitha, SSS, ICAR-CIFT.

Member Secretary: Sh. M. N. Vinodh Kumar, Asst. Admn. Officer (Cdn.), ICAR-CIFT, Kochi

Institute Joint Staff Council (IJSC)

Chairman: Dr. Ravishankar C. N., Director, ICAR-CIFT, Kochi

Members (Official Side):

1. Dr. K. Asok Kumar, PS & HOD, FP Dvn., ICAR-CIFT
2. Dr. Leela Edwin, PS & HOD, FT. Dvn., ICAR-CIFT
3. Dr. Amulya Kumar Mohanty, PS & HOD EIS Dvn., ICAR-CIFT
4. Dr. Manoj P. Samuel, PS & HOD Engg. Dvn., ICAR-CIFT
5. Shri K. S. Sreekumaran, FAO, ICAR-CIFT

Secretary (Official Side): Shri W. Sreenivasa Bhat, Sr. Admn. Officer, ICAR-CIFT

Members (Staff Side):

1. Shri K. B. Sabukuttan, Asst. Admn. Officer, ICAR-CIFT
2. Shri K. Das., Assistant, ICAR-CIFT
3. Shri Vipin Kumar V., Sr. Tech. Assistant, ICAR-CIFT
4. Shri A. Vinod, SSS, ICAR-CIFT
5. Shri P. Raghavan, SSS, ICAR-CIFT

Secretary (Staff Side): Shri P. S. Nobi, Tech. Officer, ICAR-CIFT.

Project Monitoring & Evaluation Committee (PMC)

Chairman: Dr. C. N. Ravishankar, Director, ICAR-CIFT, Kochi.

Members:

1. Dr. K. Asok Kumar, PS & HOD, FP Dvn., ICAR-CIFT
2. Dr. M. M. Prasad, PS & HOD, MFB Dvn., ICAR-CIFT
3. Dr. Leela Edwin, PS & HOD, FT. Dvn., ICAR-CIFT
4. Dr. Amulya Kumar Mohanty, PS & HOD EIS Dvn., ICAR-CIFT
5. Dr. Manoj P. Samuel, PS & HOD Engg. Dvn., ICAR-CIFT
6. Dr. Suseela Mathew, PS & HOD B&N Dvn., ICAR-CIFT
7. Dr. A. A. Zynudheen, PS & HOD QAM Dvn., ICAR-CIFT

Member Secretary: Dr. Saly N. Thomas PS & In-Charge, PME cell

List of On-going Research Projects

Institute Projects

Sl. No	Name of Project	Principal Investigator	Location of Project	Co-Investigators/ Project Associates
1	Studies on fishing operations and energy use for formulation of guidelines for selected small scale marine fisheries of India	Dr. Leela Edwin	Kochi Veraval	Dr. Saly N. Thomas Shri M. V. Baiju Dr. Manju Lekshmi N. Shri R. K. Renjith Dr. K. K. Prajith Dr. Sandhya K. M. Shri. P. N. Jha
2	Studies on fish behaviour as an input for developing responsible fishing systems	Dr. Madhu V R	Kochi Veraval	Dr. Renjith R. K. Shri P. N. Jha Shri Chinnadurai S. Shri Tejpal C. S. Dr. Prajith K. K.
3	Optimization of harvest and post-harvest techniques for Mesopelagic in south western Arabian sea	Dr. M.P. Remesan	Kochi	Shri P. N. Jha Shri R. K. Renjith Dr. A. A. Zynudheen Shri K. K. Anas
4	Improved techniques for protection of materials in marine environment.	Dr. P. Muhamed Ashraf	Kochi	Dr. Leela Edwin Dr. Saly N. Thomas Dr. Sandhya K. M. Dr. Manju Lekshmi N. Shri S. Chinnadurai
5	Development of region and species specific pots/traps	Dr. K.K. Prajith	Veraval	Dr. M. P. Remesan Dr. U. Sreedhar Dr. D. Divu (CMFRI) Dr. S. Remya Shri G. Kamei Dr. Manju Lekshmi N. Shri S. Chinnadurai
6	Fishing technological interventions for sustainable marine ecosystem services along the east coast of India	Dr. R. Raghu Prakash	Visakhapatnam	Dr. U. Sreedhar Shri M. V. Baiju Dr. V. R. Madhu Dr. P. Jeyanthi Dr. Jesmi Debbarma

7	Technological interventions for improvement of fishing systems in selected inland water bodies of India	Dr. Sandhya K. M.	Kochi Mumbai Visakhapatnam	Dr. Saly N. Thomas Dr. M. P. Remesan Dr. U. Sreedhar Shri M. V. Baiju Dr. S. Monalisa Devi Dr. R. K. Renjith Dr. Rajendra Naik Shri. G. Kamei
8	Interventions in processing and preservation of commercial and unconventional fishery resources	Dr. George Ninan	Kochi Mumbai Visakhapatnam	Dr. Zynudheen A. A. Dr. Bindu J. Dr. Mohan C. O. Dr. Joshy C. G Dr. Binsi P. K. Dr. Mandakini Devi H. Smt. Sreelakshmi K. R Dr. K. Sarika Dr. Parvathy U. Sh. Sreejith S. Ms. Rehana Raj Smt. Laly S. J. Smt. Greeshma S. S. Dr. Jeyakumari A. Dr. Abhay Kumar Dr. Viji P.
9	Biodegradable Packaging Materials for Fish and Fishery Products	Dr. Bindu J.	Kochi Veraval Visakhapatnam Mumbai	Shri Sreejith S. Shri Satish Kumar Dr. Sarika K. Smt. Priya E. R. Dr. Anupama V. Dr. Renuka V. Dr. Remya S. Dr. Ashish Kumar Jha, Dr. Jessmi Debbarma
10	Technological Interventions for Enhancing Utilization of Secondary Raw Materials of Aquatic Origin	Dr. Zynudheen A. A.	Kochi Mumbai Veraval	Dr. Femeena Hassan Dr. Binsi P. K. Dr. Elavarasan K. Dr. Jeyakumari A. Dr. Parvathy U. Dr. Mandakini Devi H. Dr. Joshy C. G. Shri Satish Kumar Dr. Pankaj Kishore Dr. Devanda Uchoi Dr. Renuka V. Dr. Remya S. Dr. Visnu Vinayagam Smt. Laly S. J.

11	Development of Active and Intelligent Packaging System for Fish & Shellfishes	Dr. C. O. Mohan	Kochi	Dr. Ravishankar C. N. Dr. K. Ashok Kumar Dr. Muhamed Ashraf Dr. Satyen Kumar Panda Dr. Joshy C. G. Dr Visnuvinayagam S. Dr. Nagalakshmi K. Dr. S. Remya Dr. Pankaj Kishore Dr. Anuj Kumar Dr. Elavarasan K. Smt. Sreelekshmi K. R.
12	Development of processing protocols for emerging farmed fishery resources	Dr. Binsi P.K.	Kochi Veraval Visakhapatnam Mumbai	Dr. Jeyakumari A. Dr. Parvathy U. Dr. Devananda Uchoi Dr. Sarika K. Shri Satishkumar K. Dr. Rehana Raj Dr. Anupama T.K. Dr. Viji P.
13	Development and validation of biomedical and cosmetic products from secondary fishery raw materials	Dr. Binsi P.K.	Kochi Veraval Visakhapatnam Mumbai	Dr. Zynudheen A. A. Dr. Muhammed Ashraf P. Dr. Viji P. Dr. Renuka K. Dr. Jeyakumari A. Dr. Parvathy U. Dr. Anupama T. K. Shri Ezhil Nilavan Dr. Sarika K. Dr. Rehana Raj Dr. Manoj Samuel Dr. Femeena Hassan Smt. Laly S.J.
14	Development of Soft Computing Systems in Fisheries Technology for Technology Dissemination and Policy Formulation.	Dr. Joshy C.G	Kochi	Dr. Ashok Kumar K. Dr. George Ninan Dr. Zynudheen A. A. Dr. Satyen Kumar Panda Dr. Suresh A. Dr. Elavarasan K. Shri Premdev, MPEDA, Cochin
15	Enhancing the properties of paper based packaging material by incorporating Poly hydroxyalkanoates (PHA) from fish waste	Mrs. Sreelakshmi. K.R.	Kochi	Dr. C. O. Mohan Dr. Murugadas V. Smt. T. Muthulakshmi

16	Process development and scaling up of production of different molecular weight chitosan with different degree of de-acetylation and evaluation of their applications	Dr. K. Elavarasan	Kochi	Dr. Ashok Kumar. K. Dr. Bindu J. Dr. Mohan C. O. Dr. Joshy C. G. Dr. Renuka V. Dr. Hanjabam M. D. Shri Tepal C .S. Shri Sathish Kumar K.
17	Augmenting value and safety of wild and farmed fish of East Coast through technological approaches	Dr. B. Madhusudana Rao	Kochi Visakhapatnam	Dr. P. Viji Dr. Jesmi Debbarma Dr. K. Ahamed Basha Dr. U. Parvathy
18	Development of seaweed based edible and functional sachet for food packaging applications	Dr. Jesmi Debbarma	Kochi Visakhapatnam	Dr B. Madhusudana Rao Dr. P. Viji Shri Sreejith S.
19	Safety and quality aspects of fish and fishery product from Gujarat coast	Dr. Ashish Kumar Jha	Veraval	Dr. Toms C. Joseph Smt. Renuka V. Dr. Anupama T. K.
20	Specific technological problems and mitigation measures in fish and fishery products of Maharashtra region	Dr. L. N. Murthy	Mumbai	Dr. A. Jeyakumari Smt. Laly S. J. Dr. Abhay Kumar Dr. S. Monalisha Devi
21	Assessment of fish harvest and post-harvest technological aspects and mitigation measures for problems with special reference to Maharashtra	Dr. L. N. Murthy	Mumbai	Dr. Nikita Gopal Dr. A. Jeyakumari Smt. Laly S. J. Dr. Abhay Kumar Dr. S. Monalisha Devi
22	Food Safety Hazards of Fish and Fishery Products: Assessment and Mitigation Measures 1000663012[QAM-12/2016(3)]	Dr. Satyen Kumar Panda	Kochi, Veraval and Mumbai	Dr. Ashok Kumar K Dr. Femeena Hassan Dr. C. O. Mohan Smt. S. J. Laly Dr. G. K. Sivaraman Dr. Pankaj Kishore Dr. Anupama T. K. Dr. Bindu J. Dr. Niladri Sekhar Chatterjee Smt. Priya E. R. Dr. Devananda Uchoi Dr. Minimol V. Ms. Muthulakshmi T. Dr. Anuj Kumar

23	Enhancing Utilization of rest Raw Materials of Aquatic Origin for feed, Agricultural and Industrial product development (1000661053[P-116/2020(3)])	Dr. Zynudheen A. A.	Kochi Veraval Visakhapatnam Mumbai	Dr. Femeena Hassan Dr. Binsi P. K. Dr. Elavarasan K. Dr. Jeyakumari A. Dr. Parvathy U. Dr. Renuka V. Dr. Devanand Uchoi Dr. Joshy C. G. Dr. K. Sathish Kumar Dr. Visnu Vinayagam Dr. Remya S. Dr. Pankaj Kishore Dr. Madhu V. R. Dr. Sangeetha *(Assistant Professor, KVK Kottayam)* Dr. Sekar M. *(Scientist, Visakhapatnam RC of CMFRI)* Dr. V. Sreenivasan *(IISR, Calicut)*
24	Ensuring safety of fish and fishery products: Framework for validating Regulatory specifications (1000663018[QAM-16/2020(3)])	Dr. Satyen Kumar Panda	Cochin, Veraval and Mumbai	Dr. Zynudheen A. A. Dr. Bindu J. Dr. Femeena Hassan Dr. C. O. Mohan Dr. Joshy C.G. Dr. V. Murugadas Smt. Laly S. J. Dr. Devanand Uchoi Dr. Pankaj Kishore Dr. Anupama T. K. Smt. Priya E. R. Dr. Niladri Sekhar Chatterjee Dr. Anuj Kumar Dr. Remya S. Dr. A. Suresh Shri Tejpal C. S.

25	Occurrence, distribution and molecular characteristics of emerging and re-emerging pathogens in seafood and its environment	Dr. M. M. Prasad	Kochi, Mumbai and Visakhapatnam	Dr. Toms C. Joseph Dr. B. Madhusudana Rao Dr. G. K. Sivaraman Shri V. Radhakrishnan Nair Dr. S. Visnuvinayagam Dr. Joshy C. G. Dr. Murugadas V. Shri Ranjit Kumar N. Dr. Ahamed Basha K. Smt. Greeshma S. S. Smt. T. Muthulakshmi Dr. Abhay Kumar Shri S. Ezhil Nilavan Dr. Minimol V. S.
26	Molecular Diversity of pathogens associated with aquatic systems and harnessing aquatic niche for beneficial bacteria or products	Dr. V. Murugadas	Kochi, Mumbai and Visakhapatnam	Dr. Toms C Joseph Dr. B. Madhusudana Rao Dr. G. K. Sivaraman Shri V. Radhakrishnan Nair Dr. S. Visnuvinayagam Dr. Joshy C. G. Dr. Murugadas V. Shri Ranjit Kumar N. Dr. Ahamed Basha K. Smt.Greesma S. S. Smt. T. Muthulakshmi Dr. Abhay Kumar Shri S. Ezhil Nilavan Dr. Minimol V.
27	Development of colorimetric nano-biosensor strips for detection of food borne pathogens	Shri Ranjit Kumar Nadella	Kochi	Dr. M.M Prasad Dr. C. O. Mohan Shri Ezhil Nilavan
28	Seaweeds of Indian Coast as Source of Bioactive Compounds for Developing Nutraceuticals/ Functional Foods	Dr. Suseela Mathew	Kochi Veraval Visakhapatnam	Dr. R. Anandan Dr. K. K. Asha Dr. Niladri S. C. Shri Tejpal C. S. Dr. Anas K. K. Smt. Lekshmi R. G. K. Dr. T. K. Anupama Dr. Ashish Kumar Jha Dr. V. Geethalakshmi

29	Novel Bio-Molecules for Food and Nutraceutical Applications from Marine Resources	Dr. K. K. Asha	Kochi	Dr. Suseela Mathew Dr. R. Anandan Dr. Niladri S. C. Shri Tejpal C. S. Shri Anas K. K. Smt. Lekshmi R. G. K.
30	Design and development of tools and technologies for energy and water use optimization in fish processing industries Component A: Design and development of tools and technologies for energy and water use optimization in fish processing industries	Dr. Manoj P. Samuel	Kochi Visakhapatnam	Dr. Ashok Kumar K. Dr. George Ninan Dr. Murali S. Smt. P. V. Alfiya Dr. Aniesrani Delfiya D. S. Dr. Joshy C. G. Dr. Rejula K. Dr. Jesmi Debbarma Mr. Sujith*
31	Component B: Design and development of tools and technologies for energy and water use optimization in fish processing industries	Dr. Manoj P Samuel	Kochi	Dr. Murali S. Smt. P. V. Alfiya Dr. Aniesrani Delfiya D. S. Smt. Lekshmi R. G. K.
32	Evolving SMART EDP module for livelihood security of small scale fisherfolk through fish-preneurship	Dr. A.K. Mohanty	Kochi Veraval Visakhapatnam	Dr. S. Ashaletha Dr. Sajeev M. V. Dr. Pe. Jeyya Jeyanthi Dr. Sajesh V. K. Dr. Rejula K. Dr. Viji P.
33	Occupational structure, labour productivity and labour migration in the fisheries sector	Dr. Nikita Gopal	Kerala	Dr. V. Geethalakshmi Dr. A. Suresh Dr. M. V. Sajeev Dr. Pe. Jeyya Jeyanthi Shri V. Chandraskekar
34	Economic evaluation of resource use efficiency and management of reservoir ecosystem	Dr. V. Geethalakshmi	Kerala Tamil Nadu	Dr. Nikita Gopal Dr. P. JeyyaJeyanthi Shri V. Chandrasekar Dr. Femeena Hassan Dr. S. Chinnadurai
35	A study on the entrepreneurship ecosystem in fisheries and the cybernetics of Women Initiated Enterprises in Fisheries (WIEF) in selected coastal states of India	Dr. Ashaletha S.	Kochi Veraval Visakhapatnam Mumbai	Dr. A. K. Mohanty Dr. Suresh A. Dr. Sajesh V. K. Dr. Rejula K. Dr. Monalisha Devi Dr. Anupama T. K. Dr. Viji P.

36	Assessing the input and service delivery system for marine fisheries in Kerala	Dr. A. Suresh	Kerala	Dr. A. K. Mohanty Dr. Nikita Gopal Dr. V. Geethalakshmi Dr. S. Ashaletha Dr. Sajeev M. V. Shri V. Chandraskekar Dr. Sajesh V. K. Dr. Rejula K.
37	A study of dynamics of fish consumption in Kerala with reference to emerging health, safety and quality issue	Dr. Sajeev M. V.	Kerala	Dr. A. K. Mohanty Dr. Suresh A. Dr. Sajesh V. K. Dr. Rejula K. Smt. Alfiya P. V.
38	An Assessment of Extension System in Marine Fisheries Sector of Kerala	Dr. Sajesh V. K.	Kerala	Dr. A. K. Mohanty Dr. Ashaletha S. Dr. A. Suresh Dr. Pe. Jeyya Jeyanthi Dr. Rejula K. Shri Renjith R. K. Shri Sreejith S.
39	Development and validation of a scale to measure fisher's attitude towards responsible fishing	Dr. Rejula K.	Kerala	Dr. Sajesh V. K. Dr. S. Monalisha Devi

Externally Funded Projects

International

1.	Diagnostics for one health and user driven solutions for AMR (DOSA)	Dr. G. K. Sivaraman	Kochi	Shri Vineeth Rajan* Kum. Ardhra Vijayan*
2.	Does antimicrobial resistance (AMR) in livestock contribute to AMR in people in NE India? An interdisciplinary study investigating antibiotic use, drivers of AMR, and transmission dynamics	Dr. G. K. Sivaraman	Kochi	Dr. S. Sudha* Shri Muneeb Hamza*

3.	Establishing Value Chain for Coastal and Small Indigenous Freshwater Fish Species: Towards Nutritional Security for Rural Population.	Dr. Suseela Mathew	Kochi	Dr. C. N. Ravishankar Dr. Suseela Mathew Dr. M. M. Prasad Dr. A. K. Mohanty Dr. R. Anandan Dr. George Ninan Dr. S. K. Panda Dr. L. N. Murthy Dr. K. K. Asha Dr. M. V. Sajeev Dr. C. O. Mohan Dr. V. Murugadas Dr. C. G. Joshy Dr. N. S. Chatterjee Dr. K. Elavarasan Shri Tejpal C.S.
4.	Dialogues In Gender And Coastal Aquaculture: Gender And The Seaweed Farming Value Chain	Dr. Nikita Gopal	Tamil Nadu Kenya	Dr. P. S. Swathilekshmi, ICAR-CMFRI Dr.Betty Nyonje, Kenya Marine and Fisheries Research Institute
5.	Enhancing awareness among stakeholders of trawl systems in Andhra Pradesh and Odisha through capacity building, on use of CIFT-TED for Sea Turtle conservation	Dr. R. Raghu Prakash	Visakhapatnam	Shri G. Kamei
6.	Support mitigation of Antimicrobial Resistance (AMR) risk associated with aquaculture in Asia	Dr. B. Madhusudana Rao	Visakhapatnam	Dr. K. Ahamed Basha Shri M. Shanmukha Rao* Shri M. Dhamodher*

National				
Indian Council of Agricultural Research				
7.	Global Warming Potential (GWP) of mechanized fishing methods of India and mitigation strategies: Analysis using Life Cycle Assessment (LCA)- Data Envelopment Analysis (DEA) approach (NICRA)	Dr. Leela Edwin	Kochi, Veraval, Visakhapatnam	Dr. Raghu Prakash Dr. Madhu V. R. Shri M.V. Baiju Shri V. Chandrasekar Shri Paras Nath Jha Shri Sreejith S. Kumar * Shri Rithin Joseph* Smt. Yasmi V. S.*
8.	Zonal Technology Management (ZTM) – Agri Business Incubation (ABI) Centre	Dr. George Ninan	Kochi Visakhapatnam Mumbai	Dr. C. O. Mohan Dr. N. S. Chatterjee Dr. A. Suresh Dr. Remya S. Smt. Alfiya P. V. Smt. Razia Mohamed A.* Dr. Ajeesh Kumar K. K.* Shri Lijin Nambiar M. M.* Shri Mohd. Safwan T. A.* Dr. B. Madhusudana Rao Dr. L. N. Murthy
9.	All India Network Project on Fish Health	Dr. Asok Kumar K.	Kochi	Dr. S. K. Panda Dr. Rajisha R.* Smt. Nanitha Krishna E. K.*
10.	Investigations on Ghost Fishing by Derelict Traps and Gill Nets in selected areas of Indian waters and mitigation measures	Dr. Saly N. Thomas	Kochi	Dr. P. Muhamed Ashraf Dr. Sandhya K. M. Smt. Harsha K. * Kum. Aiswarya Ghosh K. A. * Kum. Mary Baby K. A. *

11.	ICAR-National Fellow Project- Biomodulation of Marine Biopolymers for the Preparation of Biomaterials of Healthcare Importance.	Dr. R. Anandan	Kochi	Dr. P. R. Sreerekha* Smt. Divya K. Vijayan*
12.	Indian Network for Fisheries and Animal Antimicrobial Resistance (INFAAR)	Dr. M. M. Prasad	Kochi Visakhapatnam	Dr. B. Madhusudana Rao Dr. G. K. Sivaraman Dr. V. Murugadas
Department of Science & Technology				
13.	Determining Seasonal and Spatial Occurrence of Multiclass Endocrine Disrupting Chemicals in Fishes, Crustaceans and Molluscs of the Vembanad Urban Estuary: Risk Assessment by an Untargeted Metabolomics Approach (SERB- ECRA-ED)	Dr. N. S. Chatterjee	Kochi	
14.	Green, Clean and Affordable Energy for Fishermen Community: Development of a Multipurpose Solar Thermal Conversion System with Gasifier/ Biomass Heater Backup	Dr. Murali S.	Kochi	Dr. Manoj P. SamuelDr. Aniesrani Delfiya D. S.Smt. P.V Alfiya Dr. SajeshV. K. Shri. Rijoy Thomas*
15.	Development of a foldable smart live fish transportation system for distant trade of table fish	Dr. Parvathy U.	Kochi	Dr. Binsi P.K. Shri Sathish Kumar K. Dr. Murali S. Shri Vishnu R. Nair* Shri Jithin T. J.*

Department of Biotechnology				
16.	Screening lytic phages from diverse marine and aquatic niche for controlling bacterial pathogens associated with aquaculture and post-harvest fish quality	Dr. B. Madhusudana Rao	Visakhapatnam	Dr. M. M. Prasad Dr. V. Murugadas Dr. G. K. Sivaraman Dr. S. Vishnivinayagam Kum. R. Karthika* Shri B. Manikantha*
Ministry of Food Processing Industries (MoFPI)				
17.	Design and development of hot air assisted continuous Infrared drying system for high value fish and fishery products	Dr. Aniesrani Delfiya D. S.	Kochi	Dr. Manoj P. Samuel Dr. Murali S. Smt. P.V. Alfiya Shri Prashob K.*
Indian National Centre for Ocean Information (INCOIS)				
18.	Validation and dissemination of ocean state forecast advisories along Gujarat coast	Dr. Madhu V. R.	Veraval	Dr. K. K. Prajith Shri S. Chinnadurai Shri Anand Narayan D.*
Marine Products Export Development Authority (MPEDA)				
19.	Assessing Seafood Exporting Units' needs for exporting Value added products and capacity building requirements	Dr. C. O. Mohan	Kochi Visakhapatnam Veraval Mumbai	Dr. George Ninan Dr. Madhusudana Rao Dr. L. Narasimha Murthy Dr. Sajeev M.V. Dr. Pankaj Kishore Dr. Elavarasan K. Dr. Viji P. Dr. Jesmi D. Dr. Jeyakumari A. Dr. Laly S.J. Dr. Ashish Kumar Jha S. Smt. Renuka V. Shri Sooraj Surendran N.* Kum. Silpa Thriveni* Kum. Pooja S. Gamare* Kum. Haripriya K.* Kum. Asmita Chauhan*

National Fisheries Development Board (NFDB)				
20.	National surveillance programme for aquatic animal diseases	V. Murugadas	Kochi	Dr. Toms C. Joseph Dr. S. Ashaletha Shri K. Ahamed Basha Shri Irish George*
Food Safety and Standards Authority of India (FSSAI)				
21..	Natural Levels of Formaldehyde In Freshly Harvested Finfish And Shellfish Species	Dr. S. K. Panda	Kochi Mumbai	Dr. Laly S. J. Dr. N. S. Chatterjee Smt. Priya E. R. Shri Ajeesh Kumar*
22.	Monitoring of Heavy Metal Content in Finfish and Shellfish Along the Coast of India and Possible Mitigation Measure	Dr. Satyen Kumar Panda	Kochi	Dr. Pankaj Kishore Dr. C. O. Mohan Smt Sribinanamol T. S.* Shri Shihabudeen*
23.	NETSCOFAN-Food Testing Group (FTG)	Dr. S. K. Panda	Kochi	Dr. N. S. Chatterjee Dr. Pankaj Kishore Dr. Anuj Kumar Dr. Devananda Uchoi Dr. V. Murugadas Dr. C. O. Mohan Smt. Priya E. R. Kum. Asha Mary Joseph* Shri Shamil Rafeeq*
24.	FSSAI-National Reference Laboratory	Dr. C. N. Ravishankar	Kochi	Dr. S. K. Panda Dr. Pankaj Kishore Dr. Anuj Kumar Dr. Devananda Uchoi Dr. V. Murugadas Dr. C.O. Mohan Smt. Priya E.R Kum. Pranamya C. Haridas Kum. Megha Sivadas
Coconut Development Board				
25.	Improved coconut wood canoes for small scale fishing sector of southeast coast of India	Dr. Leela Edwin	Kochi	Dr. P. Muhamed Ashraf Shri M.V. Baiju Dr. N. Manju Lekshmi Mrs. Leonna Angela Morris* Ms. Jesna Sudhakaran* Mr. Neeraj Kumar*

List of Personnel in ICAR-CIFT

(As on 31st December, 2020)

Managerial Personnel

Director: Dr. C. N. Ravishankar

Heads of Division

Fish Processing Division	:	Dr. K. Asok Kumar, Principal Scientist
Microbiology, Fermentation &Biotechnology	:	Dr. M.M. Prasad, Principal Scientist
Fishing Technology Division	:	Dr. Leela Edwin, Principal Scientist
Extension Information & Statistics Division	:	Dr. A.K. Mohanty, Principal Scientist
Engineering Division	:	Dr. Manoj P. Samuel, Principal Scientist
Biochemistry and Nutrition Division (I/c)	:	Dr. Suseela Mathew, Principal Scientist
Quality Assuranceand Management (I/c)	:	Dr. A.A. Zynudheen, Principal Scientist
Visakhapatnam Research Centre	:	Dr. R. Raghu Prakash, Principal Scientist
Mumbai Research Centre	:	Dr. L.N. Murthy, Principal Scientist
Veraval Research Centre	:	Dr. Ashish Kumar Jha, Scientist
Senior Administrative Officer	:	Shri W. Sreenivasa Bhat
Finance & Accounts Officer	:	Shri K.S. Sreekumaran

Scientific Personnel

Principal Scientist

1. Dr. T.V. Sankar
2. Dr. Saly N. Thomas
3. Dr. M.P. Remesan
4. Dr. Nikita Gopal
5. Dr. V. Geethalakshmi
6. Dr. R. Anandan
7. Dr. J. Bindu
8. Dr. P. Muhamed Ashraf
9. Dr. George Ninan
10. Dr. S. Ashaletha
11. Dr. Femeena Hassan
12. Dr. Toms C. Joseph
13. Dr. A. Suresh
14. Dr. G.K. Sivaraman
15. Dr. V.R. Madhu
16. Dr. K.K. Asha
17. Dr. S.K. Panda

Senior Scientist

1. Shri M.V. Baiju
2. Dr. M.V. Sajeev
3. Dr. C.O. Mohan
4. Dr. Pe. Jeyya Jeyanthi
5. Dr. P.K. Binsi

Scientist

1. Shri V. Radhakrishnan Nair
2. Shri V. Chandrasekar
3. Dr. C.G. Joshy
4. Dr. V. Murugadas

5. Dr. K. Nagalakshmi
6. Dr. S. Visnuvinayagam
7. Dr. V.K. Sajesh
8. Dr. Niladri Sekhar Chatterjee
9. Dr. K.M. Sandhya
10. Dr. Remya S.
11. Dr. N. Manju Lekshmi
12. Dr. U. Parvathy
13. Dr. Pankaj Kishore
14. Shri Ranjit Kumar Nadella
15. Shri S. Sreejith
16. Dr. Hanjabam Mandakini Devi
17. Dr.Anuj Kumar
18. Dr. K. Elavarasan
19. Dr. N. Rajendra Naik
20. Shri C.S. Tejpal
21. Smt. S.S. Greeshma
22. Dr. K. Rejula
23. Shri S. Chinnadurai
24. Shri Paras Nath Jha
25. Smt. T. Muthulakshmi
26. Dr. R.K. Renjith
27. Dr. K. Sarika
28. Smt. K.R. Sreelakshmi
29. Smt. E.R. Priya
30. Smt. Lekshmi R.G. Kumar
31. Dr. Devananda Uchoi
32. Shri K. Sathish Kumar
33. Dr. V.A. Minimol
34. Shri K.K. Anas
35. Shri S. Ezhil Nilavan
36. Dr. Murali S.
37. Dr. D.S. Aniesrani Delfiya
38. Smt. Rehna Raj
39. Smt. P.V. Alfiya

Technical Personnel

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Assistant Chief Technical Officer

1. Smt. P.K. Shyma
2. Dr. M. Baiju
3. Smt. T. Silaja
4. Dr. T.V. Bhaskaran
5. Smt. M. Rekha
6. Shri K.D. Jos
7. Dr. Santhosh Alex
8. Smt. K.K. Kala
9. Shri Sibasis Guha
10. Shri P.S. Babu
11. Shri G. Omanakuttan Nair
12. Dr. P. Shankar
13. Dr. Ancy Sebastian

Technical Officer

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2. Shri C. Subash Chandran Nair
3. Shri Aravind S. Kalangutkar
4. Shri P.S. Nobi
5. Smt. P.K. Geetha
6. Shri Sajith K. Jose
7. Shri P.V. Sajeevan
8. Smt. P.A. Jaya
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10. Shri G. Gopakumar
11. Smt. N. Lekha
12. Shri K.S. Babu
13. Smt. Bindu Joseph
14. Shri T.P. Saju
15. Smt. N.C. Shyla
16. Shri P.D. Padmaraj
17. Smt. Tessy Francis
18. Shri P.S. Sunil Kumar
19. Shri N. Sunil

Senior Technical Assistant

1. Shri K.V. Mohanan
2. Shri C.K. Suresh
3. Shri K.D. Santhosh
4. Shri P.A. Aneesh
5. Shri K.A. Noby Varghese
6. Shri V. Vipin Kumar
7. Smt. Vineetha Das
8. Shri T. Jijoy
9. Smt. V. Susmitha
10. Smt. P. Sruthi
11. Shri Rahul Ravindran
12. Smt. U.P. Prinetha
13. Shri Rakesh M. Raghavan

Technical Assistant

1. Dr. P.H. Dhiju Das
2. Shri K.C. Anish Kumar

Senior Technician

1. Shri G. Vinod
2. Shri Ajith V. Chellappan
3. Shri K. Ajeesh
4. Shri M.T. Udayakumar
5. Smt. Anu Mary Jose
6. Smt. G. Archana
7. Smt. P.J. Mary
8. Shri P. Suresh
9. Smt. K. Reshmi
10. Shri V.N. Sreejith

Administrative Personnel

Deputy Director (Official Language)

1. Dr. J. Renuka

Administrative Officer

1. Shri R.N. Subramanian

Assistant Finance & Accounts Officer

1. Smt. Febeena P.A.

Assistant Administrative Officer

1. Shri P. Krishna Kumar
2. Shri T. Viswanathan (On deputation)
3. Shri K.B. Sabukuttan
4. Shri M.N. Vinodh Kumar
5. Smt. T.K. Shyma

Private Secretary

1. Shri R.D. Goswami
2. Smt. Anitha K. John

Assistant

1. Shri C.K. Sukumaran
2. Smt. V. S. Aleyamma
3. Smt. K. Renuka
4. Shri K. Das
5. Smt. G. Surya
6. Smt. Nilina Elais
7. Smt. N.R. Akhila
8. Smt. A.R. Raji
9. Shri P. Mani
10. Smt. Jaya Das
11. Smt. E. Jyothilakshmy
12. Smt. P.R. Mini
13. Shri T.N. Shaji
14. Shri Santhosh Mohan
15. Smt. Shiji John
16. Shri T.R. Syam Prasad
17. Shri P.G. David

Upper Division Clerk

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2. Shri T.D. Bijoy
3. Smt. K.S. Sobha
4. Smt. T. Deepa
5. Shri P.P. George
6. Smt. Subin George
7. Smt. Suni Surendran
8. Shri Deu Umesh Aroskar
9. Shri Rajeev P.

Lower Division Clerk

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2. Kum. N. Arachana
3. Shri S.S. Subeesh
4. Shri P.M. Rizwan
5. Shri K.S. Ajith
6. Shri K.Thinakaran
7. Shri P.N. Nikhil Das

Stenographer Grade-III

1. Shri Sachin Gautam

Supporting Personnel

Skilled Support Staff

1. Shri K.K. Karthikeyan
2. Smt. P.T. Mary Vinitha
3. Shri O.P. Radhakrishnan
4. Shri S.N. Dash
5. Shri P. Raghavan
6. Shri T.M. Balan
7. Shri V. Deepak Vin
8. Shri K.R. Rajasaravanan

9. Shri A. Vinod
10. Smt. M.G. Soudamini

Auxiliary Staff

1. Shri M.V. Rajan

Visakhapatnam Research Centre
Scientific Personnel

Principal Scientist

1. Dr. U. Sreedhar
2. Dr. B. Madhusudana Rao

Scientist

1. Dr. P. Viji
2. Dr. Jesmi Debbarma
3. Shri Gaihiamngam Kamei
4. Dr. K. Ahamed Basha

Technical Personnel

Chief Technical Officer

1. Dr. Moka Swamy Kumar

Technical Officer

1. Shri H.S. Bag
2. Shri A.K. Naik

Senior Technical Assistant

1. Shri M. Prasanna Kumar

Senior Technician

1. Shri G. Bhushanam

Administrative Personnel

Upper Division Clerk

1. Shri Amit Vengraj
2. Shri Ramesh Mirdha

Lower Division Clerk

1. Shri M.S. PrabhakarRao
2. Smt. Nalla Naveena

Supporting Personnel

Skilled Support Staff

1. Shri G.B. Mahanandia
2. Shri T.N. Banchoor
3. Shri Sanyasi Ganik
4. Smt. Gyana Netri Nag
5. Shri S.K. Mehar
6. Shri Kedar Meher
7. Shri Lalit Oram

Veraval Research Centre
Scientific Personnel

Scientist

1. Dr. K.K. Prajith
2. Dr. V. Renuka
3. Dr. Anupama T.K.

Technical Personnel

Senior Technical Assistant

1. Shri S.H. Ummer Bhai
2. Shri G. Kingsely

Technical Assistant

1. Smt. Nimmy S. Kumar
2. Shri Paramanand Prabhakar
3. Shri Ranjan Singh

Senior Technician

1. Shri J.B. Malmadi
2. Shri Y.D. Kriplani

Administrative Personnel

Assistant Administrative Officer

1. Smt. V.K. Raji

Assistant

2. Shri M. Arockia Shaji

Lower Division Clerk

1. Smt. S. Joshna
2. Shri T.V. Anish

Supporting Personnel

Skilled Support Staff

1. Shri D.K. Viram
2. Shri A.M. Vala
3. Shri M.K. Kana
4. Smt. Pushpaben P. Chudasama

5. Smt. Motiben K. Fofandi
6. Shri N.K. Masani
7. Shri P. Ramakrishna
8. Shri Rotash

Auxiliary Staff

1. Smt. Veena Sreedhar Narkar

Mumbai Research Centre
Scientific Personnel

Scientist

1. Dr. A. Jeyakumari
2. Dr. Abhay Kumar
3. Smt. S.J. Laly
4. Dr. Sukham Monalisha Devi

Technical Personnel

Chief Technical Officer

1. Smt. Sangeetha D. Gaikwad
2. Smt. Thriven G. Adiga

Senior Technical Assistant

1. Smt. Priyanka Ajay Nakhawa

Technical Assistant

1. Kum. G. Megha
2. Shri T.A. Waghmare

Administrative Personnel

Assistant

1. Shri A.N. Agawane

Lower Division Clerk

1. Smt. C.G. Bhavaymol

Supporting Personnel

Skilled Support Staff

1. Smt. Priyanka P. Bait

PUBLICATIONS

PAPERS PUBLISHED IN REFEREED JOURNALS

Abhay Kumar, Gayatri Tripathi, Bhartendu Vimal, Bedeka, M. K. and Kumar, A. P. (2020) Expression study of pluripotency marker genes in gold fish. Int. J. Curr. Microbiol. App. Sci. 9 (4):639-649. http://krishi.icar.gov.in/jspui/handle/123456789/46072

Anas, K. K., Lekshmi R. G. Kumar, Tejpal, C. S. and Suseela Mathew (2020) Supercritical fluid extraction of fish oil – Recent perspectives. Int. J. Curr. Microbiol. App. Sci. 9(12): 730-735. http://krishi.icar.gov.in/jspui/handle/123456789/45810

Aneesh, P. A., Anandan, R., Lekshmi, R.G.K., Ajeeshkumar, K. K., Ashok Kumar, K. and Suseela Mathew (2020) A step to shell biorefinery—Extraction of astaxanthin-rich oil, protein, chitin, and chitosan from shrimp processing waste. Biomass Convers. Biorefin. 1-10. http://krishi.icar.gov.in/jspui/handle/123456789/45811

Aniesrani Delfiya, D.S., Murali, S., Alfiya, P.V. and Manoj P. Samuel. (2020) Drying characteristics of shrimp (Metapenaeus dobsoni) in electrical dryer. Pantnagar Journal of Research. 18(3): 280-284. http://krishi.icar.gov.in/jspui/handle/123456789/46039

Asha, K. K., Suseela Mathew, Prasad, M. M. and Ravishankar, C. N. (2020) The undernutrition conundrum in India: current scenario and the way forward. Curr. Sci. 119(4): 613-617. http://krishi.icar.gov.in/jspui/handle/123456789/44185

Aswathy Krishnan, Anandan, R. and Aneykutty Joseph (2020) Culture Medium and Growth Phase Modulate the Fatty Acid Composition of the Diatom Nitzschia palea (Kutzing) W. Smith-Potential Source for Live Feed and Biodiesel. Fish. Technol. 57 (1): 28–35. http://krishi.icar.gov.in/jspui/handle/123456789/36750

Baiju, M. V., Vipin Kumar, V., Ashok Naik, Byeong Jang and Sivaprasad, K. (2020) Application of hydraulics in fishing vessel deck equipment: Case study of F.V. Sagar Harita. Fish. Technol. 57 (3): 200-205. http://krishi.icar.gov.in/jspui/handle/123456789/44175

Chand, K., Kumar, S., Suresh, A. and M.B. Dastagiri (2020) Marketing efficiency of vegetables in developing economies: Evidences for critical intervention from Rajasthan, India, Indian Journal of Agricultural Sciences. 90 (8): 1419–1427. http://krishi.icar.gov.in/jspui/handle/123456789/45866

Chandrasekar V, MuraliGopal, S., Vidhyavathi, A., Jayanthi, C., Sathy, R. and Nikita Gopal (2020) economic valuation of Chinese dip net fishing on the Vembanad lake- using market price approach. Int. J. Curr. Microbiol. App. Sci. 9(7): 2365-2372. http://krishi.icar.gov.in/jspui/handle/ 123456789/45416

Chandrasekar, V., Geethalaskshmi, V. and Nikita Gopal (2020) Livelihood security in small reservoirs – Case study of Aliyar (Tamil Nadu). Fish. Technol. 57 (3): 213-220. http://krishi.icar.gov.in/jspui/handle/123456789/44174

Chandrasekar, V., Murali Gopal, S., Vidhyavathi, A., Jayanthi, C., Sathy, R. and Nikita Gopal (2020) Recreational value of Vembanad lake in Kerala using individual travel cost method. Int. J. Curr. Microbiol. App. Sci. 9(6):3280-3291. http://krishi.icar.gov.in/jspui/handle/123456789/45417

Chandrasekhar, V., Paramasivam, P., Jayanthi, C., Sathy, R., Nikita Gopal and Mani, K. (2020) Analysis of marine products export from India using Markov-Chain analysis. Fish. Technol. 57 (1):59–68.http://krishi.icar.gov.in/jspui/handle/123456789/36749

Chinnadurai S., Campos, C. J. A., Geethalakshmi, V., Jenni Sharma, Kripa, V. and Mohamed, K. S. (2020) Microbiological quality of shellfish harvesting areas in the Ashtamudi and Vembanad estuaries (India): Environmental influences and compliance with international standards. Mar. Pollut. Bull. 156:111255. http://krishi.icar.gov.in/jspui/handle/123456789/45805

Daniel, D. B., Muhamed Ashraf, P. and Saly N Thomas (2020) Abundance, characteristics and seasonal variation of microplastics in Indian white shrimps (Fenneropenaeus indicus) from coastal waters off Cochin, Kerala, India. Sci Total Environ. 737: 139839. http://krishi.icar.gov.in/jspui/handle/123456789/38060

Daniel, D. B., Muhamed Ashraf, P., Saly N. Thomas and Thomson, K.T. (2020) Microplastics in the edible and inedible tissues of pelagic fishes sold for human consumption in Kerala, India. Environ. Pollut. 266: 115365. http://krishi.icar.gov.in/jspui/handle/123456789/45796

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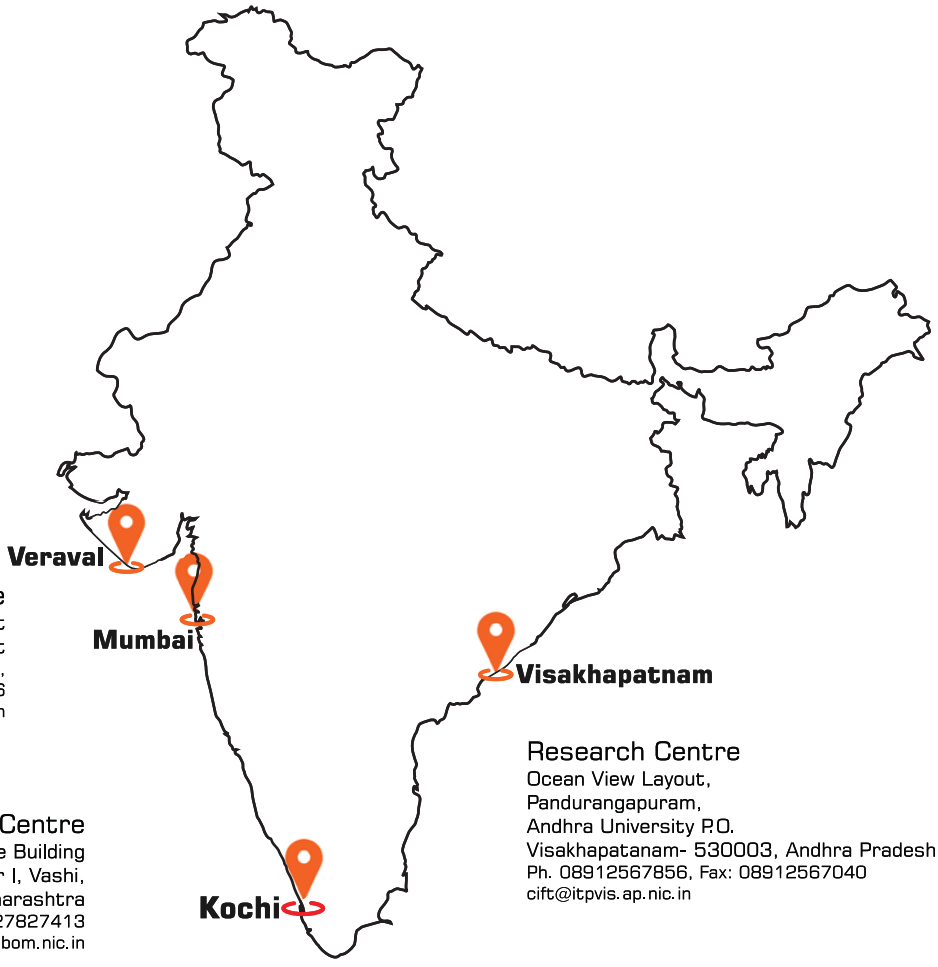

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